GENESIS64 Standard Training Manual

Version 10.8

© 2014 ICONICS, Inc. All rights reserved worldwide. This document may not be reproduced or copied in any manner without written authorization from ICONICS, Inc.

The information contained within this document is subject to change without notice. ICONICS, Inc. does not guarantee the accuracy of the information.

GENESIS64, Hyper Historian, Pocket GENESIS, BizViz and their respective modules, OPC-To-The-Core, and Visualize Your Enterprise are trademarks of ICONICS, Inc.

Windows, Windows XP, Windows 2000, Windows 2003 Server, Windows CE, Windows NT, Windows XP-64, Windows 2003-64, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8 and Windows Server 2012 are registered trademarks of Microsoft Corp. in the United States and other countries.

Other product and company names mentioned herein may be trademarks or registered trademarks of their respective owners.

Document Number: TM-GEN64-108

Visualize Your Enterprise™

ICONICS LICENSE AGREEMENT

YOU SHOULD CAREFULLY READ THE FOLLOWING TERMS AND CONDITIONS!

Opening and using the enclosed software for any purpose indicates your acceptance of the terms and conditions of this license agreement. If you do not agree with them you should return all software, documentation and copy protection keys within seven days of shipment unopened and your money will be refunded.

ICONICS provides this program and licenses its use in the United States, Puerto Rico, or internationally. You assume the responsibility for the selection of the program to achieve your intended results, and for the installation, use and results obtained from this program.

LICENSE

You are granted a personal license to use this program under the terms stated in this Agreement. You may: 1) Install and use the program on a single machine. 2) Make a single archival back-up copy of the program for the sole purpose of supporting your use of the single program on a single machine. 3) You may not use, copy, modify, or transfer the program, or transfer any copy, in whole or in part, except as expressly provided in this license, or with a written contractual agreement with **ICONICS,** Inc.

TERM

The license is effective until terminated. It will terminate if you fail to comply with any term or condition of this Agreement. You agree, upon such termination, to destroy the program and all copies that were made from it and to promptly return any copy protection key(s) to **ICONICS.**

LIMITED WARRANTY

ICONICS WARRANTS THE CD-ROM OR PHYSICAL DISKETTES, ON WHICH THE PROGRAM IS FURNISHED, AND PHYSICAL DOCUMENTATION TO BE FREE OF DEFECTS IN MATERIALS AND WORKMANSHIP UNDER NORMAL USE FOR A PERIOD OF NINETY (90) DAYS FROM THE DATE OF DELIVERY TO YOU AS EVIDENCED BY YOUR RECEIPT. THIS PROGRAM IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF TITLE, NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE ENTIRE COST OF ALL NECESSARY SERVICING, REPAIR, OR CORRECTION.

ICONICS SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, IMPLIED WARRANTIES OF TITLE, NON-INFRINGEMENT, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN PARTICULAR, WITH RESPECT TO ANY PARTICULAR APPLICATION, USE OR PURPOSE, IN NO EVENT SHALL **ICONICS** INC. BE LIABLE FOR ANY OTHER COMMERCIAL DAMAGE, INCLUDING BUT NOT LIMITED TO SPECIAL, INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES. **ICONICS** DOES NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE PROGRAM WILL MEET YOUR REQUIREMENTS OR THAT THE OPERATION OF THE PROGRAM WILL BE UNINTERRUPTED OR ERROR FREE.

LIMITATION OF REMEDIES

ICONICS' entire liability and your exclusive remedy shall be the replacement of any CD-ROM or diskette not meeting **ICONICS**' "Limited Warranty" which is returned to **ICONICS** with a copy of your receipt within the warranty period. The remedy for breach of this warranty shall be limited to replacement and shall not encompass any other damages including but not limited to loss of profit, special, incidental, consequential, or other similar claims arising out of the use or inability to use such program even if **ICONICS** has been advised of the possibility of such damages, or for any claim by any other third party.

GENERAL

This Agreement will be governed by the laws of the Commonwealth of Massachusetts. Should you have any questions concerning this Agreement, you may contact **ICONICS** in writing at:

ICONICS, Inc.
100 Foxborough Boulevard
Foxborough, MA 02035

You acknowledge that you have read this agreement, understand it and agree to be bound by its terms and conditions. You further agree that it is the complete and exclusive statement of the Agreement between you and **ICONICS** which supersedes any proposal or prior Agreement, oral or written, and any other communications between you and **ICONICS** relating to the subject matter of the Agreement.

ICONICS RETURN POLICY

All sales are final (NO RETURNS) unless one of the following conditions is applicable: Program is returned in its original packaging material within 7 days after shipment. In such a case, a full refund is provided, less all incurred shipping and handling costs. Program is returned within 30 days from the original shipment date. In such a case a 20% restocking fee is applicable. No returns are allowed on OPC ToolWorX or ActiveX ToolWorX.

1. INTRODUCTION TO GENESIS64 1-1
1.1. GENESIS64 ARCHITECTURE 1-3
1.1.1. CONFIGURATION VS. RUNTIME 1-4
1.2. ICONICS SYSTEM OPTIONS 1-7
1.3. PLCS, OPC, BACNET, SNMP AND GENESIS64 1-10
1.3.1. PROGRAMMABLE LOGICAL DEVICES (PLC) 1-11
1.3.2. OPC SERVERS 1-11
1.3.3. BACNET 1-17
1.3.4. SNMP 1-18
1.4. DATA CONNECTIONS 1-19
1.5. CONNECTIVITY 1-21
1.6. THE DATA BROWSER 1-22
LAB: TRAINING INSTALLATION AND CONFIGURATION L1-1
1.1. TASK CHECKLIST L1-1
1.2. INSTALLATION SOFTWARE AND SUPPORT FILES L1-1
1.3. INSTALLATION L1-2
1.3.1. INSTALLATION PREREQUISITES L1-2
1.3.2. INSTALLING GENESIS64 ..... L1-3
1.3.3. INSTALLING THE OPC SERVER SUITE L1-8
1.4. CONFIGURING THE OPC SERVER FOR TRAINING L1-14
1.4.1. DCOM CONFIGURATION L1-14
1.5. TRAINING SUPPORT FILES L1-15
1.6. THE OPC SERVER CONFIGURATION L1-15
1.7. CREATING THE ALARM LOGGING DATABASE L1-17
1.8. SQL SERVER PERMISSIONS REVIEW L1-18
1.9. WEB BROWSER CONFIGURATION L1-19
1.9.1. ENABLING INTERNET EXPLORER FILE DOWNLOAD L1-19
1.9.2. ADDING YOUR HOST TO THE LIST OF TRUSTED SITES L1-20
1.9.3. CONFIGURING INTERNET EXPLORER CACHE L1-21
1.9.4. INSTALLING SILVERLIGHT L1-22
1.10. THE SYMBOL LIBRARIES L1-23
1.11. THE TRAINING DATABASES L1-24
1.11.1. CREATING THE ICTONICSASSETWORX TRAINING DATABASE L1-24
1.11.2. IMPORTING ICTONICSASSETWORX DATA L1-26
1.11.3. MAKING THE ICTONICSASSETWORX DATABASE ACTIVE L1-26
1.11.4. UNIFIED DATA MANAGER L1-28
1.11.5. ALARMWORX64 SERVER L1-29
1.11.6. GLOBAL ALIASING L1-30
1.11.7. BACNET DISCOVERY L1-30
1.11.8. COPY THE AHU.GDFXS DISPLAY TO PUBDISPLAY L1-32
1.11.9. EXPLORING GENDEMO L1-32

2. WORKBENCH-SL 2-1
2.1. OBJECTIVES 2-1
2.2. INTRODUCTION TO WORKBENCH-SL 2-1
2.2.1. WORKBENCH-SL VS. WORKBENCH CLASSIC 2-3
2.2.2. OPENING WORKBENCH-SL 2-3
2.2.3. THE RIBBON 2-4
2.3. TOOLS AND PROVIDERS 2-5
2.4. PROVIDERS IN WORKBENCH-SL 2-6
2.4.1. WORKING WITH SERVICES 2-6
2.5. WORKBENCH-SL USER INTERFACE 2-7

2.6. PROJECT EXPLORER 2-7
2.6.1. WORKING IN THE PROJECT EXPLORER 2-10
2.6.2. DATA IN THE PROJECT EXPLORER 2-11
2.7. RIBBON 2-12
2.8. FILTERING AND SORTING INFORMATION IN THE WORKBENCH 2-13
2.8.1. SORTING INFORMATION 2-14
2.8.2. FILTERING INFORMATION 2-14
2.8.3. CLEARING A FILTER 2-16
2.8.4. USING CONDITIONS IN A FILTER 2-16
LAB: WORKBENCH-SL/DATA CONNECTIVITY L2-1
2.1. LAB OVERVIEW L2-1
2.1.1. TASK CHECKLIST L2-1
2.1.2. SUPPORT FILES L2-1
2.2. WORKBENCH-SL NAVIGATION L2-1
2.3. CREATE A NEW PROJECT L2-2
2.4. WORKBENCH-SL PROVIDER SELECTION L2-2
2.5. WORKBENCH-SL PROJECT PROPERTIES L2-3
2.6. GRAPHWORX64 PREFERENCES L2-3
2.7. GRAPHWORX64 DATA CONNECTIVITY L2-4
2.7.1. SIMULATED CONNECTION L2-4
2.7.2. OPC DA CONNECTION L2-5
2.7.3. OPC UA CONNECTION L2-6
2.7.4. THE DATA BROWSER MONITOR VIEW L2-7

3. ASSETWORX 3-1
3.1. OBJECTIVES 3-1
3.2. INTRODUCTION TO ASSETWORX 3-1
3.2.1. ARCHITECTURAL OVERVIEW OF ASSETWORX 3-4
3.2.2. ASSETS VS. TAGS 3-5
3.2.3. QUICK START WITH ASSETWORX 3-5
3.3. ASSETWORX CONFIGURATION DATABASES 3-6
3.3.1. EXPORTING AND IMPORTING 3-6
3.4. GENERAL SETUP IN ASSETWORX 3-7
3.4.1. ENABLING THE AVAILABLE SOLUTIONS 3-7
3.4.2. OTHER SETTINGS NODE 3-7
3.5. HOW TO BUILD THE ASSET TREE 3-10
3.5.1. WHAT IS THE ASSET TREE? 3-10
3.5.2. EQUIPMENT IN THE ASSET TREE 3-11
3.5.3. STRATEGIES FOR BUILDING THE ASSET TREE 3-13
3.5.4. ESTABLISHING THE TIERS OF THE HIERARCHY 3-15
3.6. ASSETS IN THE TREE 3-20
3.6.1. ADDING EQUIPMENT TO THE ASSET TREE 3-20
3.6.2. STEPS TO BUILDING AN ASSET TREE 3-21
3.6.3. ADDING EQUIPMENT TO THE ASSET TREE 3-22
3.7. ASSET SECURITY 3-25
3.7.1. ASSET SECURITY PRIVILEGES FOR USERS AND GROUPS 3-25
LAB: BUILDING THE ASSET TREE L3-1
3.1. LAB OVERVIEW L3-1
3.1.1. TASK CHECKLIST L3-1
3.1.2. SUPPORT FILES L3-1
3.2. PREPARING THE ICTONICS ASSET TREE L3-1
3.2.1. BUILDING AN ASSET TREE L3-1

3.2.2. Adding Equipment Properties L3-5

4. Equipment Classes and Aliasing 4-1
4.1. Objectives 4-1
4.2. Creating Equipment Classes for Use as Templates 4-1
4.3. Creating an Equipment Class 4-2
4.4. Creating a Multi-Tiered Structure of Equipment Classes 4-4
4.4.1. Steps for Creating Multiple Tiers 4-5
4.5. Using Aliases in an Equipment Class 4-6
4.6. How to Use Aliasing 4-7
4.7. Adding Equipment Properties 4-8
4.7.1. Real Time Data Tab 4-9
4.7.2. Equipment Properties as Holding Registers 4-14
4.7.3. Implementing Equipment Properties in Other ICONICS Components 4-14
4.7.4. Historical Data Tab 4-15
4.7.5. Activating Equipment 4-16
4.8. Using an Equipment Class to Add an Equipment Node to the Asset Tree 4-22
Lab: Equipment Classes L4-1
4.1. Lab Overview L4-1
4.1.1. Task Checklist L4-1
4.1.2. Support Files L4-1
4.2. Adding Tree Nodes Using an Equipment Class L4-1
4.2.1. Configuring an Equipment Class Asset L4-2
4.2.2. Adding Equipment Properties L4-4
4.2.3. Adding the Equipment Class to the Asset Tree L4-6
4.2.4. The Instantiation Process with Multiply L4-7
4.2.5. Entering Runtime L4-8
4.2.6. Expanding the Viewable Area L4-9

5. GraphWorX64 Basics 5-1
5.1. Basic 2D Shapes and Objects 5-1
5.2. Dynamics 5-4
5.2.1. Text Objects 5-4
5.2.2. Dimensions and Color Dynamics 5-5
5.2.3. Pick Actions 5-6
5.2.4. Button Objects Preloaded with the Pick Action 5-8
5.2.5. Function Key Action for the This Display Object 5-9
5.3. Object Count 5-9
5.4. Layers 5-10
5.5. Application Mode 5-14
5.6. Display Password Protection 5-15
5.7. New Settings 5-17
Lab: icTonics Monitor Display L5A-1
5A.1.1 Lab Overview L5A-1
5A.1.2 Task Checklist L5A-1
5A.1.3 Support Files L5A-1
5A.1.4 Monitor Display L5A-2
5A.1.5 Add a Level SetPoint Data Entry Field L5A-5
Lab: Layers and Dynamics L5B-1
5B.1.1 Lab Overview L5B-1
5B.1.2 Task Checklist L5B-1
5B.1.3 Support Files L5B-1
5B.1.4 Adding a Layer L5B-2

5B.1.5 ADD A SCALE CONTROL L5B-3
5B.1.6 ADD A CHURNING BLADE BUTTON L5B-5
5B.1.7 ADD A STATE FIELD L5B-5
5B.1.8 ADD A TEXT OBJECT WITH A "HIDE" DYNAMIC L5B-6

6 GRAPHWORX64 TOOLS 6-1
6.1 OBJECTIVES 6-1
6.2 GENESIS64 CONTROLS 6-1
6.2.1 ICONICS VIEWER CONTROLS 6-2
6.2.2 EARTHWORX 6-2
6.2.3 PUSHPINS 6-9
6.2.4 SMART PINS 6-9
6.2.5 SMART TILES 6-10
6.2.6 THE SCALE CONTROL 6-12
6.2.7 THE PIPE CONTROL 6-13
6.2.8 CAMERA CONTROL 6-13
6.2.9 PIVOT CONTROL 6-15
6.2.10 ASSETWORX NAVIGATOR 6-15
6.2.11 ENABLING COMMANDS THROUGH THE ASSET NAVIGATOR CONTROL IN GRAPHWORX64 6-16
6.2.12 FDD VIEWER 6-22
6.2.13 ENERGY ANALYTIX VIEWER 6-22
6.2.14 SCHEDULE CONTROL 6-23
6.2.15 SECURITY CONTROL 6-26
6.2.16 THIRD-PARTY CONTROLS 6-28
6.3 SEARCH AND REPLACE 6-29
6.4 ARRANGE CONTROLS AND OBJECTS 6-30
6.4.1 ALIGNING OBJECTS 6-31
6.4.2 CHANGING AN OBJECT'S Z-ORDER 6-31
6.5 VIEWS 6-32
6.6 THE GRAPHWORX64 RUNTIME RIBBON AND MENUS 6-34
LAB: SMART TILES L6A-1
6A.1. LAB OVERVIEW L6A-1
6A.1.1. TASK CHECKLIST L6A-1
6A.1.2. SUPPORT FILES L6A-1
6A.2. CREATING AN AHU DISPLAY L6A-1
LAB: EARTHWORX64 ..... L6B-1
6B.1 LAB OVERVIEW L6B-1
6B.1.1 TASK CHECKLIST L6B-1
6B.1.2 SUPPORT FILES L6B-1
6B.2 CREATING A DISPLAY WITH EARTHWORX L6B-1
LAB: CREATING A DASHBOARD L6C-1
6C.1 LAB OVERVIEW L6C-1
6C.1.1 TASK CHECKLIST L6C-1
6C.1.2 SUPPORT FILES L6C-1
6C.2 CREATING A DASHBOARD L6C-2
6C.1.6 ADDING THE FLOOR PLAN L6C-6
6C.1.7 CREATE THE BASE DASHBOARD DISPLAY L6C-6

7. ALARMWORX64 SERVER 7-1
7.1. ALARMWORX64 SERVER 7-1
7.2. ALARM TAGS 7-3
7.3. CONFIGURING ALARM TAGS 7-4

7.3.1. Creating Alarm Tags One at a Time 7-4
7.3.2. Limit Alarm 7-8
7.3.3. Deviation Alarm 7-10
7.3.4. Digital Alarm 7-11
7.3.5. Rate of Change Alarm 7-12
7.3.6. Rate Limit Alarm 7-13
7.3.7. Trigger Limit Alarm 7-14
7.3.8. Alarm Tag Templates 7-15
7.3.9. Creating Several Alarm Tags at Once 7-17
7.4. Group Alarm Tags by Area 7-19
7.4.1. Adding an Area 7-20
7.4.2. Adding an Alarm Tag 7-20
7.5. Importing and Exporting Components 7-22
7.5.1. Exporting Alarm Server Components 7-22
7.5.2. Importing Alarm Server Components 7-23
Lab: AlarmWorX64 Server L7-1
7.1. Lab Overview L7-1
7.1.1. Task Checklist L7-1
7.1.2. Support Files L7-1
7.2. Alarm Configuration Database L7-2
7.2.1. Alarm Areas L7-3
7.2.2. Alarm Configurations L7-4
7.3. Alarm Tag Multiply L7-7

8 AlarmWorX64 Viewer 8-1
8.1 Configuring the Viewer 8-3
8.1.1 Adding a Tab 8-4
8.1.2 Adding a Grid or Chart to a Tab 8-6
8.1.3 Adding an Alarm Subscription to a Chart or Grid 8-7
8.1.4 Configuring a Grid 8-9
8.2 Alarm Viewer Runtime Options 8-21
Lab: Viewing Alarms L8-1
8.1 Lab Overview L8-1
8.1.1 Task Checklist L8-1
8.1.2 Support Files L8-1
8.2 Alarm Container L8-2
8.3 Extended Alarm Control Configuration L8-4
8.3.1 Apply the Display Template L8-4
8.3.2 Configure the AlarmWorX64 Viewer L8-4
8.3.3 Tank Monitor Alarm Viewer L8-10

9. AlarmWorX64 Logger 9-1
9.1. Starting the AlarmWorX64 Logger Configurator 9-2
9.2. AlarmWorX64 Logger Configuration 9-2
9.2.1. Configurations 9-3
9.2.2. AlarmWorX64 Logger Subscriptions 9-4
9.2.3. AlarmWorX64 Server-Side Filter 9-4
9.2.4. AlarmWorX64 Client-Side Filter 9-5
9.2.5. Configuring the Database Connection 9-6
9.2.6. Table Management 9-7
9.2.7. Printer Logging 9-9
9.3. Column Definitions 9-10
9.4. Nodes Configuration 9-11

LAB: ALARM LOGGER L9-1
9.1. LAB OVERVIEW L9-1
9.1.1 TASK CHECKLIST L9-1
9.1.2 SUPPORT FILES L9-1
9.2. ALARM LOGGER CONFIGURATION L9-2
9.3. ALARM DATABASE CONFIGURATION L9-2
9.4. ALARM NODE CONFIGURATION L9-4
9.5. VIEWING HISTORICAL ALARMS L9-5
9.6. ALARMWORX64 VIEWER CONTROL L9-5

10. TRENDWORX64 LOGGER 10-1
10.1. TRENDWORX64 LOGGER IN THE WORKBENCH 10-2
10.2. DATABASE CONFIGURATIONS 10-3
10.3. DATABASE GROUPS 10-4
10.4. ADDING LOGGING GROUPS 10-5
10.4.1. DATA COLLECTION 10-6
10.4.2. AUTOMATED DATA COLLECTION TIMES 10-7
10.4.3. YOUR DATA LOGGING STRATEGY 10-8
10.4.4. YOUR TABLE MANAGEMENT STRATEGY 10-9
10.5. ADD TAGS TO A LOGGING GROUP 10-10
10.5.1. ADDING ONE TAG AT A TIME 10-11
10.5.2. CREATING SEVERAL TREND TAGS AT ONCE 10-12
LAB: TRENDWORX64 LOGGER L10-1
10.1 LAB OVERVIEW L10-1
10.2 TASK CHECKLIST L10-1
10.3 SUPPORT FILES L10-1
10.4 CONFIGURE TRENDWORX64 SERVER L10-2
10.4.1 CONFIGURE TRENDWORX64 SERVER L10-2
10.5 TREND LOGGER TAG MULTIPLY L10-7

11. TRENDWORX64 VIEWER CONTROL 11-1
11.1. TRENDWORX64 VIEWER MODES 11-2
11.2. TRENDWORX64 VIEWER PROPERTIES 11-3
11.2.1. APPEARANCE SETTINGS 11-4
11.2.2. ADVANCED SETTINGS 11-4
11.3. TABS 11-5
11.4. CHART VIEW 11-6
11.4.1. GENERAL TAB 11-7
11.4.2. TIME & RATE OPTIONS TAB 11-9
11.4.3. CHART ELEMENTS TAB 11-10
11.5. PLOTS AND PLOT TYPES 11-11
11.6. PEN CONFIGURATION 11-13
11.6.1. GENERAL TAB 11-14
11.6.2. RANGES TAB 11-14
11.6.3. ALARM TAB 11-15
11.6.4. IDEAL PEN TAB 11-15
11.7. THE SIDE PANEL 11-16
11.8. RUNTIME OPERATIONS 11-17
11.9. WORKBENCH VS. GRAPHWORX64 11-21
LAB: TREND VIEWER L11-1
11.1. LAB OVERVIEW L11-1
11.1.1. TASK CHECKLIST L11-1

11.1.2. Support Files L11-1
11.2. TrendWorX64 Viewer Control L11-2
11.2.1. TrendWorX64 Viewer Control Configuration L11-2
11.2.2. The TrendWorX64 Viewer Display L11-7
11.2.3. Trend Popup Display L11-7

12 Unified Data Manager 12-1
12.1 Working with Objects in the UDM 12-2
12.2 Expressions 12-4
12.3 Groups 12-8
12.4 Value Sets 12-10
12.5 Registers 12-13
12.5.1 Bridging Registers 12-15
12.5.2 Aggregation Registers 12-16
12.5.3 Data Prefetch Registers 12-17
12.5.4 Input Registers 12-18
12.6 Triggers 12-19
12.6.1 Data Triggers 12-21
12.6.2 Time Triggers 12-21
12.6.3 Using Triggers 12-25
Lab: Expressions and Registers L12-1
12.1. Lab Overview L12-1
12.1.1. Task Checklist L12-1
12.1.2. Support Files L12-1
12.2. Registers L12-2
12.3. Expressions L12-4
12.4. Adding the 'KeepAlive' Register L12-6

13 Global Aliases 13-1
13.1 Architecture 13-2
13.2 Definition of Global Alias 13-3
13.2.1 A Time Saver 13-3
13.2.2 A Design Aid 13-4
13.3 Alias Resolution 13-5
13.4 Using Themes and Theme Values 13-6
13.5 Configuring Themes and Global Aliases 13-8
13.5.1 Configuration Database for Global Aliasing 13-8
13.5.2 Configuring Themes and Theme Values 13-9
13.5.3 Configuring Global Aliases and Alias Values 13-10
13.6 Using Global Aliases 13-12
13.6.1 Using a Global Alias in a GraphWorX64 Display 13-12
13.6.2 Runtime Parameters of GraphWorX64 Display 13-13
13.6.3 Pick Actions in GraphWorX64 13-15
13.6.4 Global Aliasing with TrendWorX64 13-16
13.6.5 Global Aliasing with AlarmWorX64 13-16
13.7 Global Color Palettes 13-17
13.7.1 About Global Color Palettes 13-17
13.7.2 Configuring Global Color Palettes 13-18
13.7.3 Create a Color Palette Theme 13-18
13.7.4 Add Theme Values 13-19
13.7.5 Edit a Color Palette Alias 13-20
13.7.6 Adding Palette Values 13-21
13.7.7 Import/Export 13-23

13.7.8 Using a Global Color Palette in GENESIS64 Applications 13-23
Lab: Global Aliasing L13-1
13.1. Lab Overview L13-1
13.1.1. Task Checklist L13-1
13.1.2. Support Files L13-1
13.2. Global Alias Configuration L13-2
13.2.1. Theme Configuration L13-2
13.2.2. Alias Configuration L13-3
13.3. GraphWorX64 Implementation L13-4

14. PortalWorX-SL 14-1
14.1. Objectives 14-1
14.2. Introduction to PortalWorX-SL 14-2
14.2.1. Opening PortalWorX-SL 14-2
14.3. Switching Between PortalWorX-SL and Workbench-SL 14-3
14.3.1. From PortalWorX-SL to Workbench-SL 14-3
14.3.2. From Workbench-SL to PortalWorX-SL 14-4
14.4. Ribbons 14-5
14.4.1. File Ribbon 14-6
14.4.2. Home Ribbon 14-10
14.4.3. Layout Ribbon 14-12
14.4.4. Project Ribbon 14-17
14.5. AssetWorX Navigator 14-25
14.5.1. What is AssetWorX Navigator? 14-25
14.5.2. AssetWorX Navigator in PortalWorX-SL 14-27
14.5.3. Using Commands Through AssetWorX Navigator 14-28
14.5.4. Saving Files for Display in PortalWorX-SL 14-33
14.6. Viewers 14-34
14.6.1. AlarmWorX64 Viewer 14-34
14.6.2. Energy AnalytiX Viewer 14-41
14.6.3. FDDWorX Viewer 14-48
14.6.4. GridWorX64 Viewer 14-55
14.6.5. GraphWorX64 Viewer 14-59
14.6.6. Report Executor 14-63
14.6.7. ReportWorX Viewer 14-67
14.6.8. TrendWorX64 Viewer 14-71
Lab: PortalWorX-SL L14-1
14.1. Lab Overview L14-1
14.1.1. Task Checklist L14-1
14.1.2. Support Files L14-1
14.2. Preparing Existing Files for Use in PortalWorX-SL L14-2
14.2.1. Preparing Files for Use in PortalWorX-SL L14-2
14.2.2. Saving a Display as a Silverlight Version L14-2
14.2.3. Saving a TrendWorX Viewer as a Silverlight Version L14-4
14.2.4. Defining Web Part Zones in PortalWorX L14-4
14.2.5. Adding Viewer Web Parts to Zones L14-8
14.2.6. GraphWorX64 Viewer L14-8
14.2.7. TrendWorX64 Viewer L14-9
14.2.8. AlarmWorX64 Viewer L14-10
14.2.9. Saving your Layout L14-11

15 SECURITY 15-1
15.1 SECURITY SYSTEM COMPONENTS 15-2
15.2 GLOBAL SETTINGS 15-3
15.2.1 CRITICAL POINTS 15-6
15.2.2 CRITICAL ALARMS 15-7
15.3 SECURITY OBJECTS AND THEIR RELATIONS 15-8
15.3.1 GROUP 15-8
15.3.2 USER 15-8
15.3.3 GROUPS AND USERS 15-10
15.3.4 ACCOUNT POLICIES 15-11
15.4 SECURITY PRIVILEGES 15-15
15.4.1 PROCESS POINTS 15-16
15.4.2 ALARMS 15-17
15.4.3 FILES 15-17
15.4.4 STATIONS 15-19
15.4.5 METHODS 15-20
15.4.6 ASSETS 15-20
15.4.7 PERMISSIONS 15-21
15.4.8 WILDCARDS AND PERFORMANCE OPTIMIZATION 15-21
15.5 LOGGING-IN AND LOGGING-OUT 15-22
15.5.1 SECURITY LOGIN DIALOG 15-23
15.5.2 MULTIPLE LOGINS 15-24
15.6 ADVANCED SETTINGS 15-25
15.6.1 HIDING GRAPHWORX64 LAYERS BASED ON SECURITY 15-25
15.6.2 THE ?DATAPOINT:TAGNAME FEATURE 15-26
15.6.3 HIDING OR SHOWING OBJECTS BASED ON USER PERMISSIONS 15-28
15.6.4 LAYERS 15-31
15.7 FRAMEWORX64 SERVER 15-34
LAB: SECURITY L15-1
15.1 LAB OVERVIEW L15-1
15.1.1 TASK CHECKLIST L15-1
15.1.2 SUPPORT FILES L15-1
15.2 SECURITY USERS L15-2
15.3 SECURITY GROUPS L15-4
15.4 FRAMEWORX64 COMMUNICATION OUTLINE L15-5
15.5 FRAMEWORX64 NODE DISCOVERY L15-7
15.6 FRAMEWORX64 TESTING L15-9
15.7 PLATFORM SERVICES CONFIGURATION L15-12

A. GRAPHWORX64 SHORTCUTS A-1

B. DELIMITERS AND SYNTAXES B-1

C. GLOSSARY C-1

D. GRIDWORX64 1
D.1 GRIDWORX64 SERVER CONFIGURATOR 2
D.1.1 CONNECTIONS 3
D.1.2 CREATING A DATA SOURCE (SIMPLE SQL DESIGNER) 4
D.2 CREATE A GRID USING GRIDWORX64 11
D.3 CREATE A GRID IN A GRAPHWORX64 DISPLAY 12
LAB: GRIDWORX64 CONFIGURATION LD-1

D.1. Lab Overview LD-1
D.2. Task Checklist LD-1
D.3. Support Files LD-1
D.4. GridWorX64 Configuration LD-2
D.4.1. Connecting to a Database LD-2
D.4.2. Create a Data Source LD-4
D.4.3. Create a Data Item LD-6
D.4.4. Create a Data Manipulator LD-7
D.5. Interacting with Data from GraphWorX64 ..... LD-9
D.5.1. Adding GridWorX64 Viewer LD-9
D.5.2. Configure a GridWorX64 Viewer for Database Data. LD-10
D.5.3. Configure Data Entry Fields LD-11
D.5.4. Using Filters in Runtime LD-12

LE. Lab: Recipes (Value Sets) LE-1
E.1. Lab Overview LE-1
E.1.1. Task Checklist LE-1
E.1.2. Support Files LE-1
E.2. Value Sets LE-2
E.3. Changing Recipes in GraphWorX64 ..... LE-3
E.4. Using Parameters LE-5

LF. Lab: Pivot Tables LF-1
F.1. Lab Overview LF-1
F.1.1. Task Checklist LF-2
F.1.2. Support Files LF-2
F.2. Creating a New Display LF-2

LG. Lab: Remote Configuration LG-1
G.1. Lab Overview LG-1
G.1.1. Task Checklist LG-1
G.1.2. Support Files LG-1
G.2. Viewing Displays in Internet Explorer LG-2
G.3. Remote Workbench LG-7

Introduction to GENESIS64 1

Look around. In any modern industrial economy, the water you drink, the food you eat, the clothes you wear, the energy you use, and the myriad other necessities and amenities of life are made possible through computer-aided observation and control of automated systems used to process them. Industrial automation takes data issued by devices, puts them into a form that can be sent over a network, and delivers that data to the computer that has the software necessary to process it. Process control, in turn, takes commands issued by automation software on a computer and sends them to the correct device(s) where each command is translated into action. For this scheme to work in an open system (multi-vendor environment), devices and systems must be discoverable, communication must use known transport protocols, and data must be in a predictable format– all of which require standards.

The software you will be learning in this course, the ICONICS GENESIS64 automation suite, is an open system software suite based on Microsoft Windows and industry standardized networking protocols. Listed below are some applications and functions within the GENESIS64 suite:

- Displays process data in near real-time within GraphWorX64
- Allows hierarchical organization with AssetWorX
- Monitors events and alarm conditions with AlarmWorX64
- Logs historical data for analysis with TrendWorX64 or with the unique high speed Hyper Historian
- Displays geographical information for your assets with EarthWorX64
- Displays database data from various sources with GridWorX64

GENESIS64 allows you to construct Graphical User Interfaces (GUIs) in a visual object-oriented development environment. Your displays can model your processes or systems such that controls look and feel just like real devices. GENESIS64 masks the complexity of the underlying data in a way that it displays only the information that an operator needs, which uses configuring controls and presents them in a meaningful, instantly recognizable way. You can change flows with simulated dials, observe temperatures with simulated thermometers, check tank levels with a cut-a-way figure showing the water level in the tank – practically anything you can think of!

With scripting, aliasing (variables), reusable Microsoft .NET Framework components, open standards, and being Web-enabled, GENESIS64 works seamlessly in a multi-vendor environment. Once you learn how to use GENESIS64 products, you can reuse components, apply complex shapes and controls with mouse click, and rapidly develop the displays you need.

Consider the Industry Case Studies in the GenDemo application (Figure 1.1) as an example of the possibilities with GENESIS64. Each case study was built using GENESIS64 technology. To see these case studies in GENESIS64, click Start → All Programs → ICONICS → GENESIS64 → GenDemo. Click on the text for *Examples* on the left to load the Industry examples. Select GENESIS64 or GENESIS32 in the options that load on the left (GENESIS64 examples can also be accessed from the Navigation Menu → Industries tab). Then click on an image to open a display with sample data.

Figure 1.1 - GenDemo: Industry Case Studies

After completing this chapter, you should:

- Understand the GENESIS64 architecture
- Know how to open a display
- Distinguish Configuration mode from Runtime mode
- Know how to connect a process point or dynamic to device data
- Understand OPC UA and other OPC specifications
- Know the different applications in the GENESIS64 Suite
- Understand the benefits of using GENESIS64 on Microsoft Silverlight and with Windows Operating System features

1.1. GENESIS64 Architecture

GENESIS64 is a massive suite of applications. Naturally, you are wondering, “Where do I start?” and “How do the applications communicate?”. Luckily, we have created a single location to manage all your project details; the Workbench.

You can perform all system configurations in the Workbench. From your Alarm Server configuration, to your system security, to configuring your HMI displays, you can do it all within the Workbench. The GENESIS64 application architecture is shown in Figure 1.2 below. The Workbench offers a centralized configuration environment for layers labeled Application Servers and Platform Services.

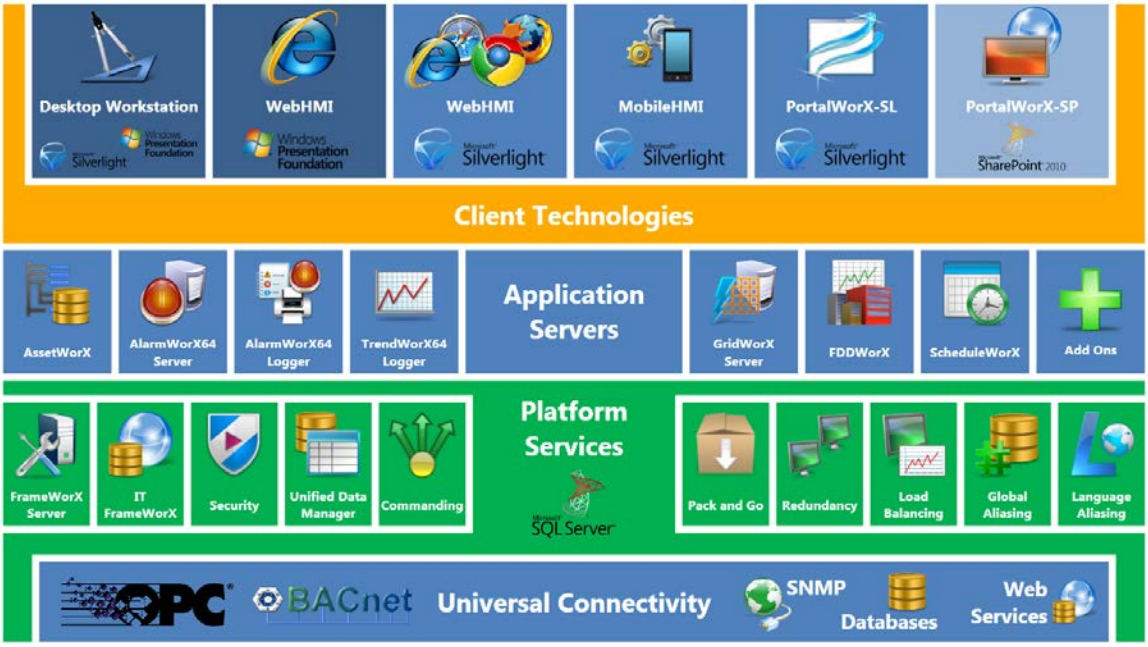


Figure 1.2 - Architecture

As you see from Figure 1.2, you can connect to and configure many different GENESIS64 modules within the Workbench. Some of the applications that you can access include:

- ICONICS viewers (.NET controls) for GraphWorX64, TrendWorX64, AlarmWorX64, EarthWorX, Push Pin, Smart Pin, and Pipe
- Server configuration utilities such as the AlarmWorX64, Security, Licensing, and many others
- ICONICS utilities such as Global Aliasing, Language Aliasing, Unified Data Manager and others, which are front ends to SQL Server data stores
- Communication server configurations for the FrameWorX (OPC UA) server, GenTray (for GenBroker), BACnet, SNMP, and more

Aside from the utilities and the configurators, we have containers for viewing different types of data in the Workbench. These containers are also controls that you can add into GraphWorX64 displays. Unlike GENESIS32, where containers are standalone applications, most containers in GENESIS64 can only be configured and run within the Workbench. The GraphWorX64 container is the only one in the GENESIS64 suite that allows for configuration and runtime without going into the Workbench. Like the Workbench, you can configure and even go into runtime mode to view data using these containers.

1.1.1. Configuration vs. Runtime

When you create or edit a display, you are in configuration mode where you may see a button in the top right hand corner of the display that says Runtime. Runtime is the mode in which data is accessed, while Configuration mode allows you to modify the display or environment while viewing sample data only. In runtime, you may see a button on the display that says Configuration that lets you switch to configuration mode. However, in a display that has been opened in Runtime Only Mode for operators, you won't see a button in runtime that would let you switch to configuration mode.

In Figure 1.3, the Workbench is shown in runtime mode; to open this display in configuration mode you would go to Configuration mode and use the navigation tree on the left to right-click the display and choose an Edit Display menu item.

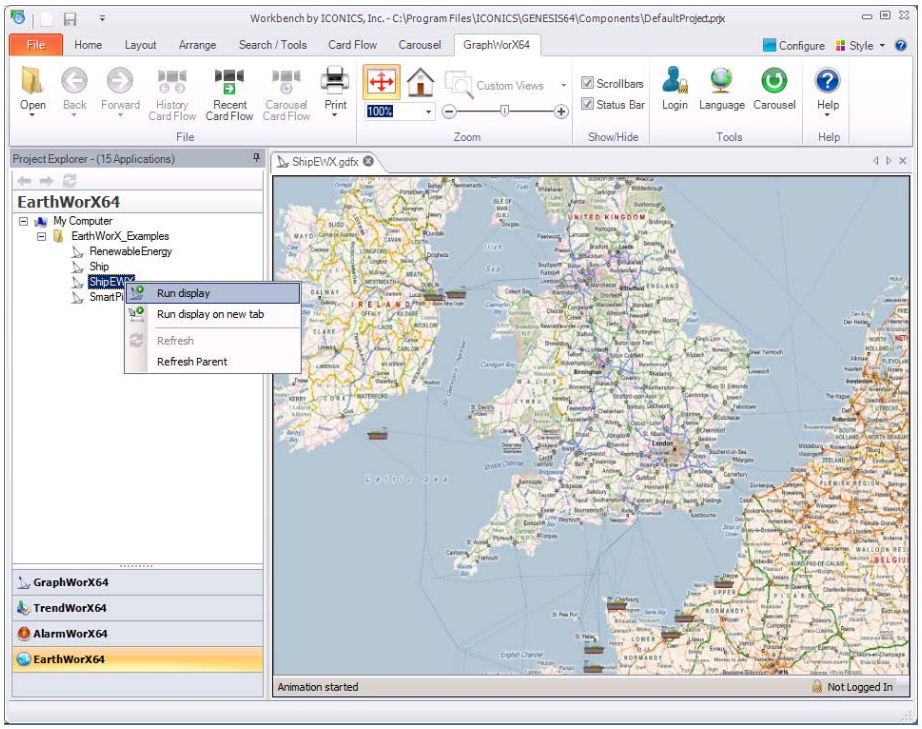


Figure 1.3 - Workbench: EarthWorX64 Display in Runtime

A GENESIS64 application is created and edited in Configuration mode only. In Configuration mode, you have access to all of the objects in the viewers, their properties, and the methods (commands or operations) you can apply to each object. The object hierarchy for the viewer objects uses the PEM model (properties, events, and methods) that characterizes visual development environments such as Visual Basic. A gauge is shown in Configuration mode within the work area in Figure 1.4.

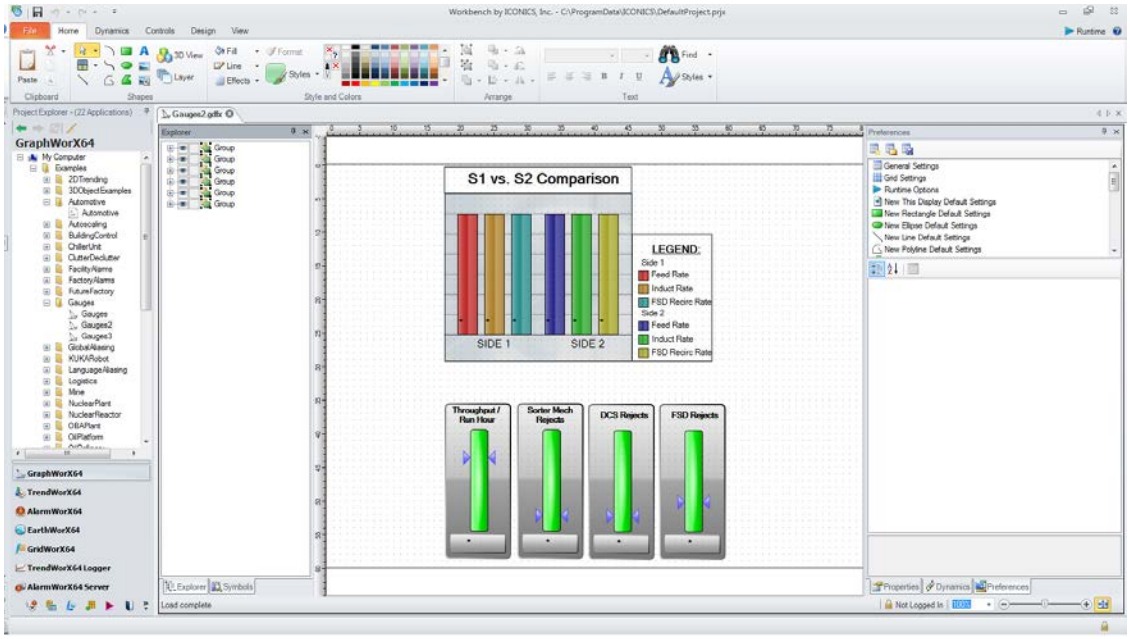


Figure 1.4 - Workbench: Gauges in GraphWorX64

Some applications in the Workbench, such as AlarmWorX64, have a preview mode that allows you to view sample data. However, the data shown are for display purposes and do not match data coming from your OPC server. When you want to see your display with real data, you click the Runtime button (located at the right of the menu bar) to switch the display into Runtime mode. To make additional changes you switch back into Configuration mode by clicking the Configuration button.

Servers and configuration utilities in the Workbench use online forms for enforcing settings on the servers and services. If you are familiar with the Microsoft Management Console (MMC), then the forms used by the Workbench should seem familiar to you.

Figure 1.5 shows a form for the default account policy in the Security Server. ICONICS security provides access to user and group accounts using policies applied to these security objects.

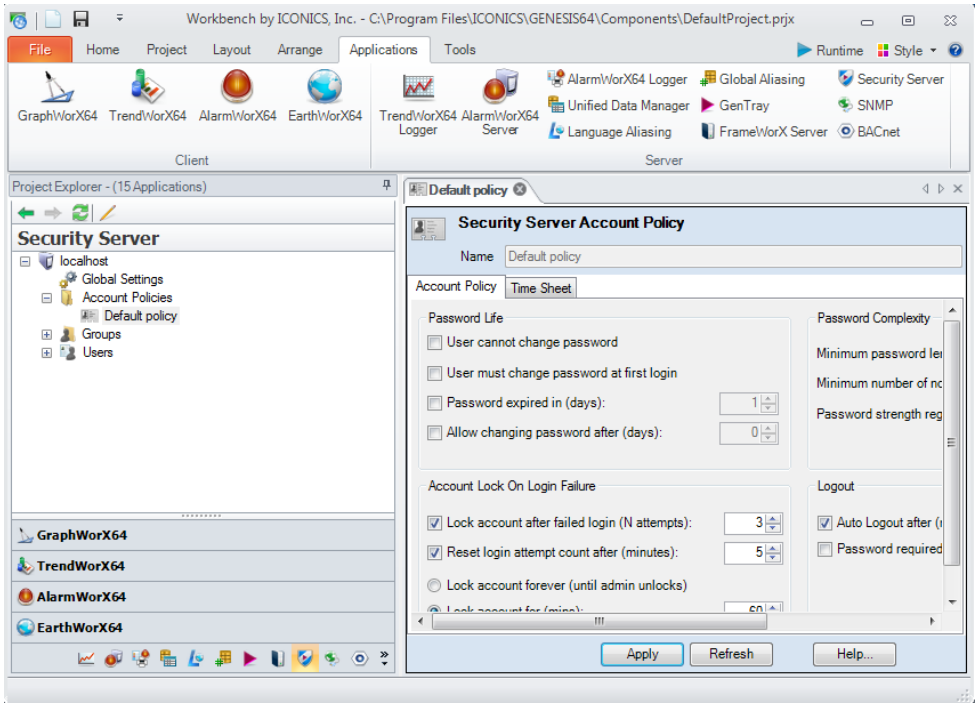


Figure 1.5 - The Security Configuration

The unification of applications into the Workbench environment means that the tools used can be common to all applications. You will find that templates, layouts, shapes, colors, and many other facilities are manipulated identically in GENESIS64 applications, making it easier to learn and use.

The complete collection of server settings, application defaults, opened displays, and other aspects of a working environment are saved into a GENESIS64 *project file* (.PRJX). A project file can be packaged (zipped) and that package can be deployed in additional locations with minimal effort.

1.2. ICONICS System Options

Users have different options in installing a comprehensive ICONICS system solution, including Simple Visualization, Normalized Visualization, and Visualization with Calculations.

Simple Visualization

The Simple Visualization, as pictured in the following figure, option entails data connections from multiple sources passing through ICONICS FrameWorX Servers then, utilizing users' preferred communications technologies (such as BACnet or Modbus Ethernet, for example), providing data to visualization dashboards.

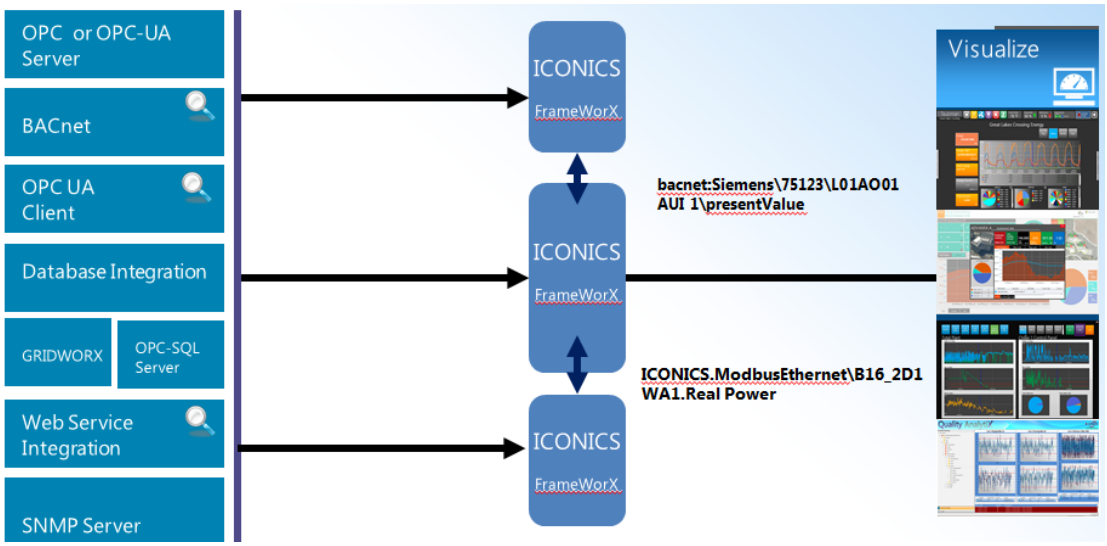


Figure 1.6 - Simple Visualization Option

Normalized Visualization

The Normalized Visualization option, as pictured in the following figure, entails data connections form multiple sources passing through ICONICS FrameWorX Servers, similar to the Simple Visualization option. However, this data can then be branched through an ISA-95-compliant, asset-based utility such as ICONICS AssetWorX, as well as through a more traditional, Windows explorer-based utility such as ICONICS' Unified Data Manager tool. The benefits of both these approaches will be discussed in this training. The data from either branch then re-enters ICONICS FrameWorX Server to then proceed to visualization dashboards.

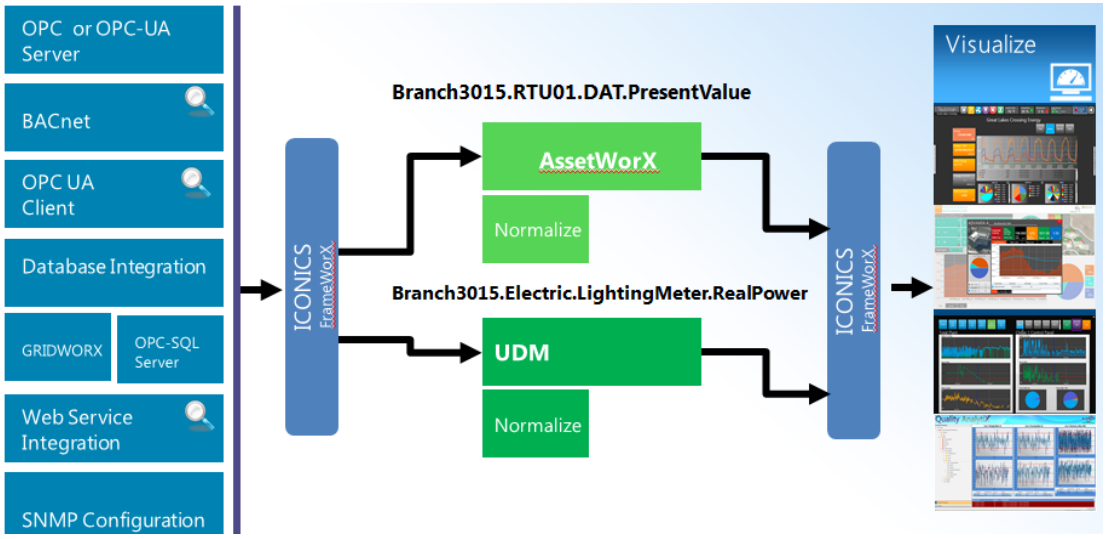


Figure 1.7 - Normalized Visualization Option

Visualization with Calculations

The Visualization with Calculations option, as pictured in the following figure, uses the same concept as the Normalized option, but includes the ability to perform calculations with the data using ICONICS Expression Engine. Of course, users can still opt to send the data directly, without calculations, as noted below.

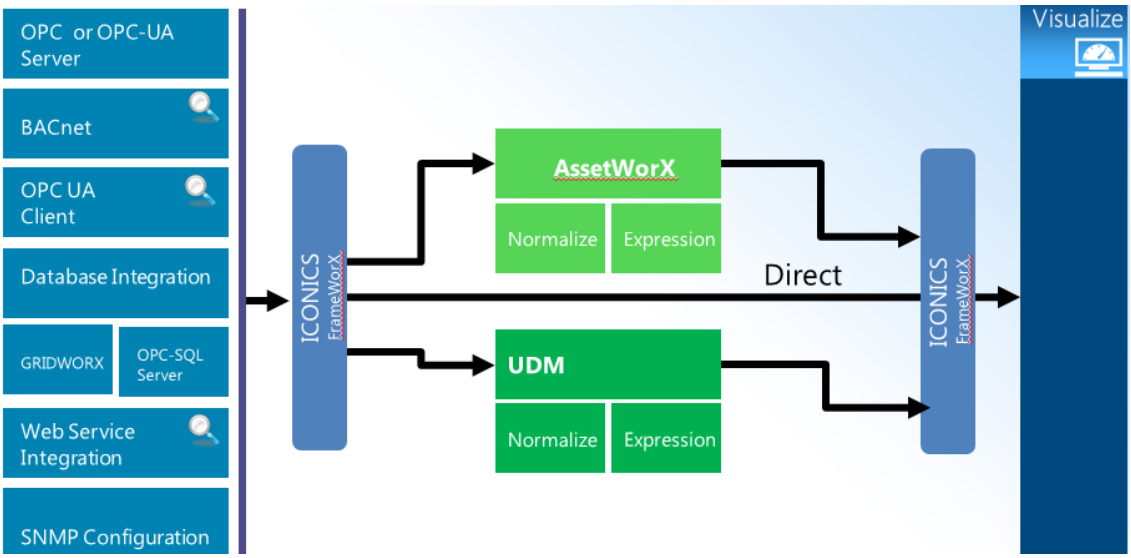


Figure 1.8 - Visualization with Calculations Option

Additional Choices and Applications

Additional choices are available depending on which approach you select. For instance, if you decide upon a Normalized Visualization or Visualization with Calculations option, you could add a Fault Detection and Diagnosis and/or Energy Analysis component to your asset-based (incorporating AssetWorX technology) approach, as shown below.

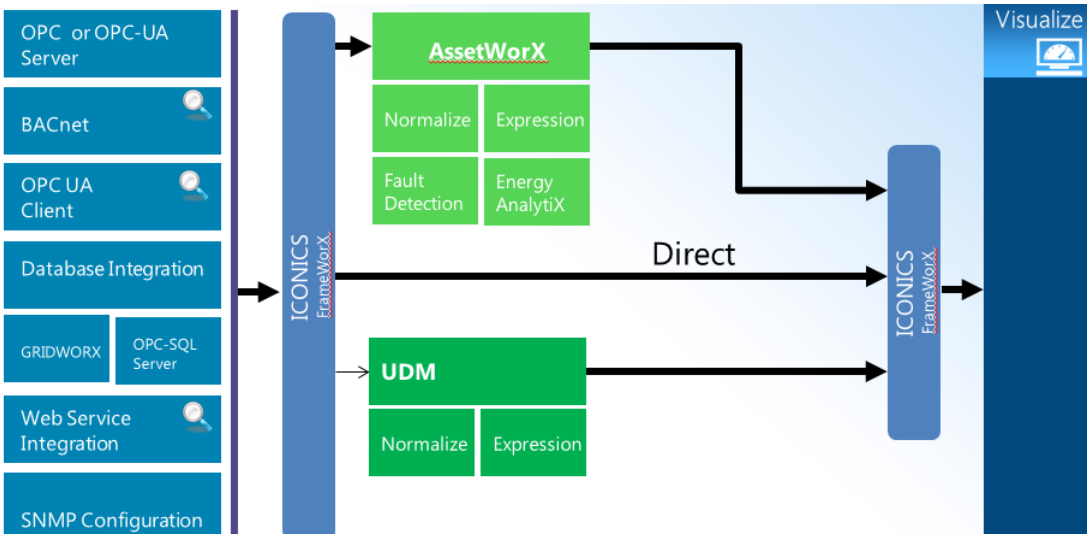


Figure 1.9 - Additional Choices for Normalized Visualization or Visualization with Calculations Options

ICONICS provides additional customization via add-on components such as an Alarm Server, Alarm Logger, Hyper Historian, Performance Calculations and SPC, SQL-integration, Productivity Analysis, User Security, Global Alias Server, Language Alias Server and more.

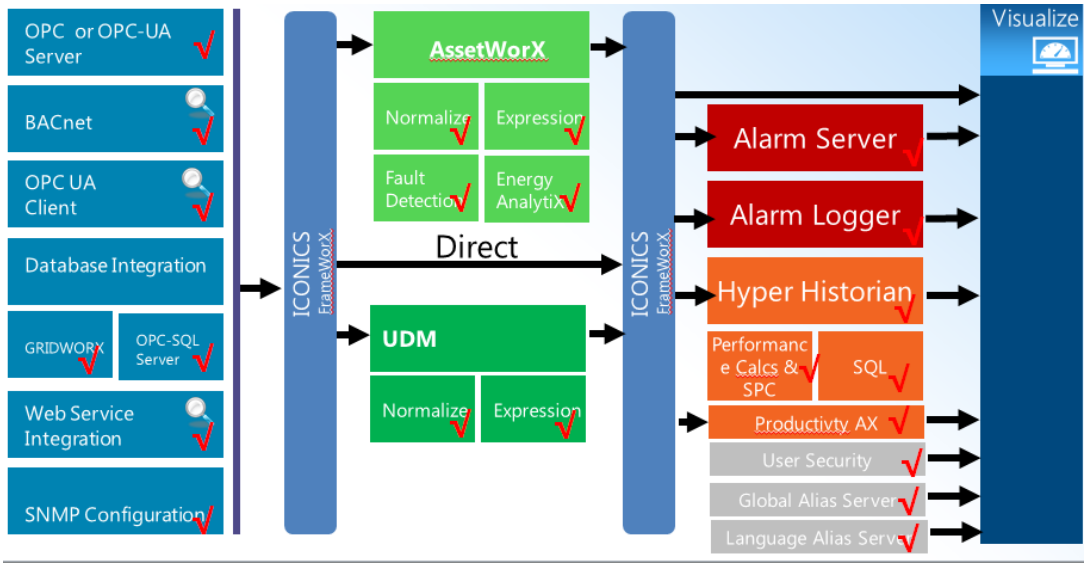


Figure 1.10 - Additional Applications

1.3. PLCs, OPC, BACnet, SNMP and GENESIS64

Consider a simple device like a resistance thermometer that is used to measure temperatures. Resistance thermometers use platinum films or wires because platinum exhibits a linear resistance to temperature ratio. A highly accurate four wire Kelvin connection thermometer (the additional wires are used to cancel out lead resistances) like the one in Figure 1.11 has the property that, at a constant voltage, the resistance measured changes linearly with temperature.

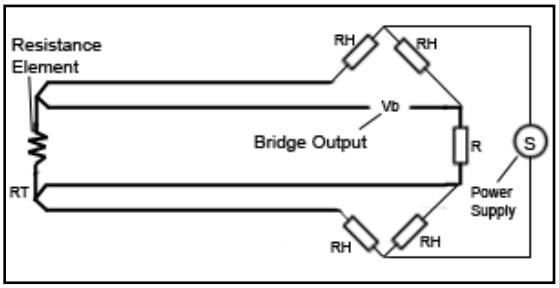


Figure 1.11 - A Four-wire Resistance Thermometer

A computing device can sample the value of the resistance, and that value is then converted from the value in ohms to a temperature measurement based on a standard physical property. While this device has one measurement of interest (the temperature as converted from the resistance), in order for the information to be useful, the temperature value needs to be packaged with additional pieces of information, including:

- The address and identification of the thermometer
- The time that the sample was collected
- The units of measure (Fahrenheit or Celsius, for example)
- The precision of the measurement

Even though the field data sought is a single value measurement, at least three or four related values must be transmitted with it to make the data useful; and they must be packaged in such a way (addressed) that allows the data to be found (browsed) and understood.

1.3.1. Programmable Logical Devices (PLC)

At the lowest level, sensors and other devices are wired into collection devices where data sources are identified (tagged), aggregated (collected), and transmitted (when required). Originally, large automation systems were proprietary hardware/software solutions referred to as Distributed Control Systems (DCS). But the advent of Ethernet and server-based network operating systems (Windows, Netware, and UNIX) led to the development of aggregation devices called Programmable Logic Controllers (PLC). Figure 1.12 shows an example of a Programmable Logic Controller (PLC).

Figure 1.12 - PLC Modules

A PLC is a small computer industrially hardened against dust, moisture, heat, cold, etc. The PLC's embedded operating system is an example of a real-time operating system since input conditions are expected to result predictably in corresponding outputs within a defined period and in a particular order. Programs to control the inputs and outputs (I/O) are typically stored in non-volatile, battery-backed memory. These programs coordinate the reading of inputs and writing of outputs to and from digital and analog sources such as temperature and pressure sensors, limit switches, actuators, electric motors, pneumatics, relays and solenoids. Some even use machine vision. PLCs can have simple I/O built into a single unit or may have external I/O modules attached to a network.

1.3.2. OPC Servers

The appearance of PLC devices led to the specification of some large industrial projects in the late 1980's and early 1990's, particularly in the automobile industry in which Ford Motors was a prominent example. In order for vendors' products to interoperate, several vendors got together to create a standard based on PLC communications. One of these efforts was the industry task force that eventually became the OPC Foundation (http://www.opcfoundation.org/). The OPC Foundation released the first set of standards in 1994 based on Windows as the operating system and Ethernet networks as the transport.

OPC originally stood for Object Linking and Embedding for Process Control; a name chosen because the technology was based on Microsoft's inter-application communication (IAC) standard at the time, OLE. The rise of the Internet led Microsoft to update OLE with first, the Common Object Model (COM), and in rapid fashion DCOM (Distributed COM). DCOM added the ability to communicate with remote networked systems.

You can recognize software built using DCOM because it loads ActiveX components into a browser or into a container application. GENESIS32 versions 5 through 9 all used ActiveX technology inside container applications.

The OPC standard specifies a set of objects, interfaces (APIs), and methods that are used by automation software in an open system. OPC bridges devices like PLCs and DCS to client applications using applications called *OPC servers* that communicate using the OPC protocol. An OPC server can be a local service running on the same system as the client (also known as the *localhost*), on a server on the LAN, or somewhere in the clouds (WAN).

OPC communication eliminates the need for developers to write individual device drivers to connect clients to individual devices. As long as a client understands the correct flavor of OPC, the connection or "subscription" may be made. OPC ended up publishing a number of different specifications based on DCOM as they embraced different classes of devices. Eventually OPC included:

- OPC Data Access (OPC DA). This set of standards connects real time data acquisition devices to applications.
- OPC Alarm and Events (OPC AE). These standards provide event-based alarm communication.
- OPC Historical Data Access (OPC HDA). Historical data access specifies how to log data to a data store and retrieve the data for later analysis.
- OPC Security. This specification sets the protocol for applications to securely communicate with OPC devices and systems.
- OPC Batch. The batch standard offers communication methods useful for batch processing needs.
- OPC XML-DA. XML DA extended the Data Access specification so that it communicates using XML over Microsoft Simple Object Access Protocol (SOAP).
- OPC Complex Data. This specification extended OPC to include binary data, complex data objects (like BLOBs), and XML documents.

Of the different standards it is only the first three – OPC DA, OPC AE and OPC AE – that find widespread use.

You can now see the reasons for the origin of individual ICONICS GENESIS applications to support each of the different standards:

- GraphWorX supports OPC DA access
- AlarmWorX is used for OPC AE access
- TrendWorX is used for OPC HDA access

Each application leverages the different capabilities of the individual types of OPC data. The GenBroker service (introduced into GENESIS32 version 6) facilitates the need for remote OPC communication, overcoming communication hardship via DCOM.

1.3.2.1. *OPC UA*

ICONICS GENESIS64 (version 10) is based on the newest OPC standard, called OPC Unified Architecture (OPC UA). OPC UA is based on the Microsoft .NET Framework and is meant to leverage the capabilities of object oriented languages such as C#. OPC UA specifies a Service Oriented Architecture (SOA) with multi-platform implementation using ANSI C, Java, or .NET. OPC UA data sources communicate through the ICONICs FrameWorX64 server in GENESIS64.

OPC UA defines a classic object-oriented address space. Items exist in an object hierarchy and can contain objects of other types. Objects based on another object have the property of inheritance, they start with all of the properties, events, and methods (PEM) of the parent and add additional properties to that. Figure 1.13 shows a view of part of the OPC UA address space.

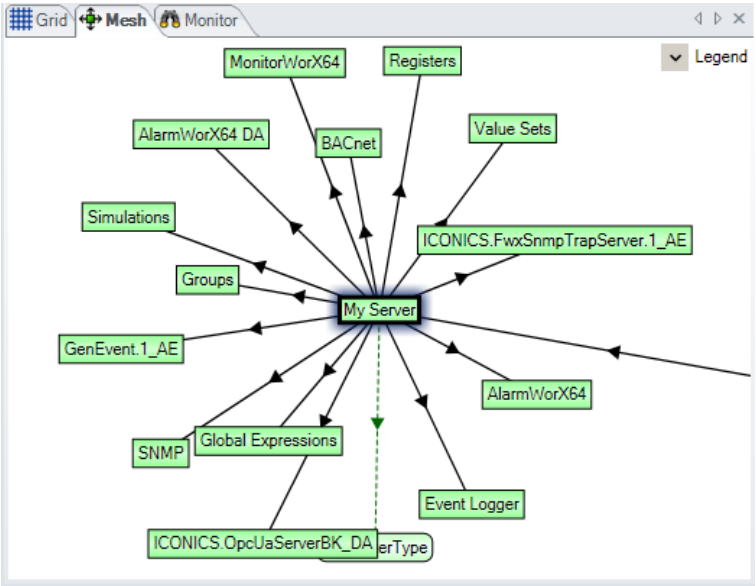


Figure 1.13 - Mesh Browser

In a process control system, a boiler, a sensor, or valve can be an object, and so forth. It is only necessary that the address of the object be unique so that you can differentiate sensor 1 from sensor 2 regardless of the boiler. The data associated with any object is expressed as the *value that is assigned to a property* of that object. Therefore, the assignment of an object property to a process point in GENESIS64 represents the data connection.

Objects have one-way relationships to other objects, and the relationships themselves are objects with properties. In the OPC UA namespace, you can define hierarchical and structural relationships, as well as mesh-line and free form relationships. Vendors may define their own address spaces as long as they follow the rules of OPC UA. Eventually OPC UA will replace OPC based on DCOM, but GENESIS64 still contains GenBroker to allow older protocol devices to be observed and controlled.

1.3.2.2. *Data Displays*

Figure 1.14 shows a display of a building of HVAC sensors for a well-known casino. This display was built using the GENESIS automation suite. Notice that the display contains a combination of digital signals (states and alarms) and analog signals (values) from multiple devices. On the display, flow data is shown numerically, in white text boxes which are READ only, as well as graphically.

A display can also show alarms, maps, and trends, which can be added to a GraphWorX64 display as TrendWorX64, AlarmWorX64, and EarthWorX64 viewers.

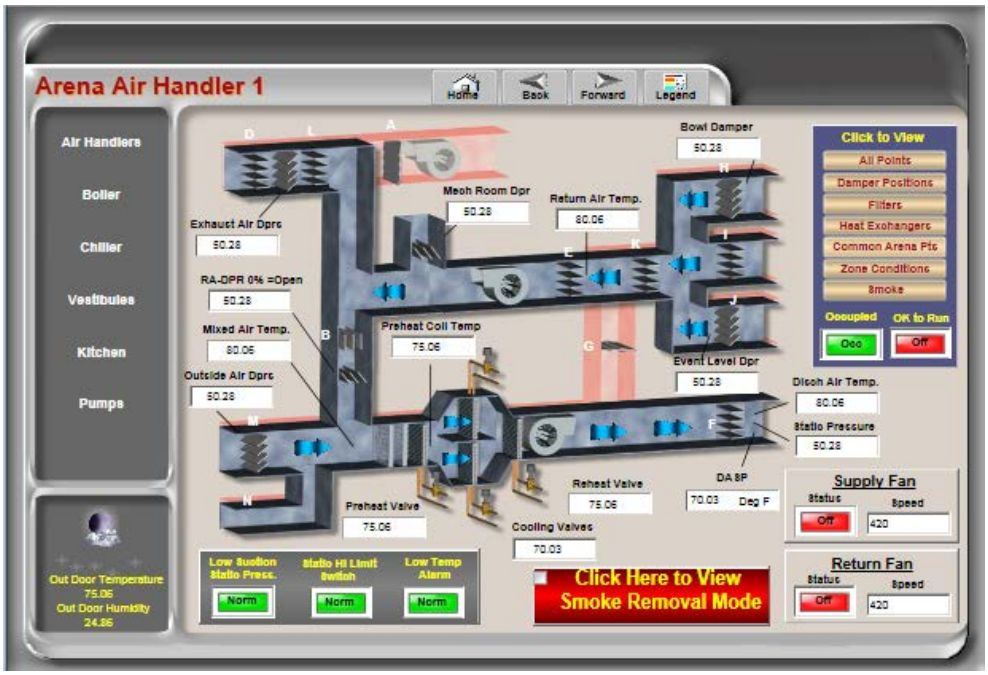


Figure 1.14 - An HVAC Display with Multiple Process Points

This type of display is commonly referred to as a Human Machine Interface (HMI); or alternatively the display portion of a SCADA or Supervisory Control and Data Acquisition system. HMI or SCADA is just industry jargon for a GUI display.

The displays generally show only the data of interest, which represents only a small fraction of the data that the underlying devices are transmitting and which are received and/or stored. Each switch can be drawn to show its state: closed, open. Underlying the display is process logic that the developer creates to control behavior. For an alarm condition, perhaps the developer will choose to draw the affected portion of the system in red, or flash an alarm. Or maybe the developer will include a button on the screen that can initiate an action. All of these options are made possible by monitoring a point coming from the OPC Server. Such points are called *OPC Tags* or *process points*.

1.3.2.3. *OPC Tags*

Consider the schematic of a boiler shown in Figure 1.15 with three different process points:

- the top temperature sensor outputs the temperature of the return fluid,
- the middle sensor indicates whether an alarm condition exists, and
- the bottom temperature sensor outputs the temperature of the supply fluid.

These three sensors can all be wired into a single PLC device and transmitted to a single OPC server where the data is aggregated into a data set. Then that data set can be transmitted as a unit or single transaction. Alternatively, the two real-time data sensor temperature outputs could be sent to one OPC server that is a process system while the alarms are sent to another OPC server for events. OPC UA is flexible enough to handle either scenario.

Figure 1.6 - GenDemo: Boiler Display

From the standpoint of a client, the connection to meaningful data values defines a data point as opposed to the method used to package the data and communicate it. If an OPC server exposes the OPC data as a single object (all three values) – for the sake of simplicity let's call the object "Boiler" – GENESIS64 would require you to browse the OPC UA data as a single object that shows all of the different individual values. If instead there were two objects, one called "Flows" (with temperatures) and another called "Alarms" (with events), then GENESIS64 would require that you browse two different OPC UA objects in order to assign a data source to a process point on a display.

In either scenario, there are three values connected to the display and GENESIS64 treats both scenarios as if there were three individual data points, also called tags. A tag is therefore considered to be the connection of a GENESIS64 display to a single useful value.

Note that a tag was defined as the connection to a *meaningful data point*. A temperature value or alarm condition is meaningful data. However, when you are dealing with data that is multi-valued, the entire definition of the data point is part of the same tag. In EarthWorX64, GPS locations are used, which include values for latitude, longitude, and altitude. Each value would be meaningless without the other two, so the connection to all three values as a unit is considered to be a single tag.

To take this one step further, if you have a truck moving on your EarthWorX64 map and you show location, load condition, and direction, then you consume two tags. The first tag is for the GPS location, as described in previously. The second tag is for the load condition: whether it is empty, full, or in a partially loaded state. The third displayed metric for direction is not assigned a tag value because it is based on a calculation between the last two GPS locations – with the vector connecting the two – defining a direction in your display's coordinate system.

Since ICONICS GENESIS64 uses the number of tags as part of its licensing scheme, you can see that the number of tags used has real-world financial implications. So keep in mind that objects in OPC UA can be complex data types, while usage defined by their tag values can be either simple (single-valued) or complex (multi-valued).

1.3.3. BACnet

BACnet is a non-proprietary system, initially developed through the combined efforts of both building management system vendors and customers. According to the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standing Standard Project Committee 135, BACnet is "a data communication protocol for building automation and control networks." Also according to ASHRAE, BACnet, "is an American national standard, a European standard, a national standard in more than 30 countries, and an ISO global standard." For more information about BACnet, please visit *www.bacnet.org*.

A data communication protocol is a set of rules governing the exchange of data over a computer network. The rules take the form of a written specification that spells out what is required to conform to the protocol; they govern the exchange of data over a computer network. These rules spell out what is required to conform to the BACnet protocol. What makes BACnet unique is that its rules relate specifically to the needs of building automation and control equipment; they cover things like how to ask for the value of a temperature, define a fan operating schedule, or send a pump status alarm. Common BACnet applications include HVAC controls, fire detection and alarm, lighting control, security, "smart" elevators and utility company interfaces.

BACnet Client-Server Architecture

BACnet is based on a client-server model. BACnet messages are called "service requests." A client machine sends a service request to a server machine that then performs the service and reports the result to the client. BACnet currently defines 35 message types that are divided into 5 groups or classes.

One class contains ***messages*** for accessing and manipulating the properties of the objects described above. A common message is the "ReadProperty" service request. This message causes the server machine to locate the requested property of the requested object and send its value back to the client. Other classes of services deal with ***alarms and events***; ***file uploading and downloading***; managing the ***operation of remote devices***; and ***virtual terminal functions***.

ICONICS BACnet solutions integrate BACnet communications into the GENESIS64 and GENESIS32/Workbench32 product families. **ICONICS BACnet** solutions address customers' facility monitoring needs. Facility Engineers, facility managers and others involved with building management will appreciate its integration with ICONICS GENESIS32/Workbench32 and GENESIS64 HMI/SCADA suites.

Note that ICONICS is compliant with ANSI ASHRAE Standard 135-2008.

NOTE: Types which are part of the specification above are supported by ICONICS as well as other BACnet standards. ICONICS supports read/write property for all BACnet objects, but only the objects defined in ANSI ASHRAE Standard 135-2008 would be correctly shown in ICONICS clients (e.g. GraphWorX64).

1.3.4. SNMP

SNMP stands for Simple Network Management Protocol, and is a simple protocol that allows devices to expose useful information to other devices. This information can be the CPU fan speed of a computer or the routing table of the router. Almost every network device answers to SNMP requests. SNMP gives Network Managers access to information from nearly every device connected to the Network.

An SNMP network consists of a Network Management System (NMS), Managed Devices, and agents. NMS is software that collects data from the devices, organizes it, and shows it to the end user. The ICONICS SNMP connector functions as a manager in an SNMP scenario. An NMS would monitor or control managed devices that provide SNMP information through the agents. An agent is software that runs on a device (such as a router, printer or PC) and answers to the messages from the NMS. These messages can either be ***read*** messages (NMS wants to retrieve data) or ***write*** messages (the manager wants to set data). The agent can also send a ***trap*** to the NMS. A trap is a notification similar to an alarm, such as "the CPU Temperature is too high!" For more information, refer to SNMP Basic Components, and SNMP Basic Commands.

Each variable that SNMP can read/write is identified in the form of an Object Identifier (OID). The OID identifies the information in a sequence of numbers. For example, 1.3.6.1.2.1.1.1 is an OID that describes the description (*sysdescr*) of the device. All of the OIDs for a device make up the MIB (Management Information Base), which represents all the data that the device can expose through SNMP. This information for a device is provided by the manufacturer in the form of a MIB text file. This MIB file acts as a dictionary for the device. The MIB files can be used by the NMS to translate numerical OID strings into human-readable text. For example, 1.3.6.1.2.1.1.1 can be translated as "iso.org.dod.internet.mgmt.mib-2.system.sysdescr", which describes the location for sysdescr (the description of the system) that is inside the folder "system" which is inside "mib-2", and so on.

ICONICS' SNMP provider allows you to create your own Network Management Systems. It allows you to manage the network through SNMP and perform Supervisory Control and Data Acquisition (SCADA through OPC) with the very same application. Moreover, you can monitor and manage the Ethernet-based PLC-control networks through SNMP for a complete and universal network management.

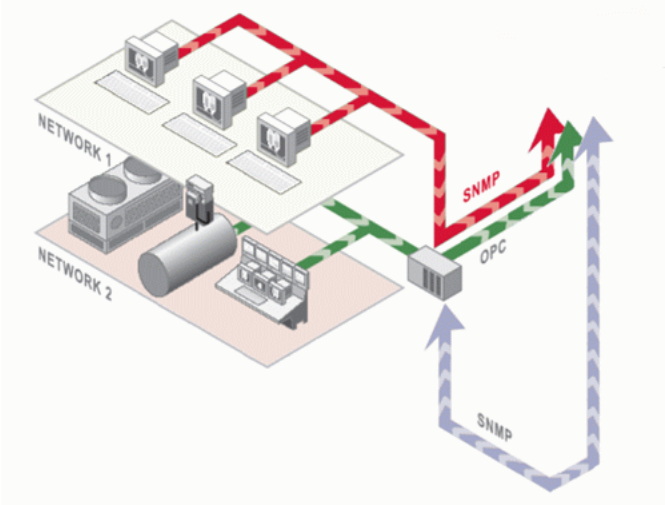


Figure 1.16 - Network Management Using SNMP Connector

With ICONICS' SNMP provider, you can quickly analyze a network, discover new devices, and create SNMP tags. However, this is just a little part of what is possible to do. Searching through the MIBs of the devices, you can find multiple types of information. The only limit to what is possible to do with SNMP is just the imagination.

1.4. Data Connections

GENESIS64 requires that you establish a data connection when you want to display time-varying data from a data source. GENESIS64 provides the tools needed to connect to a wide variety of data sources.

Data sources can be:

- Variables
- Simulation functions
- Real time OPC servers with tags that can be READ-only, WRITE-only, or READ/WRITE
- Historical data that has been stored in a memory cache or saved in a disk file or log
- Custom data stored in a database or provided by a web-service for use when required

Consider the simple dial with its corresponding process point data value shown below in Figure 1.17. The dial works by having a defined rotation angle that starts at the beginning of the range (the 0 point) and ends at the end of the range (the 100 point). It's the relationship between the process point value (here having a value of 53) and the rotational angle of the indicator shape (the chevron) that is important.

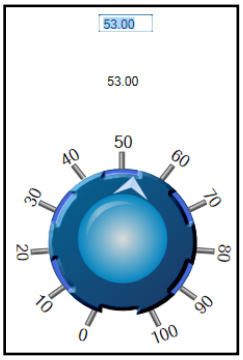


Figure 1.7 - A Dial

Other properties determine how many increments the knob has, what the labels of each increment are, whether the knob is analog or digital (has steps), and other properties. The data point might have a one-to-one correspondence of each process point's value to the labels of the knob, but the relationship can be linear, exponential, or whatever you define.

Both the text box and the rotation dynamic of the chevron object in the dial are connected to the same data source. You assign the data source for each of these two objects by entering the address of the variable, simulation, expression, or tag into the DataSource property.

As long as the value you enter into the DataSource property is syntactically correct, it will be allowed; it is up to the developer to determine the correctness of the assignment. At runtime, the value of the data source refreshes at an interval that is another property of the display.

The knob and the process point in Figure 1.17 display READ-only data, which allows for observation but no operator input. However, if the OPC tags are writable, you can easily make this into a device where you can control the value by turning the knob or writing a value in the process point. Conceptually, control is as simple to perform as observation in the OPC model.

1.5. Connectivity

ICONICS utilizes cutting edge technology in order to provide multiple Configuration and Runtime options that suit our customer and partner needs.

From Microsoft Silverlight to Windows Presentation Foundation (WPF) to SharePoint to HTML5 technology, ICONICS software solutions cover the evolution of Flexible or Frame-based Canvas Technology for data visualization.

Flexible Canvas			**Frame-based Canvas**		
Users: *SCADA, BAS, Plant Control, Machine Builder*			**Users: *IT Personnel, Enterprise-level, MES, Analytics/Reporting***		
Product	**Technology**	**Deployment**	**Product**	**Technology**	**Deployment**
GraphWorX64	Windows Presentation Foundation	Desktop	PortalWorX	Microsoft SharePoint	Web-based
MobileHMI	Microsoft Silverlight	Mobile App	PortalWorX-SL	Microsoft Silverlight	Web-based
WebHMI	Microsoft Silverlight	Web-based	Workbench Classic Runtime	Windows Presentation Foundation	Web-based
Any Glass	HTML5	Web-based			

ICONICS provides both Flexible and Frame-based Canvas Data Visualization based on your organization's deployment needs (Desktop, Mobile or Web-based) and preferred technology standards (WPF, Silverlight, SharePoint or HTML5).

ICONICS 'Any Glass' technologies, integrated with HTML5, provide users with an additional mobile, Web-based option for data visualization using today's popular tablets and smartphones including iPad, iPhone and Android-based devices.

1.6. The Data Browser

As you can see from the previous knob example, you can connect graphical objects to OPC points to display the value. You can either type in the address of the point or select it in the Data Browser in the DataSource field. In Configuration mode, when a developer clicks in the DataSource entry box, an ellipsis button appears to the right of the DataSource property box as shown in Figure 1.18. An ellipsis button in GENESIS64 indicates that more choices are available through a utility, menu, or some other interface element.

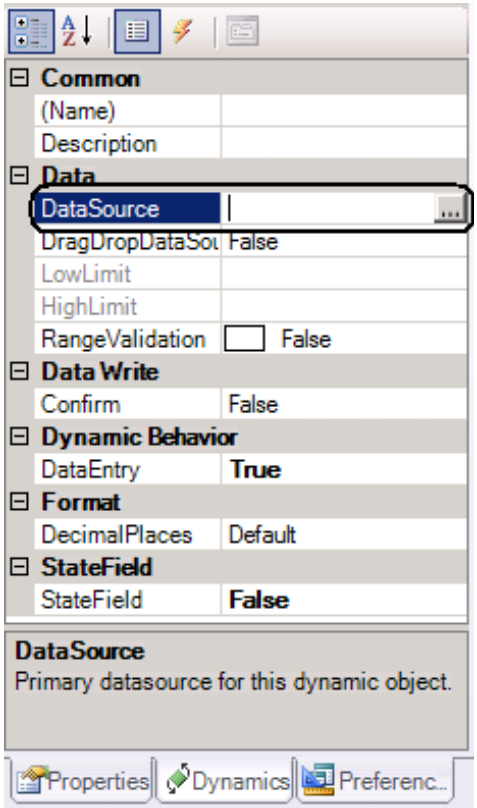


Figure 1.8 - The Data Source Property

For the DataSource property, the ellipsis button opens the ICONICS Data Browser utility, shown in Figure 1.19. (You saw the mesh view of the Data Browser for OPC UA address space previously in Figure 1.13.) The Data Browser has many functions, each of which is isolated on the individual tabs of the dialog box.

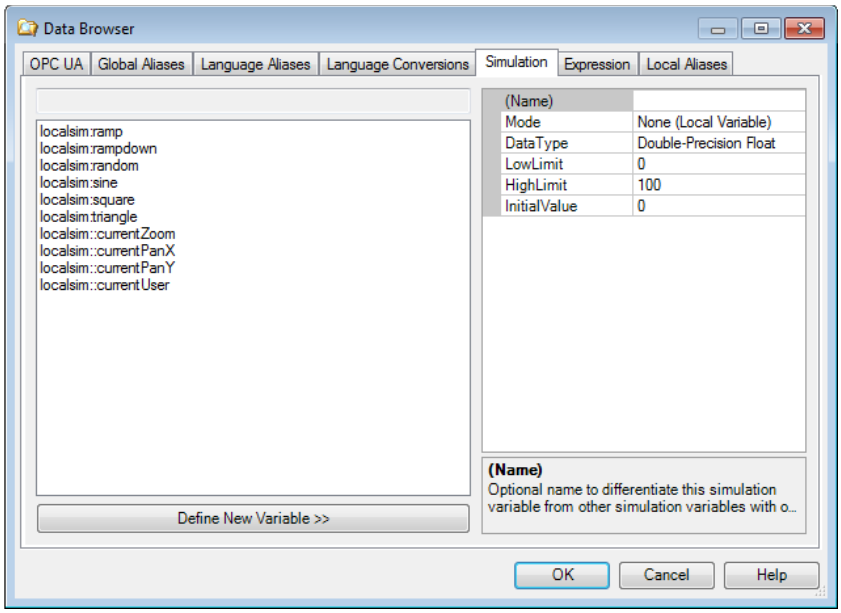


Figure 1.9 - Data Browser: Simulation Tab

For example, the Simulation tab allows you to select one of ICONICS' GENESIS64 simulator functions as the data source: a ramp function, sine wave, random number generator, square function, and so forth. These simulators enter their expressions in the form *localsim::sine* to indicate that the simulator is on the local system; *sine* is the actual name of the function. More formally, *localsim::sine* is an address that GENESIS64 knows how to parse and when you select this function and click the OK button, the Data Browser enters the correct address and syntax back into the Data Source property.

The Data Browser gives you a set of tools for navigating the OPC address space, browsing data sources, and selecting the exact data source (tag) that you require. In Figure 1.20, the OPC UA tab is shown with a tag already selected. Notice that the address to the device tag is displayed in the address bar. (When the address bar isn't selected as it was here, it appears in a breadcrumb style.) When you click OK the Data Browser enters the address in the DataSource property in the correct form using the appropriate syntax.

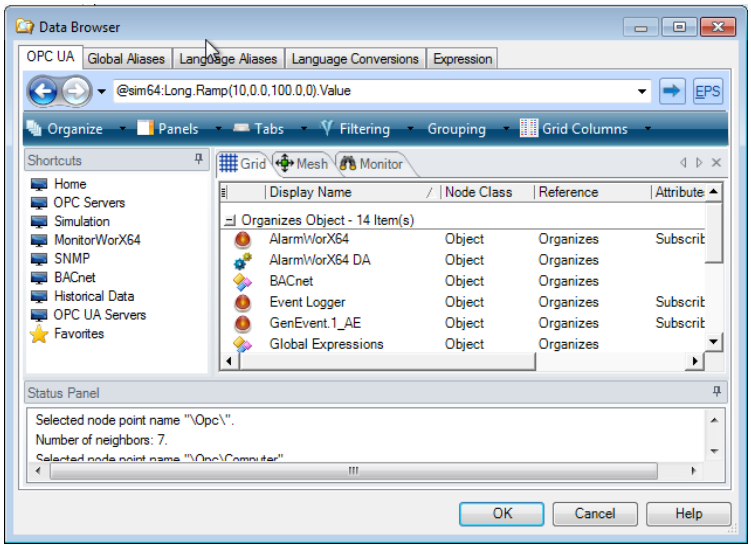


Figure 1.10 - Data Browser: Grid View

The power of the Data Browser is that it lets you know what data sources are actually available and correctly defines the addresses using the appropriate syntax. All data source requests go through the FrameWorX64 Server. However, to keep backward compatibility, the FrameWorX64 server uses GenBroker to communicate to legacy systems (e.g., OPC DA) and expose these data in the OPC UA address space. Obviously, the syntax for a true OPC UA tag is different from a tag coming from a legacy system. The Data Browser frees you from having to know the individual syntax coming from the different servers. You can simply browse for tags; the addresses are entered back into the display configuration in the correct form. Now when you save your configuration and go into runtime, the needle is connected to the tag you just assigned to it and it changes appropriately.

Lab: Training Installation and Configuration

L1

In this lab, we will install GENESIS64 and apply the necessary files for the rest of the training. If you are attending this training course at one of our training facilities and are using one of our provided machines, you may not need to perform this lab. Your instructor will clarify.

Estimated time to complete this lab: 90 minutes

1.1. Task Checklist

In this lab, you will complete the following tasks:

- Install GENESIS64
- Install the ICONICS OPC Server Suite
- Apply the training support files
- Create necessary database files

1.2. Installation Software and Support Files

You will need the following file(s) to complete this lab:

- Installation Software
  - GENESIS64 Installation Disk 10.8
  - ICONICS OPC Servers Installation Disk (Current)
- Support Files
  - GENESIS64TrainingSymbol.sdfx
  - ButtonsAndSwitches.sdfx
  - SI_BA_Training.sdfx
  - DashboardSymbols.sdfx
  - icTonics.opf
  - icTonics-logo.png
  - icTonicsAlarmServerConfig
  - icTonicsAssetWorX_10.8.csv
  - icTonicsGASConfig.csv
  - icTonicsUDMConfig.csv

1.3. Installation

In this section, we will walk you through the installation of GENESIS64 as well as list software that you should have on the system before you begin the install process.

- Other goals for this lab are to:
    - Install GENESIS64 on the training machine.
    - Understand the privileges inherent to local user “admin” (which you are automatically logged in as) on each training machine.
    - Review and/or adjust user permissions through SQL Server.

1.3.1. Installation Prerequisites

Before we install any ICONICS applications, it is generally a good idea to make sure that the required software has already been installed on the computer. Below is a list of what is recommended that you already have installed.

- Internet Information Services (IIS) with FTP components
    - FTP is required when you intend to publish displays for use with WebHMI clients.
- The latest .Net Framework – the GENESIS64 installation will try to detect this component and install it if it is not there. This can take up to an hour to install.
- SQL Server 2005 SP4 Express or higher – configuration database in GENESIS64 can only be an MS SQL 2005 SP4 or higher database.
- User Account Control (UAC) – Although GENESIS64 works with UAC, it's best to have it turned off during installation.

Depending on your operating system, the IIS installation may require your operating system's installation disk. You should obtain this from your IT personnel. Additionally, the path where IIS needs to be installed varies by operating system. You may want to ask your instructor its required location on the operating system you will be using.

1.3.2. Installing GENESIS64

First, insert the GENESIS64 installation disk.

When the splash screen comes up, click on the "GENESIS64 Installation" link. In case the splash screen does not pop up (you may have auto-run disabled), you can go to your DVD drive and double-click on the "**Default.hta**" file to bring up the splash screen.

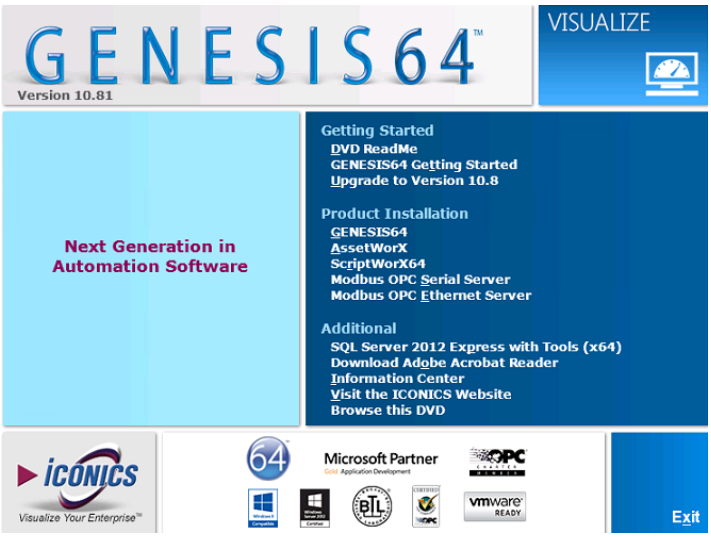


Figure L1.1 - Installation Splash Screen

1. You should then see the **InstallationShield Wizard** as shown below. Click on "**Install**" to continue. Your list of prerequisites may not match the figure below.

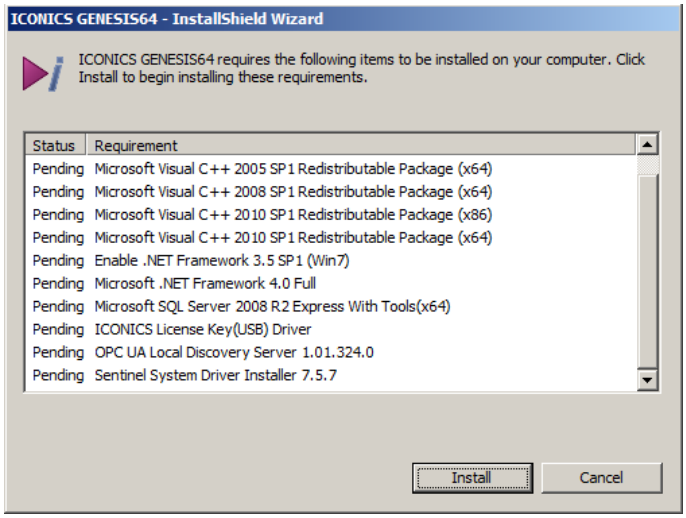


Figure L1.2 - Installation Shield Wizard

Note: If you get any popup security warning messages, just click on "**Run**" to continue the installation.

2. If you don't have SQL Server pre-installed on your machine, you will get a message, as seen below. If you are only doing a local installation, just click on "Yes" to proceed. If you are doing a corporate installation, you may not need to install the SQL Server now. But, you need to ask your IT personnel to provide you with a domain, as well as SQL server user account.

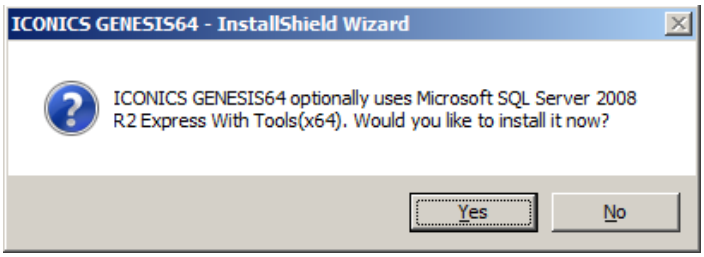


Figure L1.3 – SQL Server Installation

3. When the prerequisites installation is complete, you will be prompted to reboot. Click **Yes** to reboot.

4. After the reboot is complete, the installation will continue. Click **Next**.

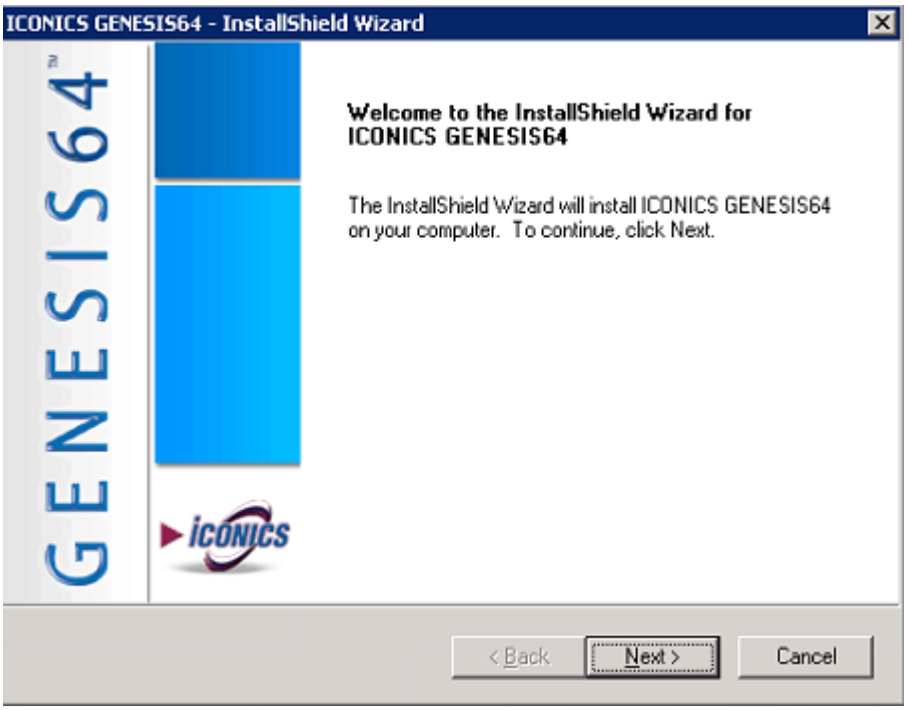


Figure L1.4 – The InstallShield Wizard

5. Select the radio button "**I accept the terms of the license agreement**".

6. Click **Next**.

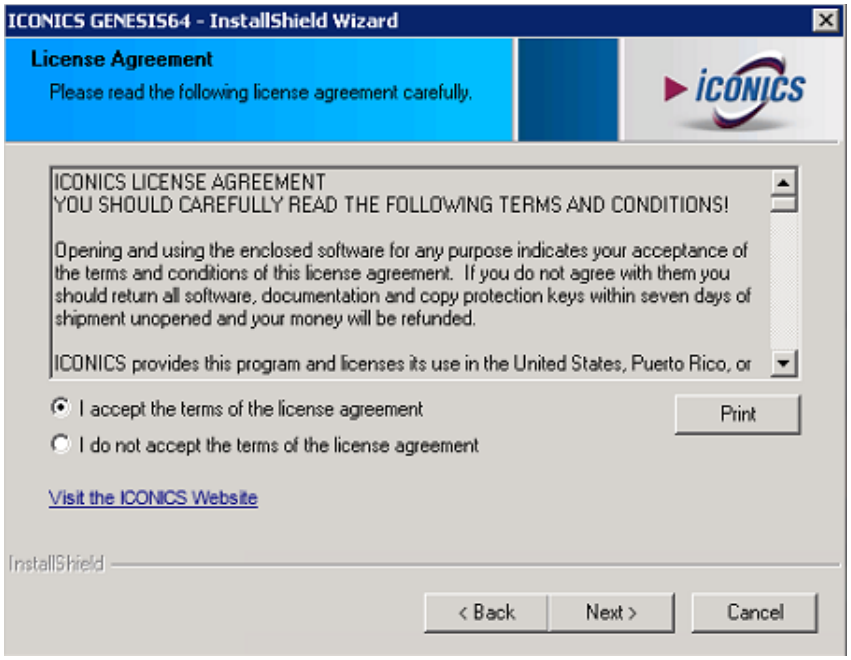


Figure L1.5 – The License Agreement

7. You will be prompted for **Login Information**. Enter the user name and password of the user performing the installation.

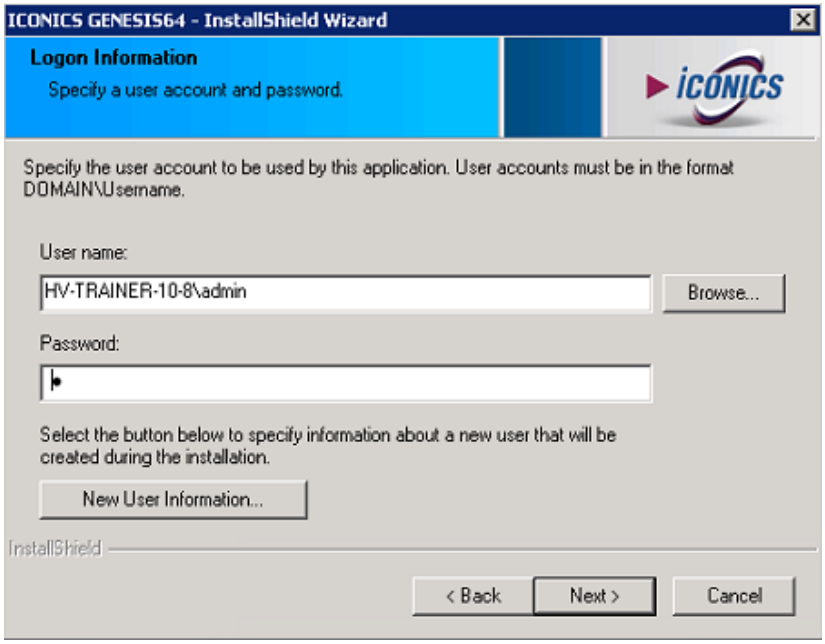


Figure L1.6 – Login Information

8. Leave the setup type as **Typical** and click **Next** to proceed.

9. As seen in the following figure, on the **Database Server** dialog, you can choose the SQL Server from the dropdown list. If your SQL Server Browser services are not running, you may not be able to see a list of installed SQL Servers. In this case, you will need to type in the SQL Server name. If you installed the SQL Server with the GENESIS64 Installation disk, the instance name is *hostname*\SQLEXPRESS where *hostname* is the name of your computer. Since SQL Express is installed on the local hard disk, using the following syntax to connect **(local)\sqlexpress** is also sufficient.

Note: You can open up the command prompt from the Windows start menu, and type "hostname" (without quotes) to verify your hostname.

10. Connect using **Windows authentication**. Click **Next** to proceed.

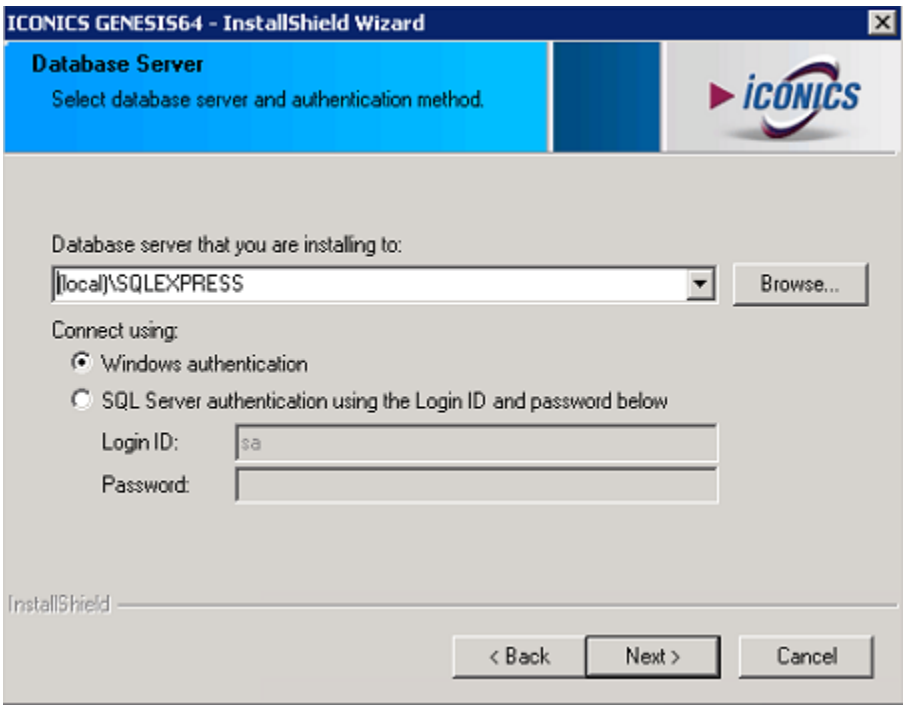


Figure L1.7 – Database Server

11. Select the check box to install **GenDemo**. Click **Next**.

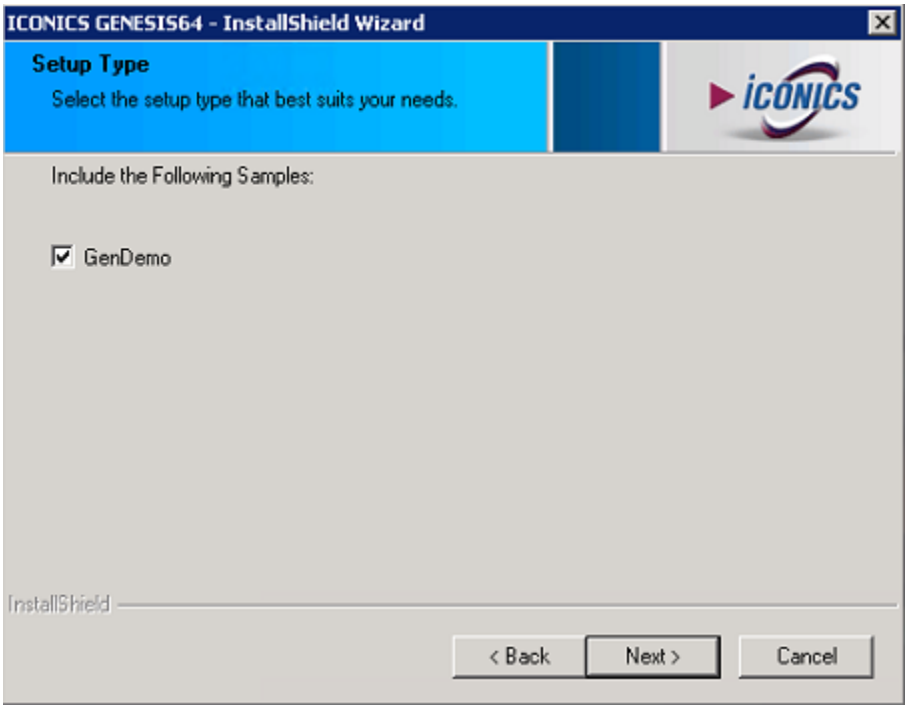


Figure L1.8 – GenDemo Installation Selection

12. At the **Ready to Install the Program** dialog, click **Install**.

13. At the **Database and Services** dialog, the default selections should be fine. Click **Install**.

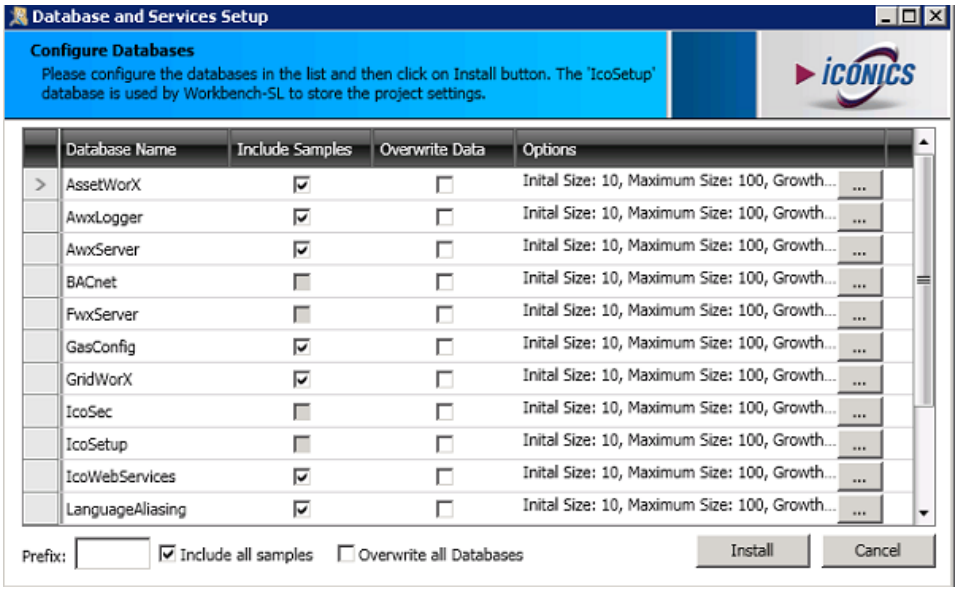


Figure L1.9 – Database and Services Setup

14. At the **InstallSheild Wizard Complete** dialog, click **Finish**.

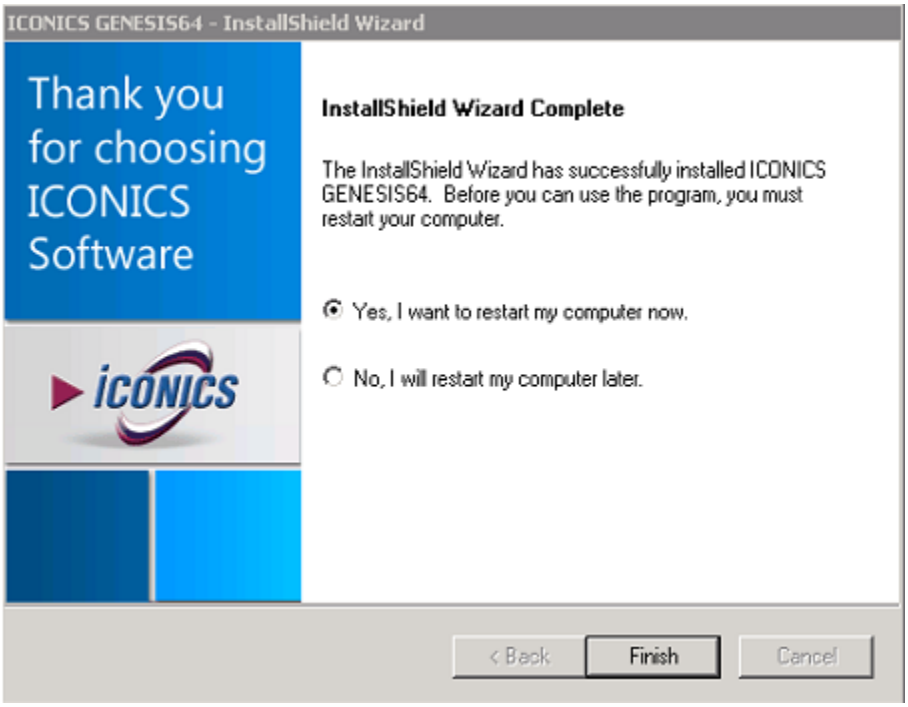


Figure L1.10 - Installation: Completed

1.3.3. Installing the OPC Server Suite

1. Insert the OPC Servers installation disk.
2. When the splash screen comes up, click on the "OPC Standard Server Suite" link, which is circled in Figure L1.11. In case the splash screen does not pop up (you may have auto-run disabled), you can go to your DVD drive and double-click on the "Default.hta" file to bring up the splash screen.

Figure L1.11 - OPC Servers Installation Splash Screen

3. You should see the **InstallShield Wizard** come up. Click on "Install" to being the pre-requisite installation.

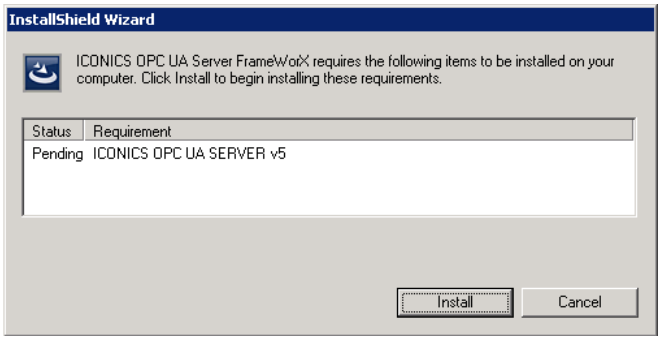


Figure L1.12 - Prerequisites for OPC Server Installation

4. Once the prerequisites are installed, you should see the OPC Server Suite 5 Setup Welcome screen. Click on "Next" to continue.

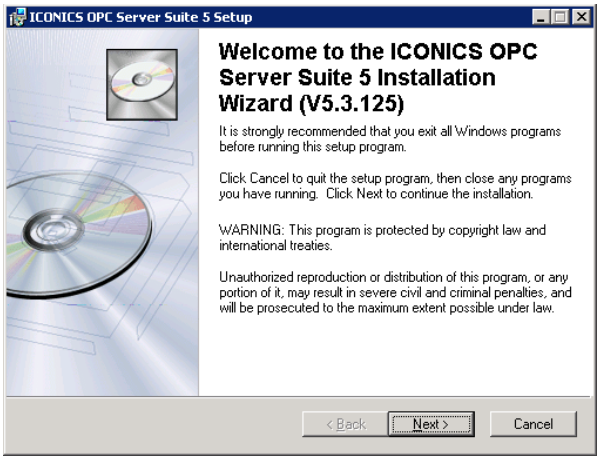


Figure L1.13 - ICONICS OPC Server Suite 5 Setup: Welcome Screen

5. On the Licensing Agreement screen, choose the "I accept the license agreement" option and click on "Next".

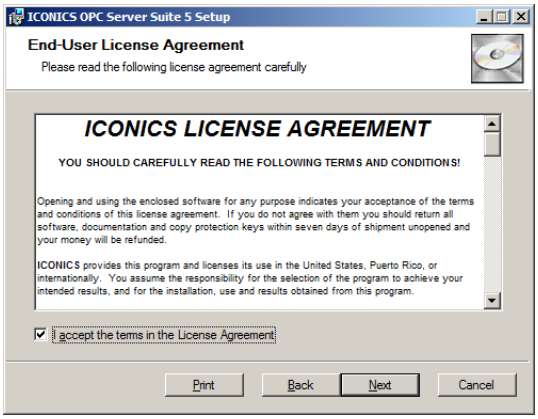


Figure L1.14 - ICONICS OPC Server Suite 5 Setup: License Agreement

6. Leave the Destination folder as default on the next screen and click on "**Next**" to continue.

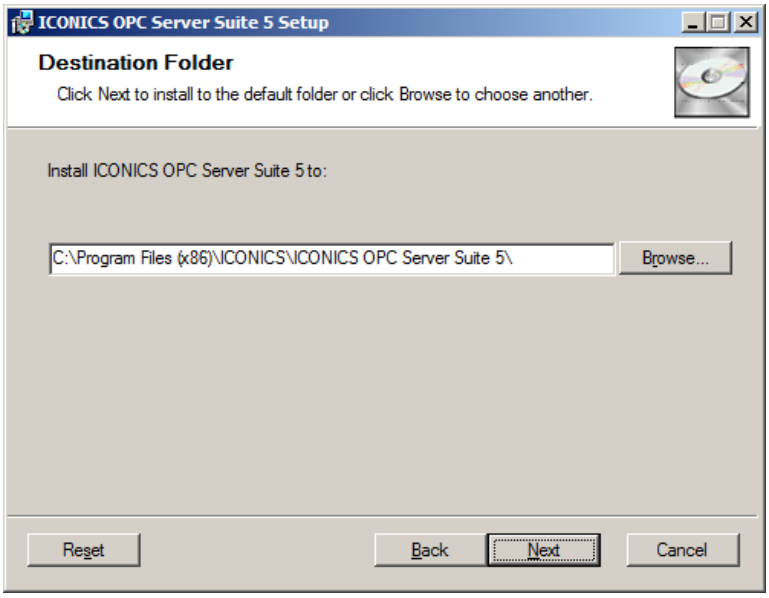


Figure L1.15 - ICONICS OPC Server Suite 5 Setup: Destination Folder

7. Leave the application data folder as default and click on "**Next**".

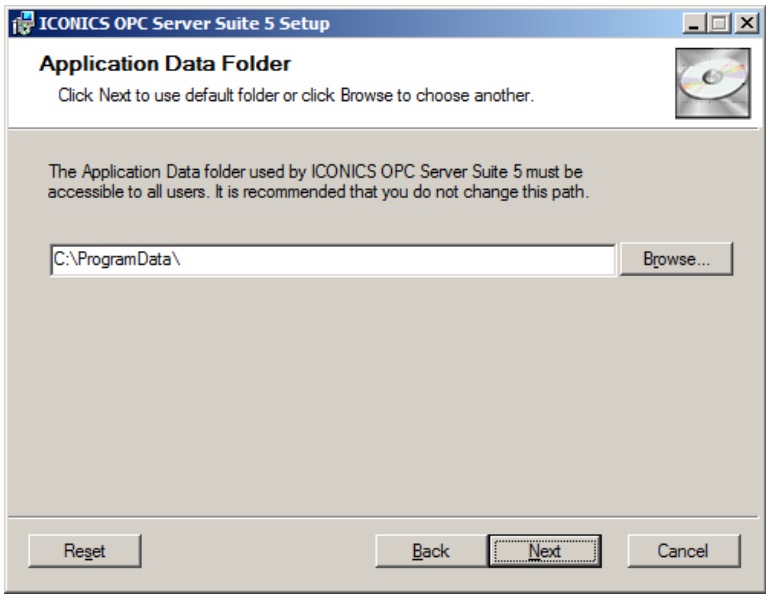


Figure L1.16 - ICONICS OPC Server Suite 5 Setup: Specify Application Data Folder

8. Leave the Shortcut folder as default and click on "**Next**".

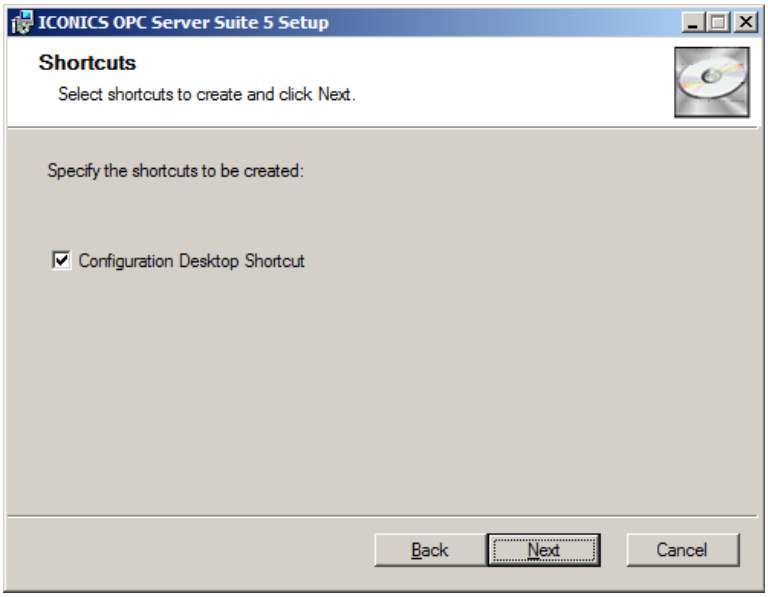


Figure L1.17 - ICONICS OPC Server Suite 5 Setup: Shortcuts Folder

9. On the Select Feature Screen, make sure that all features are selected and click on "**Next**"

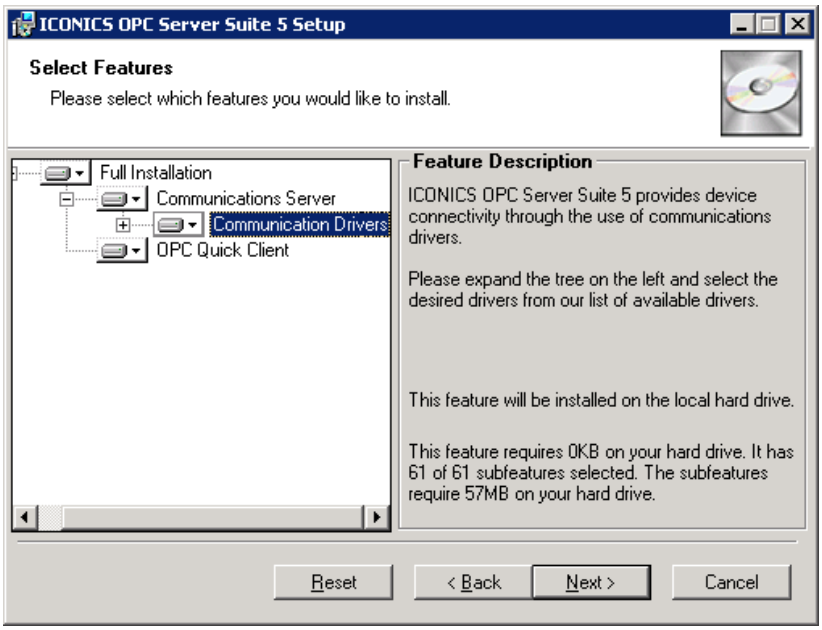


Figure L1.18 - ICONICS OPC Server Suite 5 Setup: Select Features

10. Click on "**Next**" on the Ready to Install the Application screen to begin installation. This may take a few minutes.

11. When the installation completes, you will see the 'successful installation' screen. Click on "**Finish**" to complete the installation.

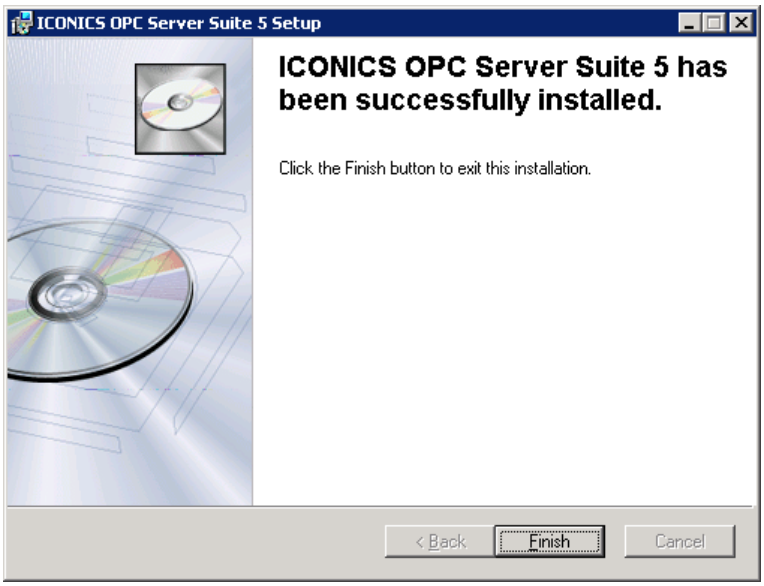


Figure L1.19 - ICONICS OPC Server Suite 5 Setup: Successfully Installed

12. You will then see the **OPC UA Server FrameWorX Installation Wizard** welcome screen. Click on "**Next**" to continue.

Figure L1.20 - ICONICS OPC UA Server FrameWorX: Welcome Screen

13. Click on "**Install**" on the 'Ready to Install the Program' screen to begin installation for the OPC UA Server FrameWorX. This will take a few minutes.

14. When the installation completes, you should see a confirmation screen. Click on "**Finish**" to close the wizard.

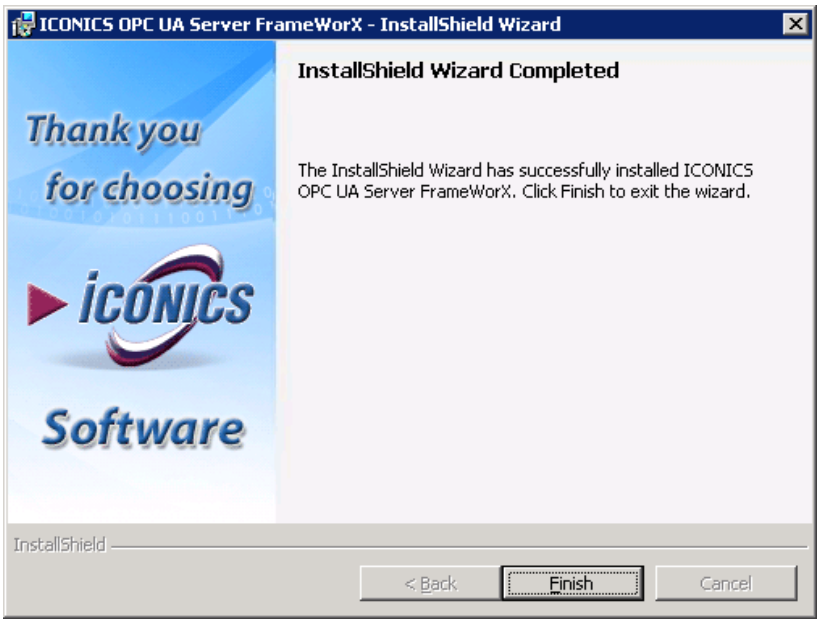


Figure L1.21 - ICONICS OPC UA Server FrameWorX: Installation Completed

15. Click on "**Exit**" on the splash screen to close it.

1.4. Configuring the OPC Server for Training

1.4.1. DCOM Configuration

1. Go to Start, in the 'Search program and files' dialog, type in **dcomcnfg** and hit the Enter key.
2. In the **Component Services** Window, expand **Component Services** → **Computers** → **My Computer** → **DCOM Config** on the left-hand pane.
3. Find the "**ICONICS OPC Server Suite 5.5**" component in the list, right-click on it and select "**Properties**".
4. In the **ICONICS OPC Server Suite Properties** dialog box, select the Security tab.
5. Change the Access Permissions to "**Use Default**".

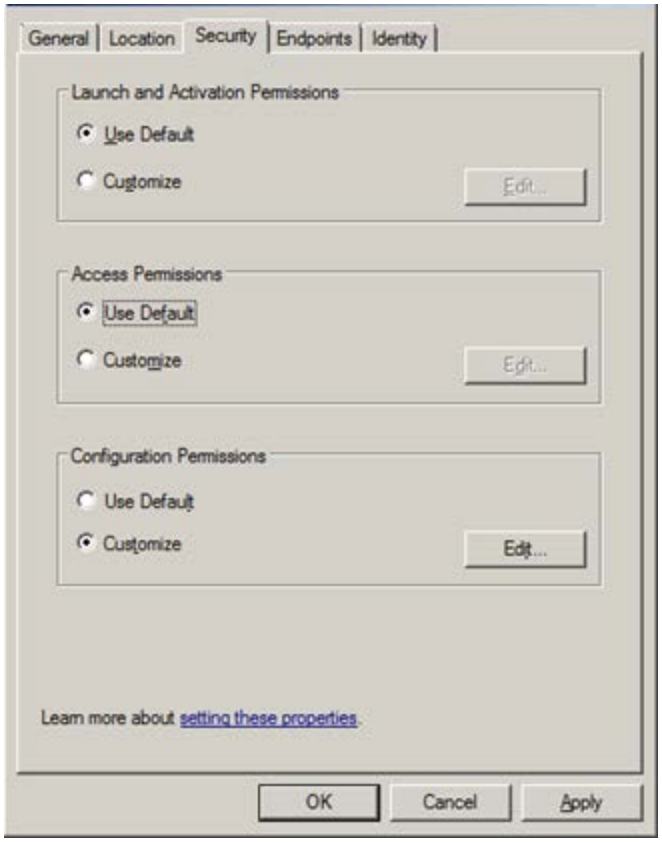


Figure L1.22 - ICONICS OPC Server Suite Properties: Security

6. Click **OK** to close the **Component Services** window.

1.5. Training Support Files

There are some support files that you will need in order for the training to run smoothly. Again, if you are using one of the ICONICS provided training computers you do not need to do the steps in this section.

1. Open Windows File Explorer and navigate to **C:**
2. Create a folder here called **Training**. This folder will be your project folder and you will store all of the training files into this folder.
3. Copy the support files (listed in the beginning of this lab) into the **C:\Training** folder:

Note: Ask your instructor for the support files if you do not have them.

1.6. The OPC Server Configuration

In this section, we will use the **OPC Server Configurator** to open the configuration file designed to support this training course.

1. Start the ICONICS OPC UA Server 5 Configurator by going to Start → All Programs → ICONICS → ICONICS OPC Server Suite 5 → **ICONICS OPC Server 5 Configuration.**
2. Go to File → Open and browse to **C:\Training**.
3. Select the "**icTonics.opf**" file and click on "Open".
4. Select "**Yes, Update**" if you see the following screen in Figure L1.23.

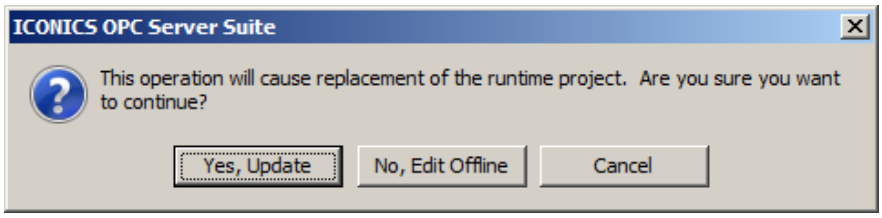


Figure L1.23 – Update OPC Server

5. Close the **ICONICS OPC Server Suite Configurator**.
6. Open the **OPC UA Configuration** by going to Start → All Programs → ICONICS → ICONICS OPC Server Suite 5 → OPC UA Configuration.

7. On the Server Endpoints, select the **opc.tcp://127.0.0.1:49460** endpoint and **uncheck** the **Enable** checkbox near the bottom of the dialog box.

8. Select the **opc.tcp://*ComputerName*:49460** endpoint where ***ComputerName*** is the name of your computer.

9. Click on the **Edit** button near the bottom of the dialog box to bring up the **Endpoint Definition** dialog box.

10. **Uncheck** the **Basic128Rsa15** and **Basic256** options. The dialog box should now look like the figure below.

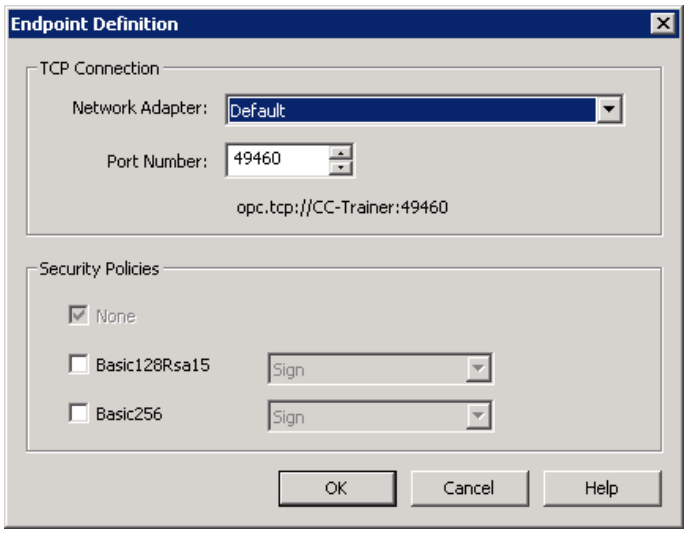


Figure L1.24 - Endpoint Definition

11. Click on **OK** to close the dialog box.

12. Check the **Enable** checkbox at the bottom of the **OPC UA Configuration Manager** and click on **Close** to save the settings and close the dialog box.

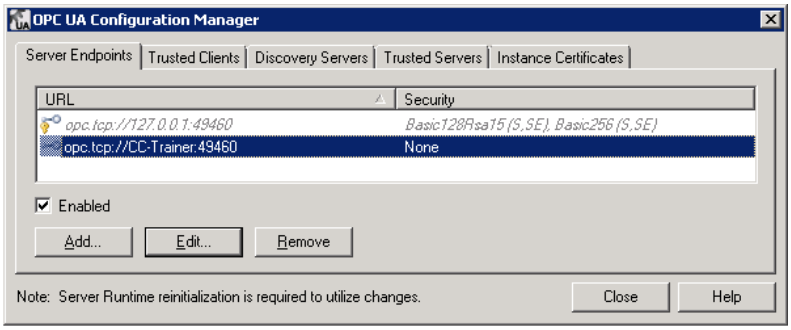


Figure L1.25 - OPC UA Configuration Manager

1.7. Creating the Alarm Logging Database

In this section we will create the databases that you will use in the course to log Trend and Alarm data. We recognize there are many different versions of SQL Server available. The following steps were written against SQL Server 2012. This procedure will also apply for other versions of SQL Server.

1. Open the SQL Server Management Studio by going to **Start → All Programs → Microsoft SQL Server 2012 → SQL Server Management Studio**.

2. Once the Management Studio opens, you will receive a dialog box that asks you to connect to a SQL Server. If this is the first time you are using the SQL Management Studio, you may receive a **welcome** and **setup** dialog box prior to the **connection** dialog box. You can use the default credentials that are already filled in the dialog box. Take note of these credentials. Click on **Connect** to connect to the server.

Note: If the server name field is blank, enter: **(local)\SQLEXPRESS** into it.

3. Once you are connected, expand your server instance → Databases in the Object Explorer on the left-hand side.

4. Right-click on Database in the Object Explorer and select **New Database**.

5. In the **New Database** dialog box, type in **icTonicsAlarmData** in the **Database name** field.

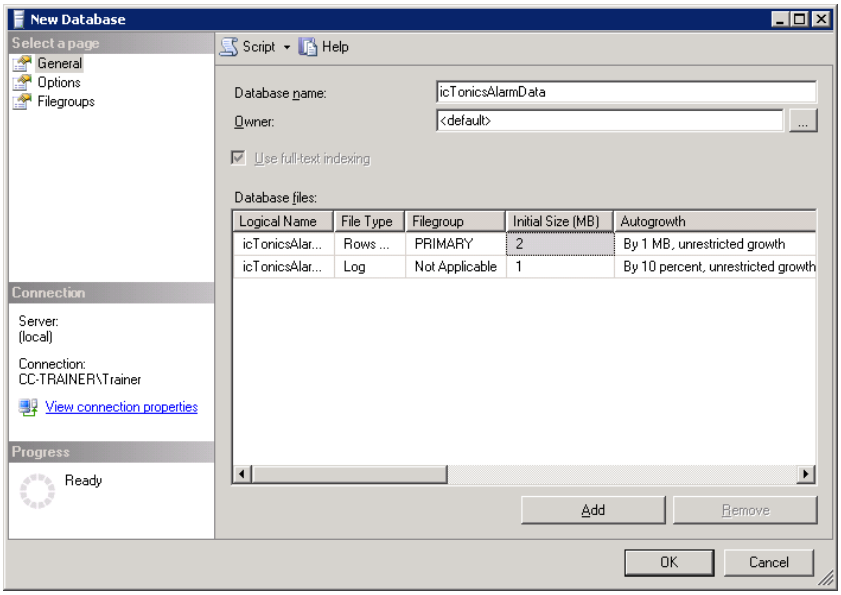


Figure L1.26 - Creating a New SQL Database

6. Click on **OK** at the bottom of the dialog box to create the database. This may take a few seconds.

7. Following the same procedure, create a second database named **icTonicsTrendData**.

1.8. SQL Server Permissions Review

1. Go to Start → All Programs → Microsoft SQL Server 2012 → SQL Server Management Studio.

2. Within the management studio, expand **Security** → **Logins**, then double-click on *Hostname\Username* (in your case the username should be "admin") and then navigate to **User Mapping**.

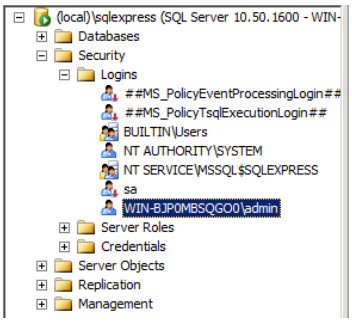


Figure L1.27 – Admin User Account in SQL

3. Make sure the following databases have been checked: AwxLogger, AwxServer and TwxConfig. Also, you need to confirm that the role membership for each one of the databases is db_owner, seen in the figure below.

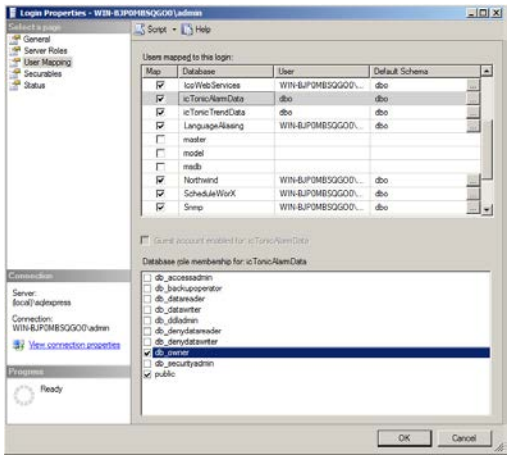


Figure L1.28 – Authorize Admin User Permission

1.9. Web Browser Configuration

1.9.1. Enabling Internet Explorer File Download

For training at the Foxborough, MA facility, we use a Windows Server class operating system. Although GENESIS64 is certified for Windows 2012 Server, at the moment, we're using Windows 2008R2 Server.

I mention this because the operating system version affects how Silverlight gets installed. We will have to make an **Internet Explorer Security** change to **Enable File Download**. Here we go.

1. Select **Start → Control Panel → Internet Options** to launch the Internet Properties dialog.

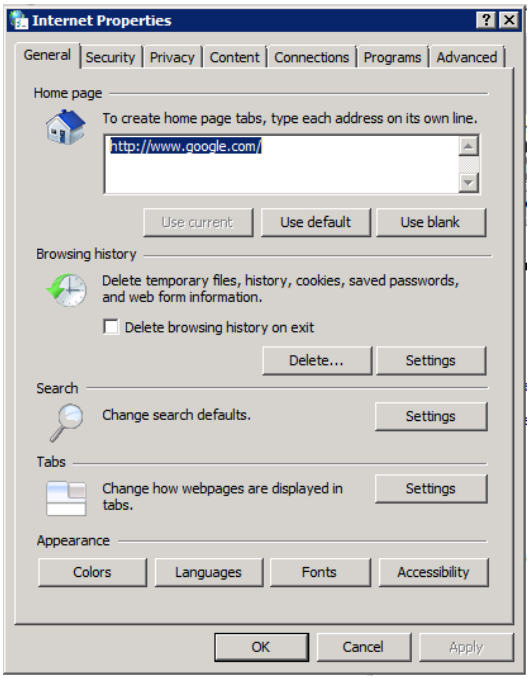


Figure L1.29 – Configuring Internet Options

2. Select the **Security** tab.

3. Select the **Internet Icon**.

4. Click on the **Custom level** button.

5. Click on the empty section of the scroll bar on the right 5 times to expose the **Downloads** property.

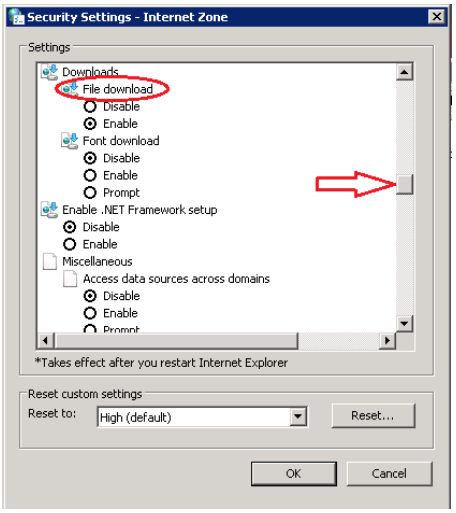


Figure L1.30 – Configuring Internet Options

6. **Enable** the '**File Download**' property.
7. Click **OK**.
8. Click Yes to confirm the Zone Settings Change. Keep the **Internet Properties** dialog **open**.

1.9.2. Adding your Host to the List of Trusted Sites

1. From within the **Internet Options** dialog, select the **Security** tab.
2. Select the **Trusted Sites** icon.
3. Click on the **Sites** button.

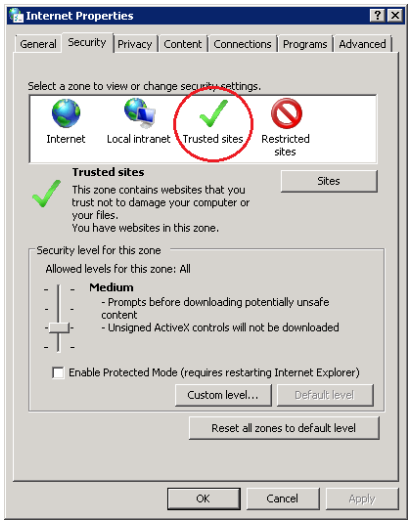


Figure L1.31 – Internet Explorer Trusted Sites

4. **Uncheck** the **Require server verification (https:) for all sites in this zone** checkbox.
5. In the **Add this website to the zone:** field, enter: **http://localhost**.
6. Click **Add**.
7. Click **Close**.
8. Leave the Internet Properties dialog open.

1.9.3. Configuring Internet Explorer Cache

The following setting is suggested during development. However, for performance reasons, you may want to leave this setting as 'Automatic' at the time of deployment.

1. From within the **Internet Properties** dialog, select the **General** tab.
2. In the **Browsing history** section, click on the **Settings** button.
3. Under the header "**Check for newer versions of stored pages:**", select the "**Every time I visit the webpage"** radio button.
4. Click **OK.**
5. Click **OK** again to close the **Internet Properties** dialog.

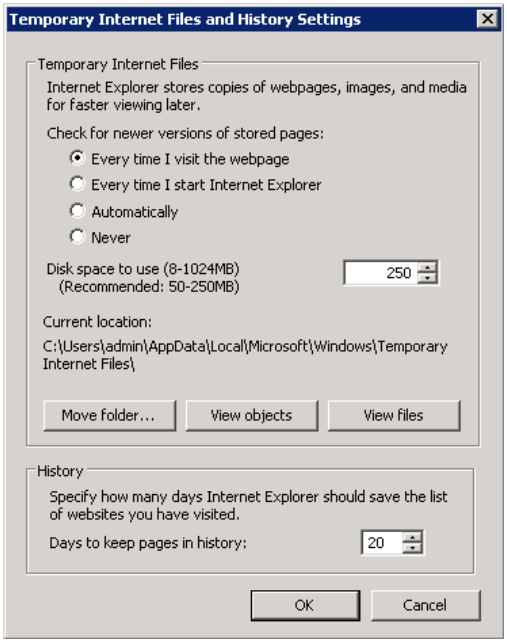


Figure L1.32 – Internet Explorer Cache Setting

Note: From within PortalWorX, hitting the F5 key will force Internet Explorer to refresh the Web page. This may be necessary after making changes to a Silverlight version of a GraphWorX64, TrendWorX64, AlarmWorX64, etc… file that is used in a PortalWorX64 viewer.

1.9.4. Installing Silverlight

Silverlight is an add-on to Internet Explorer. When you launch Workbench-SL for the first time, you will be prompted to install Silverlight, if it is not already installed.

1. Launch Workbench-SL by selecting **Start → All Programs → ICONICS → Workbench-SL**.
2. You may see a Login dialog. Log in with the username and password you used to install GENESIS64.
3. When you see the Silverlight dialog, click on the '**Click now to install**' button.

Figure L1.33– Silverlight Installation Dialog

4. Click **Run** and follow the **Silverlight installation** instructions.
5. You should see an **Installation Successful** notification. Click **Close**.
6. **Press F5 to refresh** the Internet Explorer session and to **launch Workbench-SL**.

1.10. The Symbol Libraries

The following steps describe how to add symbol libraries to GraphWorX64.

1. Launch GraphWorX64 by selecting **Start → All Programs → ICONICS → GENESIS64 → GraphWorX64 → GraphWorX64.**
2. Once GraphWorX64 opens, you should see the Explorer on the left-hand side. At the bottom of the Explorer, you should see a tab called **Symbols**. Select this tab.
3. Click on the "**Symbol Library commands menu**" icon at the top of the explorer and select "**Open Existing Category**" from the popup menu.
4. In the **Open** dialog box, look for the **GENESIS64TrainingSymbols.sdfx** in **C:\Training**. Click on "**Open**" to add the library.
5. Re-execute the steps to also add the categories **ButtonsAndSwitches.sdfx, DashboardSymbols.sdfx** and **SI_BA_Training.sdfx**.
6. If you click on the dropdown list of the Symbol library now, you should see the symbol libraries you added in the category list.
7. Leave the GraphWorX64 instance open.

1.11. The Training Databases

1.11.1. Creating the icTonicsAssetWorX Training Database

1. From within **Workbench-SL**, be sure the **AssetWorX** provider is selected in the navigation tree on the left side, as seen in the figure below.

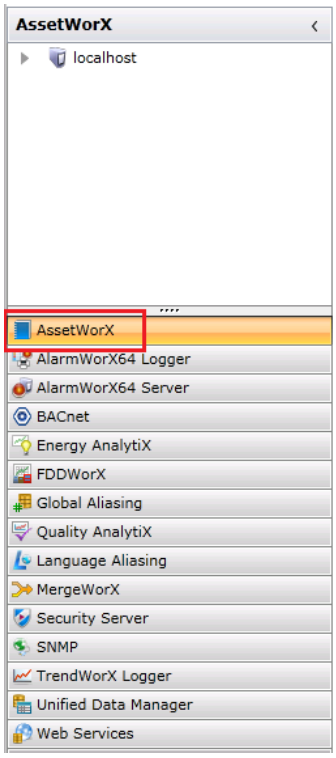


Figure L1.34 – AssetWorX Provider in the Workbench-SL Navigation Tree

2. Right-click on the localhost node in the AssetWorX navigation tree and select **New Database**, as shown in the figure below.

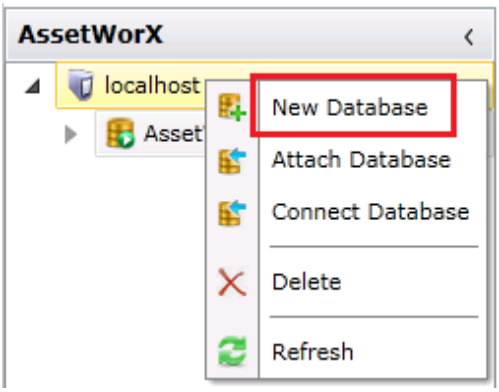


Figure L1.35 – Creating a New Database in Workbench-SL

3. You may see a message indicating that the changes you are about to make will be propagated to other AnalytiX providers. Click **OK** to continue.

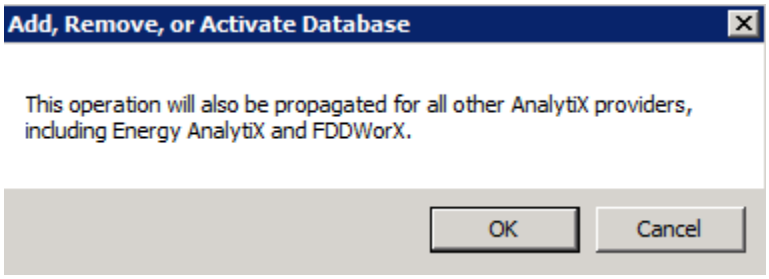


Figure L1.36 – Activating a New Database Propagates Changes to all AnalytiX Providers

4. The **Create a new Database** dialog box will appear when loading is complete. Enter the **Database name:** icTonicsAssetWorX.

5. Confirm that the **Include sample data** checkbox is **unchecked**.

6. Leave the remaining fields as they are and select **OK** to continue.

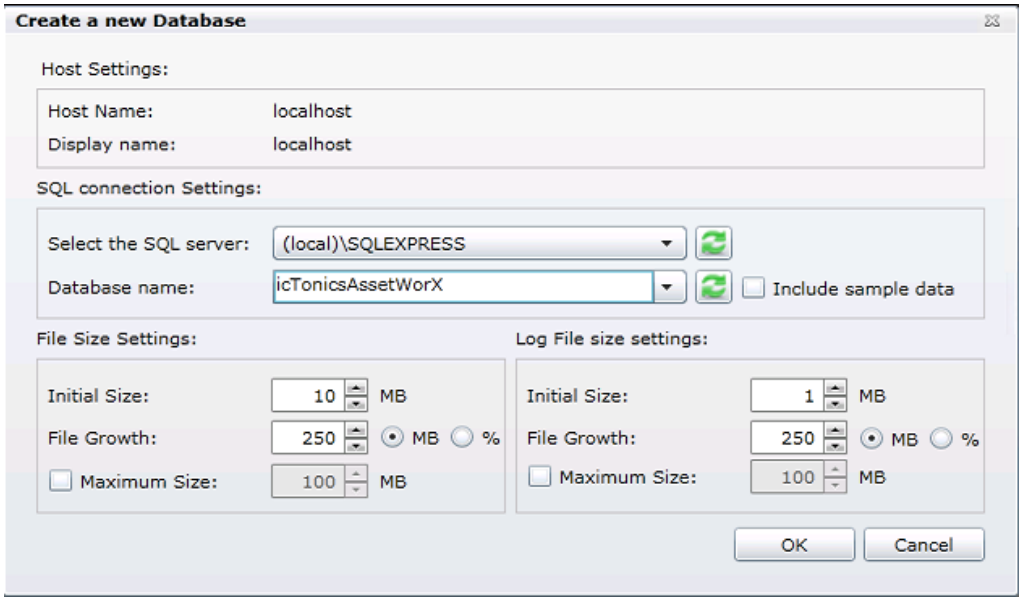


Figure L1.37 – Create a New Database Dialog Information

7. When the database creation is complete, in the navigation tree on the left, you will see a second node under localhost called "**icTonicsAssetWorX**". This entry will have a red circle on the icon. This **Red** (**Not Active**)/**Green** (**Active**) indicator defines which database is currently Active.

1.11.2. Importing icTonicsAssetWorX Data

You can import data into the AssetWorX database or into the asset tree or equipment class node. It is assumed that the data you want to import has been exported from an AssetWorX database and is stored in a .CSV (comma-separated values) file. Be aware of the data being imported so that you import it to an appropriate location in the Project Explorer. For example, do not import equipment classes into the asset tree.

1. With the AssetWorX selected, right-click on the icTonicsAssetWorX database and select Import.
2. From the "**Import a file into the database**" dialog, click on the Browse button.
3. Locate and select the **C:\Training\ icTonicsAssetWorX_10.8.csv** file. Click the Open button.
4. Click **Upload**. There should not be any errors. Errors are obvious in the report.
5. Click **Close**.
6. Right click on the icTonicsAssetWorX database and select **Refresh**.
7. You should see an **icoUniversity** asset under the Assets tree node.

1.11.3. Making the icTonicsAssetWorX Database Active

When we created the icTonicsAssetWorX training database, we learned that the AssetWorX provider can support multiple databases in one project instance. However, it is important to note that only one database can be Active at one time.

When GENESIS64 is installed, by default, the AssetWorX database is active. We will select our icTonicsAssetWorX training database and make this the active database.

1. The figure below shows the Asset Tree collapsed for each database.

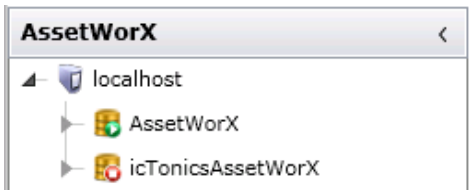


Figure L1.38 – Two AssetWorX Databases

2. The **AssetWorX** database has a **Green** (Active) icon and the **icTonicsAssetWorX** training database has a **Red** (Not Active) icon.

3. Select the **icTonicsAssetWorX** training database with a right mouse click and select **Make Active**.

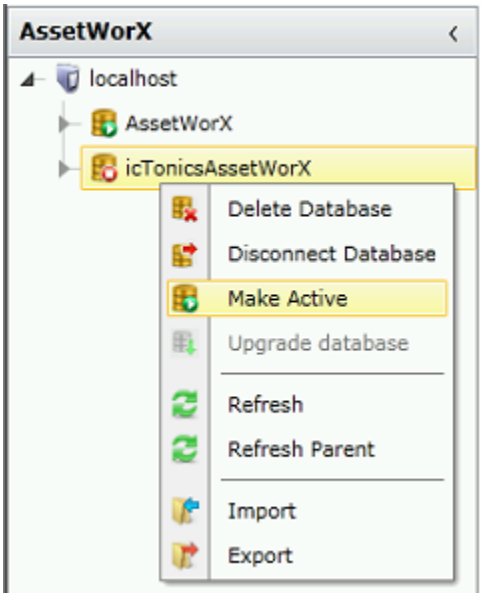


Figure L1.39 – Switching the Active Database

4. You will see a message indicating the changes you're about to make will be propagated to other AnalytiX providers.

5. Click **OK** to continue.

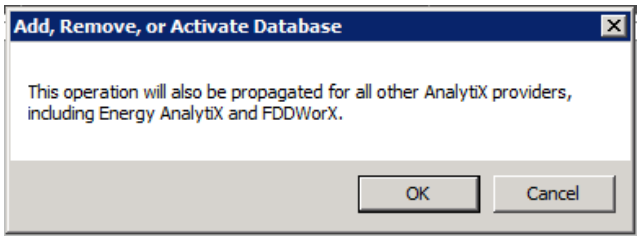


Figure L1.40 – Creating a New Database Propagates Changes to All AnalytiX Providers

6. The icTonicsAssetWorX training database icon should turn green and the AssetWorX icon should turn red.

1.11.4. Unified Data Manager

The Unified Data Manager (UDM) is a framework application that supports data management for a number of different and disparate ICONICS GENESIS64 applications. Just like the Microsoft Management Console or MMC supports snap-ins that expose different Windows settings and Windows application and service settings, the Unified Data Manager's is a front end to data stored in a SQL database containing values, data, and stored functions required for use elsewhere in the GENESIS64 application suite. Some items are exposed as OPC objects and can be accessed from ICONICS applications via the Unified Data Browser. By using the Unified Data Manager, you can reduce development time and eliminate redundant work by storing items in a database for common use.

1. Start Workbench-SL by going to **Start → All Programs → ICONICS → Workbench-SL.**

2. Once Workbench is opened, click on the "**Unified Data Manager**" icon or select the UDM in the provider list to load it's configuration in the Project Explorer.

3. Right-click on "**localhost**" and select "**New Database**".

4. In the **Create Database Wizard** pop-up box**,** click on **Next** (you may notice a **pause**, be patient) to get to the change common database options screen.

5. Change the Database Name to **icTonicsUDMConfig**.

6. Uncheck the "Include Sample Data" checkbox. Your **Create Database Wizard** should look similar to Figure L1.41.

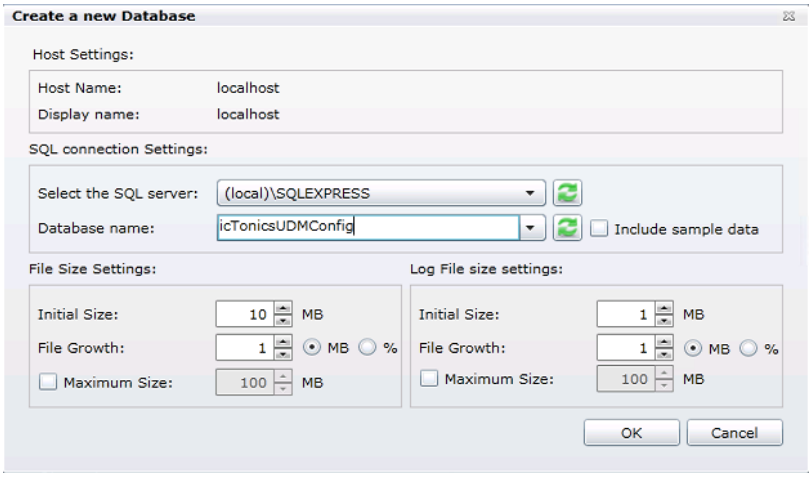


Figure L1.41 - Create Database Wizard: Common Database Options

7. Click on **Finish** to create the database. This may take a moment.
8. Once the database is created, right-click on **icTonicsUDMConfig** and select **Import**.
9. In the **Open** dialog box click on the Browse button and go to the **C:\Training** folder.
10. Select the **icTonicsUDMConfig.csv** then click on **Open**.
11. No other changes are necessary. Click **Upload** to import the file.
12. You may see **errors** related to **\Triggers\UNNAMED**. This is normal. Click Close.
13. Once the file imports, right-click on icTonicsUDMConfig and select **Make Active**.
14. You should see **icTonicsUDMConfig** (Active) in the navigation tree and the icon to the left should contain a green element.

1.11.5. AlarmWorX64 Server

AlarmWorX64 Server is an ICONICS server application that communicates with OPC-UA, OPC-AE, and OPC-HDA real-time and historical data sources. The AlarmWorX64 Server receives field data from any OPC-compliant Data Access server and performs alarm detection and reporting based on the OPC Alarm and Events Standard.

1. Following the same procedure as the UDM above, select the **AlarmWorX64 Server** provider.
2. Create a new database called **icTonicsAlarmServerConfig**,
3. Import the file called **C:\Training\ icTonicsAlarmServerConfig.csv**
4. **Make** the icTonicsAlarmServerConfig database **Active**.

1.11.6. Global Aliasing

The Global Aliasing System or GAS is a powerful referencing feature implemented in GENESIS64 that you can use in applications like GraphWorX64, TrendWorX64, and AlarmWorX64 to display multiple data sources using a single reference. When you use global aliases a dynamic operation such as a mouse up on a button can change the reference from one value or group of values to another. This allows you to change between one group of objects and any other group of objects that have a similar set of properties.

1. Following the same procedure as the UDM above, select the **Global Aliasing** provider.
2. Create a database called **icTonicsGASConfig**,
3. Import the file called **C:\Training\icToncisGASConfig.csv**
4. Make the icTonicsGASConfig database **Active**.

1.11.7. BACnet Discovery

BACnet is based on a "client-server" model of the world. BACnet messages are called "service requests." A client machine sends a service request to a server machine that then performs the service and reports the result to the client. BACnet currently defines 35 message types that are divided into 5 groups or classes.

For example, one class contains messages for accessing and manipulating the properties of the objects described above. A common one is the "ReadProperty" service request. This message causes the server machine to locate the requested property of the requested object and send its value back to the client.

Other classes of services deal with alarms and events; file uploading and downloading; managing the operation of remote devices; and virtual terminal functions.

Note: The following BACnet steps were written to discover the BACnet devices on the ICONICS training network. This BACnet section may not work if you're performing these steps outside of ICONICS.

1. Start Workbench-SL by going to **Start → All Programs → ICONICS → Workbench-SL.**
2. Once Workbench is opened, click on the **BACnet** in the provider list to load it’s configuration in the Project Explorer.

3. Expand the localhost tree and **Right** click on the **Devices** tree node.

4. Select **Network Discovery**.

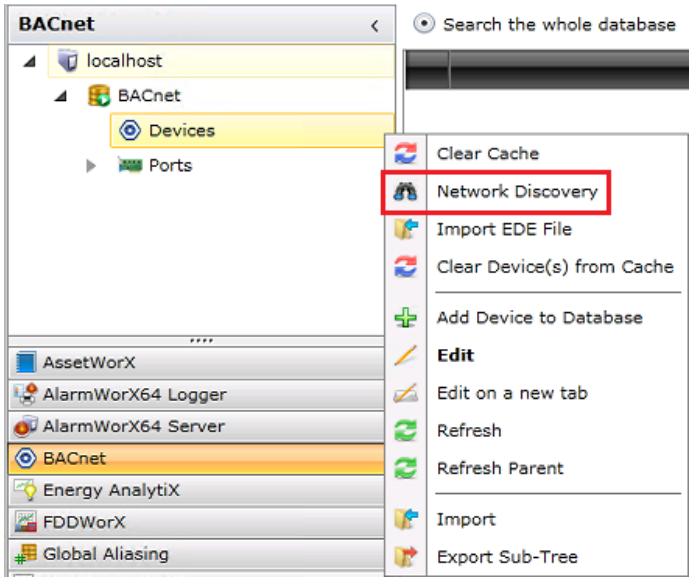


Figure L1.42 – Discovering BACnet Network Devices

5. Click on the **Scan** button in the following dialog.

6. After the discovery is complete, click on the green **+ (plus)** sign associated with the **Veris E50_02** device.

7. The discovery process will pause momentarily. Select **Close**.

8. Expand the **Devices** tree node.

9. Select the **Veris E50_02** device.

10. From the split window, on the right select the **Current Instantaneous Phase A** entry.

11. You will see the **Current Instantaneous Phase A** tab open in the bottom section of the split window.

12. Preview the **Present Value** object. This value should be changing.

1.11.8. Copy the AHU.gdfxs display to PubDisplay

In order for displays to be viewed in PortalWorX the display has to reside in the PubDisplay folder (by default) and the display has to be saved as a Silverlight (.gdfxs) version. We will proceed to copy the AHU.gdfxs file to the PubDisplay folder.

1. Copy the C:\Training\AHU.gdfxs file to the C:\Program Files\ICONICS\GENESIS64\WebSites\PubDisplay folder.

We will open the AHU display in PortalWorX in a subsequent lab.

1.11.9. Exploring GenDemo

There are many helpful displays within GenDemo that can serve as examples when needed. In this section, we will explore a few of these displays.

2. Open **GenDemo** by going to **Start → All Programs → ICONICS → GENESIS64 → GenDemo**. Opening this version of GenDemo allows us to go into GraphWorX64 configuration mode.
3. Once the display opens, hover over the objects on the right and click on the **Navigation Menu** button.
4. Select the **GraphWorx64** selection.
5. To **Pause** the carousel, click on the arrow in the circle in the upper left.
6. Select **Architecture** from the list on the left.
7. The architecture display shows an overall view of how different components, such as your OPC server, Databases, and different GENESIS64 components, all work together.
8. Hover your mouse over the icons on the right and select the **Tutorials** button. We've included the Tutorials in GenDemo to demonstrate the different tools available in configuration mode.
9. Click on a selection from the list on the left and then click on the items inside the display to see how they react. Consider using this as a future reference.

This concludes this lab.

Workbench-SL 2

Workbench-SL

ICONICS Workbench-SL is intended to provide functionality that is similar to the WinForms/Windows Presentation Foundation (WPF)-based Workbench, now known as the *Workbench Classic* of prior GENESIS64 versions, but with improved "reach" and ease-of-deployment that Silverlight technology offers.

2.1. Objectives

After completing this chapter, you should know:

- How to Use Workbench-SL Web-based Configuration Tool
- How to Access Tools and Providers
- How to Use the Project Explorer

2.2. Introduction to Workbench-SL

Workbench-SL offers light-weight deployment with fast startup time, which also supports third-party plug-ins. It is capable of using existing data services (created using the Software Factory toolkit) as well as new WCF RIA Services. Workbench-SL has a look and feel similar to the Workbench Classic, including familiar elements such as a toolbar ribbon and Project Explorer, but now has enhanced user-friendly options such as a list-view Project Explorer for browsing, which can be filtered and sorted.

The Silverlight edition of the Workbench runs in all browser platforms, including Microsoft Internet Explorer, Firefox, and Safari, etc. Its Silverlight components are also available as Web Parts in SharePoint and can run on the Windows 8 Phone.

Workbench-SL supports providers similar to its WPF-based counterpart, but also additional ones including AssetWorX, FDDWorX and Energy AnalytiX.

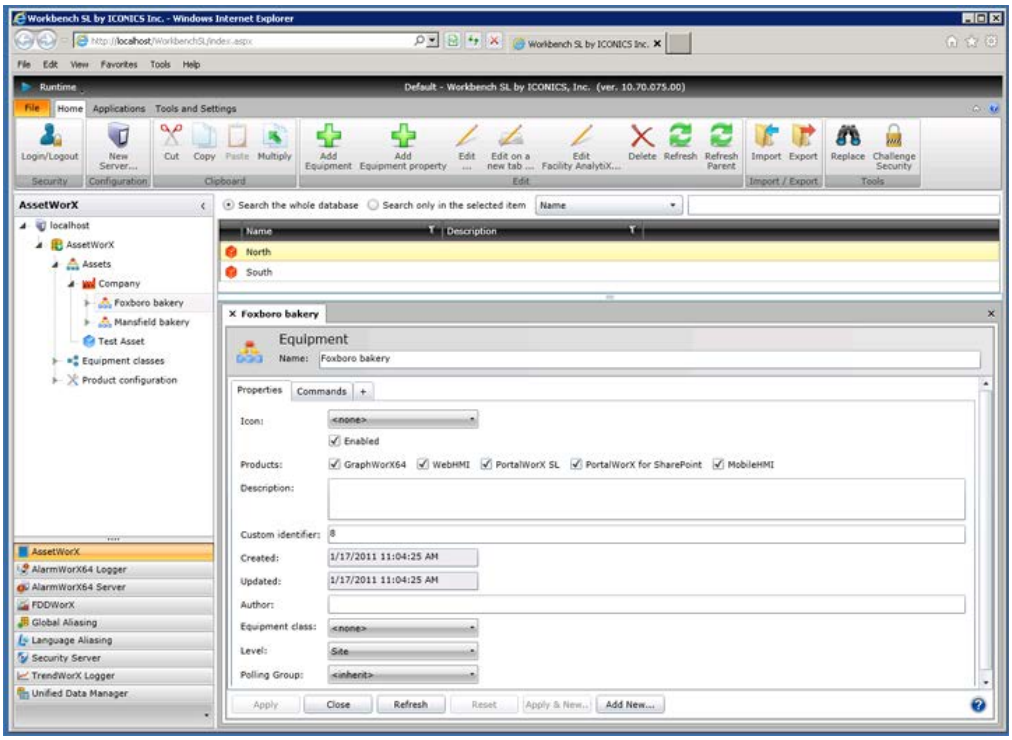


Figure 2.1 - Workbench-SL

In Workbench-SL, You Can:

- Organize data sources on the basis of a hierarchical structure of assets and equipment, using AssetWorX.
- Configure EA to calculate, report on, and manage energy use if the Energy AnalytiX provider is installed.

At the same time, the *Workbench Classic* still acts as a single interface where you can use every component of GENESIS64. It is a configuration tool in which you can also simulate an operator's runtime interface and manage projects. You can, of course, continue to use Workbench Classic as a companion tool to Workbench-SL. Many GENESIS64 configurations can be done from within Workbench-SL. What cannot be done inside the Workbench-SL is still available from within the Workbench Classic.

2.2.1. Workbench-SL vs. Workbench Classic

Features to note about Workbench-SL and Workbench Classic are:

- They are two independent applications.
- Both include Pack & Go technology.
- Their Projects are NOT shared - The provider and database lists are maintained separately.
  - Workbench-SL's providers and databases are within the IcoSetup databases
  - Workbench Classic's providers are within the project file (*.prjx) and databases are within web.config.
- Just the active databases are shared between them - via the file, IcoSetup64.ini, where the active database is stored.

2.2.2. Opening Workbench-SL

To open Workbench-SL from the Windows **Start** button, select **All Programs** → **ICONICS** → **Workbench-SL**.

When you open Workbench-SL for the first time, you see all of the applications, tools, utilities and services listed in the Project Explorer that you can open within Workbench-SL. It is made up of:

- The **ribbon bar** (along the top)
- Two **Project Explorers** that you can hide or display:
  - A **tree explorer** that gives you a way to navigate and browse; and buttons that give you access to ICONICS providers
  - A **grid explorer** you can use for searching
- The **content** or **work area** where configuration forms open

2.2.3. The Ribbon

The ribbon helps you to quickly find the commands you need to complete a task. Commands are organized in logical groups with tabs. You can minimize the ribbon by double-clicking on the ribbon tabs.

The ribbon has three tabs:

- **Home tab** - Contains all commands and changes depending on the currently selected item in the Project Manager and on the application that is currently loaded in the Workbench.
- **Applications tab** - Gives you access to the providers (applications) in the Tree Explorer's button bar.
- **Tools and Settings tab** - Lets you show or hide various elements of the window as well as personalize the project properties.

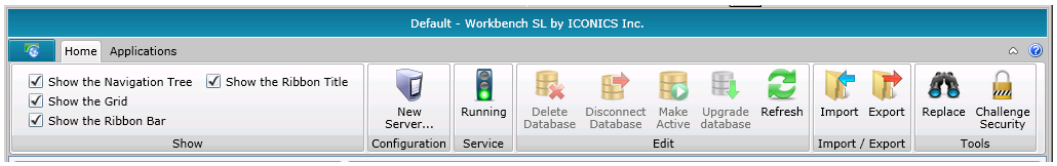


Figure 2.2 - Sample Home Tab in the Workbench-SL Ribbon

Note: This Ribbon changes as you select different Providers.

2.3. Tools and Providers

GENESIS64's Workbench and Workbench-SL save all of your tools, application providers, and settings with your projects in their project files so that you can reopen and reuse your project and settings easily. In each project are stored:

- **Application providers**
- **Database configurations** such as Global Aliasing, Language Aliasing, and other SQL databases
- **Network services tools** (Classic WB only) such as GenTray, SNMP, the FrameWorX Server, and the Security Server
- **Workbench configuration settings** that you apply to the Workbench window position, styles, modifications to the design surface, layouts, and templates

A project is typically stored where the servers are running, but in actuality, several servers may need to be accessed in order to run the different displays of an enterprise. As long as you have defined the servers' connections, those connections are stored with the project, too.

Centralized security allows all GENESIS64 operations to be secured. Security Server limits access permissions to projects and plug-in, including file access to create, modify, or read only. Historical data is stored.

The Workbench is designed for concurrent configuration by multiple development team members over the internet. It follows the *optimistic concurrency model*; there are no database locks. Multiple application servers and databases can be configured simultaneously. An additional ICONICS Workbench Toolkit can also be used to create plug-ins from third-party content providers.

2.4. Providers in Workbench-SL

Development and runtime modes of all installed and licensed ICONICS GENESIS64 products can be accessed and used in the Workbench. Even though the following providers are available in Workbench-SL, you can pick and choose which providers appear in the Workbench's Project Explorer, as shown in the figure below.

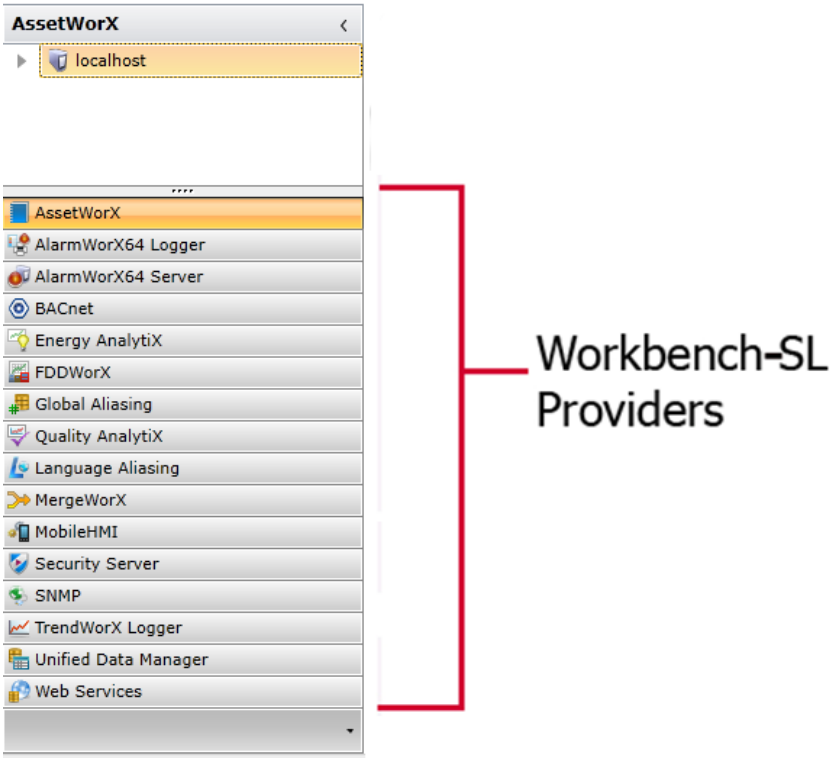


Figure 2.3 - Workbench-SL Providers

2.4.1. Working with Services

A number of GENESIS64 components are servers or services that you can control and modify within Workbench-SL. They include:

- **AlarmWorX Server** starts and stops the alarm server, as well as provides a configuration interface to configure alarms.
- **Global Aliasing System (GAS)** stores variable names and their values within an SQL database so that these variables can be used throughout GENESIS64 applications. Start, stop, create, and modify global aliases using this interface.

- **Language Aliasing System (LAS)** makes substitutions for language aliases whenever the assigned language in the Language Selector dialog box is changed.
- **Unified Data Manager (UDM)** is a central location for storing expressions, subscriptions, groups, values, registers, triggers, and other data that can be used by any GENESIS64 application. The service can be started, stopped, and all of these data types and data instances can be created and modified within the UDM in the Workbench.

2.5. Workbench-SL User Interface

Workbench-SL is used for the following purposes:

- To display a configuration form
- To host a viewer component for an application

GENESIS64 stores configuration data organized in object form into a set of SQL databases. Many of the other components of GENESIS64 are essentially front ends to different databases and the data contained inside them. When you load a utility within Workbench-SL, it loads a configuration form in runtime. These forms often come with Apply and Refresh buttons since the data is stored in a database and may require that changes be committed or that current data be retrieved.

2.6. Project Explorer

In GENESIS64's Workbench-SL, there are two Project Explorers: the

- **Tree Explorer**, which contains a tree structure for navigating the assets. A section in the lower left for the providers (or applications); and the
- **Grid Explorer**, which contains the content of the item that is selected in the Tree Explorer and serves as a way to search the selected item and the items children. These explorer features are highlighted in the following example. Note that the **Home** ribbon has options for showing or hiding these two explorers.

Note: In this training manual, the terms "node" and "tree items" are interchangeable (unless otherwise noted). They both signify a specific level (or branch) of a navigable tree.

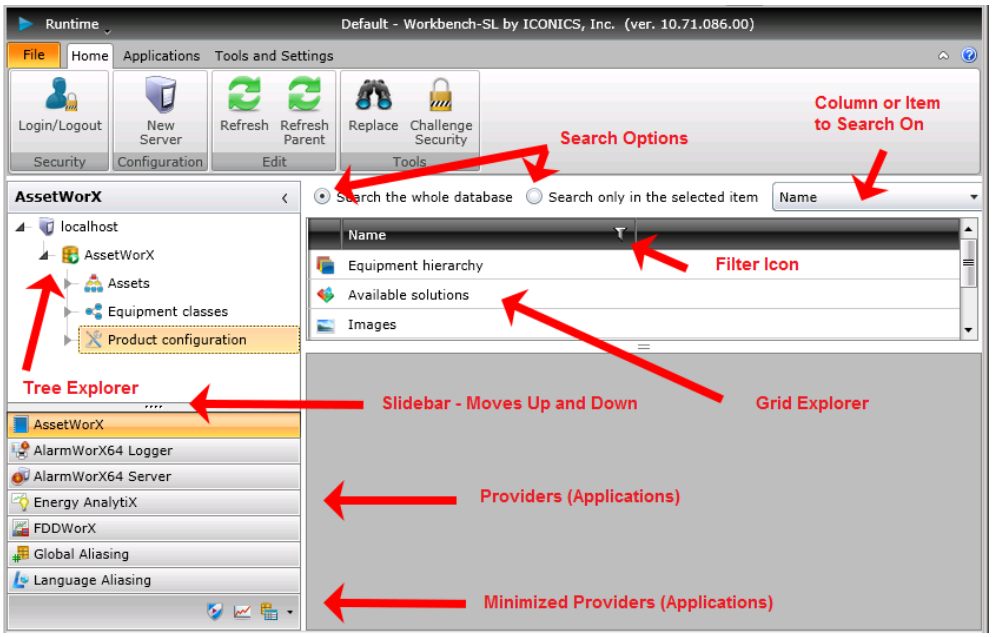


Figure 2.4 - The Project Explorers in the Workbench

The Tree Explorer is the primary navigational component for quickly accessing data in the installed applications. Button bars and icons make it easy to access applications from inside the Workbench. Its components can also be moved. In moving them you can:

- **Leave them free floating** by clicking and dragging the toolbar of the Project Explorer off of a docked position to make it free floating. Double-click on the Project Explorer title bar to return the pane to its last docked position.
- **Dock them** to any side of the Workbench64 window. To move the pane, click the title bar and move the pane onto any of the arrow icons of the Diamond Dock feature.

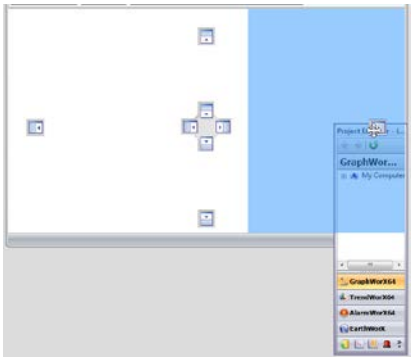


Figure 2.5 - Diamond Dock

- **Minimize them to a tab** by clicking the push pin icon in the Project Explorer title bar to minimize the panel to a tab. The following image shows how the Project

Explorer components look when they are minimized. To view the Project Explorer expanded, click on the minimized tab; you can then click again on the push pin if you want to return the panel to maximized view.

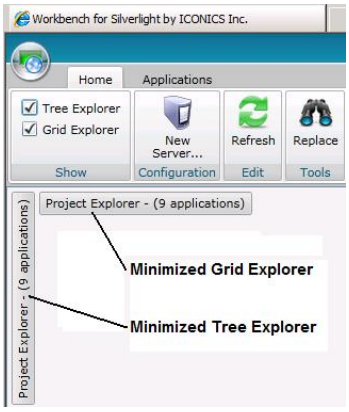


Figure 2.6 - Minimized Project Explorers in the Workbench

The Project Explorer is always in view within the Workbench64 in one form or another.

Searchable Grid Project Explorer: Selecting a node in the Tree Explorer displays the node's content in Grid Explorer. Note that you can search the selected item or you can search the entire database. You can also click on a column's filter icon to limit the content that appears in the pane.

Note: You cannot search the Tree Explorer, but you can search the Grid Explorer.

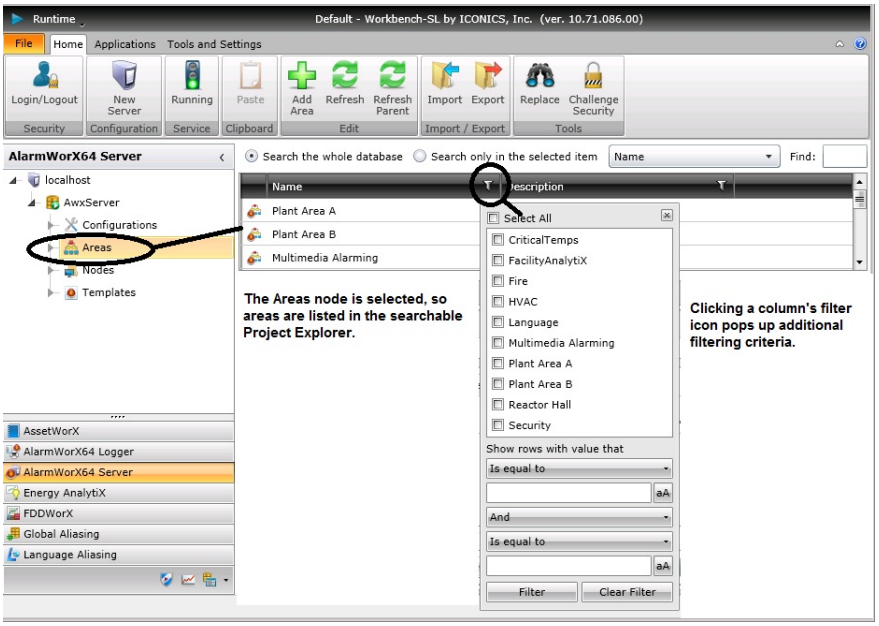


Figure 2.7 - Searchable Project Explorer Options

2.6.1. Working in the Project Explorer

The Tree Explorer can be modified to show just those applications, tools, and services that you need for your project. You can re-size the pane, as well as to move the slider up or down to view more button bars. The Workbench-SL project explorer allows for efficient provider access by opening each provider's configuration in a separate tab.

To Move between the Providers (applications) in the Workbench:

- Click the buttons listed in the bottom of the Project Explorer. Below is an example of some available provider buttons.

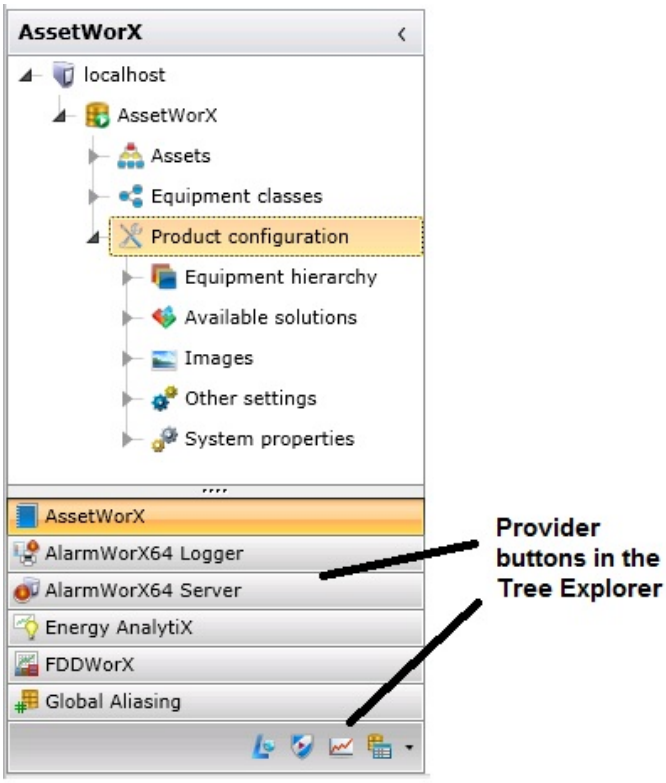


Figure 2.8 - Application Buttons

2.6.2. Data in the Project Explorer

When you view components in the Tree Explorer you are viewing either configuration or data display files. For example, while AssetWorX shows you a navigation tree of configuration options and the asset tree, the AlarmWorX64 Server shows you a set of configuration forms for object data stored in the AlarmWorX64 SQL database. Provider data are organized into a hierarchical object tree of Server database with Database object at the top, stored Configurations for different items with alarms of different types, geographical organization using the group object called Areas, and a group object called Nodes which organizes redundancy configuration aspects.

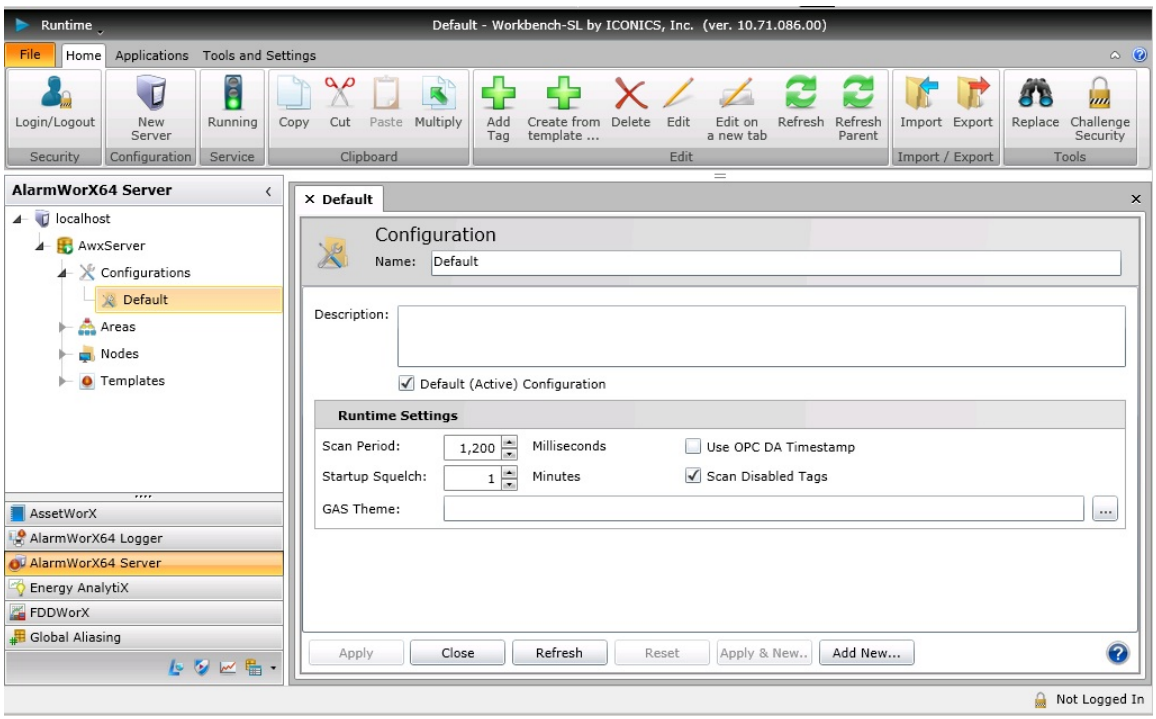


Figure 2.9 - Data in the Tree Explorer

2.7. Ribbon

The ribbon for Workbench-SL is designed to help you quickly find the commands you need to complete a task. Commands are organized in logical groups. The ribbon has two tabs: the **Home** tab provides general tool bar functions and changes depending on the item that is selected in the Project Manager, and the **Applications** tab gives you access to the providers (applications) that are in the Tree Explorer's button bar. Examples of both are shown below. You can minimize the ribbon by double-clicking on the ribbon tabs.

Figure 2.10 - Sample Home Tab in the Workbench-SL Ribbon: This Ribbon Changes with Your Project Explorer Selections

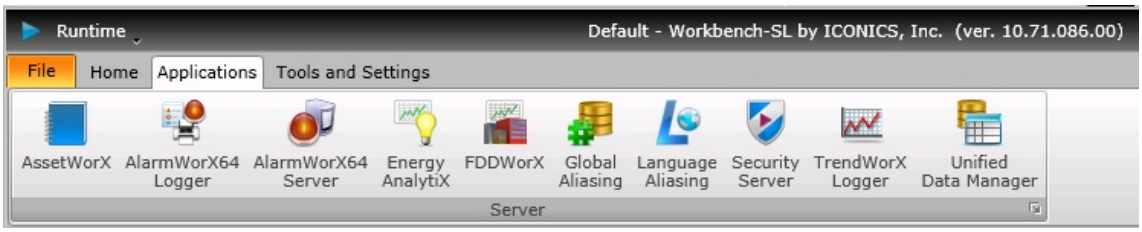


Figure 2.11 - Sample Applications Tab in the Workbench-SL Ribbon

2.8. Filtering and Sorting Information in the Workbench

In the Silverlight edition of Workbench64, you can filter and sort lists of objects in tabs. If there are a lot of calculations that are listed on the tab, you can filter out (within the Grid Explorer) the ones you don't want to see by clicking any of the filter icons in the column heading on the tab. Clicking a filter icon pops up a small dialog where you can enter filter criteria. In the following example, we clicked the filter icon for the Name column, which popped up a filter window to filter table content to show rows for specific names.

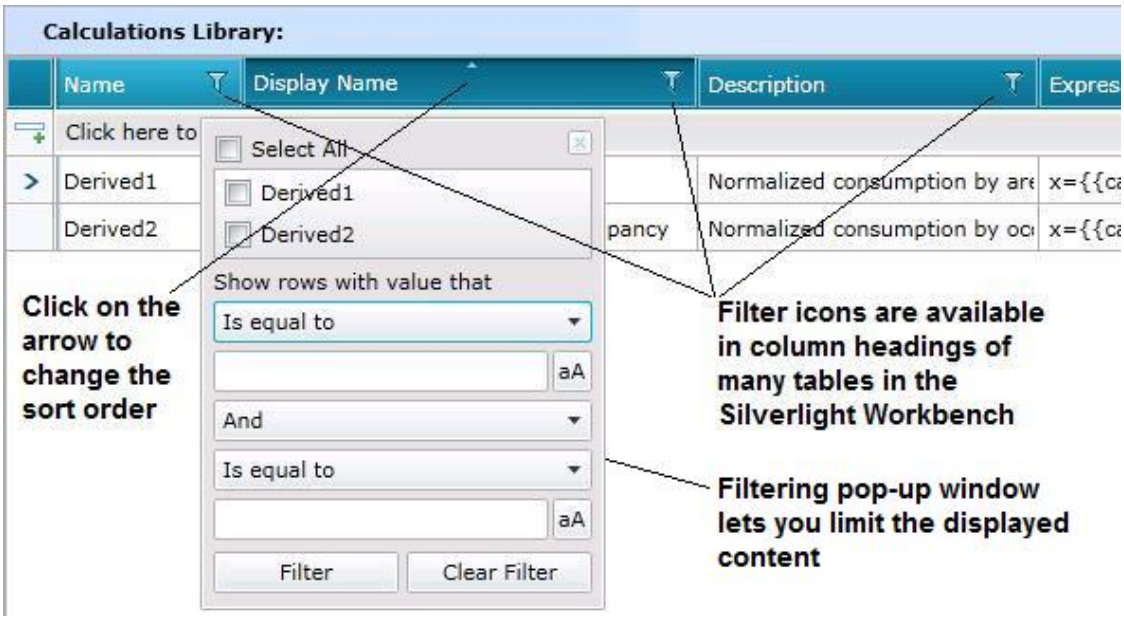


Figure 2.12 - Sorting and Filtering Options

Steps for filtering and sorting are provided in this topic:

- Sorting information
- Filtering information
- Clearing a filter
- Using Conditions in a Filter

2.8.1. Sorting Information

To sort the content of a table on the basis of values in one column, click on the column heading. This makes the sorting icon visible. Then click on the sorting icon to make the table sort in ascending or descending order, using the column as its basis.

2.8.2. Filtering Information

To filter information to display only what you want to see:

1. Start by thinking about what you want included in the listing and decide which column will let you choose that information.

2. Click on that column's filter icon in the column heading. This opens the column's popup filter.

3. Now specify your filter criteria. The data you select will be included in the table. There a few ways you can filter data:

   - You can select any or all of the items listed in the top half of the filter. Selecting no rows is the same as selecting all of them. But as soon as one item in the list is selected, only the selected items are included in the results. The following figure shows an example where all were selected using the Select All check box, and then individual items were deselected.

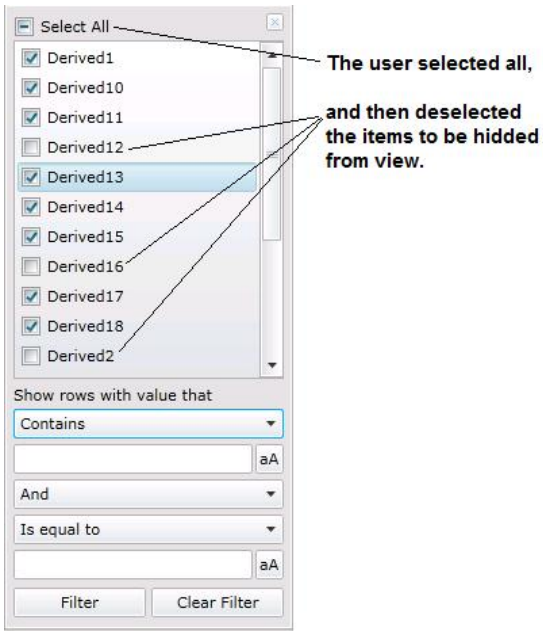


Figure 2.13 - All Items Selected, Then Specific Items Deselected

- You can also (or alternatively) enter one or two conditions. The figure below shows the fields where you enter conditional information. For example, you can include only those rows that have "Foxboro" in the description, or exclude only those rows. Under the **Show rows with value that** heading, you can enter a condition (for example, **Starts with**) and then optionally choose a Boolean value (**And** or **Or**), and then another condition. For help using this part of the popup filter, see the 'Using Conditions in a Filter' topic.

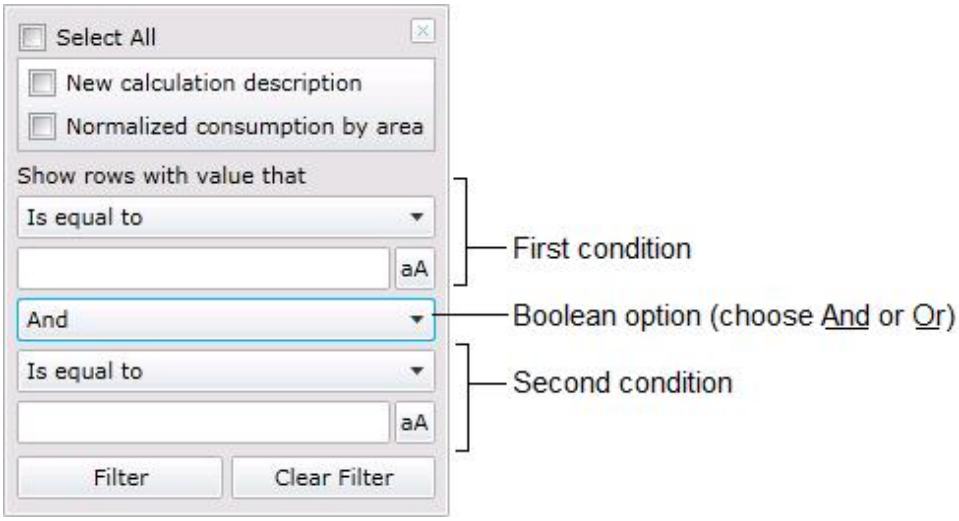


Figure 2.14 - Conditional Options for Filtering Rows in a Table

4. Click the **Filter** button to update the results in the table. In some cases, as you enter values, the data in the table is instantly filtered so you can see the result; in others you will have to click the Filter button to see updated results.

5. You can filter on more than one column. For example, you can filter the Name column to eliminate a few known rows, then filter on the Description column to display rows that rows that contain the word "West" in the description.

6. When you are done with a filter, simply click outside the filter box or click the popup box's **X** button to close it.

2.8.3. Clearing a Filter

You can tell which columns have a filter in place by the appearance of the column filters.

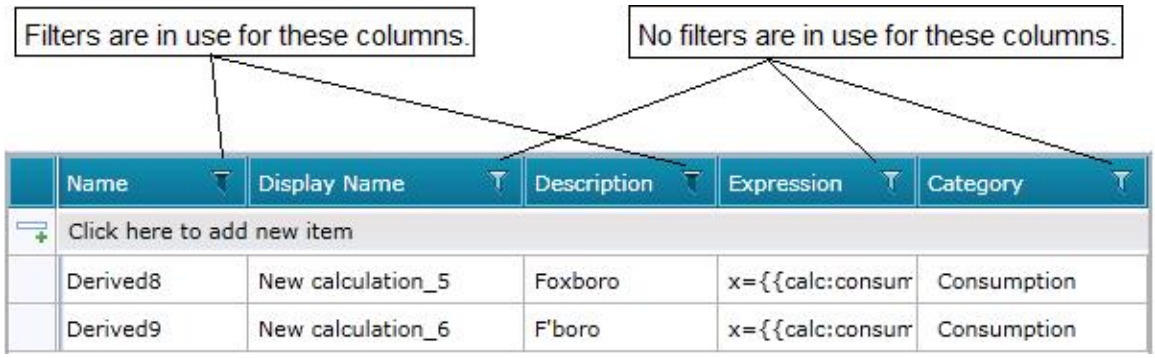


Figure 2.15 - Appearance of the Filter Icons in Column Headings

To clear a filter so that no rows are hidden based on that column:

1. Click on the filtered column's filter icon in the column heading. This opens the column's popup filter.
2. Click the Clear Filter button.
3. Click outside the popup filter or click the popup box's **X** button to close it.

2.8.4. Using Conditions in a Filter

In a column's filter popup window you can include up to two conditions for listing information, as shown in the sample below.

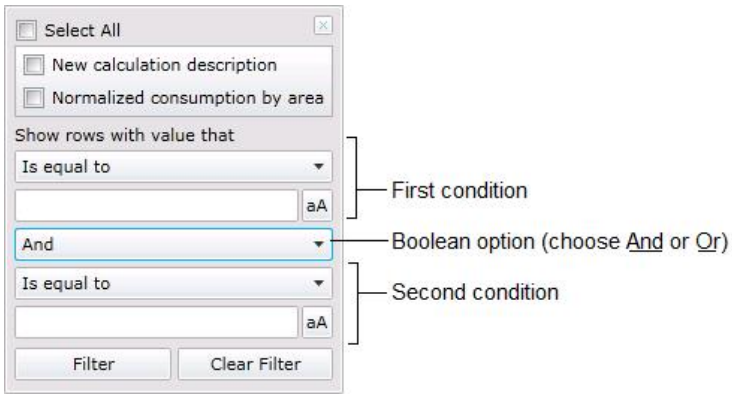


Figure 2.16 - Conditional Options for Filtering Rows in a Table

Each condition is made up the condition and the values for that condition. For the condition, you can select one of the following and enter an appropriate value in the field below your selection. If the value must be case-specific, you can click the **aA** button, also.

- **Is equal to**: Rows must contain the exact string that you specify as the value -- no more and no less.
- **Is not equal to**: Rows must not contain the exact string that you specify as the value.
- **Starts with**: Rows must begin with the string you specify as the value.
- **Contains**: Rows must have the string you specify as the value. For example, you might use this to list vendors with a phone number that contains "1-508".
- **Does not contain**: Rows must not have the string you specify as the value.
- **Ends with**: Rows must end with the string you specify as the value. For example, if you enter "USA" as the value, a row that has "Foxborough East USA" will be included but a row that has "Foxborough West U.S.A." will be filtered out.

Below are some examples.

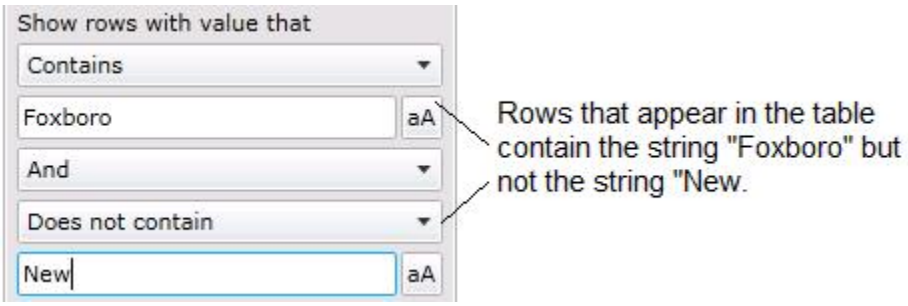


Figure 2.17 - Example 1

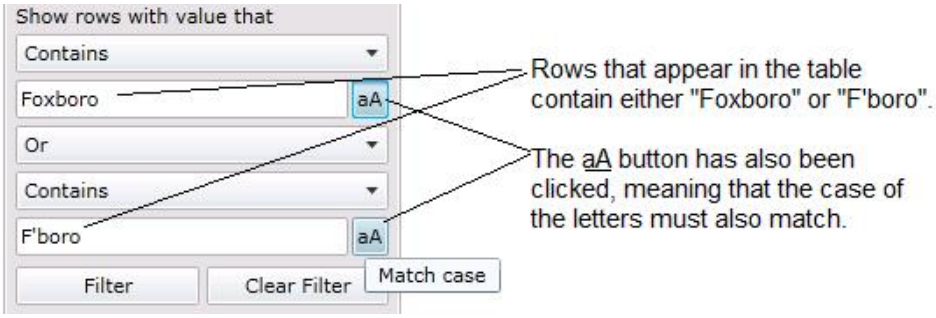


Figure 2.18 - Example 2

Lab: Workbench-SL/Data Connectivity *L2*

2.1. Lab Overview

In this section, we will also give you a chance to practice inserting OPC DA, OPC UA and BACnet tags into GraphWorX64 to view live data. You will also learn to use the Monitor feature in the Data Browser.q

Estimated time to complete this lab: 20 minutes

2.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Connect your PLC to an OPC server.
- Connect to OPC tags.
- Use the Monitor feature of the Data Browser.
- View and manipulate OPC tags within GraphWorX64.

2.1.2. Support Files

You do not need any additional supporting files to complete this lab.

2.2. Workbench-SL Navigation

Let's take a look at some of the Workbench-SL features.

1. Since Workbench-SL acts as a centralized location to access most of the applications, we will use it throughout this course to manage our training course project. Open the **Workbench-SL** from **Start → All Programs → ICONICS → Workbench-SL**.

Figure L2.1 - The Workbench-SL Ribbon Bar

2. As explained in the Chapter 2 lecture, there are four sections in Workbench-SL: the **Ribbon Bar** (shown in the previous image), the **Project Explorer** (which lists the providers), the **Grid explorer** (used for searching and displaying selected item content) and the **Content Area** (or work area where configuration forms open).

2.3. Create a New Project

The GENESIS64 Providers are exposed in the Project Explorer located on the left side of the Workbench-SL. The list of providers can be expanded or retracted by selecting the bar above the AssetWorX provider.

1. Since Workbench-SL acts as a centralized location to access most of the applications, we will use it throughout this course to manage our training course project. Open the Workbench-SL from **Start → All Programs → ICONICS → Workbench-SL.**
2. Let's create a new project for training.
3. Select the **File** menu in the upper left section (to the left of the Home menu) of the workbench.
4. Select **New**. Then select **Clone Project**.
5. Enter the name "**GENESIS64 Training**" in the Name: field.
6. Both '**Name**' and '**Description**' are required fields. Enter a description for this project. Any description will do.
7. You should see the GENESIS64 Training project name as a prefix to the product identifier in the top of the Workbench window.

2.4. Workbench-SL Provider Selection

In the following steps, we will edit the project and delete the providers that we will not use during training.

1. Select the **File** menu. Then select **Edit**.
2. From the **Edit the list of plugins for Project** dialog, select the row with FDDWorX. This should highlight the entire FDDWorX entry.
3. Hit the **Delete** key.

4. You will see a dialog requesting that you confirm the deletion. Click **OK**.
5. Select the following providers, one at a time, and delete each of them.
    - Energy AnalytiX (if it exists)
    - Language Aliasing
    - MergeWorX
    - SNMP
    - TrendWorX Logger
    - Web Services

2.5. Workbench-SL Project Properties

In this section, we will define and save the Author project property.

1. Select the '**Tools and Settings**' menu.
2. Enter you name in the **Author:** field.

Note: The Version field is also editable but the Last Update: field is maintained automatically.

2.6. GraphWorX64 Preferences

In this section, we will change the default location where display files are saved.

1. Open GraphWorX64 from Start → All Programs → ICONICS → GENESIS64 → GraphWorX64 → GraphWorX64.
2. It is recommended that you save all the training material you either create or modify to the **C:\Training** folder on the virtual machine. While we're here, we will set the GraphWorX64 **DefaultSaveLocation** property.
3. On the lower right-hand side of the GraphWorX64 editor, click on the **Preferences** tab.
4. With the **General Setting** category selected, locate the DefaultSaveLocation property in the lower window and click on the browse button.

5. Under the Computer selection, locate and select the **C:\Training** folder.

   Note: When you close GraphWorX64, the Preferences changed become permanent.

2.7. GraphWorX64 Data Connectivity

2.7.1. Simulated Connection

Although you may have had little exposure to GraphWorX64, by following the step-by-step procedures below, you will connect to various tags. Through GraphWorX64, you can view and control values within the application. This exercise is designed to expose you to data connectivity. We will dig into GraphWorX64 in more detail later in this training.

1. From the menu, select the **Dynamics** tab. In the **Text Objects** section, click on the **Process Point**. Place the cursor (notice it is a crosshair cursor) in the middle of the display. Hold the left mouse key and draw a rectangle. Release the mouse key. This launches the Data Browser.

2. In the **Data Browser**, click on the **Simulation** tab, and select the **localsim:ramp** tag. Notice the tag properties on the right-hand pane, and then click "**OK**".

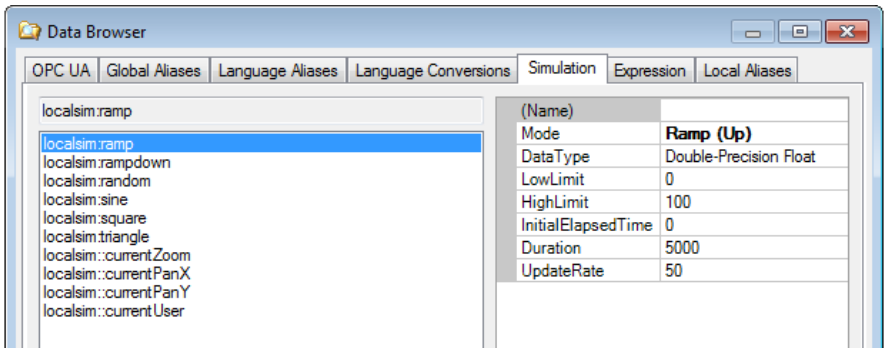


Figure L2.2 - Data Browser

3. Click on the "**Runtime**" button in the upper right corner to enter Runtime mode and watch the data change.

4. In the upper right, click on the **Configure** button to go back into Configuration mode.

5. Select the **Process Point** on the display canvas with a left mouse click.

6. From the right-hand side, select the **Dynamics** tab. In the **Dynamics explorer**, notice that the **Data Source** property says only **localsim:ramp**. This is because we are using a GraphWorX64 local simulation tag. You will not be able to use this tag outside of GraphWorX64.

2.7.2. OPC DA Connection

The OPC Data Access Specification is the first of a group of specifications known as the Classic OPC Specifications. OPC Data Access is a group of standards that provides specifications for communicating real-time data from data acquisition devices such as PLCs to display and interface devices like Human-Machine Interfaces (HMI). The specifications focus on the continuous communication of data

1. Now we need to set some options to be able to see other tags. Go to **Start → All Programs →ICONICS → ICONICS OPC Server Suite 5 → ICONICS OPC Server 5 Administration**. This launches the "**ICONICS OPC Server Suite – Runtime**" dialog.

2. **Right-click on the ICONICS OPC Server Suite 5.5 icon** (located in the lower right-hand section of the Windows task bar (**near the clock**) as seen in the figure below and select **Settings**. This launches the "**ICONICS OPC Server Suite Settings**" dialog box.

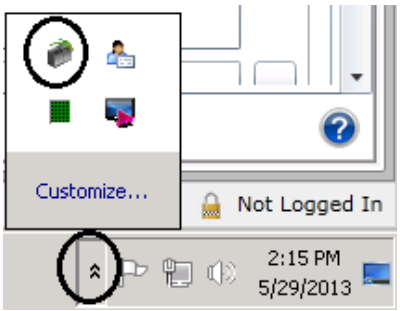


Figure L2.3 – ICONICS OPC Server Suite 5.5 Icon

3. Click on the **Runtime Process** tab and, from the drop-down menu, select **Interactive**. Click **Apply**.

4. You may see a notification that this will disconnect other clients. Click **Yes**.

   Note: Clicking Yes in the step above will cause runtime to reinitialize. Be patient, this might take a minute. When the Close button is selectable, initialization is complete.

5. Click on the **Configuration** tab and check the box **"Allow runtime to accept remote connections**".

6. Click **Apply** then **OK** to save changes. You may receive notification that this operation may cause clients to be disconnected. Click **Yes**.

7. Select **Start → All Programs → ICONICS → ICONICS OPC Server 5 Configuration.**

8. From the "**ICONICS OPC Server Suite – Runtime**" dialog, reinitialize the server by clicking on menu **Runtime → Reinitialize**.

9. Return to GraphWorX64 add another process point to your display. Then, in the **Data Browser**, select the **OPC UA** tab, then select **OPC Classic Servers → My Server → ICONICS.IconicsOPCUAServer.V5 → Channel_0_User_Defined → Ramp → Ramp1**, and click on "**OK**". Now, notice the syntax for the data source property looks like this:

@ICONICS.IconicsOPCUAServer.V5\Channel_0_User_Defined.Ramp.Ramp1.Value

10. The prefix **@** and suffix ***.Value*** indicates that **this is a tag from an OPC DA server and not an OPC UA server**.

2.7.3. OPC UA Connection

OPC Unified Architecture is the most recent Object Linking and Embedding for Process Control (OPC) specification from the OPC Foundation and differs significantly from its predecessors. The first version of Unified Architecture was released in 2006, after 3 years of specification work and another year of prototyping. The Foundation's goal for this project was to provide a path forward from the original OPC communications model (namely COM/DCOM) to a cross-platform service-oriented architecture (SOA) for process control, while enhancing security and providing an information model.

1. Add one final **Process Point** and click **Cancel** to close the **Data Browser**.

2. This time, we will type in a portion of the path and then browse. In the **Dynamics** Explorer on the right, find the **DataSource** field and type in:

opc.tcp://ComputerName:Port

Notes:

- Replace ***ComputerName*** with the name of your computer or IP address.

- ***Port* 49460**. The port number 49460 is fine for a training computer. However, it's worthwhile noting that the OPC UA server port number is defined through the OPC UA Configurator that you launched in Lab 1.

3. At the end of the **DataSource** field, click on the **Ellipsis** [...] button to launch the **Data Browser.**

4. Notice that the ***opc.tcp://ComputerName:Port*** is populated in the Data Browser. **Click** on the **Blue right arrow** and locate the tag:

   Server.:ServerStatus.:BuildInfo.:ManufacturerName

5. Click **OK** and go to **Runtime** mode to see that all of your data shows up with some value. The UA field should show the word **ICONICS**. If you do not see the entire word ICONICS (because the process point field is too short), go back into Configuration mode and select the process point red handle and stretch the rectangle to the right. Enter Runtime again to test.

2.7.4. The Data Browser Monitor View

Monitor view presents you with the current values of the nodes that you select and add to this particular view. Use the Monitor view to check the current values of the different tags and variables that you use in your projects in real time. If the nodes being monitored are writable, you can write a value from the monitor viewer.

1. With GraphWorX64 in Configuration mode, from the Dynamics tab, in the Text Objects section, select Data Entry.

2. Using the same technique as with the process point, place the Data Entry field into the display. This launches the Data Browser.

3. Select the tag **Home → OPC Classic Servers →My Server → Simulations → Bool** and right click on the **Static** tag.

4. Select "**Monitor this node**".

5. Click on the **Monitor** tab. Note the **Value** and **Status Code (Good)** fields.

6. Right click on the **Static** tag and select "**Write value**".

7. In the top field enter **True** or **False**.

8. Click **OK** and you should see the value change.

9. This completes this exercise, be sure to click on the **Grid** tab.

This concludes this lab.

AssetWorX 3

AssetWorX

AssetWorX is an enterprise control system for integrating business and manufacturing control systems in Workbench-SL. It provides a tree-like structure in which you can build your enterprise in the form of physical locations and business units, and organize equipment such as buildings and machinery in one centralized system for analysis by the ICONICS GENESIS64 suite of products. The tree-like structure provides a functional hierarchy for navigation and data roll-ups. Physical locations and areas of responsibility can be identified in this hierarchy.

3.1. Objectives

After completing this chapter, you should know:

- The Architecture of the AssetWorX provider in Workbench-SL
- Configure an AssetWorX database and Data Import or Export
- Define Units of Measure, Temperature Sources/Instances and Polling Groups
- Build Hierarchical Tiers within the Asset Tree

3.2. Introduction to AssetWorX

When learning to use AssetWorX, one must first become acquainted with Nodes. Nodes are the expandable selection in the Asset Tree. For example, in the Figure below, underneath "AnalytiX Demo" you see the tree nodes "General Options, "Consumption," "Costs," "Carbon," "Calculations" and "Triggers." The individual Nodes are what composes an Asset Tree.

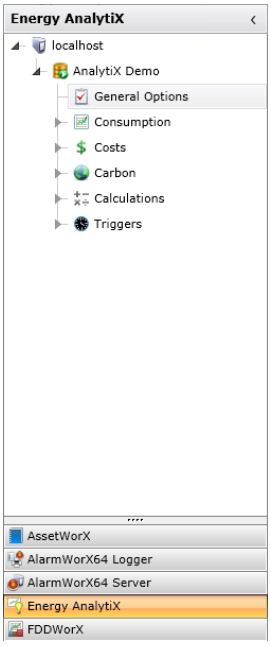


Figure 3.1 - Nodes in Asset Tree

Features of AssetWorX

- Designed for Massive Systems - able to handle millions of tags
- Object-oriented Database - to work with real world objects
- AssetWorX Runtime - store, cache and checkpoint tags
- Base for AnalytiX Products - integration with Energy AnalytiX/Facility AnalytiX

The asset tree provides a way to organize data sources (OPC, database, web services) and visualizations (such as human-machine interfaces (HMI), charts, and reports) in a logical hierarchical structure. For example, rather than OPC data sources being organized based on the address space of the server itself, these data sources can be organized by geographic/physical locations of the associated sensors (for example, by site, building, floor, and machine).

AssetWorX allows you to collect data from multiple applications and configures it into a single tree, organized in a logical structure that you define. AssetWorX comes with three predefined nodes at the highest level of the structure. These nodes are:

- **Assets**, which is where you configure your equipment and house your hierarchical asset tree.
- **Product Configuration**, which is where you identify your preferences for AssetWorX settings.

It is in these three nodes that you configure your asset tree, define the structure of the asset tree, and set general configuration options for AssetWorX.

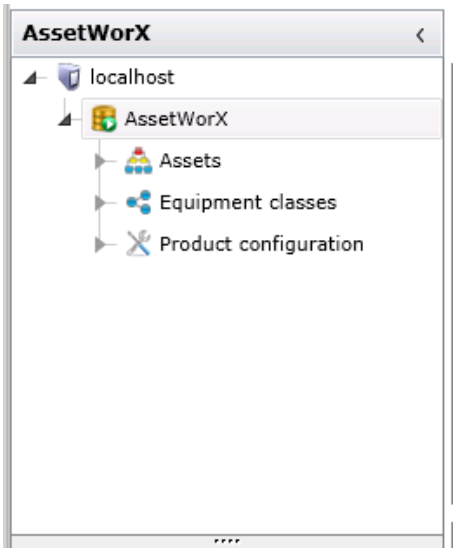


Figure 3.2 - The Three AssetWorX Nodes

At any enterprise, equipment is interconnected with its physical location and in business units that are easily organized hierarchically. You define the interconnected relationships of equipment using a tree-like structure called the **asset tree**. Each piece of equipment gets its own node in the asset tree. Each piece of equipment in the asset tree can have its own associated properties. A property might be a variable data source, a reference to an HMI graphic, or a static value. It is at these nodes where you can analyze data to obtain an ongoing, current energy analysis for each piece of equipment, where both configuration and runtime features are available.

In configuration mode, for each node in the tree, you can add properties like dynamic data connections or associated runtime layouts. In runtime mode, the tree becomes the interface from which runtime users launch reports and HMI layouts, as well as visualize alarm summary data.

The asset tree conforms to a hierarchy of tiers that are predefined in AssetWorX. The hierarchical structure of the assets follows the ISA-95 standard for organization levels. Each tier in the hierarchy represents a type of equipment, such as cities, campuses, buildings, product lines, stockrooms, and machinery. Rules for each tier determine how equipment can be configured on each tier. A set of default asset tree tiers is installed for you as an example, but it is expected that you will customize these tiers later on.

AssetWorX is a Workbench-SL tool for setting up the tools and applications that are used by other applicable Providers (for instance, Energy AnalytiX, FDDWorX, etc.).

AssetWorX has three main nodes:

- **Assets -** Defines equipment in the asset tree
- **Equipment Classes -** Defines templates that make it easier to define equipment
- **Product Configuration** - Configures settings for the products installed in the Silverlight Workbench

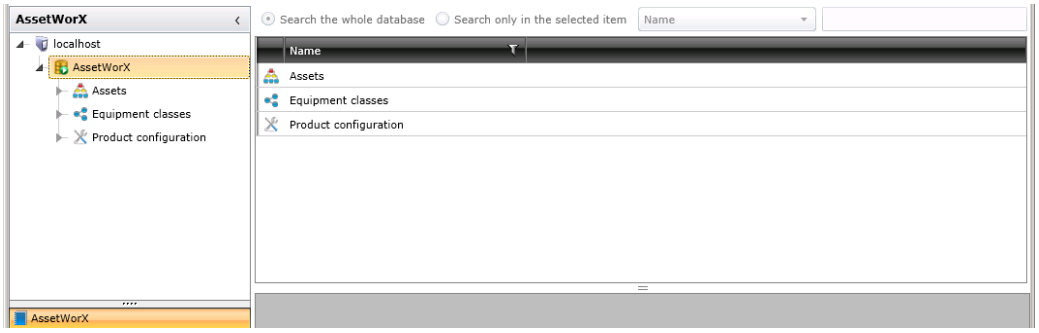


Figure 3.3 - AssetWorX in the Project Explorer's Tree View (Left) and Search Panel (Right)

3.2.1. Architectural Overview of AssetWorX

The AssetWorX provider found in GENESIS64's Workbench-SL provides data sources and visualizations (HMI, charts, etc.) in a logical hierarchical structure. The Asset Tree itself provides intuitive, easy setup and configuration to any level of aggregation, from an entire campus or enterprise down to a specific meter or user. AssetWorX, following ISA-95 and S88 standards for organizational levels, allows users to import AutoDesk BIM and Automation ML models for faster deployment.

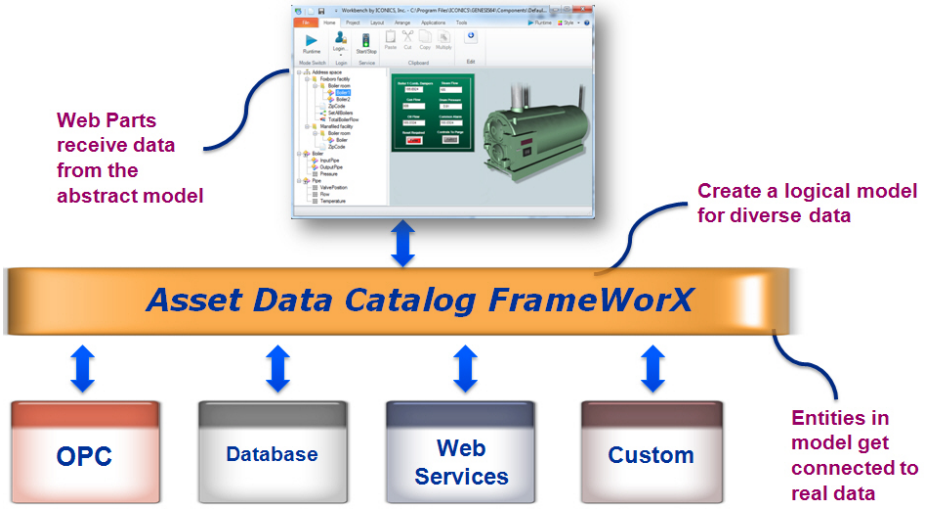


Figure 3.4 - AssetWorX Architecture

Below is an example of several asset tree characteristics.

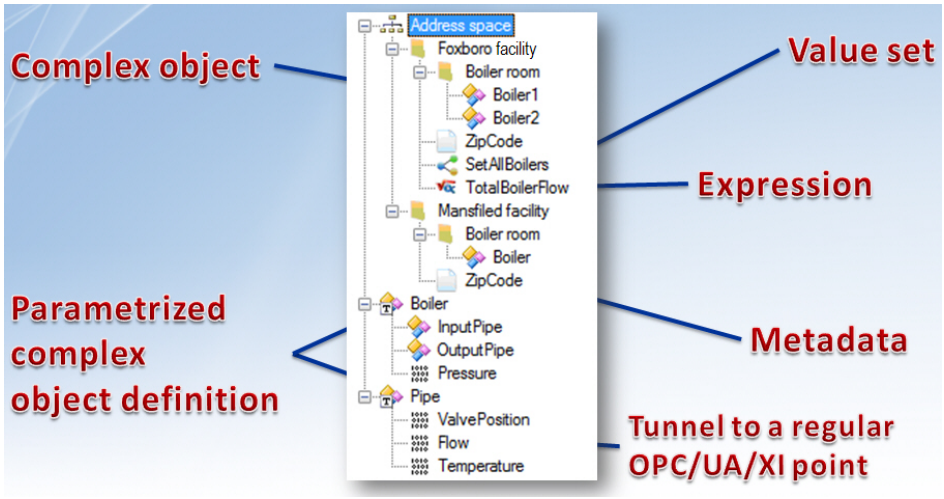


Figure 3.5 - Asset Tree Characteristics

3.2.2. Assets vs. Tags

Tags	Assets
Complex Path Structure	Tree Structure
Complex Naming ➤ @opc:…/…/…/… .Value	Simplified Naming ➤ Rapid Mixer 01
Varied Organization ➤ OPC Server Dependent ➤ Protocol Dependent	Hierarchical Organization ➤ Empty Asset Folders ➤ Parent/Child Relationships
BACnet/OPC-UA ➤ Object Oriented ➤ Non-Hierarchical Tags	Associated Properties ➤ Objects with Multiple Properties per Asset

3.2.3. Quick Start with AssetWorX

This section outlines the general steps you must take in order to use AssetWorX to build an asset tree. (Take note that "equipment nodes" are also known as "assets".)

1. Create an AssetWorX Configuration Database, Connect to it, and Activate it.
2. Define basic information required on the Product Configuration node.
3. Follow the Steps to Building an Asset Tree, then add equipment to the Asset Tree.

3.3. AssetWorX Configuration Databases

When you first launch AssetWorX in ICONICS' Workbench-SL, a default database will appear in the tree explorer. You have the option to either create a new database or connect to an existing one. In Workbench-SL, any AssetWorX database that you create is shared among all AnalytiX providers (e.g. Energy AnalytiX and FDDWorX). Any changes made to an AssetWorX database will be propagated to all AnalytiX providers. You will see an example of an existing and added AssetWorX database during this chapter's lab. Activating an AssetWorX Configuration Database

Setting the active database in AssetWorX sets the active database for all participating servers. You can add multiple databases within the AssetWorX tree explorer, but only one can be active at any time. This concept will be reviewed in the lab for this chapter.

3.3.1. Exporting and Importing

3.3.1.1. Exporting Data from AssetWorX

You can export data from an AssetWorX database, asset tree, or equipment class node to a .CSV (comma-separated values) file. The file can then be imported into AssetWorX for use elsewhere. Note that you can export from any equipment node in the asset tree, or from any equipment class. The name you assign to the .CSV file that is created should identify the exported content.

3.3.1.2. Importing Data into AssetWorX

You can import data into the AssetWorX database or into the asset tree or equipment class node. It is assumed that the data you want to import has been exported from an AssetWorX database and is stored in a .CSV (comma-separated values) file. Be aware of the data being imported so that you import it to an appropriate location in the Project Explorer. For example, do not import equipment classes into the asset tree.

3.4. General Setup in AssetWorX

3.4.1. Enabling the Available Solutions

When you create an asset, you will have the option of adding the Energy AnalytiX extension. If the Energy AnalytiX solution is disabled, the option of adding the extension will also be disabled. This is done via the 'Available solutions' branch of the 'Product configuration' node in the AssetWorX provider, as shown below.

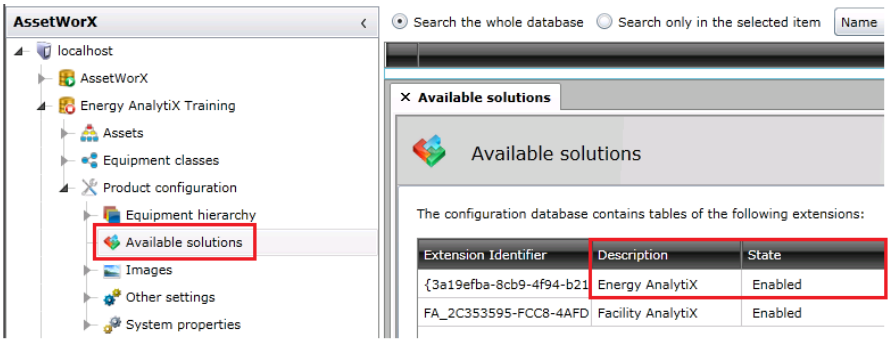


Figure 3.6 – Available Solutions: Energy AnalytiX Enabled

3.4.2. Other Settings Node

In AssetWorX, the Product Configuration node is where you set your system settings. In the Project Explorer, under ***localhost* → [the name of your AssetWorX database. In our examples, we've named it '*AssetWorX*']** → ***Product Configuration***, select **Other Settings**. This displays the Other Settings window, shown below. Within the Other Settings window are the General and Caching tabs.

General Tab - Deals with Equipment Classes, which you will learn about later in this training.

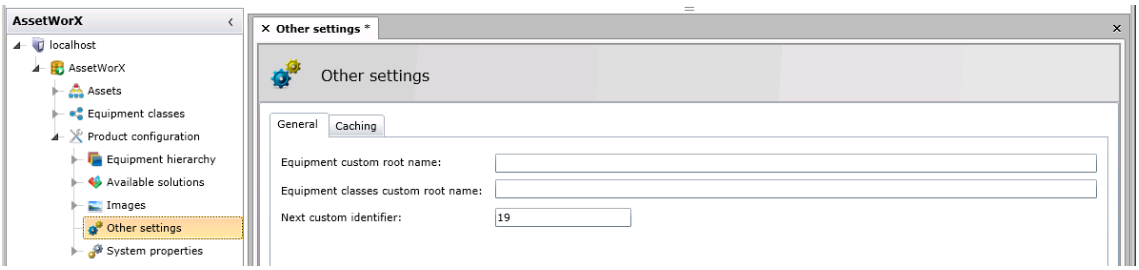


Figure 3.7 - Other Settings: General Tab

Caching Tab

The **Data Store** section of the Caching tab within 'Other settings' allows you to set a data storage location.

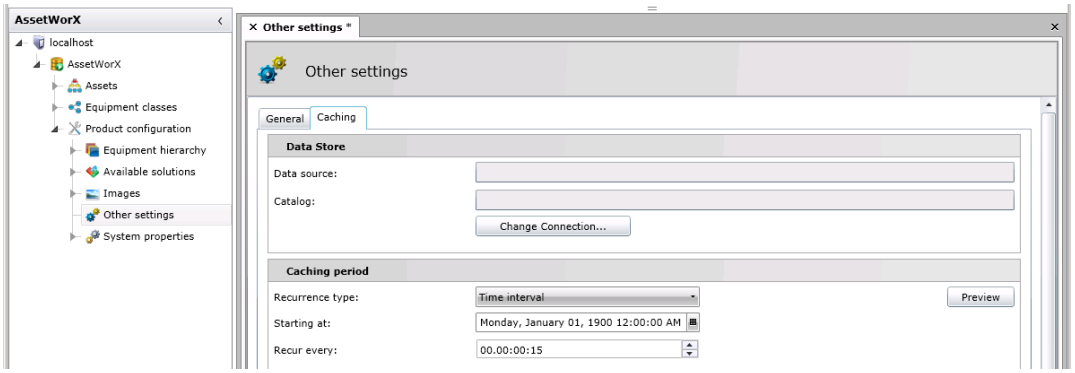


Figure 3.9 - Other Settings: Caching Tab

Data Store - The Data Store section of the Caching tab within 'Other settings' allows you to set a data storage location. Clicking on the 'Change Connection' button opens the following window:

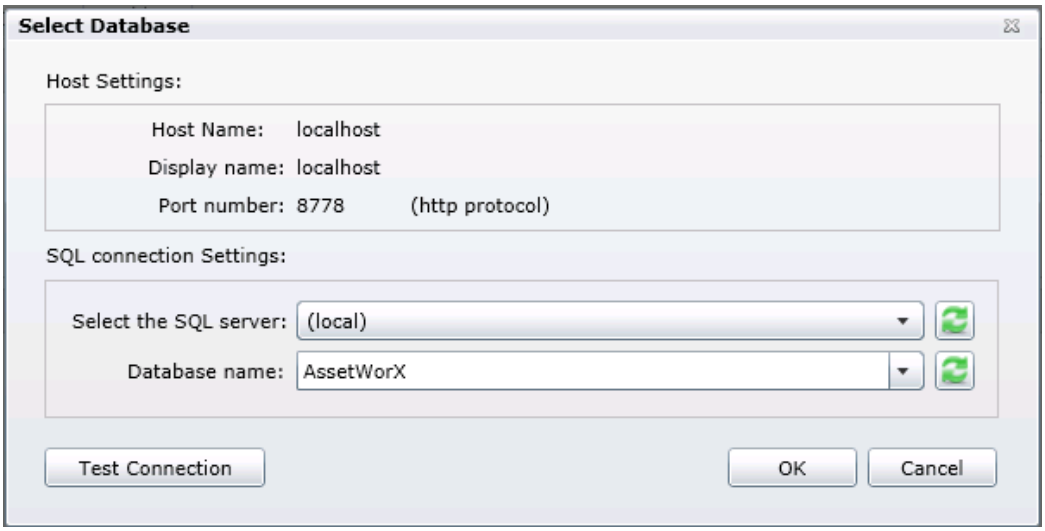


Figure 2.29 - Select Database Window

Use the pull-down menus to select a SQL server and Database name. Should you wish to make sure the connection will work, click on the 'Test Connection' button. Once you have made you selections, click the 'OK' button to return to the Caching tab of the 'Other settings' window. Your selections will now appear in the 'Data source:' and 'Catalog:' fields.

Caching period - The Caching period section of the Caching tab allows you to set a time period for caching data.

Recurrence Type - Choose from One time only, Time interval or Specific dates and times.

Starting At – This function allows users to decide when caching should first occur (either once or repeatedly at a programmable time). You can enter a day, date and time in the text entry field OR click on the calendar button ( ). Clicking the calendar button opens a calendar selection tool. Select your date and time, then click 'Close'. Your selected day, date and time will appear in the text entry field.

Recur every - This function allows users to decide how often caching should occur. Set the amount of days/minutes/hours/seconds you wish the caching to recur. Highlight a day/minute/hour/second section within the text entry field and use the up and down arrows to change in set increments.

Click 'Apply' to save your settings or 'Apply & Close' to save your settings and return to the main Workbench-SL/AssetWorX provider screen.

3.4.2.1. AssetWorX Server Caching

Benefits of AssetWorX Server Caching are:

- Values of properties can be stored persistently
- Data is served to clients faster than OPC Servers that may be slower
- Stores values written from the client

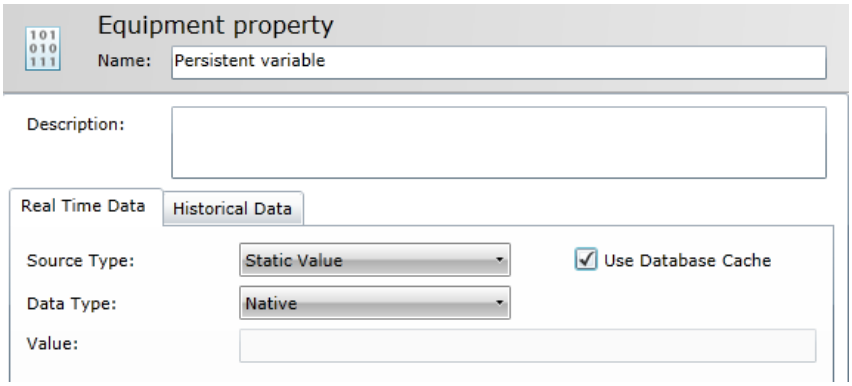


Figure 3.10 - Database Caching Selected within an Equipment Property in AssetWorX

3.5. How to Build the Asset Tree

In AssetWorX, the asset tree defines the physical distribution of equipment and assets for your corporation. In the Equipment node of the configuration database, you build the asset tree to be used by your enterprise for all aspects of reporting and rolling up costs for your business. If you will be installing additional providers, the providers place requirements on the asset tree that you must familiarize yourself with **before** adding equipment to the asset tree in AssetWorX. For example, if Energy AnalytiX and FDDWorX are or will be installed, the asset tree is where you will be reporting and calculating energy consumption, energy-related costs, and carbon emissions. It is also where fault reporting will be generated for FDDWorX.

3.5.1. What Is the Asset Tree?

The asset tree is a structure that represents the physical locations and/or business configuration of your enterprise. It contains buildings, equipment, product lines, and other components that affect costs at your company. Once built, it is a navigational tool for you to use for navigating your corporate structure. Runtime users will have access to the asset tree, and will be able to navigate it for running reports that are available to them through providers that are installed for use in Workbench-SL.

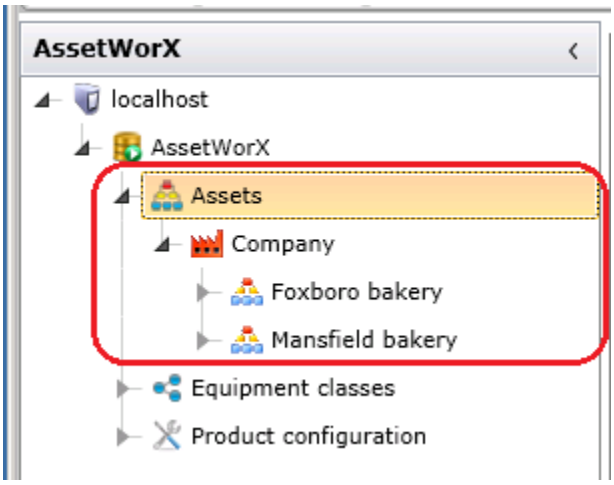


Figure 3.11 - The Asset Tree Resides on the Asset Node

The levels in the asset tree are determined by the equipment hierarchy, and cannot break from the hierarchy's rules. The following illustration shows a sample asset tree (on the left) with the equipment hierarchy that regulates it (on the right).

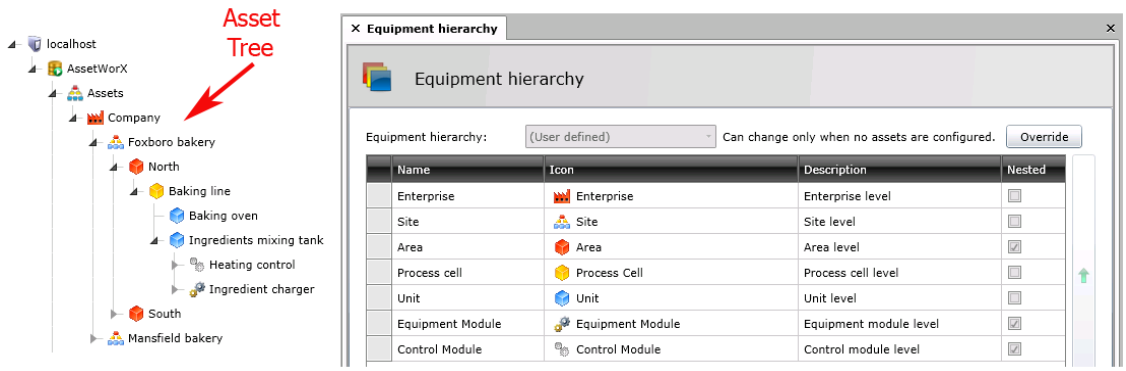


Figure 3.12 - An Asset Tree and its Regulating Equipment Hierarchy

3.5.2. Equipment in the Asset Tree

In order to be able to report on equipment, you must define all of the physical equipment you want to report on. In defining equipment, you need to consider the providers you will be using the asset tree for. If you will be installing the ICONICS Energy AnalytiX and/or FDDWorX providers, then these providers place requirements on the asset tree that you must familiarize yourself with **before** adding equipment to the asset tree. For an understanding of the requirements that any particular provider has, refer to the documentation for that provider before building the asset tree.

As you define equipment, you embed it into a hierarchical reporting structure called an asset tree. Each tier of the asset tree categorizes and defines the equipment for that level. In Workbench-SL, the asset tree appears in the Project Explorer. A default asset tree is installed for you but it is expected that you will override it with your own equipment structure.

AssetWorX displays in a tree-like structure in Workbench-SL's Project Explorer. An example of an asset tree is shown below. Note that the company has two bakeries (Foxboro bakery and Mansfield bakery), and the Foxboro bakery is divided between the North and South branches. The North branch's baking line is expanded so you can see some of its equipment.

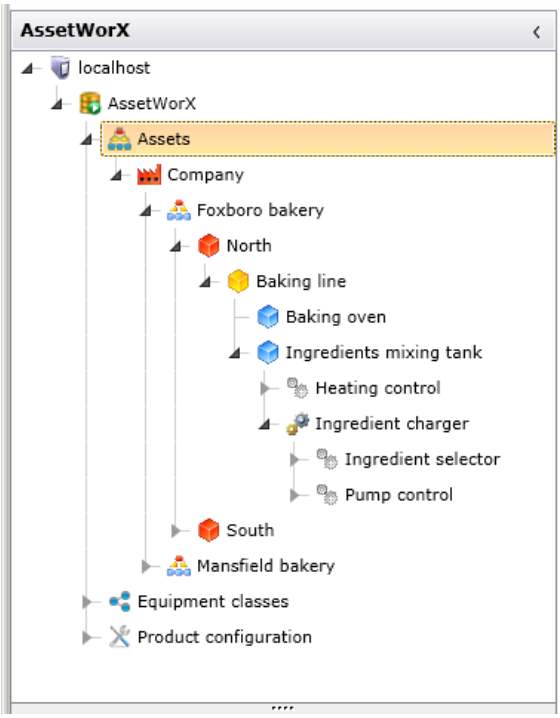


Figure 3.13 - Sample Asset Tree

This is just one example of an asset tree. Obviously, yours will be unique to your company's needs. For that reason, before you begin you must plan out your asset tree structure to make sure you have included all equipment and to make sure it is organized in a way that makes its use intuitive and useful.

Make sure you include all types of equipment you want to report against. Start at the highest level, such as a corporate entity or a geographic region, then break that level out into more detail about equipment that is lower in the asset tree. Continue with each level until you have worked your way down to individual robots, machinery, or other equipment such as meters. Once you have a plan that includes everything you want to report on and that accounts for future plans, too, you can create your asset tree.

Obviously, you have equipment that can be seen physically in front of you, such as robots, production lines, and plants. But you can also create *logical* structures such as business units that group your physical equipment into a hierarchy which you can use to review availability, performance and quality on a broader scale.

3.5.2.1. Equipment Placement in the Asset Tree

If you are using other providers with AssetWorX, those providers may require where in the asset tree some equipment is placed. For example, if Energy AnalytiX is installed, the placement of meters is critical to your ability to analyze energy consumption. It is critical that you pay attention to the requirements to each of the providers that are not installed today, but also the providers you plan to install in the future.

3.5.2.2. Icons in the Asset Tree

Note that equipment in the asset tree has icons. You can specify the icons that represent certain types of equipment tiers, equipment nodes, and equipment classes. Use these icons in a way that lets users easily identify the nodes in the tree. Providing well-planned icons gives your users a way to quickly and easily identify locations, buildings, types of equipment, types of meters, and so on. Make sure to use icons in a way that can provide this type of ease.

3.5.3. Strategies for Building the Asset Tree

Before building your asset tree in AssetWorX, it is important that you put together a strategy. The structure you ultimately create must reflect all of the needs for all of the providers you will be installing for use in the AnalytiX configuration database. You do not want to have to change its structure once it is built. Also, you should be aware of all of the tools available to you for building it so that you can exploit features that will help you.

3.5.3.1. Plan Before You Start!

First of all, make sure you are familiar with what the asset tree is and what it provides for you. This means reviewing all of the documentation for setting it up **before** you actually build the asset tree.

Then, if you will be using Energy AnalytiX, FDDWorX, or other providers, refer to the online help and documentation for those providers before you construct the asset tree. This is important to do up front because once your asset tree is created you can no longer take advantage of the template capabilities that are available with aliasing.

You can apply uniform information only while building the nodes of the asset tree; after that you will be maintaining each node individually. For that reason, set aside time to plan before you move ahead.

Of particular importance are the following considerations:

- Make sure you understand the Steps to Building an Asset Tree.
- **Some providers' requirements** may prompt you to change the structure of your *asset tree*. For this reason alone, it is important that you consider any future requirements you may have, also.
- Create an asset tree that is **easy to add to and modify**. For example, if you will be adding buildings or changing energy technologies, make sure the asset tree you create will be easy to change.
- Use **icons** in a way that makes the asset tree easy to work with. You can provide your own icons that represent certain types of equipment tiers and equipment nodes,. Use these icons in a way that lets your users easily identify the nodes in the tree. Providing well-planned icons gives your users a way to quickly and easily identify locations, buildings, types of equipment, types of meters, and so on. Therefore, use icons in such a way, as to provides that type of ease.
- Come up with a strategy for applying **permissions** for runtime users to access equipment nodes in the asset tree, along with types of commands in each node's runtime menu. You can use the asset tree's structure to exploit the ability for equipment nodes to inherit the permissions set in parent nodes. The strategy for granting permissions is described in the Defining User and Group Permissions for Equipment topic as well as the Permissions Tab for Equipment topic. Permissions in the asset tree use the Security Server users, groups, and settings defined using the Classic GENESIS64 Workbench.
- Familiarize yourself with all of the **tools** in AnalytiX providers, including the ability to "Make Copies Using the Multiply Function", "Export Data", and "Import Data".

3.5.3.2. How to Proceed

Follow these general steps in order to build the asset tree:

1. Review the AssetWorX documentation as well as the documentation of all providers in Workbench-SL, and then plan what the tiers and structure of the asset tree will be. Create the equipment hierarchy (Defining Tiers for the Asset Tree).
2. Start adding equipment nodes to the asset tree (Adding Equipment to the Asset Tree).

3.5.4. Establishing the Tiers of the Hierarchy

Why do you need an Equipment Hierarchy with Tiers? When you configure your equipment in AssetWorX, you create an **equipment hierarchy** that specifies which types of equipment belongs at each tier of the asset tree. Doing this controls the structure of the asset tree by preventing you from accidentally assigning certain types of equipment to inappropriate tiers, and it also controls whether an asset level can have multiple tiers of equipment at each level. Therefore, the equipment hierarchy applies universally throughout the configuration database's asset tree.

When you first install AssetWorX, you will find that there are three different equipment hierarchies provided for you to choose from, each with their own predefined tiers. You can alternatively decide to define a hierarchy of your own choosing. Your options include the following:

- The **Batch Production** equipment hierarchy consists of tiers that structure the equipment typically used in batch processing.
- The **Building Automation** equipment hierarchy consists of tiers for buildings and campuses.
- The **Discrete Manufacturing** equipment hierarchy consists of tiers for the equipment that is frequently found in discrete manufacturing.
- The **User Defined** option lets you choose of the preexisting equipment hierarchies as a starting point, and lets you define the tiers that you need for your installation. You can add any number of levels, and can even define and add iconic images that uniquely identify each tier.

You can use these levels as they are, rename them, delete them, move them, and add more levels. Do what you need to do so that they suit your enterprise's purposes. The objective you want to keep in mind when doing so is that each tier defines a specific type of equipment that occupies that tier.

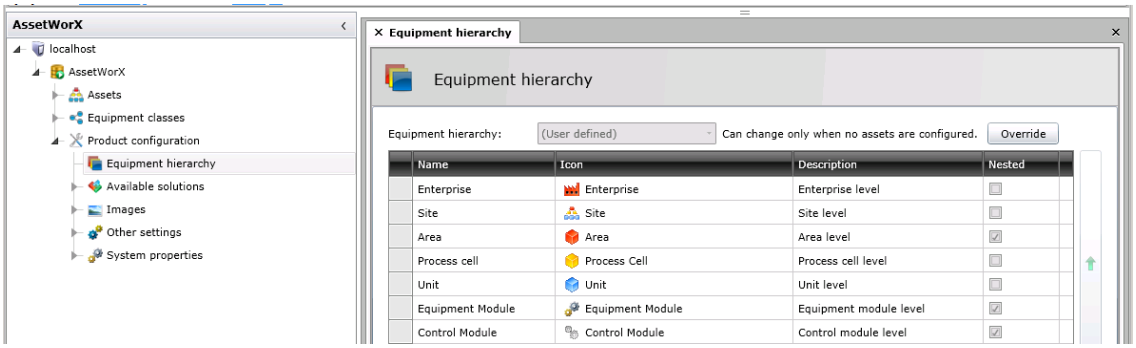


Figure 3.14 - Asset Tree (left) and the Equipment Hierarchy that Controls it (right)

3.5.4.1. Understanding the Rules of the Equipment Hierarchy

Before you define the tiers of the equipment hierarchy, put together a plan for structuring your company's equipment in a tree-like structure. Then define the tiers of the equipment hierarchy in AssetWorX. You can add images that identify each level.

So that you can do this, it is important that you understand how the hierarchy works.

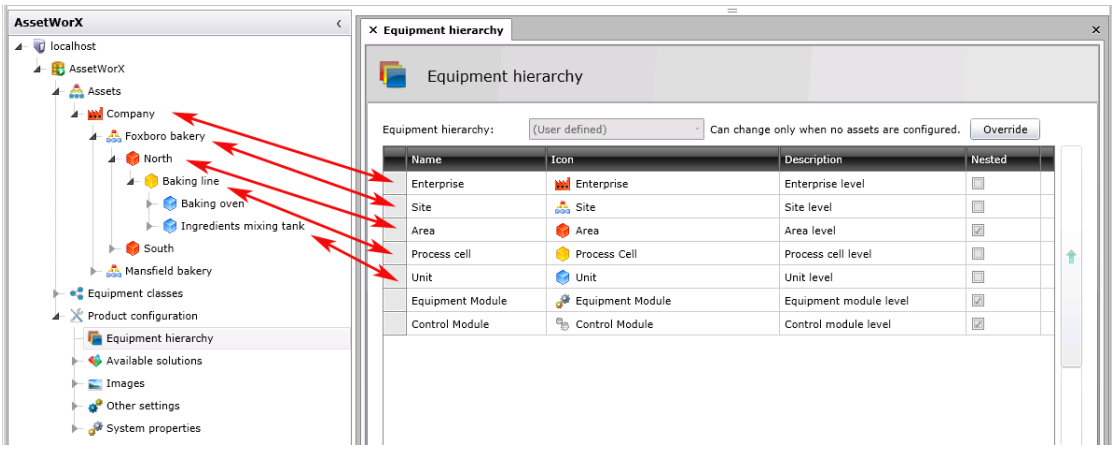


Figure 3.15 - Asset Tree (left) and the Equipment Hierarchy that Controls it (right)

Here are a few rules you need to keep in mind when deciding what you want the tiers of the equipment hierarchy to be:

- **Each tier identifies a type of logical or physical equipment.** Furthermore, each tier is intended to be a summarized version of the tier below it so that, as you work your way down the hierarchy you find that each tier is made up of the equipment at the next lower tier. For example, if the enterprise is made up of sites, each site is made up of areas, each area has process cells, each process cell has units, and so on. The tiers in this example are Site, Area, Process Cell, Unit, and so on.

- **Equipment that you add to the asset tree cannot skip tiers.** For example, if you are using the tiers listed in the prior bullet item, the Site's child tier always contains equipment definitions for areas, and an area's child tiers are always equipment definitions for process cells. An area cannot have a child tier full of equipment definitions for units.

- **A tier can repeat itself for more than one level if you identify the tier as one that can be *nested*.** This means, for example, that facilities can contain other facilities.

- **The tiers display in the sequence, from broadest to most details, from top to bottom.** Once equipment is defined to a tier in the asset tree, you cannot raise or lower that tier in the equipment hierarchy.

3.5.4.2. Defining the Tiers of the Equipment Hierarchy

Use the Equipment Hierarchy tab to identify asset levels in your asset tree, by following these steps:

1. In AssetWorX, in the Project Explorer navigation tree expand ***localhost*** → **[the name of your AssetWorX database. In our examples, we've named it '*AssetWorX*']** → **Product Configuration**.

2. Click on **Equipment Hierarchy**. This opens the Equipment Hierarchy tab, which looks like this:

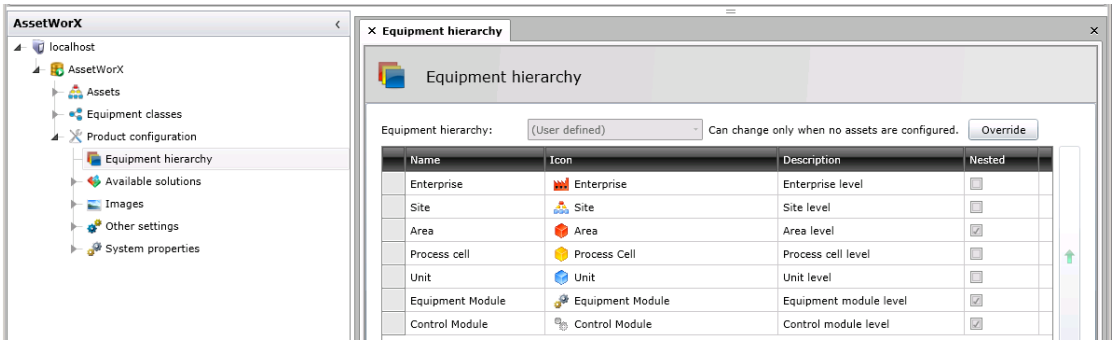


Figure 3.16 -Equipment Hierarchy Defines the Tiers of the Asset Tree

3. If there are assets in the asset tree already, an **Override** button appears on the tab. You cannot change the equipment hierarchy unless you click the Override button.

4. From the **Equipment Hierarchy** drop-down list, select the hierarchy you want to use for this configuration. If you are creating the hierarchy for the first time, choose the hierarchy that is closest to the one you want to use, then follow the steps below to modify it.

5. To add a new tier to the hierarchy, click on the gray row that says **Click here to add new item**. The row becomes enabled so that you can define a new tier. Enter the following:

   a. Enter a **Name** for the new tier.

   b. Choose the **Icon** to represent the tier in the equipment hierarchy. You can use any .jpg or .png as a placeholder if you like. For help creating and configuring a new icon, refer to the Configuring icons for the equipment hierarchy section, below in this topic.

   c. Enter a **Description**.

   d. If more than one level of equipment can be created in the asset tree for this tier, put a checkmark in the **Nested** column. If only one level of this tier can be created in the asset tree, leave the checkbox empty.

6. Click **Apply** to save the new tier.
7. Now, with the tier still selected, click the down arrow at the right of the table to move the tier to the position where it belongs in the hierarchy. Click the up and down arrows to position the new tier in the hierarchy. Note that the new tier cannot be inserted above any tier that has equipment in it in the asset tree.
8. Repeat these steps to define additional tiers.
9. To remove a level, select the level and press the **Delete** key on your keyboard.
10. Click **Apply** to save the change, or click **Apply & Close** to also close the tab.

3.5.4.3. Configuring Icons for the Equipment Hierarchy

Tiers in the equipment hierarchy and equipment in the asset tree are represented by small, iconic images that have been configured in the AnalytiX Catalog. If you are adding a new tier to the equipment hierarchy, you must choose an icon in AssetWorX that will represent the tier in the hierarchy. You can use any image as a placeholder until you have finalized the images you will be using.

Uses

Icons in the equipment hierarchy are used by default for each tier in the asset tree. You can, however, use icons for each individual type of equipment which you select at the time you add equipment to the asset tree. For example, you can use the icon of an office building for the Building tier of the hierarchy, but when you add a warehouse, select the warehouse icon instead. If you are using Energy AnalytiX, you can create a separate set of icons that identify meters and utility sources.

You can create icons that represent:

- **Tiers in the equipment hierarchy.** For steps to associate icons with tiers, refer to the Defining tiers for the asset tree topic. Icons that are defined for tiers are used by default for any equipment node that you add to the asset tree without the use of an equipment class.
- **Individual types of equipment in the asset tree.** For steps to associate an icon with any equipment node in the asset tree, refer to the Adding Equipment to the Asset Tree topic. Equipment that you add to the asset tree is given a default icon that you can override for that equipment node.

Strategies

Plan out the icons you intend to use. How you use them and set them up will be determined by your enterprise, the complexity of your asset tree, and the needs at your organization. Keep in mind that the icons in the asset tree will be used not only by the personnel who configures providers in the Workbench-SL, but also by runtime user who are viewing charts and reports. For this reason, you might want to set strategies in place for colors and shapes that you use in the asset tree, to make equipment in the asset tree easy to identify.

AssetWorX comes to you with some default images in place. You can use these images or create your own. If you want to use your own, then you must configure them in AssetWorX by following the steps provided below. The images must be saved to a file in a **.JPG** or **.PNG** format.

Steps

To Configure an Icon for Use in a Tier of the Equipment Hierarchy:

1. Open Workbench-SL, and click the AssetWorX provider button in the Project Explorer.
2. **Expand** *localhost* → [the name of your AssetWorX database. In our examples, we've named it "*AssetWorX*"] → Product Configuration.
3. Right-click on the **Images** node and select **Edit** or **Edit on New Tab**. This opens the Images tab, which looks like this:

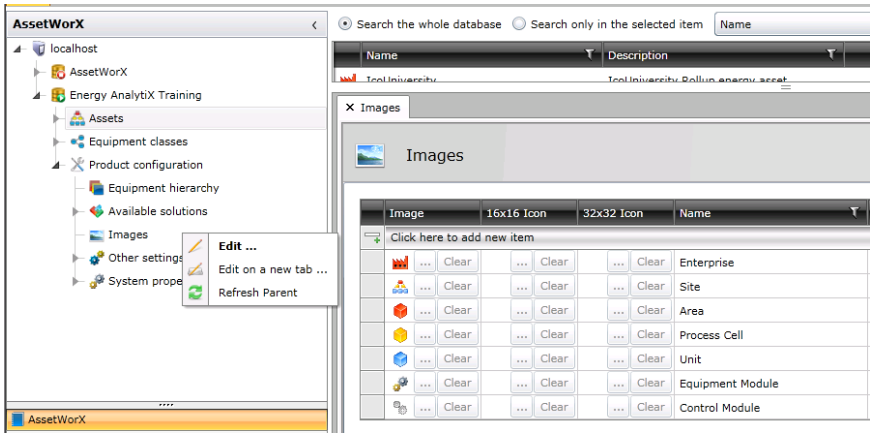


Figure 3.17 - Configure Icon Images for Use in the Equipment Hierarchy

4. Click on the gray row that says **Click here to add new item**. This enables the row.

5. Click the ellipsis button [...] in the **Image** column to choose the image as it will appear in the asset tree. This opens an Open dialog where you must navigate to the .jpg or .png file created for this purpose. Select the file and click the **Open** button; the dialog box closes and the file image appears in the Image column.

6. Optionally, in the **16x16 Icon** column you can choose a 16-pixel by 16-pixel version of the icon. If you leave this column empty, the icon in the Image column is used by default.

7. Optionally, in the **32x32 Icon** column you can choose a 32-pixel by 32-pixel version of the icon that appears on the Equipment tab when you are modifying equipment values. If you leave this column empty, the icon in the Image column displays on the Equipment tab.

8. Enter a **Name** and **Description** for the new tier.

9. Move it to the correct location in the hierarchy by clicking the up and down arrow buttons at the right.

10. Click **Apply** to save the change, or click **Apply & Close** to also close the tab.

3.6. Assets in the Tree

3.6.1. Adding Equipment to the Asset Tree

In order to do production, energy, facility, or any other type of analysis on equipment at your enterprise, you must build your equipment into an asset tree. Equipment can be added to the asset tree one tree node at a time.

- You can create equipment classes (which are templates) for individual types of equipment, and then use those equipment classes as a basis for adding equipment.
- You can build equipment classes into a tree structure that can be copied to the asset tree and used as a basis for building equipment into your asset tree.
- You can control which equipment is visible within an Asset Navigator within certain platforms (GraphWorX64, WebHMI, PortalWorX-SL, PortalWorX-SP and/or MobileHMI).
- On the Equipment form there are several tabs, including the Properties tab, Commands tab, Permissions tab, and + tab.

3.6.2. Steps to Building an Asset Tree

In the "Strategies for Building the Asset Tree" topic, we looked at ways in which you can build the asset tree in AssetWorX. It is critical that you pre-plan and formulate a strategy for the creation of the asset tree.

Before you Begin

- Review the documentation of ***all other providers*** that are installed or will be installed.
- Create a strategy for building an asset tree that incorporates all of the other providers.
- Create the tiers of the asset tree as described in the Why an Equipment Hierarchy with Tiers? topic.

Top-Down Strategy

To build the asset tree, you must start at the top-most tier in the equipment hierarchy and work your way down to the bottom-most tier of the equipment hierarchy. The asset tree is always contained in the Assets node in AssetWorX. Here is a general description of how you get started:

1. In Workbench SL, open AssetWorX if it is not already open. (You can open it by clicking the AnalytiX Catalog provider button in the Project Explorer.)

2. Expand ***localhost*** > **[the name of your AssetWorX database. In our examples, we've named it '*AssetWorX'*]**, and then right-click **Assets**, and select **Add Equipment**. This displays the Equipment form, with the **Properties** tab on top.

3. In this tab, note your options in the **Level** drop-down list: you can only select the level or levels that are allowed by the rules defined in the equipment hierarchy. So when you define an asset directly under the Asset node, you can select only the top-most tier of your equipment hierarchy; in the example below, the top-most level is Enterprise. At this level, the equipment you are defining is most likely a business entity or location.

Figure 3.18 - Level Drop-down List

4. After defining the top-most level of your asset tree, now you can begin to define the next level of the asset tree. To do this, in the Project Explorer, right-click the equipment you just added to the Asset node and select Add Equipment again. Once again, this displays the Equipment form, with the **Properties** tab on top, except that now you are one level down in the equipment hierarchy. In the example below, this is the Site level.

Figure 3.19 - Site Level

5. You can continue to build the asset tree in this way, one equipment record at a time, or you can set up equipment classes that you can use a templates for creating similar pieces of equipment quickly and easily. Note that you can even set up structures of equipment classes that for quickly setting up multiple levels of the asset tree in one action.

3.6.3. Adding Equipment to the Asset Tree

In order to do production, energy, facility, or any other type of analysis on equipment at your enterprise, you must build your equipment into an asset tree. There are a few ways you can do this:

- You can add equipment to the asset tree piece by piece
- You can create equipment classes (which are templates) for individual types of equipment, and then use those equipment classes as a basis for adding equipment
- You can build equipment classes into a tree structure that can be copied to the asset tree and used as a basis for building equipment into your asset tree
  The steps provided below describe how to add equipment one node at a time. On the Equipment form there are several tabs, including the Properties tab, Commands tab, Permissions tab, and + tab; each tab is shown below. Alternately, you can use equipment classes as templates to speed things up; for more about equipment classes, refer to the "Using an Equipment Class to Add an Equipment Node to the Asset Tree" topic.

To Add Equipment to the Asset Tree:

1. In Workbench SL, open AssetWorX if it is not already open. (You can open it by clicking AssetWorX provider button in the Project Explorer.)
2. Expand ***localhost*** > **[the name of your AssetWorX database. In our examples, we've named it '*AssetWorX*']** > **Assets**. This takes you to the asset tree.

3. If you are just beginning to build your asset tree, start by adding the topmost tier (or tiers) to the Asset node itself. Expand the asset tree so that you can see the asset you want to add the asset to.

4. Right-click the asset you want to add the asset to, and select **Add Equipment**. This displays the Equipment form, with the **Properties** tab on top, as shown in the following image. For a description of the fields on this tab, refer to the Properties Tab for Equipment topic.

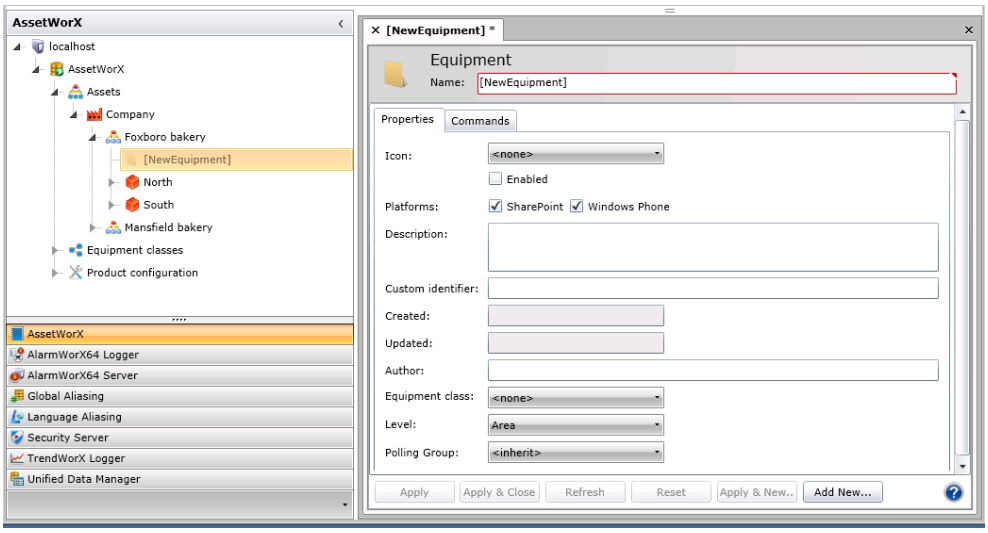


Figure 3.20 - Equipment Form - Showing the Properties Tab

A second tab called **Commands** is also available, as shown below. On this tab, you Set up Commands for Runtime Navigation. For more help using this tab, refer to the "Commands Tab for Equipment" topic.

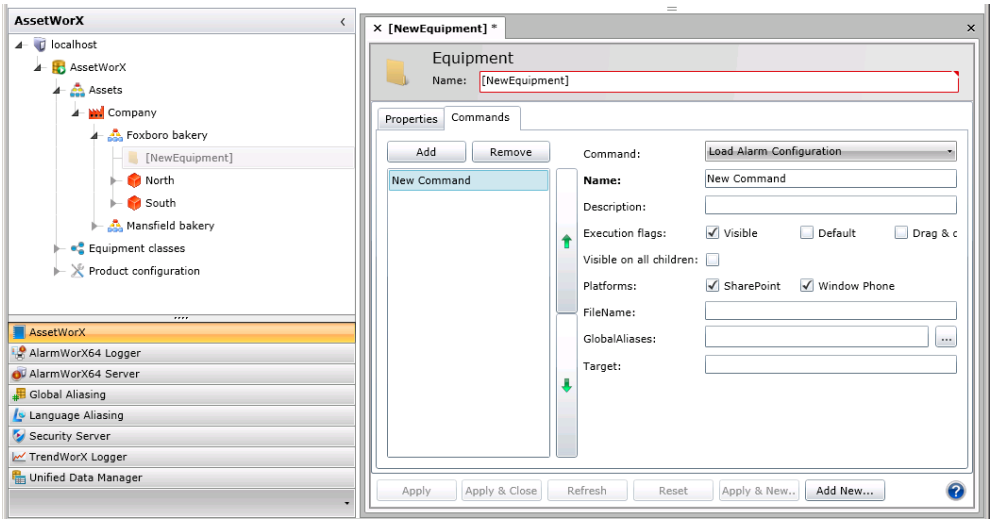


Figure 3.21 - Equipment Form - Showing the Commands Tab

When you save the new equipment record, an additional tab, the + tab, appears. Use this tab to add tabs to the form, as shown in the following image. In this example, the asset is an energy asset, so the Add New drop-down list lets the user configure the equipment for use in Energy AnalytiX. If FDDWorX is installed, the user could also configure the equipment for use with it, too. This tab is described in the + Tab for Equipment topic.

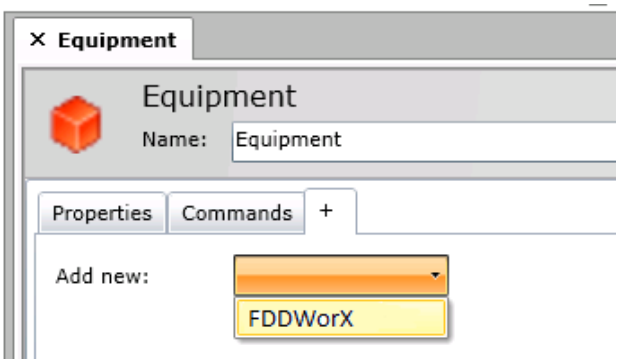


Figure 3.22 - Equipment Form - Showing the + Tab

For example, if the user elects to select Energy AnalytiX so that the equipment can be included in analysis in Energy AnalytiX, the tab shown below would be added to the form. For more about application-specific forms, refer to the help for the applications that appear in the + tab's **Add New** drop-down list.

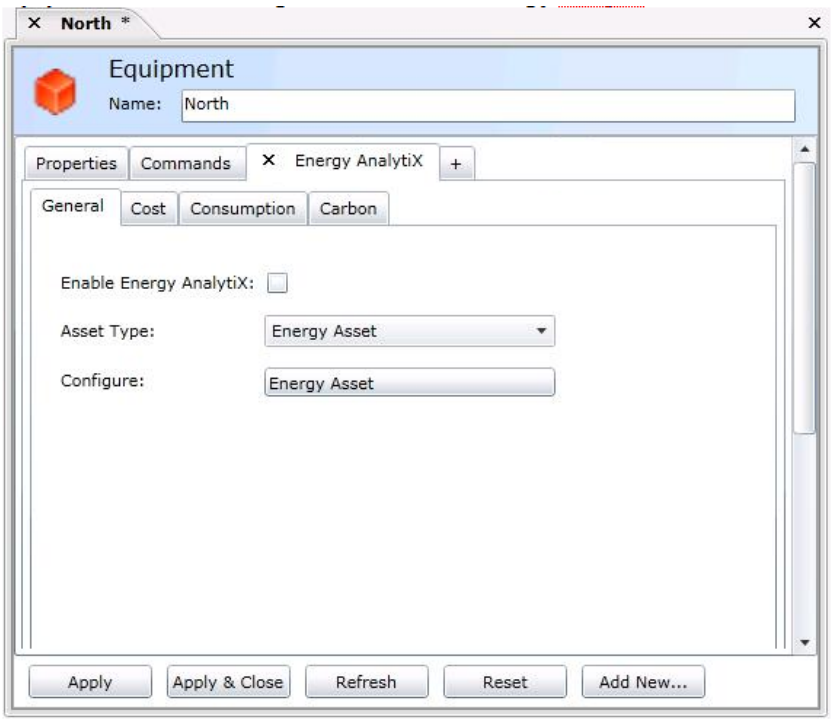


Figure 3.23 - Equipment Form - Showing an Added Tab for Energy AnalytiX

3.7. Asset Security

GENESIS64 uses a security model that is both granular and additive. You can set individual rights and access based on users and groups, create named policy settings that can be applied to users and groups, and control access to individual applications, features, systems, and more based on time settings if you wish. The Security Server, the service that provides user and group policy-based security to the different GENESIS64 applications and features, offers a powerful means for configuring access to your applications. The security model evaluates the membership of users and groups and will deny access to a user when that feature is denied to them regardless of the group's access rights. However, if a user's access isn't specified as 'Denied' or 'Allowed', then the group membership sets the access policy.

The security system contains two components:

- **The Security Server** which manages user logins, and
- **Security system clients** contained within the applications in the GENESIS64 family (e.g., GraphWorX64 , TrendWorX64 , AlarmWorX64, etc.). Any stimulus that causes a change in security status (e.g., a user login or logout) will be immediately posted to the affected clients.

Security settings are configured in the Security Server using the classic Workbench or Workbench-SL.

3.7.1. Asset Security Privileges for Users and Groups

The Security Server, as shown in the following figure, offers nearly identical security options for user accounts and for groups. You can apply security restrictions at the group level, the user level, or both. The Security Server uses the following rules for determining whether a privilege is extended or denied to a user based on his or her security:

1. If a user lacks a privilege and is added to a group that has that privilege, the privilege is extended to the user.

2. If a user or group has a privilege that is denied, then that privilege is denied to the user even if the user was allowed that privilege at the user account level. **Denials always take precedence**.

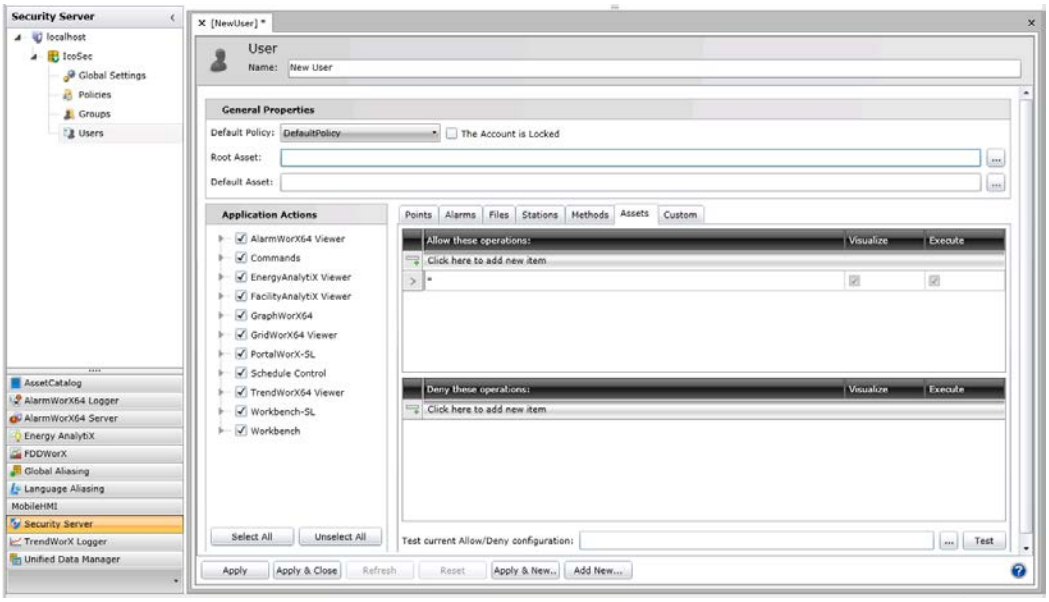


Figure 3.24 - New User Form within the Security Server Accessed via Workbench-SL

The **General Properties** section of the User form (or of the Groups form) allows you to:

- Set a Default Policy (if already set through the Policies node in the same Security Server provider) as well as lock the account.
- Set a Root Asset (where the set security is carried through all its contained assets)
- Set a Default Asset.

Clicking the ellipsis [...] button opens the data browser, shown below, where you are able to select your specific asset.

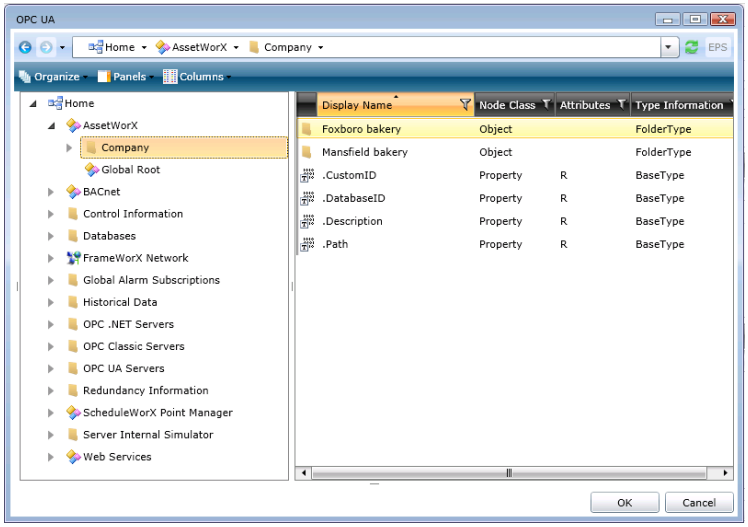


Figure 3.25 - Using the Data Browser to Select Either a Root or Default Asset for Security Privileges

Once you define a group or user account, you define its privileges. The **Applications Actions** section of the User (or Group) security settings provides the ability to Allow or Deny the use of certain features within GENESIS64 components. Most relevant to this training is the 'Commands' section, shown below. All components are allowed by default, with a checkmark signifying the User (or Group) is currently able to use that feature. Removing the checkmark and saving the User's (or Group's) security setting means that feature will be restricted.

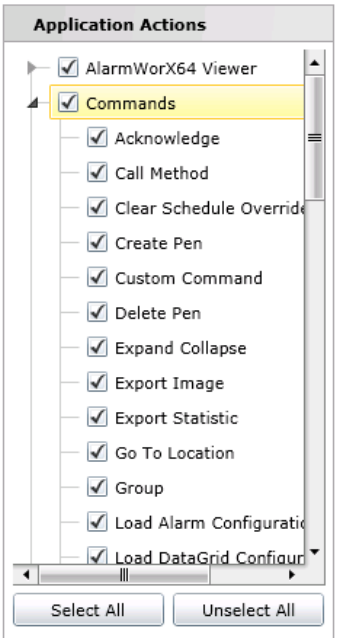


Figure 3.26 - Application Actions Section of the User Security Settings Form

Further security privileges (for a User or Group) can be defined by using the several listed tabs (Points, Alarms, Files, Stations, Methods, Assets and Custom). Note that the Application Actions section of the User or Group properties remains visible, regardless of which of these tabs is selected. This training will cover the 'Assets' tab. (More information on the Security Server, and the other tabs in the User or Group security settings, is available in other training sessions and materials.)

The Assets tab allows you to select specific assets (using the ellipsis button [...] to access the Data Browser) and allow visualization and/or execution operations for that asset or deny them, as shown in the following figure.

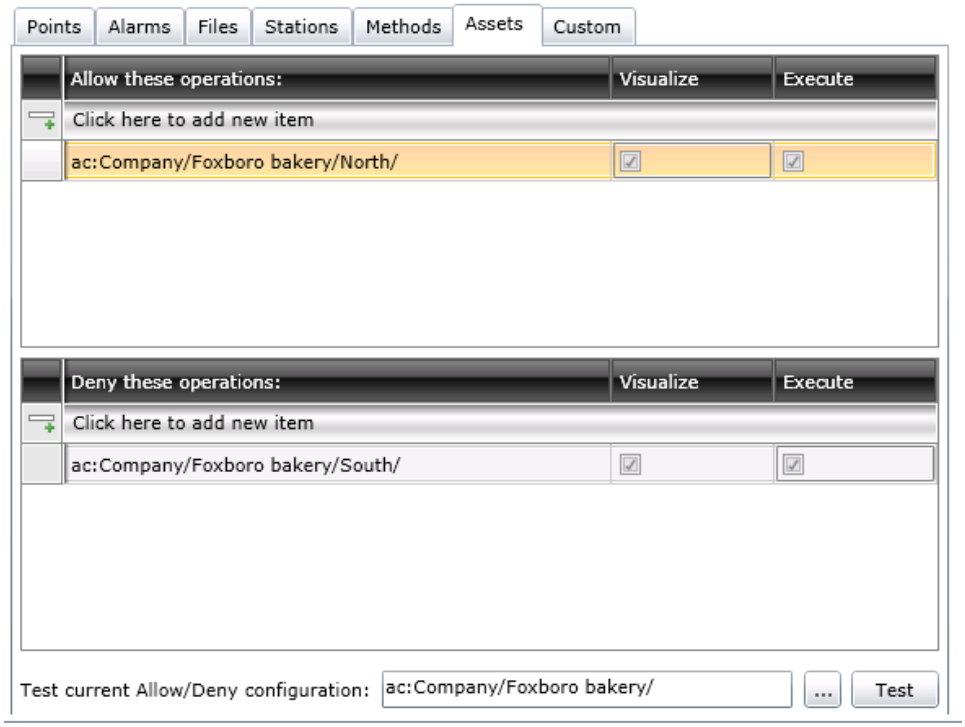


Figure 3.27 - Allowing/Denying Asset Operations for a User in the Security Server Provider in Workbench-SL

In the figure above, this specific user would be allowed to both visualize and execute operations for the /Foxboro bakery/North asset, but would be denied visualization or execution for the /Foxboro bakery/South asset.

Lab: Building the Asset Tree *L3*

3.1. Lab Overview

With Lab 1 complete, your training configuration is intact. Silverlight is installed and ready for action. With this lab, we will build the asset tree that corresponds to the icTonics project.

Estimated time to complete this lab: 30 minutes

3.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Build an asset tree in Workbench-SL that correlates to the icTonics theme.
- Implement expressions and static equipment properties.

Note: You should have completed Lab 1 and Lab 2 to configure the OPC server and install Silverlight.

3.1.2. Support Files

You do not need any supporting files to complete this lab.

3.2. Preparing the icTonics Asset Tree

Having completed Lab 2, the prerequisites have been installed and our systems are set up to accommodate PortalWorX-SL and Workbench-SL. Let's get started!

3.2.1. Building an Asset Tree

At any enterprise, equipment is interconnected with its physical location and in business units that are easily organized hierarchically. You can define the interconnected relationships of equipment using a tree-like structure called the **Asset Tree**.

Now that we have the icTonicsAssetWorX training database created, we will need to add our assets. Through the execution of the following steps, we will create an asset tree similar to the structure defined in the figure below.

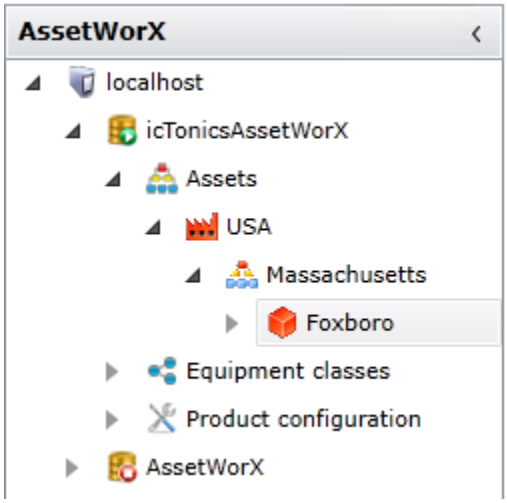


Figure L3.1 – Training Class Asset Structure

1. From within Workbench-SL, select the AssetWorX provider.
2. Expand the **icTonicsAssetWorX** training database and right-click on the Asset node.
3. Select **Add Equipment.** (Notice that you are in the **NewEquipment**, **Properties** sub tab.)

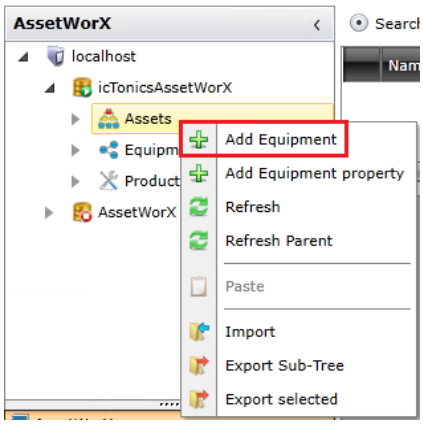


Figure L3.2– Adding the First Asset

4. From the **[New Equipment]** tab on the right, with the **Properties** tab selected, enter the following entries into the appropriate fields:

   - **Name:** USA
   - **Icon:** Enterprise
   - **Description:** The USA Asset

   Although each asset also has a **Commands** subtab, the configuration of the assets in this section will not require Command changes. However, we will be using commands later during this training.

5. Click **"Apply & Close"** after completing the property entries for each asset.

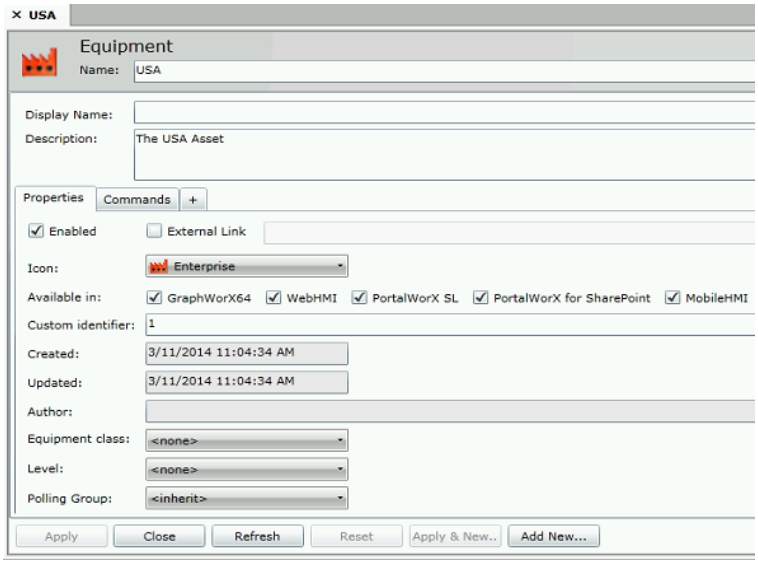


Figure L3.3 – Sample Asset Properties Dialog

6. Proceed by selecting each newly created asset with a right-click and select **Add Equipment** until you have completed the asset tree as depicted in the figure below. Remember to click **Apply & Close** to commit the property changes.

   Note: Be sure to add the RTU_EXAMPLE asset under the Assets tree node (not under the Foxboro node).

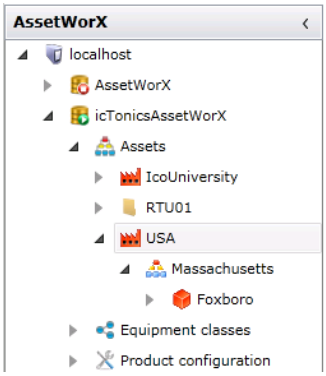


Figure L3.4 – Asset Tree Build Out Continued

Note: Reference the previous figure to check that your asset tree is being built as described.

7. Starting with a right-click on the 'USA' asset, select the **[New Equipment]** tab on the right and, with the **Properties** tab selected, enter the following entries into the appropriate fields:

   - **Name:** Massachusetts
   - **Icon:** Site
   - **Description:** Massachusetts Asset

8. Right-click on 'Massachusetts'. From the **[New Equipment]** tab on the right, and with the **Properties** tab selected, enter the following entries into the appropriate fields:

   - **Name:** Foxboro
   - **Icon:** Area
   - **Description:** Foxboro Asset

9. Continue by adding the following assets.

10. Click **Apply** after adding **Each** remaining asset.

11. Under the Assets asset, called RTU_EXAMPLE:

   - **Name:** RTU_Example
   - **Icon:** Process Cell
   - **Description:** Roof Top Unit1

3.2.2. Adding Equipment Properties

Equipment Properties allow you to connect the associated asset to real-time (utilizing multiple data source options) or historical data sources. **Note**: The concept of Equipment Properties will be covered in more detail in Chapter 4.

1. Right-click on the **RTU_Example** asset and select **Add Equipment property** with the following criteria:

Name:	CLG_STG1_ENA
Description:	Cooling Stage1 Enabled
Source Type:	Static Value
Use Database Cache	Checked
Data Type:	Boolean value
Value:	False

2. Click **Apply**.

3. From within the **Grid Explorer** (the upper section of the split window), right-click on the **CLG_STG1_ENA** equipment property and select **Multiply**.

4. In the Multiply Options dialog, enter the following criteria:

   - Make sure the **Description** and **Name** Modify checkboxes are **Checked**.

   - **Uncheck** the **Realtime Value** Modify checkbox.

Number of Copies	3
Description	Cooling Stage{0} Enabled
Name	CLG_STG{0}_ENA
RealtimeValue	False
First Number	2
Numeric Places	1
click **Apply to all**	

5. The {0} is a placeholder that will be replaced by the number generated during the multiply process.

6. The completed dialog should resemble the figure below.

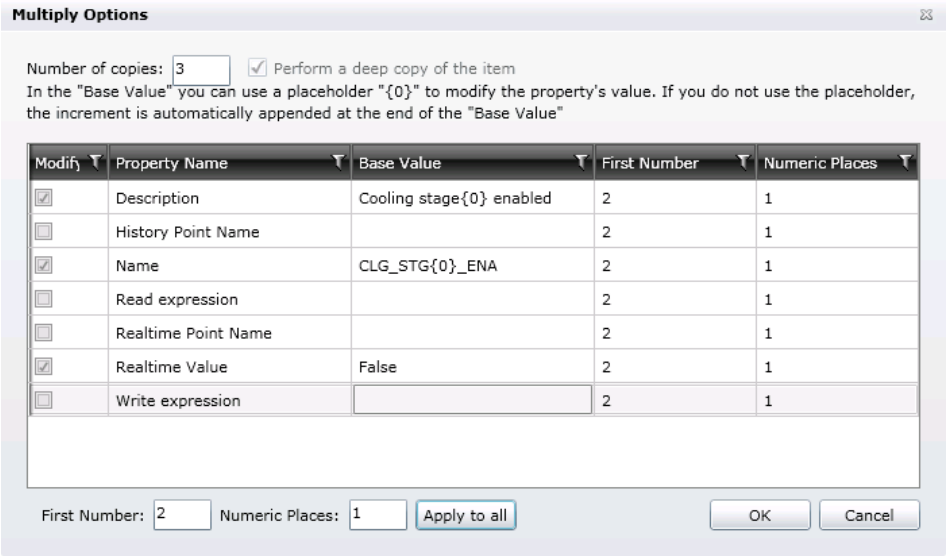


Figure L3.5 – Multiply Options Dialog

7. Click **OK**.

8. Add a fifth equipment property with the following criteria.

Name:	CLG_STG_ACT_STS
Description:	Cooling Stage Active Status
Source Type:	Expression
Use Database Cache	Checked
Data Type:	32 bit signed integer
Read Expression:	x={{ac:RTU_EXAMPLE/CLG_STG1_ENA}}+ {{ac:RTU_EXAMPLE/CLG_STG2_ENA}}+ {{ac:RTU_EXAMPLE/CLG_STG3_ENA}}+ {{ac:RTU_EXAMPLE/CLG_STG4_ENA}}

9. You can enter this **{{ac:RTU_EXAMPLE/CLG_STG1_ENA}}+** and then copy, paste and edit it three times to help expedite the creation of the complete expression.

10. With the Read Expression complete, click on the **X=** button to launch the **Expression Editor**.

11. Click on the button that has a **Red Checkmark**. This executes a syntax check. If you see **No errors**, click OK. Otherwise, correct any reported issues and click OK.

12. We will be working more in depth with the Expression Editor later in this training.

13. To review the result of the expression, you can use the **Data Browser Monitor**.

14. From within **GraphWorX64**, from the **Dynamics** tab, select and draw a **Data Entry** field in to the display. This launches the **Data Browser**.

Note: In the Data Browser, we will be working with the **Grid** and **Monitor** tags.

15. With the **Grid** tab selected, browse to **Home → AssetWorX →RTU_EXAMPLE**.

16. Right-click on each of the **five** CLG* tags and select **Monitor this node**.

17. Click on the **Monitor** tab.

18. Your configuration should resemble the figure below.

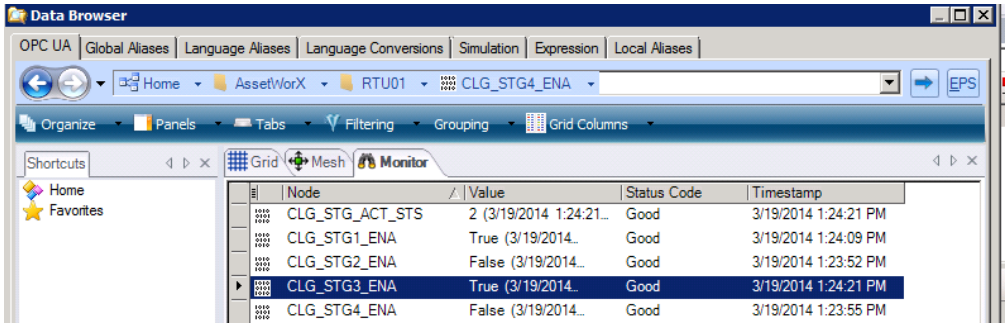


Figure L3.6 – Monitoring Equipment Properties

19. Right-click on any of the tags ending in **_ENA** and select **Write Value**.

20. Change False to **True** and click **OK**.

21. Since the expression is written to accumulate the number of ENA tags that are True, you can see the **CLG_STG_ACT_STS** tag **increment** each time you write True to an ENA tag.

22. **Important**: Be sure to select the **Grid** tab in the **Data Browser** when you're done testing.

23. You could have also used GraphWorX64 Runtime as a test if you were to add one process point (connected to CLG_STG_ACT_STS) and four Data Entry objects to the ENA tags.

24. We will add Data Entry fields in the following labs.

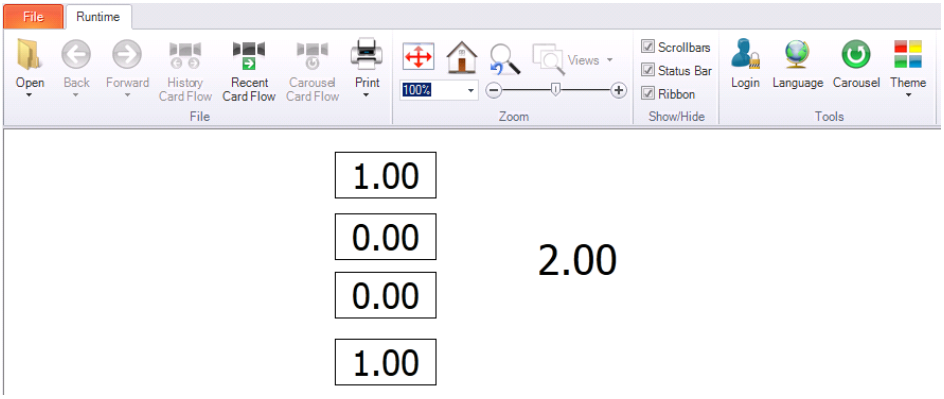


Figure L3.7 – Equipment Properties Test Display in Runtime

This concludes this lab.

Equipment Classes and Aliasing 4

It is strongly recommended that you create equipment classes for use as templates when adding equipment nodes to the asset tree in AssetWorX. An equipment class looks a lot like an equipment node, except an equipment class is stored on the Equipment Classes node in AssetWorX, not in the asset tree itself. An equipment class is really just a template for creating an equipment node. As such, its properties are only anticipated values or default values or aliases. Using aliases in an equipment class lets you establish placeholders for properties and easily define these properties after the equipment node is added to the asset tree.

4.1. Objectives

After completing this chapter, you should know:

- How to Create Equipment Classes for Use as Templates
- How to Create a Multi-Tiered Structure of Equipment Classes
- How to Use Equipment Properties
- How to Use Aliases in an Equipment Class
- How to Use an Equipment Class to Add Equipment to the Asset Tree

4.2. Creating Equipment Classes for Use as Templates

You can build equipment classes into multi-tiered structures so that they appear much like they would in the asset tree. Some equipment class configurations may require you to build a multi-tiered structure. For example, if you have installed the Energy AnalytiX provider, before you can configure a raw consumption calculation for an equipment class to be used for adding energy assets to the asset tree, you must create a second, "child" equipment class for a meter. Then you can use the multi-tiered equipment class as the basis for defining machines that have a meter.

Below are some possible uses you may have for creating single and multi-tiered equipment classes. You can create an equipment class to be used for defining the following:

- Buildings (the top tier) with many floors (as child tiers) in the asset tree.
- Machinery (the top tier) on a plant floor and the meters that monitor it (child tiers).
- A plant (the top tier) with workstations (child tiers).
- Campuses (one tier); or campuses with buildings (two tiers); or campuses with buildings and meters (three tiers).

By creating these structures in advance, you can preload all of their equipment information that they have in common, such as the right-click commands to be used for all sites. You can also provide aliases for equipment information, allowing you a way to easily define uniform information to be used for your equipment nodes.

The remainder of this topic describes how to work with equipment classes and use them as templates.

- Create an Equipment Class
- Create a Multi-Tiered Structure of Equipment Classes
- Use Aliases in an Equipment Class
- Use an Equipment Class to Add an Equipment Node to the Asset Tree
- Handle Instantiation Errors

4.3. Creating an Equipment Class

To Create an Equipment Class to be Used as a Template:

1. In Workbench SL, open AssetWorX if it is not already open. (You can open it by clicking the AssetWorX provider button in the Project Explorer.)
2. Expand ***localhost*** **> [the name of your AssetWorX database. In our examples, we've named it '*AssetWorX*'] > Equipment Classes**.
3. Right-click **Equipment Classes** or right-click the equipment class **folder** you want to add the equipment class to. Then select **Add Equipment Class** from the pop-up menu. This opens the Equipment Class form with the Properties tab on top and the Commands tab underneath it.
4. In the **Name** field, type the name of the new equipment class. Use the name field to identify the type of equipment node that this equipment class is designed to create.

Note that whatever you type here will be used as the name of any equipment that is created from this equipment class. For example, if you type "Template for Multi-Story Building" then every equipment node that you create from this equipment class will be given that same name. You will have to modify the name for each equipment node that you create.

Alternatively, you can enter an alias, instead. For example, if you type /?Multi Story Building NAME?/, when you create an equipment node, you will be prompted to replace the name as the equipment node is created. For more details, refer to the "Using Aliases in an Equipment Class" section, later on in this document.

5. Click **Apply**. This saves the equipment class in the Equipment Classes node and enables the + tab, which we will get to later.

6. Complete the fields on the **Properties** tab. These fields are described in the "Properties Tab for Equipment Classes" topic.

7. Go to the **Commands** tab to define any standard right-click menu items you want provided during runtime for equipment nodes created from this equipment class. For detailed information about how to use this tab to create runtime menus, refer to the "Setting up Commands for Runtime Navigation", as well as "Commands Tab for Equipment Classes" later in this manual.

8. Go to the **Permissions** tab to define permissions for accessing the node and its menu items at runtime. For detailed information about using this tab, refer to the "Defining User and Group Permissions for Equipment", as well as "Permissions Tab for Equipment Classes".

9. If you have installed **other providers** that will be using the asset tree, or if you will be installing other providers that will use the asset tree, **now is the time to define information that those providers will be using**. Their information will be added as you add new equipment nodes to the asset tree. You cannot use equipment classes to add information once an equipment node has already been added.

   If any provider that you will be using has not yet been installed, take the time now to install the provider so you can define information to be used by the provider. For more information, refer to "Installing Available Solutions".

10. If all of the providers you will be using are installed, click on the **+ tab**. On this tab you will see a drop-down list of all of the providers that are installed.

11. From the **Add New** list, select the provider whose information you want to configure for the equipment class. This adds a tab for the selected provider. For example, if you select FDDWorX from the drop-down list, then a tab called FDDWorX is added to the Equipment Class form.

12. Go to the provider's tab and define the information. For help, refer to the provider's help for that tab. For example, use the help for the FDDWorX tab or the Energy AnalytiX tab.

13. Return to the **+ tab** as many times as you need to configure information for additional providers.

14. Click **Apply** to save the equipment class.

15. At this point you can create additional equipment classes and add create a multi-tiered structure if you want to. For more information, refer to "Creating a Multi-Tiered Structure of Equipment Classes" below.

16. When you are done you can use the equipment class to add equipment nodes to your asset tree. For how to do this, refer to the "Using an Equipment Class to Add an Equipment Node to the Asset Tree" section later in this document.

4.4. Creating a Multi-Tiered Structure of Equipment Classes

Now that you know how to create an equipment class (as described above), let's take a look at how you can create a multi-tiered structure of equipment classes. As we work with multi-tiered equipment classes, keep in mind that a multi-tiered structure has a parent at the top tier with children under it in the next tier down. If there is a third tier, then the children have children too.

A multi-tiered structure equipment class has one parent at the top, but the parent can have as many child equipment classes as is necessary, and as many tiers as needed. You will want to take time to plan out your multi-tiered structures so that they are detailed enough to be of good use to you, but not so elaborate that they become cumbersome. You may need to experiment with them before putting them to use.

Example

The following illustration shows a multi-tiered structure of equipment classes for creating a building. The Multi-Floor Building equipment class is the parent, and the Floor Template equipment class is its child. The Electric Meter is the child of the floor template. Keep in mind that a child equipment class can also be used independently of its parent. Following the example shown in the image on the next page, you can use the Multi-Floor Building equipment class to create a building with one floor and one meter, and then use the Floor Template equipment class to add additional floors and meters, as shown in the sample asset tree (on the right) for the Atlanta equipment node.

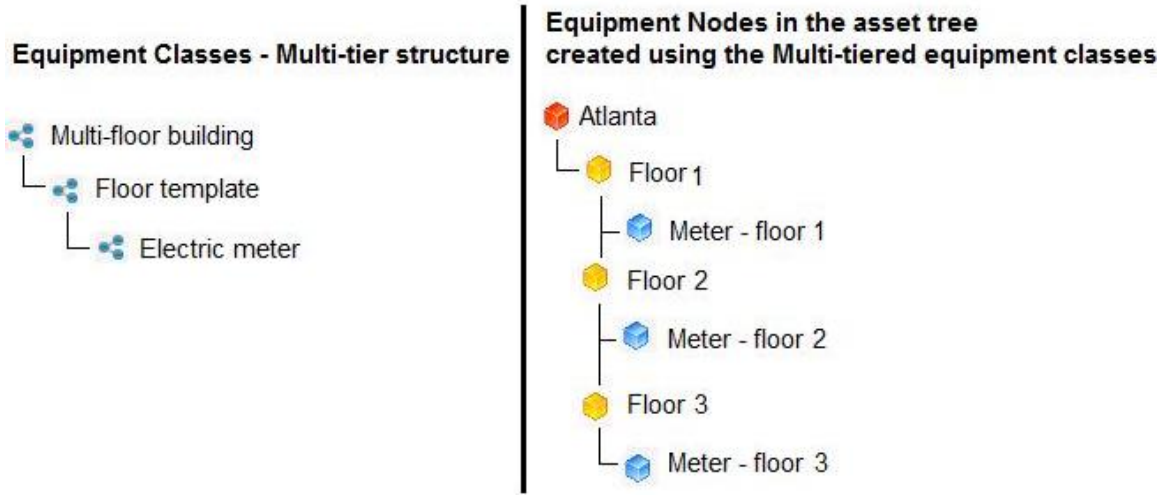


Figure 4.1 - Using a Multi-Tiered Equipment Class for Adding Equipment to the Asset Tree

4.4.1. Steps for Creating Multiple Tiers

The following steps assume that you are familiar with how to define an equipment class, described above in the "Creating an Equipment Class" section.

To Create a Multi-tiered Structure of Equipment Classes:

1. Create the ***parent*** equipment class first. The parent must be created in either the **Equipment Classes** node or the equipment class **folder** you want to add the parent to.

2. Add a new ***child*** equipment class by right-clicking the parent equipment class and selecting **Add Equipment Class** from the pop-up menu. This adds a new equipment class to the parent. Save the child equipment class.

3. At this point, you can add more child equipment classes to the parent, or can add a third tier by adding a new child equipment class to the child defined in step 2.

4. When you have finalized the structure that you want, you can return to each equipment class and refine its definitions so that as much information as possible is included in the equipment class before it is used as a template. For example, you can do the following:

   - You can use aliases as described in the following "Using Aliases in an Equipment Class" section.

   - Define any standard right-click menu items you want provided during runtime for equipment nodes created from this equipment class. For detailed information, refer to "Setting up Commands for Runtime Navigation", as well as "Commands Tab for Equipment Classes"..

- If other providers will be using the asset tree, or if you will be installing other providers that will use the asset tree, **now is the time to define information that those providers will be using**. If any provider that you will be using has not yet been installed, take the time now to install the provider so you can define information to be used by the provider. For more information, refer to "Installing Available Solutions".

5. When you are done you can use the equipment class to add equipment nodes to your asset tree. For how to do this, refer to the "Using an Equipment Class to Add an Equipment Node to the Asset Tree" section later in this topic.

4.5. Using Aliases in an Equipment Class

When creating an equipment class, you must populate its fields with information that defines the type of equipment. For example, an equipment class for creating buildings might contain all of the pop-up menu commands to be associated with buildings. However, not all buildings share the same information. For that reason, after using the equipment class to add a building to the asset tree, you will need to visit every field that needs to be defined uniquely for the building. You do not, however, want important information to go undefined for the building. To prevent this from happening, and to easily manage the information that will need to be defined, you can use aliases in you equipment classes.

An alias is simply a placeholder for information that will need to be defined for any equipment node that is defined using the equipment class. Instead of entering values in every equipment class field, you can enter an alias surrounded by **/?** and **?/**, like this: **/?** ***Alias*** **?/**. The alias can be any text string that you want. Just make sure that it describes the information to be added, for example, /?BuildingName?/ or /?DescriptionOfMeter?/.

Then, when you use the equipment class to create an equipment node (as described in the following section, "Using an Equipment Class to Add an Equipment Node to the Asset Tree"), you will be prompted to replace each alias with the information needed for defining the equipment node. If you are unable to provide the information at that time, the aliases will remain on the equipment node until information can be provided. When information becomes available, you can easily enter it by instantiating (or replacing) the aliases, as described in "Instantiating an Equipment Node's Aliases".

It is important that you realize that not all equipment class fields can be aliased. If you are not sure, you can enter an alias to see if one is allowed, or you can refer to the online help topics for the equipment class tabs in AssetWorX.

4.6. How to Use Aliasing

The following tips and reminders will help you to use aliases:

- You can enter aliases only on equipment classes, as described above in "Creating an Equipment Class".
- To enter an alias in a field, type the alias surrounded by the characters **/? ?/** as in the following format: **/?*alias*?/**
- The alias is a string that can contain any alphanumeric characters as well as spaces and punctuation characters.
- You can use aliases as the names of equipment classes such as, **/?electric meter name?/** or **/?warehouse name?/**. As a result, the alias will appear as the name of the equipment class in the Equipment Class tree structure, as shown below. When an equipment node is created using the equipment class, the alias will be used as the node name until the alias is instantiated.

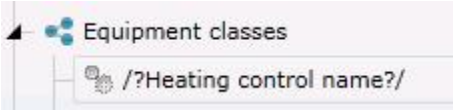


Figure 4.2 - Alias as Equipment Node Name

You can use an alias inside a string such as a URL or a description, as in the examples highlighted in red in the Description field in the following illustration:

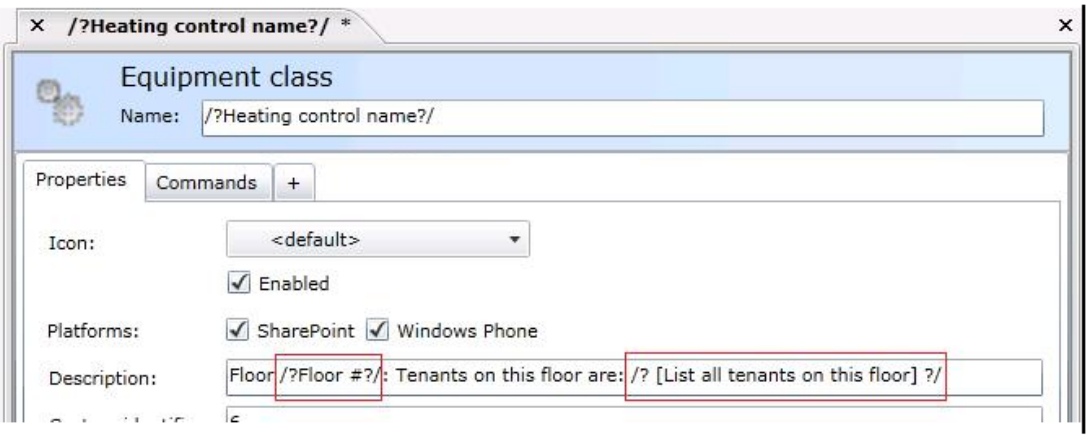


Figure 4.3 - Alias Used Inside String

Other examples:

- http://www./**?office website?**/.com
- **/?Product-Line?/** manufacturing in **/?City, State of building?/**

4.7. Adding Equipment Properties

For each level of Assets within the tree control of the AssetWorX provider in Workbench SL, you can add Equipment Properties. These allow you to connect the associated asset to real-time (utilizing multiple data source options) or historical data sources

To Add an Equipment Property to an Existing Equipment Asset in AssetWorX

1. First, you must have already created an asset. You could assign an equipment property to the top-level 'Assets' node if you wish, but in our example, we are connecting to a sub-branch in the tree, an equipment asset we've named 'Test Asset'.

   You can add the property by either right-clicking on the equipment in the asset tree and selecting 'Add Equipment property' OR you can click on the item and then, once the contextual ribbon changes to the items relevant to your item selection), click on the 'Add Equipment property' button in the Home ribbon at the top of the screen. Both methods are highlighted in the following image.

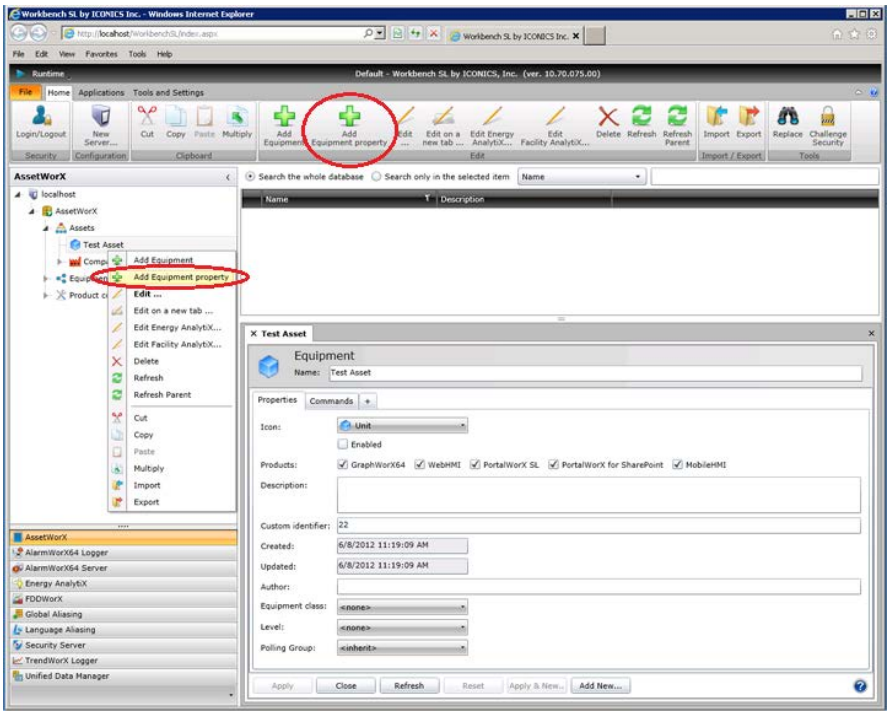


Figure 4.4 - 'Add Equipment Property' in AssetWorX

2. This will open a [NewEquipmentproperty] tab in the right-side window of Workbench SL, as well as a placeholder in the top right items list. This items list shows any sub-items connected to an asset, as well as any of its connected properties. Give your property a name and description and then decide whether your property will need to connect to Real Time Data or Historical Data.

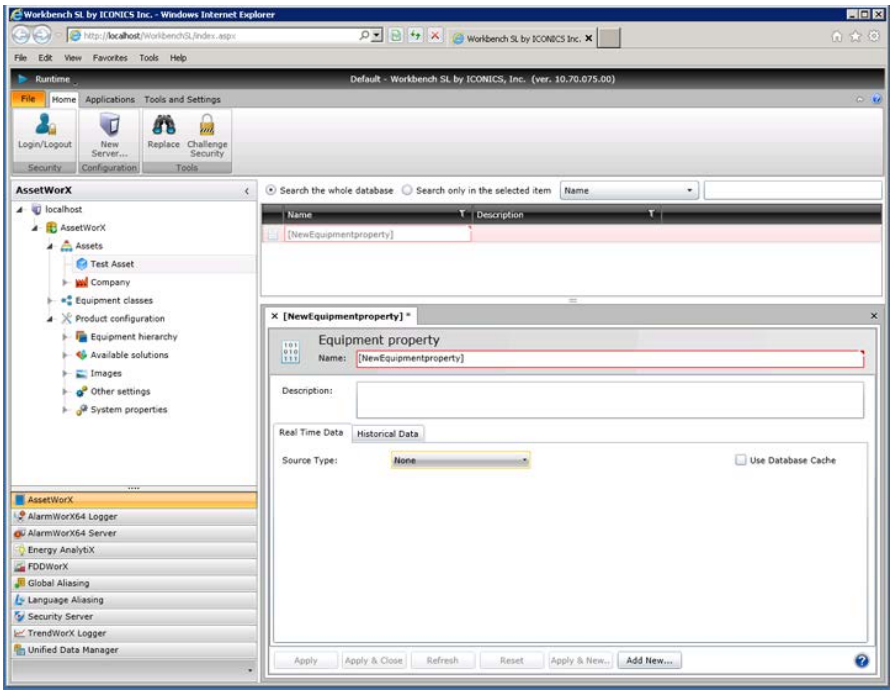


Figure 4.5 - Equipment Property Settings in Workbench SL

Next, see the following options for selecting either Real Time or Historical Data.

4.7.1. Real Time Data Tab

- **Source Type: None**

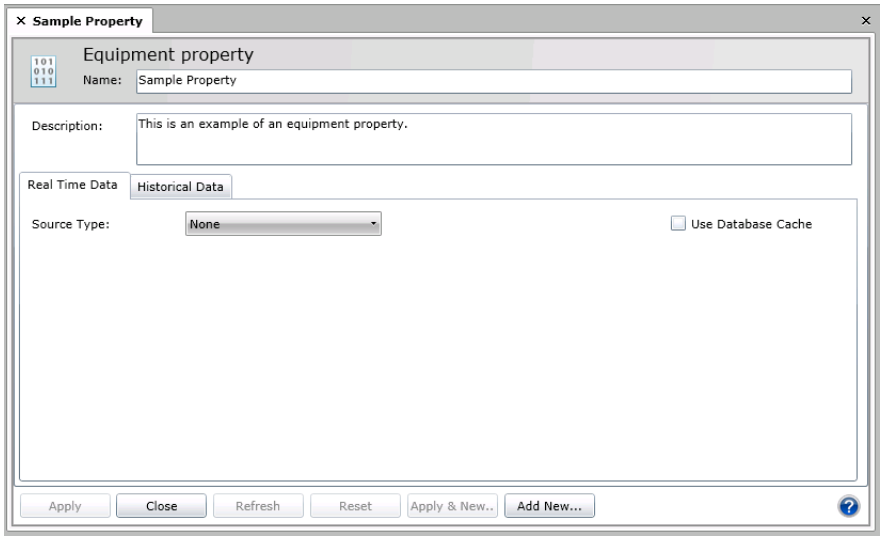


Figure 4.6 - Real Time Data - Source Type: None

In this instance, you won't require a connection to any Real Time data. You can still decide to use any existing data cached in the database by clicking on the 'Use Database Cache' checkbox.

- **Source Type: Static Value**

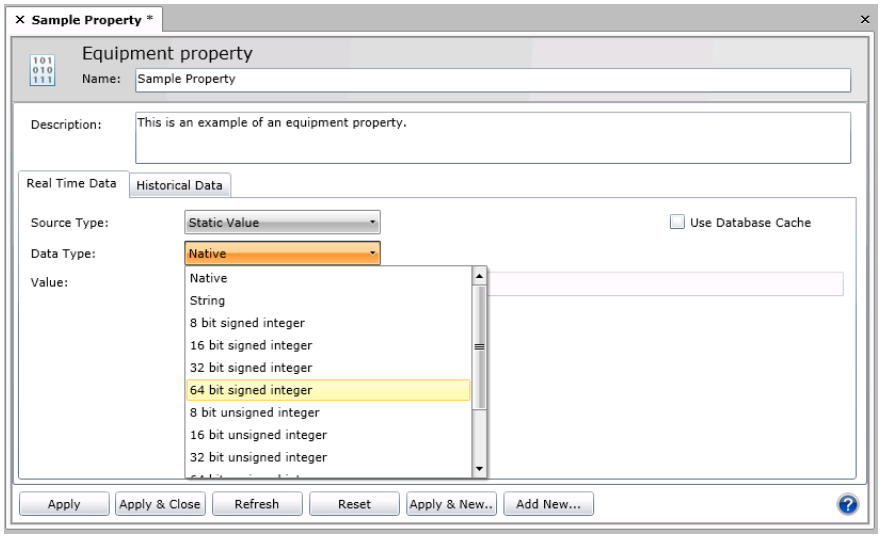


Figure 4.7 - Real Time Data - Source Type: Static Value

In this instance, once you select 'Static Value' from the pull-down menu, you'll see options to select a 'Data Type' and, depending on that type, be able to enter a Value (in the following text entry field). You can also decide to use any existing data cached in the database by clicking on the 'Use Database Cache' checkbox.

Data Types include:

- Native - will prevent you from entering anything in the Value text field.
- String
- 8 bit signed integer
- 16 bit signed integer
- 32 bit signed integer
- 64 bit signed integer
- 8 bit unsigned integer
- 16 bit unsigned integer
- 32 bit unsigned integer
- 64 bit unsigned integer

- 32 bit floating point number (single precision)
- 64 bit floating point number (double precision)
- Boolean value

- **Source Type: Dynamic Tag**

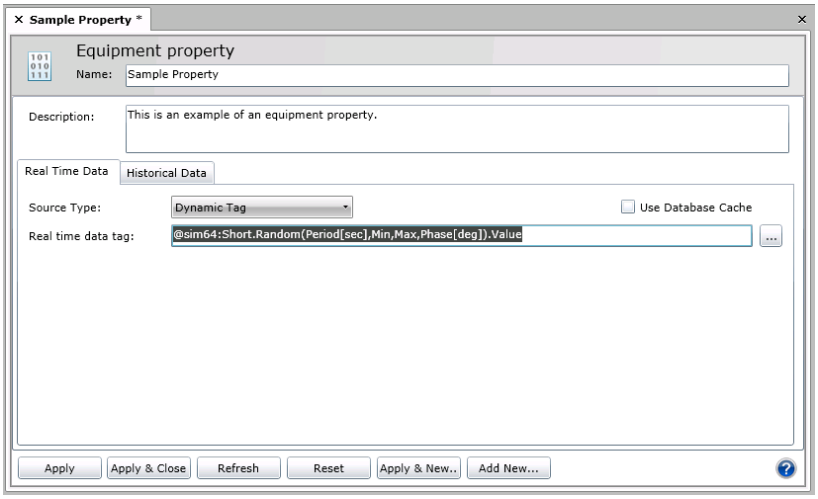


Figure 4.8 - Real Time Data - Source Type: Dynamic Tag

In this instance, once you select 'Dynamic Tag' from the pull-down menu, you'll be able to enter a **Real time data tag**. If you don't know the exact location, you can click on the ellipsis [...] button to bring up the Data Browser, where you will be able to select from all connected data sources. In the example above, we are using a simulated data value source. You can also decide to use any existing data cached in the database by clicking on the 'Use Database Cache' checkbox.

- **Source Type: Polled Dynamic Tag**

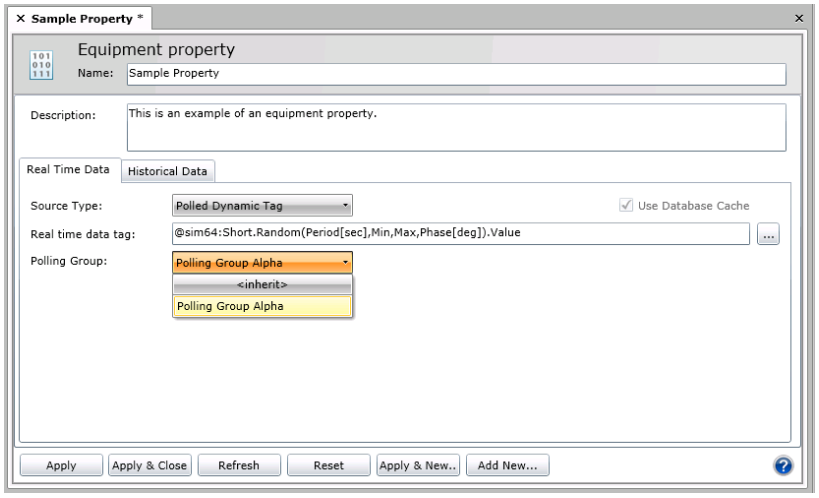


Figure 4.9 - Real Time Data - Source Type: Polled Dynamic Tag

In this instance, once you select 'Polled Dynamic Tag' from the pull-down menu, you'll be able to enter a **Real time data tag**. In the example above, we are using a simulated data value source.

In comparison to the regular 'Dynamic Tag' option explained above, the Polled Dynamic Tag allows you to set times/recurrences for data retrieval, using a **Polling Group**. Polling Groups, set through the Product configuration/System properties/Polling groups node in AssetWorX, contain polling criteria such as the scan rate, read timeout, group splitting, recurrence type, starting time/date and time of recurrence.

In the Equipment property, if you don't know the exact location, you can click on the ellipsis [...] button to bring up the Data Browser, where you will be able to select from all connected data sources. The **Polling Group** pull-down allows you to either <inherit> the polling settings from the higher branches of the asset tree in which this particular equipment asset has been placed OR you can select a Polling Group that has been created through the Polling Groups feature of the AssetWorX provider's System properties (in this example, we are selecting 'Polling Group Alpha').

You can also decide to use any existing data cached in the database by clicking on the 'Use Database Cache' checkbox.

Benefits of AssetWorX Server Polling include:

- Periodically gets values from occasionally connected OPC Servers
- Stores values into AssetWorX cache
- Reads data in groups of configurable size

- **Source Type: Expression**

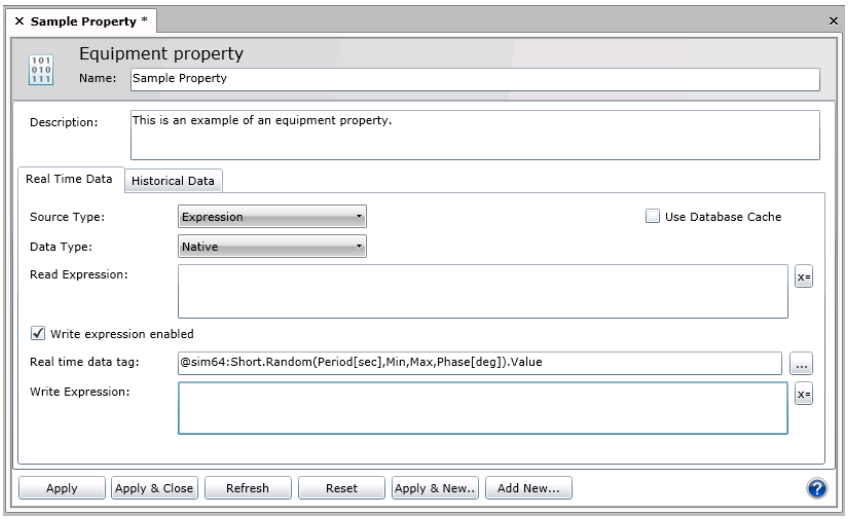


Figure 4.10 - Real Time Data - Source Type: Expression

In this instance, once you select 'Expression' from the pull-down menu, you'll see options to select a 'Data Type' and, depending on that type, be able to enter a Value (in the following text entry field). You can also decide to use any existing data cached in the database by clicking on the 'Use Database Cache' checkbox.

Data Types include:

- Native - will prevent you from entering anything in the Value text field.
- String
- 8 bit signed integer
- 16 bit signed integer
- 32 bit signed integer
- 64 bit signed integer
- 8 bit unsigned integer
- 16 bit unsigned integer
- 32 bit unsigned integer
- 64 bit unsigned integer
- 32 bit floating point number (single precision)
- 64 bit floating point number (double precision)
- Boolean value

Next, you'll be able to either enter a Read Expression directly into the text entry field or click on the [X=] button to open the Expression Editor.

Once you have entered a Read Expression, you have the option of also creating a Write Expression. Click on the 'Write expression enabled' checkbox in order to allow the remaining text entry fields to become active.

You'll be able to enter a **Real time data tag**. If you don't know the exact location, you can click on the ellipsis [...] button to bring up the Data Browser, where you will be able to select from all connected data sources. In the example above, we are using a simulated data value source.

Next, you'll be able to either enter a Write Expression directly into the text entry field or click on the [X=] button to open the Expression Editor.

4.7.2. Equipment Properties as Holding Registers

When adding an Equipment Property, and selecting the Real Time Data tab, you will be able to select a Source Type. By selecting “Static”, it means this Property has no further OPC input or output. If you also elect to "Use Database Cache" (by clicking the checkbox) on that property, it allows for Read/Write by clients. With these settings made, you can use GraphWorX64 (or any other client, or even a server) to write a value to this Property and AssetWorX will remember it, even during computer shutdown, as the value is being written to the Database Cache. In this way, the Property works as a sort of memory cell or holding register for ICONICS applications.

4.7.3. Implementing Equipment Properties in Other ICONICS Components

In real world applications, there are all sorts of OPC servers connected to different devices. When a user starts designing GraphWorX64 displays, in order to get to the OPC points, he or she has to browse all the different OPC servers, each possibly with a uniquely organized address space. In cases where the GraphWorX64 display designer is NOT the same person who configured the individual OPC servers, it might be difficult for the designer to immediately understand where to look for each required OPC point. For this reason, the person configuring the OPC servers could make things easier by creating an AssetWorX Property for each OPC point and organizing them into a logical structure.

Also, this decouples the GraphWorX64 displays from the OPC point names, so when an OPC point name changes (possibly due to someone starting to use a different OPC server or just due to a mistake), it is then possible to just update the OPC input of a single AssetWorX Property that maps this specific OPC point. There could be a dozen GraphWorX64 displays or other components (AlarmWorX64 Server, Hyper Historian, etc…) that subscribe to this AssetWorX Property, but they do not need to be re-configured to get data from the new OPC input, as they do not subscribe directly to it.

4.7.4. Historical Data Tab

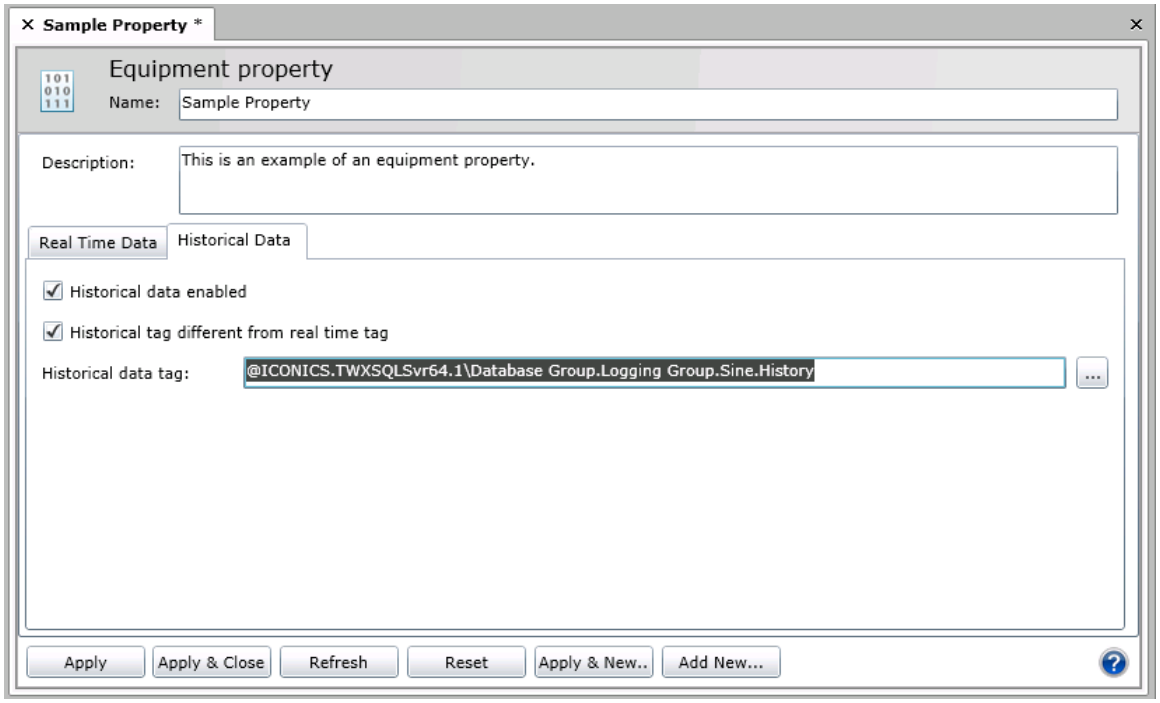


Figure 4.11 - Historical Data Tab in the Equipment Property Settings in AssetWorX

First, if you decide to utilize historical data with your equipment property, click on the checkbox for 'Historical data enabled'.

If you have not already changed settings in the Real Time Data tab, the 'Historical tag different from real time tag' checkbox will be inactive. If you did make changes to the Real Time Data tab, click the checkbox if you wish to use a different data tag. In the example above, we have used a simulated historical tag.

You'll then be able to enter a **Historical data tag**. If you don't know the exact location, you can click on the ellipsis [...] button to bring up the Data Browser, where you will be able to select from all connected data sources. In the example above, we are using a simulated data value source.

4.7.5. Activating Equipment

Equipment in the asset tree is not available for runtime processing until you activate it. For an equipment node to be active, it (as well as all parent nodes in the asset tree) must be active. If the equipment or any node above it in the tree is not activated, it will not be available for Runtime processing.

Note: You can create an equipment class so that any equipment node it creates is automatically activated. Simply make sure the Enable check boxes for the equipment class are selected (that is, make sure they have a check mark in them). For more information, refer to the "Creating Equipment Classes for Use as Templates" topic.

To Activate an Equipment Node:

1. In the Workbench SL, open AssetWorX if it is not already open. (You can open it by clicking AssetWorX provider button in the Project Explorer.)
2. Expand ***localhost*** **> [the name of your AssetWorX database. In our examples, we've named it '*AssetWorX*'] > Assets**. This takes you to the asset tree. Expand the asset tree until you reach the equipment node to be activated
3. Select the node. If the Equipment form does not open, click the **Edit** button on the Home ribbon, or right-click the node and select **Edit** from the pop-up menu.
4. On the Properties Tab, click the **Enabled** check box to put a check mark in it as highlighted in the following image.

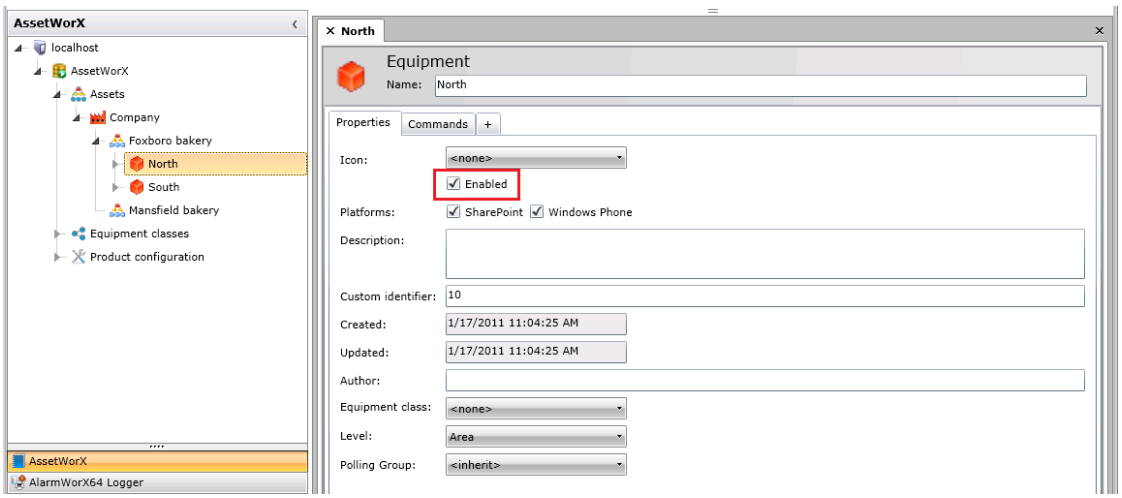


Figure 4.12 - Setting the Enabled Checkbox

5. If other providers' tabs are available for the equipment, make sure the equipment is enabled for the providers you want it to be used for. For example, if the Energy AnalytiX provider is installed and the Energy AnalytiX tab appears in the Equipment form, go to the Energy AnalytiX tab and make sure to click the **Enable Energy AnalytiX** checkbox to put a check mark in it as highlighted below.

6. Click **Apply**.

7. Repeat steps 3 through 6 for each equipment node above the equipment node in the asset tree. For example, following the example shown in these steps, you would repeat the steps for the Foxboro Bakery and Company nodes.

4.7.5.1. Setting up Runtime Menus for Equipment Nodes (Commanding)

At runtime, users can access reports, displays, trends, alarms, and other information about equipment from the AssetWorX's asset tree by right-clicking on any node in the tree. Right-clicking pops up a menu of options that you have defined for runtime users. Runtime menus can vary from node to node, and from platform to platform. For example, you can create menu options that are available only from a desktop monitor or only from a phone app.

All runtime menu options described below are configured on the **Commands** sub-tab of an equipment node's **Equipment** tab. Note however that the same commands can be configured for equipment classes using the **Commands** sub-tab of an equipment class's **Equipment Class** tab.

To Configure a Runtime Menu, Do the Following:

1. Open Workbench SL and, in the Project Explorer, click the **AssetWorX** provider button to open AssetWorX.

2. Then in the navigation tree do either of the following:

   - Expand ***localhost*** > **[the name of your AssetWorX database. In our examples, we've named it '*AssetWorX*']** > **Assets** to access the asset tree. Expand the asset tree and click on the equipment you are defining runtime menu commands for. This displays the Equipment tab, with the **Properties** tab on top.

   - Expand ***localhost*** > **[the name of your AssetWorX database. In our examples, we've named it '*AssetWorX*']** > **Equipment Classes** to access equipment classes. Navigate to the equipment class you are defining runtime menu commands for and select it. This displays the Equipment Class tab, with the **Properties** tab on top.

3. Click the **Commands** sub-tab.

4. On the Commands sub-tab, click the **Add** button to add a command to the menu. A form appears at the right.

5. From the **Command** drop-down menu, select the command you want to add. The remainder of this topic describes all of the commands and options for configuring runtime menus for equipment nodes and equipment classes. Commands let users do the following in Runtime mode:

   - **Load a display** into the runtime view. You can load GraphWorX displays, trends created in TrendWorX, and alarms created in AlarmWorX.
     - For an **equipment node's menu**, refer to the "Load Display Command", "Load Alarm Display Command", or "Load Trend Display Command" topic for equipment nodes.
     - For an **equipment class**, refer to the "Load Display Command", "Load Alarm Display Command", or "Load Trend Display Command" topic for equipment classes.

   - **Write a value** to a field.
     - For an **equipment node's menu**, refer to the "Write Value Command" topic for equipment nodes.
     - For an **equipment class**, refer to the "Write Value Command" topic for equipment classes.

   - **Run a transaction** using ICONICS BridgeWorX.
     - For an **equipment node's menu**, refer to the Run Transaction Command topic for equipment nodes.
     - For an **equipment class**, refer to the Run Transaction Command topic for equipment classes.

   - **Set global aliases**.
     - For an **equipment node's menu**, refer to the "Set Global Aliases Command" topic for equipment nodes.
     - For an **equipment class**, refer to the "Set Global Aliases Command" topic for equipment classes.

   - **Open a URL** in the runtime view.
     - For an **equipment node's menu**, refer to the "Open URL Command" topic for equipment nodes.
     - For an **equipment class**, refer to the "Open URL Command" topic for equipment classes.

   - **Run a report**.
     - For an **equipment node's menu**, refer to the "Run Report Command" topic for equipment nodes.
     - For an **equipment class**, refer to the "Run Report Command" topic for equipment classes.

- **Load a single report or multiple reports** into the runtime view.
  - For an **equipment node's menu**, refer to the "Load Report Command" or "Load Executed Reports Command" topic for equipment nodes.
  - For an **equipment class**, refer to the "Load Report Command" or "Load Executed Reports Command" topic for equipment classes.

- **Load data from ICONICS FDDWorX**.
  - For an **equipment node's menu**, refer to the "Load FDDWorX Data Command" topic for equipment nodes.
  - For an **equipment class**, refer to the "Load FDDWorX Data Command" topic for equipment classes.

- **Load data from ICONICS Energy AnalytiX**.
  - For an **equipment node's menu**, refer to the "Load Energy AnalytiX Data Command" topic for equipment nodes.
  - For an **equipment class**, refer to the "Load Energy AnalytiX Data Command" topic for equipment classes.

Commands appear on the left, and looks something like the following example.

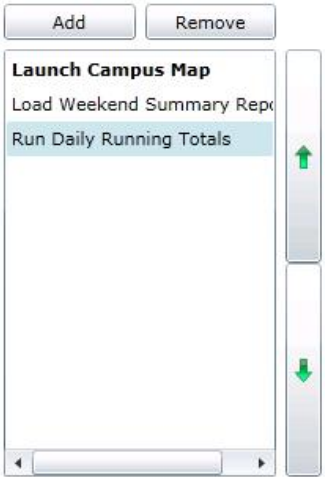


Figure 4.13 - Sample Menu Items on the Commands Sub-tab

6. If you want to modify the behavior of a menu item, select the item in the list so that it's configuration information appears on the right. Then modify the menu item's configuration. Note that the type of change you want to make may require you to delete them existing menu item and create a new one.

7. If you want to delete a menu item, select the item in the list and click the **Remove** button.

8. If you want to change the sequence of menu items in the list, select a menu item you want to move, and then click the **up** or **down arrow** to move it up or down in the list.

9. If you want to change the text that appears in the menu, select the menu item with its configuration information on the right. Type the new name in the **Name** field.

10. Complete the fields for the command, and save the command by clicking **Apply** or **Apply & Close**.

4.7.5.2. Making Copies Using the Multiply Function

The Multiply command is particularly convenient for creating a number of new items such as equipment nodes or equipment classes in AnalytiX Catalog. You can use it to make multiple copies of an item in the Project Explorer. Use it to make three copies or 50 copies or more. In making multiple copies you can enter the formula to be used for populating fields in the copies: you can leave those fields unchanged, or you can specify a number to be appended to those values.

If you are making copies of a node that has a multi-level structure, the entire structure is copied. Copies will appear above the original item in the same level of the asset tree as the original. The names of copies will have numbers appended to them in accordance with your numbering specifications.

To Use the Multiply Function:

1. In Workbench SL's **Project Explorer**, right-click the item you want to copy. From the pop-up menu, select **Multiply**, as shown below. (The Multiply function may not be available for all items.)

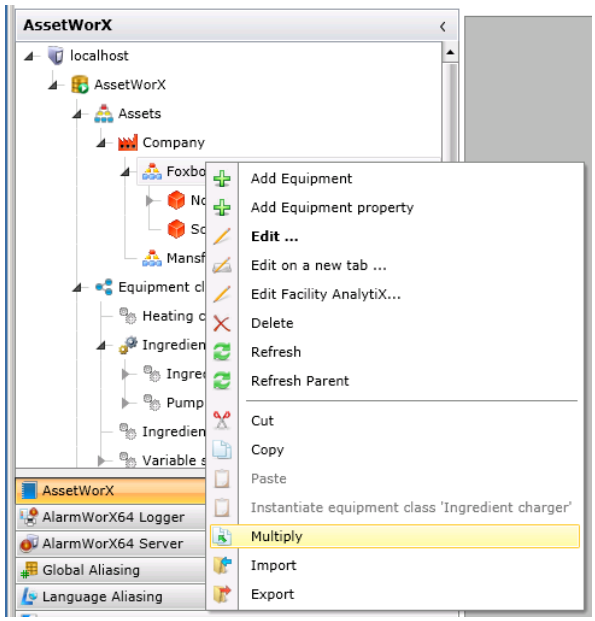


Figure 4.14 - Selecting Multiply from the Pop-up Menu

The Multiply Options dialog box appears, and will look something like the following:

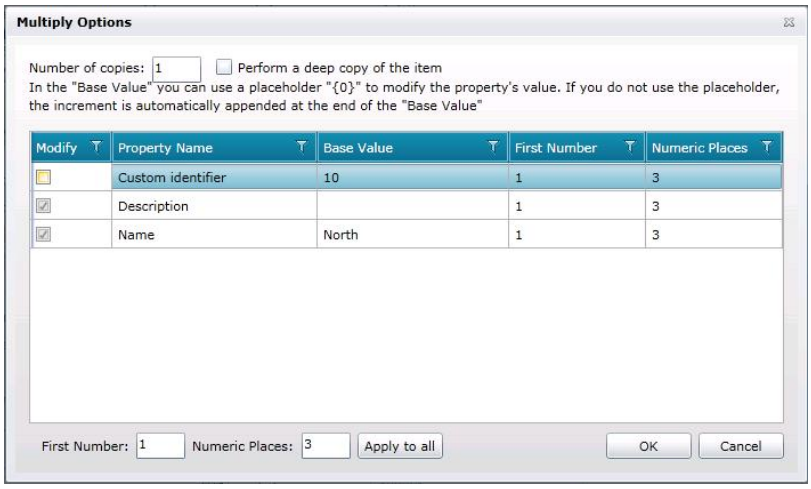


Figure 4.15 - Multiply Options Dialog Box

2. In the **Number of Copies** field, specify the number of copies you are creating.

3. This dialog box lists the properties that you can modify in the copies that are created. The item's properties are listed in the **Property Name** column, and the properties' values are listed in the **Base Value** column. If you want the base value to remain unchanged in all copies that are created, remove the check mark from the **Modify** column. (Note that some properties may be required to change; if they are, you will get an error message when you apply changes.)

4. Change the **Base Value** of any properties as you wish. If you wish the Base Value to be the incremented number that is generated when the multiples are created, enter {0} as the **Base Value**. Otherwise, the number will be added as a suffix to the base value.

5. For each property value that will change, in the **First Number** column specify the first number to be assigned to copies (for example, 100). In the **Numeric Places** column specify the number of numeric places to be reserved for the numbers that are appended. For example, if you enter 5, then five numeric places will be reserved; if the first number is 100, the first copy's name will be appended with 00100, the second with 00101, the third with 00103, and so on.

   Alternatively, you can apply a uniform numbering scheme to all properties that are being modified by entering values in the **First Number** and **Numeric Places** fields at the bottom of the dialog box, then clicking the **Apply to All** button.

6. When you are ready, click the **OK** button. A progress monitor will appear; when it is done a message will appear at as the last item, as shown below.

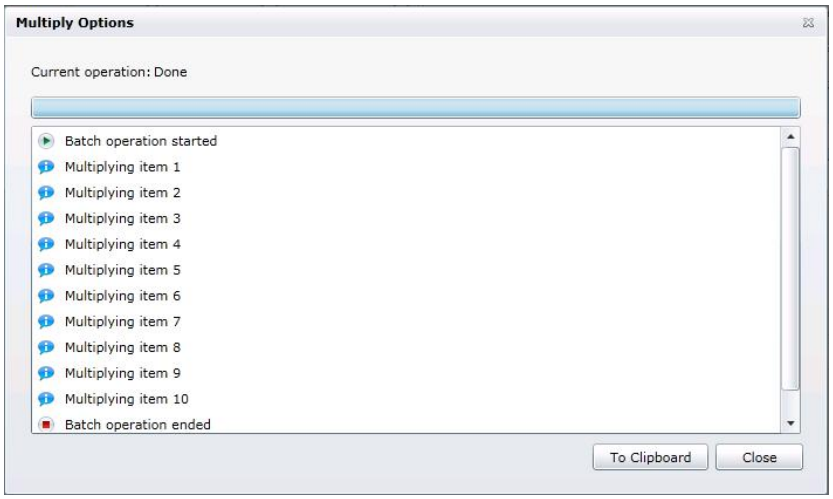


Figure 4.16 - Ten Copies

7. If there are errors, you can click the **To Clipboard** button to copy the displayed messages to the Windows clipboard, then open a text editor and paste them there for later reference.

8. Click **Close** to complete the process. The copies appear in the Project Explorer.

4.8. Using an Equipment Class to Add an Equipment Node to the Asset Tree

Once you have defined an equipment class for the type of equipment you want to add to the asset tree, you can use it to define equipment nodes in the asset tree. You do this by dragging the equipment class from the Equipment Class node and dropping it into the asset tree where it belongs and instantiate the aliases.

To Add an Equipment Node to the Asset Tree by Using an Equipment Class:

1. In Workbench SL, open AssetWorX.

2. Under the **Assets** node, expand the asset tree to expose the equipment node you want to add equipment to.

3. Under the **Equipment Classes** node, find the equipment class to be used at the template for the equipment you are adding to the equipment tree.

Select the equipment class and hold down the mouse while you **drag the equipment class** from the *equipment class tree* to an asset in the *asset tree* and hold the cursor over the equipment node you are adding a child node to. It should look something like the following example in which the equipment class called "Ingredient charger" is being held over the equipment node called "Mansfield bakery".

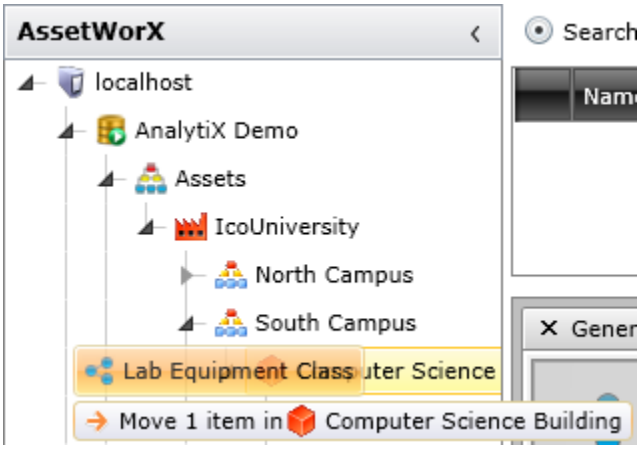


Figure 4.17 - Dropping an Equipment Class into the Asset Tree

4. When the equipment class is in the correct location, **release the mouse** to drop the equipment class into the asset tree. At this point the equipment class (or classes, if you are using a multi-tiered equipment class) is in the asset tree, but not yet saved.

5. The **Instantiation Options** dialog box appears. This is where you will instantiate (or assign values to) the aliases in the equipment class(es). Before you continue, read these conditional items:

   - If you copied the equipment to the wrong equipment node, you can click the **Cancel** button. The dialog box will close and no change is made to the asset tree.

   - If the message "**No aliases found**" appears in the dialog box, click the Instantiate button. A second dialog box will appear; click **Close**, and you are done.

6. The **Instantiation Options** dialog box lists all of the aliases defined for all of the equipment classes you just used. The following example shows two aliases, but there may be many.

Figure 4.18 - Aliases in the Instantiation Options Dialog Box

At this point, you will be replacing aliases with values to be used for the equipment node you are creating -- or *instantiating* values for the equipment node. It is important to understand that you are not required to provide replacements for aliases at this point. In fact, it is possible that you do not yet know the values to use for the equipment node you are creating. You can skip step 8, or just instantiate a few aliases if you like, and go straight to step 9. You can instantiate aliases at any time later on by following the steps in "Instantiating an Equipment Node's Aliases".

7. For each alias in the dialog box, go to the **Replace With** column and replace the alias with the value to be used for the equipment in the asset tree. In the following example, both aliases have been replaced. The *charger_description* alias has been changed to "Forklift charger" and the *displayname* alias has been changed to "Load recharge times report". You also have the option to **multiply** the number of instances (setting first number and numeric places).

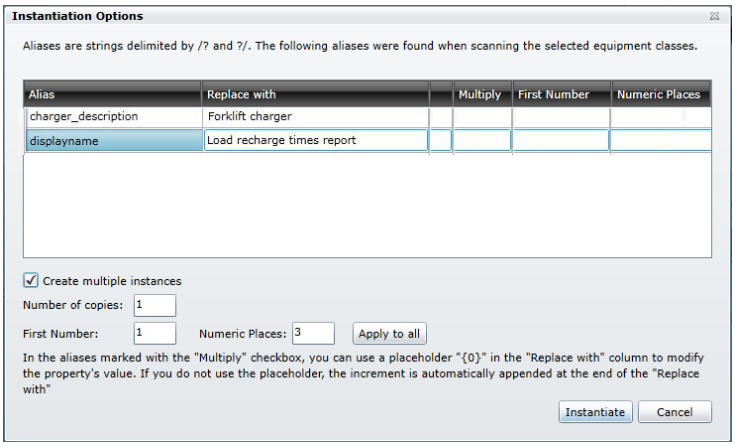


Figure 4.19 - Aliases Replaced with Real Values

8. Click the **Instantiate** button. The replacements are made and the new equipment nodes are saved in the asset tree. If the save is successful, you will see the following dialog box. You are done.

   However, if there were errors, no changes were saved to the asset tree; refer to the steps under the heading "Handling Instantiation Errors".

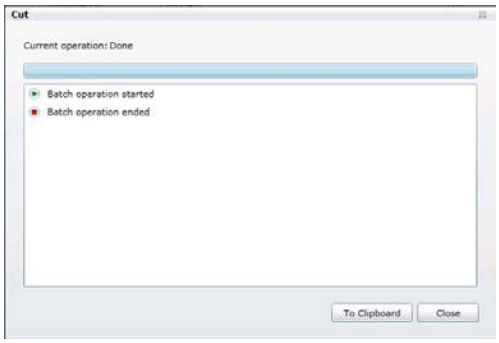


Figure 4.20 - A Successful Instantiation

4.8.1.1. Handling Instantiation Errors

1. If there were errors in the instantiation of the equipment class's aliases, you will see an error message in the resulting dialog box, like the example shown below. In this case, none of the new equipment nodes are saved. To easily record any errors that occurred, click the **To Clipboard** button; this copies all messages from the dialog box to the Windows clipboard.

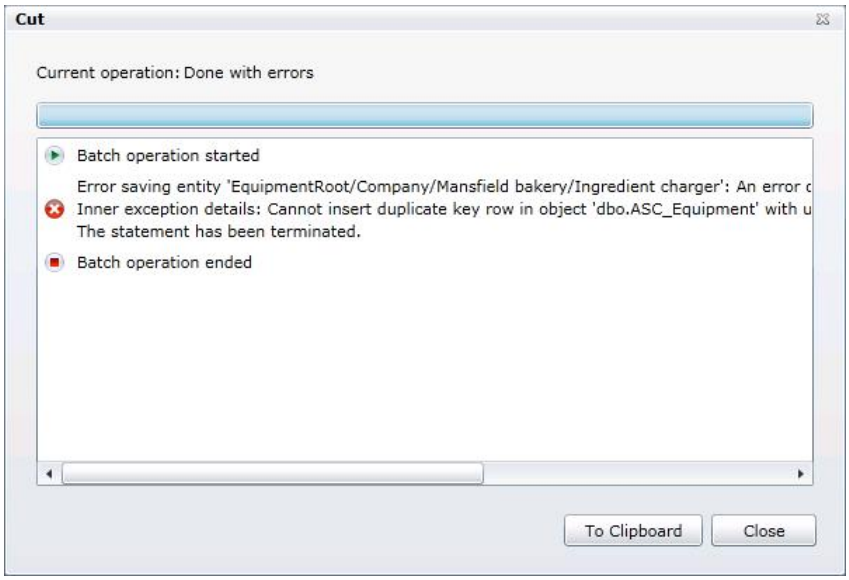


Figure 4.21 - Instantiation Error

2. You may be prompted for permission to access the clipboard. If you are prompted, grant permission to the clipboard.

3. Once the dialog boxes close, the changes are not saved. Open a text editor such as Microsoft Notepad and paste the text into the file, which you can save. Use the error text to correct the error, then try to create the equipment node again.

   The following example shows the error's test pasted into a Notepad file.

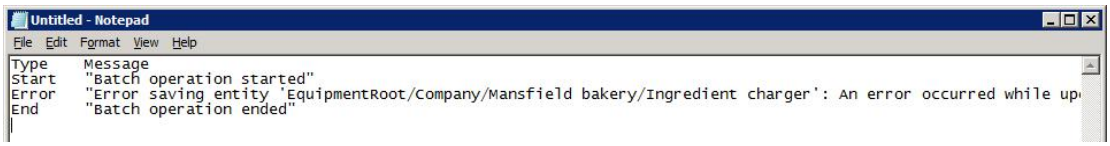


Figure 4.22 - Error Content Pasted into Notepad

Lab: Equipment Classes L4

4.1. Lab Overview

In a previous lab, you created the foundation of the asset tree that will be used for the remainder of this training course. In this lab, we will proceed by creating an equipment class and dragging equipment class assets into the asset tree.

Estimated time to complete this lab: 45 minutes

4.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Create an equipment class with equipment properties.
- Drag and drop equipment class tree nodes into the asset tree.
- Instantiate the equipment class to resolve alias definitions.

4.1.2. Support Files

You do not need any support files to complete this lab.

4.2. Adding Tree Nodes Using an Equipment Class

Let's get started.

4.2.1. Configuring an Equipment Class Asset

The Equipment classes node is empty. We will proceed by creating a child node under the Equipment classes branch.

1. Launch Workbench-SL by selecting **Start → All Programs → ICONICS → Workbench-SL**. Type in the username and password that was used to install GENESIS64.

2. From within the Project Explorer on the left, select the **AssetWorX** provider.

3. Expand the **icTonicsAssetWorX** database asset tree. After completing Lab 2, this should be the active database.

4. Right-click on the **Equipment classes** node and select **Add Equipment class**.

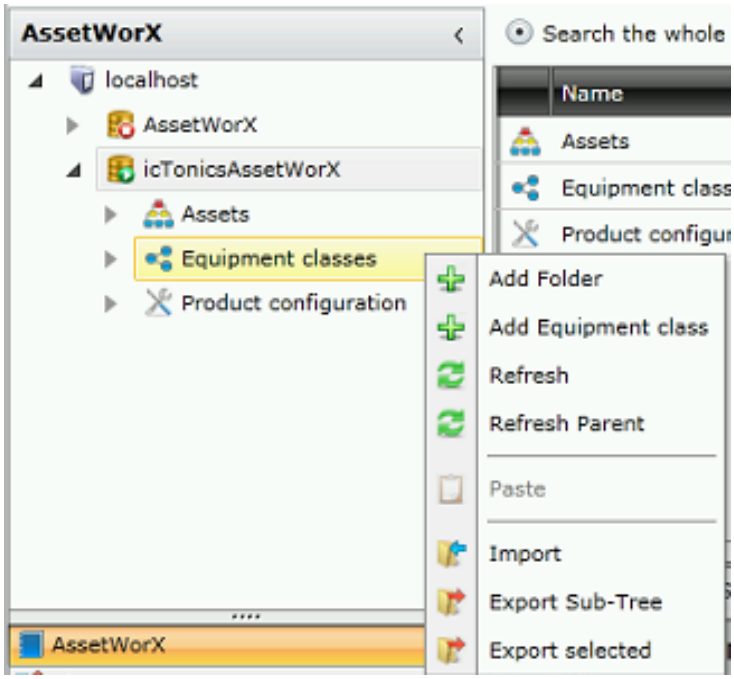


Figure L4.1 – Adding an Equipment Class

5. Name the Equipment class **/?RTU_Name?/**.

   Note: The delimiters /? and ?/ are place holders for values that will be entered during the instantiation process.

6. Select **Process Cell** as the **Icon** type.

7. Click **Apply**. Your configuration should resemble the figure below.

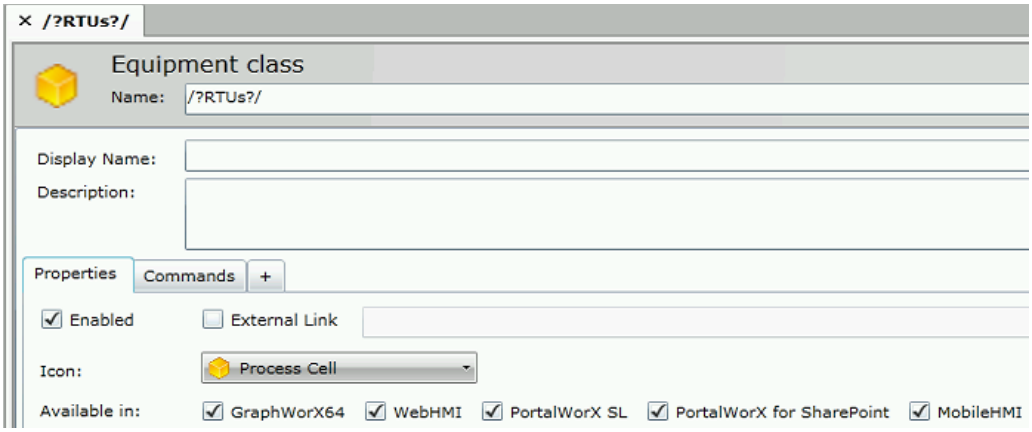


Figure L4.2 – Define the Icon: as Process Cell

8. Select the **Commands** sub-tab.

9. Click on the **Add** button.

10. Configure the **Command** as described below:

    Note: Leave the default settings in any field that is not mentioned below.

    - **Command:** Load Graphics Display
    - **Name:** LoadDisp_AHU
    - **Description:** Load Graphics Display AHU
    - **Execution flags:** Visible and Drag & drop
    - **Filename:** http://localhost/PubDisplay/AHU.gdfxs

    Note: Manually enter the **URL** associated with the **Filename:** (above).

    Note: Localhost could be replaced with the hostname or IP address of the computer where IIS is running and the displays have been published.

    - **GlobalAliases:** RTUsTheme=&/?RTU_Number?&/Theme/0;

    Note: While working with an equipment class, if you select the Tank1 global alias using the ellipsis button [...], your syntax may resemble this (RTUsTheme=RTU1Theme/0;) and you will have to manually modify the syntax to duplicate the equipment class aliasing syntax above.

11. Your configuration should resemble the figure below.

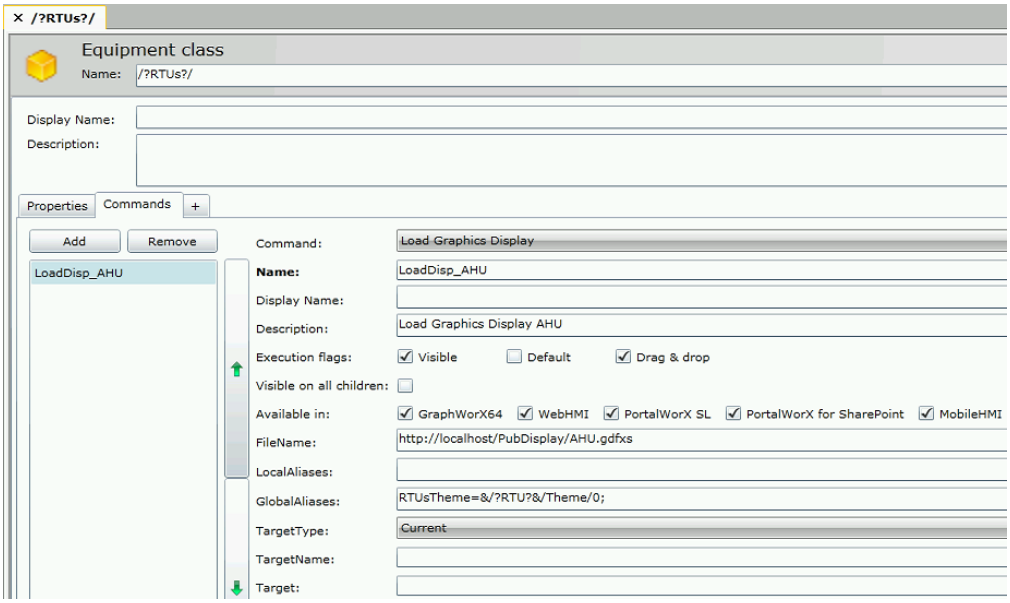


Figure L4.3 – &/?RTU?&/ Equipment Class Definition

12. Click **Apply & Close**.

4.2.2. Adding Equipment Properties

For each level of Assets within the tree control of the AssetWorX provider in Workbench-SL, you can add Equipment Properties. These allow you to connect the associated asset to real-time (utilizing multiple data source options) or historical data sources. Let's proceed to learn how this works.

1. We will continue by defining Equipment Properties within the /?RTU_Name?/ Equipment Class.

2. Let's proceed by right-clicking on the **/?RTU_Name?/** node under **Equipment classes**. Then select **Add Equipment class property.**

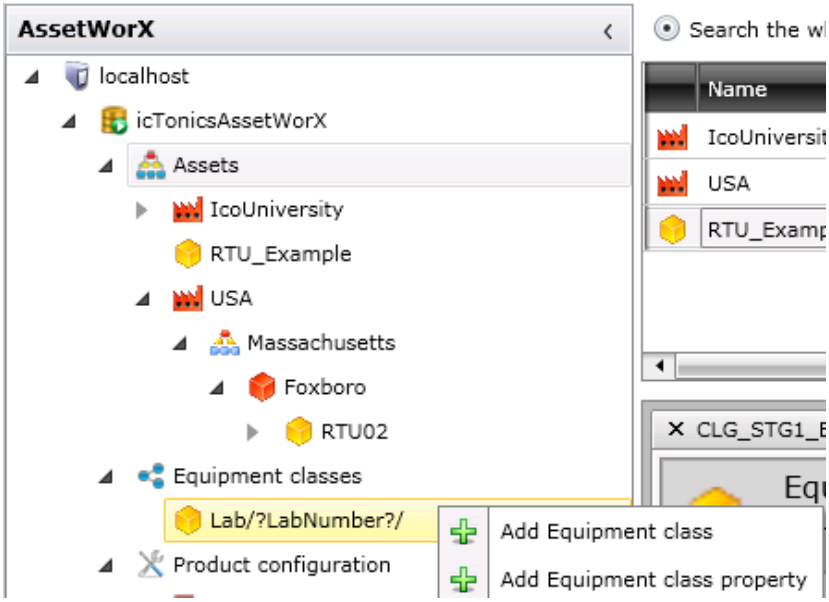


Figure L4.5 – Adding an Equipment Property to the RTUs Equipment Class

3. Configure the first property:

- **Name:** RoomTemperature
- **Source Type:** Dynamic Tag
- **Real time data tag:**

ac:IcoUniversity/North Campus/Engineering

Building/HVAC 01/RoomTemperature_opc

Note: You can either type in the tag manually or you can click on the ellipses to launch the Data Browser and browse for the tag Home → AssetWorX → IcoUniversity → North Campus → Engineering Building → HVAC 01 → RoomTemperature_opc

4. Click **Apply**.

4.2.3. Adding the Equipment Class to the Asset Tree

The figure below depicts the current asset tree. We will proceed by dragging the /?RTU_Name?/ equipment class and dropping the equipment class onto the Foxboro node. This initiates the instantiation process which in turn resolves /?RTU_Name?/ into a usable string.

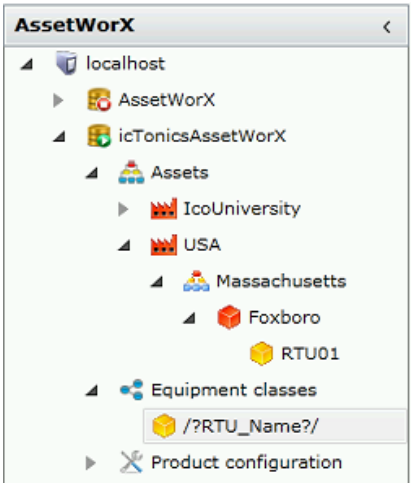


Figure L4.6 – A View of the Current Asset Tree

1. Expand the **USA** tree until **RTU01** is exposed.
2. Also, expand the **Equipment classes** asset tree.
3. Select the **/?RTU_Name?/** equipment class.
4. **Click and hold**, with the **left mouse key**, on the **/?RTU_Name?/** equipment class.
5. While holding the left mouse key down, **drag the /? RTU_Name?/** equipment class and hover over the **Foxboro** asset as seen in the following figure.

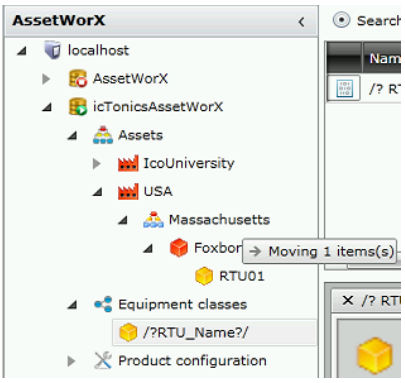


Figure L4.7 – Dragging and Dropping the /?Tank?/ Equipment Class into an Asset Tree

6. While hovering over the **Foxboro asset**, when you see the "**Moving 1 item(s)"** message, release the mouse key. This starts the instantiation process. Continue on to the next step.

4.2.4. The Instantiation Process with Multiply

The following section outlines the process required to Instantiate the aliases.

1. At this point, you should see the **Instantiation Options** dialog.
2. Select the **Create multiple instances** checkbox.
3. In the **Replace with** field
   - change /?RTU_Name?/ to **RTU{0}**
   - change /?RTU_Number?/ to **RTU{0}**
4. **Number of copies:** 1
5. **First Number:** 2
6. **Numeric Places:** 2
7. Your completed dialog should resemble the figure below.

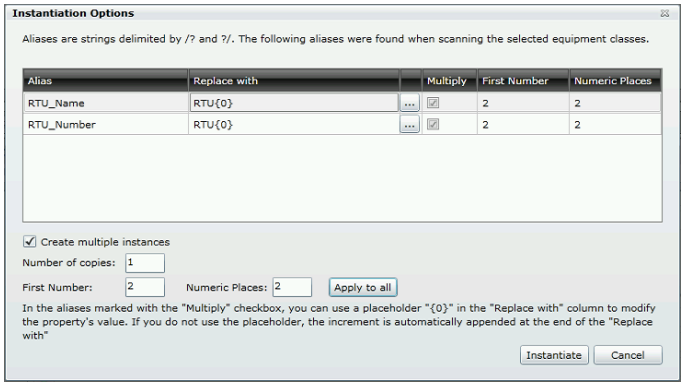


Figure L4.8 – Defining the /?RTU_Name?/ Equipment Class Alias with Multiply.

8. Click the **Apply to all** button.
9. Click on the **Instantiate** button. When you see the **"Current operation: Done"** message, as seen in the following figure, the instantiation process is complete.

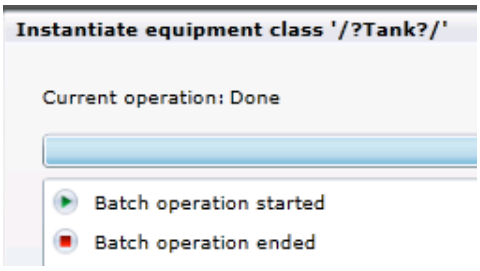


Figure L4.9 – Instantiation Process Complete

10. Click **Close**.

11. Expand the asset tree below the **Foxboro** asset.

12. Select the newly created **RTU02** asset. This will expose the RTU02 properties on the right.

13. Select the **Commands** sub-tab.

14. Select the **LoadDisp_AHU** command entry.

15. You should notice two things. First, all the configurations defined in the /?RTU_Name?/ equipment class have been applied to the RTU02 asset. Second, notice that the syntax of the GlobalAlias has been automatically modified to accommodate global alias resolution in Runtime.

4.2.5. Entering Runtime

Until now, we've only done Configuration. In the following steps, you will launch PortalWorX Runtime, add a GraphWorX Viewer Control to a Layout and drag and drop the rtu02 asset into the GraphWorX Viewer to display real time data. Let's proceed by spending some time working with our configuration in Runtime.

Testing the Tank Assets in Runtime.

1. From within **Workbench-SL**, in the upper left corner, click on '**Runtime**'.

   Note: If you do not see the '**Runtime**' selection, click on the **Tools and Settings** tab and confirm that the **Show the Ribbon Title** checkbox is checked.

Figure L4.10 – Initiating Runtime from Workbench-SL

2. Clicking on Runtime opens PortalWorX in a new browser session. Notice the **AssetWorX Navigator** on the left and the **Viewer Control window** on the right.

3. You should have a blank layout.

   Note: If you wanted to create a new blank layout, you would select the Project tab and click on the upper left layout.

4. Select the **Home** tab. Note the list of **Viewers** in the **GENESIS64 Controls** section of the ribbon.

5. Select the **GraphWorX Viewer** control.

6. Leave the **Configure Web Part** dialog as default and click **OK**.

7. By selecting and holding the RTU02 asset with the left mouse key, **Drag and Drop** the **RTU02** asset into the **GraphWorX Viewer**.

8. We will be exploring PortalWorX-SL in more detail during upcoming labs.

4.2.6. Expanding the Viewable Area

1. Let's expand the viewable area of this Internet Explorer session.

2. Select the **PortalWorX-SL Project** tab.

3. From within the **Show / Hide** section select **None** from the **Ribbon** drop down list.

   Note: Upon clicking OK in the next step, near the top of the banner, look for the notification, which will be displayed briefly, indicating how the key sequence **CTRL+F1** will re-expose the **Ribbon**.

Figure L4.11 – CTRL+F1 to Show Ribbon

4. A **Warning** dialog requiring user confirmation that the ribbon will be hidden appears. Click **OK**.

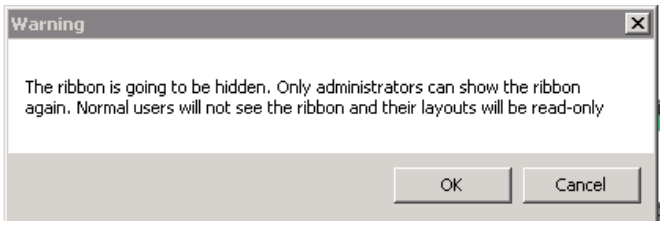


Figure L4.12 – Hidden Ribbon Warning

5. Press **F11** to hide the Internet Explorer Ribbon.

6. Essentially, all that should be visible in the browser at this point is the **Banner**, **AssetWorX Navigator** and the **list of viewers**.

7. Take a moment to poke around and get acquainted with the **PortalWorX-SL runtime** environment.

8. Press **Ctrl-F1** and **F11** to return to the default view.

This concludes this lab.

GraphWorX64 Basics 5

As you know by now, GraphWorX64 is a platform for you to develop HMI. Being such a platform, it offers some basic drawing capabilities as well as dynamics and pick actions that animate displays. In this chapter, we will explore this aspect of GraphWorX64. After completing this chapter, you should know how to do the following:

- Work with 2D shapes and objects.
- Work with text objects.
- Work with layers.
- Work with 2D color and dimension dynamics.
- Work with pick actions, buttons, and the Function Key action.
- Count objects in your display.
- Change the application mode.

5.1. Basic 2D Shapes and Objects

GraphWorX64 uses vector graphics for designing animated objects in its displays. It also supports data display and processing of OPC data from a variety of data sources. When you open a GraphWorX64 display in Configuration mode, you can add shapes and other objects including bitmap images, labels, and other static objects.

Some objects (such as buttons) come with actions, called *dynamics*. By default, buttons perform a dynamic called the Load Display action, which means that at runtime a click of the button animates the loading of a display. But you can change that action to any of a number of other possibilities. You can create a button that performs a sequence of actions when clicked. But you can change the trigger from clicking the mouse to something else, like moving the cursor over the object.

First, let's start with the basic shapes in GraphWorX64, which are:

- Line
- Arc
- Spline
- Polyline
- Rectangle, square
- Ellipse, circle
- Polygon

Once you have drawn basic shapes, you can combine them into new, more complex shapes by using the Combine Objects button in the Home ribbon's Arrange section. Figure 5.1 shows an example of the different commands that you can use to create a complex shape.

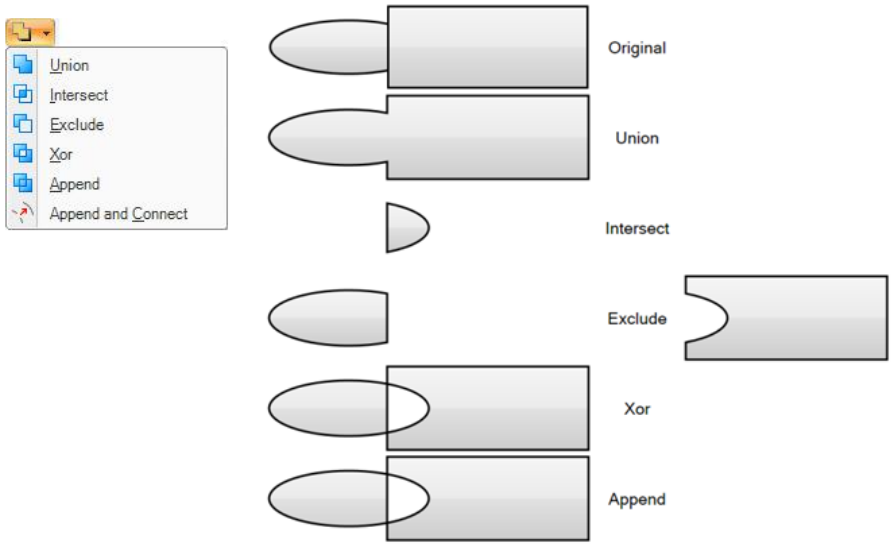


Figure 5.1 - Combine Basic Shapes into Complex Shapes

Using these and other shape manipulation methods, you can create complex and dazzling objects from basic shapes. You can flip shapes horizontally, vertically, or rotate them in 90° increments using options in the Arrange pane on the Home ribbon, shown in Figure 5.2.

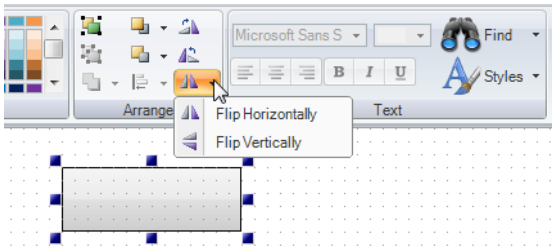


Figure 5.2 - Flip and Rotate

You can freely rotate the shape by dragging the corner when you see the arrows connected by a curved line: . This handle appears when you hold the cursor on the outside of a shape's *corner* handle. Grab the corner to rotate the shape freely or, if you hold down the Shift key, the rotation happens in 15° increments.

Skewing the shape is simple, too. Just hold the cursor on the outside of a *side* handle until you see the mouse change into two arrows separated by a line, similar to: . Then grab the handle and move it using your mouse to skew the shape.

Experiment on your own. Try out different shape combinations to get astonishing new shapes like the one shown in Figure 5.3. It is made by using a circle in the middle, crossed by four ellipses, and then applying the XOR arrangement. Then we applied a style from the Style and Colors tab on the Home ribbon to the shape.

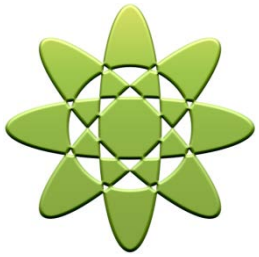


Figure 5.3 - Complex Shape Created Using Ellipses with a Predefined Style

Combining these shapes with smart symbols and controls will give you the ability to create easily dashboards (like the one shown in Figure 5.4), processing and electrical systems, facilities, campuses, and much, much more.

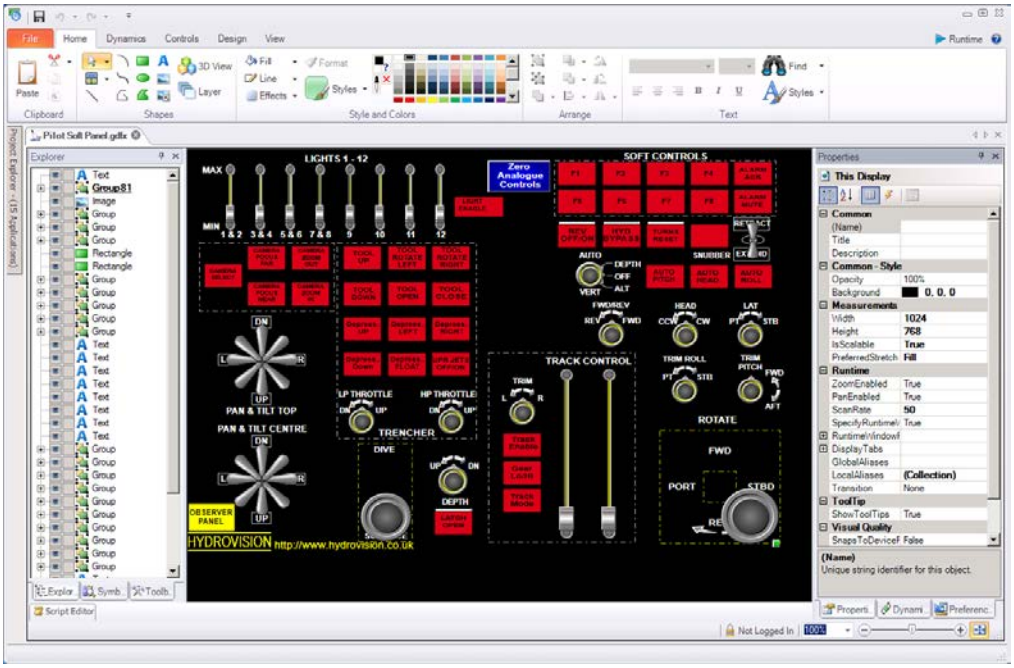


Figure 5.4 - Example of a Display in Configuration Mode

In Figure 5.4, you can see sliders, dials, buttons, lights, and switches. You could add temperature gauges, a clock, indicators, pressure gauges, and perhaps a dozen other active data points. This GraphWorX64 display has, among its many object types, push buttons that perform actions such as turning a pump on or off. We could add thumbnails of other displays that open additional GraphWorX64 displays for TrendWorX64, AlarmWorX64, and EarthWorX64. GraphWorX64 puts the power of the entire GENESIS64 programming suite at your disposal.

5.2. Dynamics

As suggested by their name, *dynamics* are objects that show changing information. A *process point* is one example of a dynamic. The value of a process point changes as it reads the changing value from the OPC server. Some objects are dynamics. But you can also apply dynamics to shapes and objects to show process information graphically. For example, you can attach a dynamic to a rectangle to create a slider. In this section, we will discuss the different types of dynamics available in GraphWorX64.

5.2.1. Text Objects

Process Points, Data Entry, and Time Date objects are three variants of a dynamic object type called *Text Objects*. You can create any of these three objects by using the Text Objects section in the Dynamics tab on the ribbon, as shown in Figure 5.5.

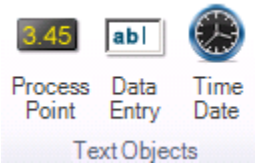


Figure 5.5 - Text Objects

A **Process Point object** is a text object that you can associate a data source to and display dynamic or static values in a GraphWorX64 display. By default, a Process Point is a read-only object; runtime users typically don't need to update the value of a Process Point, they just want to see its value. You would use a Process Point to display OPC-UA tag values, results from expressions, or any other time-dependent data.

A **Data Entry object** is a Process Point object but with different default property settings. The most striking difference is that, by default, it can be updated and it has a textbox that allows runtime users to enter values. Use a Data Entry object for an OPC point that runtime users need to be able to set or change the value of. Where you use a Data Entry object in a GraphWorX64 display, runtime users can change a state, assign a value to a variable, or make a selection that controls a process, changes other objects, or provides other forms of user-generated input – depending on how you configure the object.

Advanced settings in both of these object types can make a Process Point writeable and a Data Entry object read-only, essentially interchanging their default behavior leaving only slight visual clues that their original identities were something different. Typically you'll have no need to do this though.

The third Text Label object is the **Time Date object**, which displays the time and date. The Time Date object's properties are similar to those of Process Point and Data Entry objects.

5.2.2. Dimensions and Color Dynamics

Besides text objects, there are other dynamics such as Buttons, Dimensions, colors, etc., that you can use to create a spectacular display. In particular, the dimensions and color dynamics are most often used to add animation to a display. Some objects in the Symbols Library, such as knobs and gauges, come with dynamics that animate them.

To use these dynamics, you start by connecting a shape to an OPC tag so that the shape can receive the tag's values. Then you apply the dynamic to the object. This lets you use the value of the OPC tag to set the size, color, location, etc., of the object. Figure 5.6 illustrates a list of the simple dynamics you can apply to a shape or object. You can change an object's size, location, and color, and you can rotate it, hide it, and disable it.

Figure 5.6 - Dimensions and Color Dynamics

Also, you can combine any of these dynamics into one object. For example to create a ventilator like the one in Figure 5.7, you can use the *rotation dynamic* to spin it and the *color dynamic* to make it change colors depending on the speed. Notice that the object's dynamics are listed at the top of the Dynamics explorer, where there is also a dynamics toolbar so you can add and remove the object's dynamics if you like.

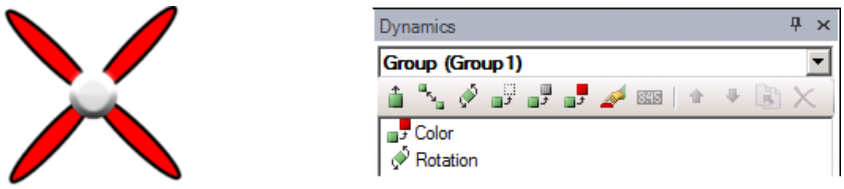


Figure 5.7 – A Ventilator (Left), with its Dynamics in the Dynamics Explorer (Right)

5.2.3. Pick Actions

A Pick action is a dynamic that is triggered by an action, such as a mouse click, taken by a runtime user. You define the user action and what happens in response to the user's action. Most commonly, a Pick action opens a display or a popup window, downloads a value to an OPC Tag, or runs a script. You can add a Pick action to any shape by using the Pick button on the Dynamics ribbon. Then, in the Pick action's Dynamic properties, shown in Figure 5.8, you specify the user action that will *trigger* the action, and choose the *command* that the action will perform. Notice that when you click on a property, a helpful tip appears at the bottom of the Dynamics explorer.

There are two different types of Pick actions in GraphWorX64: Local Pick Actions and Global Pick Actions. Local Pick Actions refer to actions within the GraphWorX64 display while Global Pick Actions utilize AssetWorX Commanding to affect modules outside of the GraphWorX64 display. While some Pick Actions are duplicated and may seem similar between Local and Global types, there are differences in the properties.

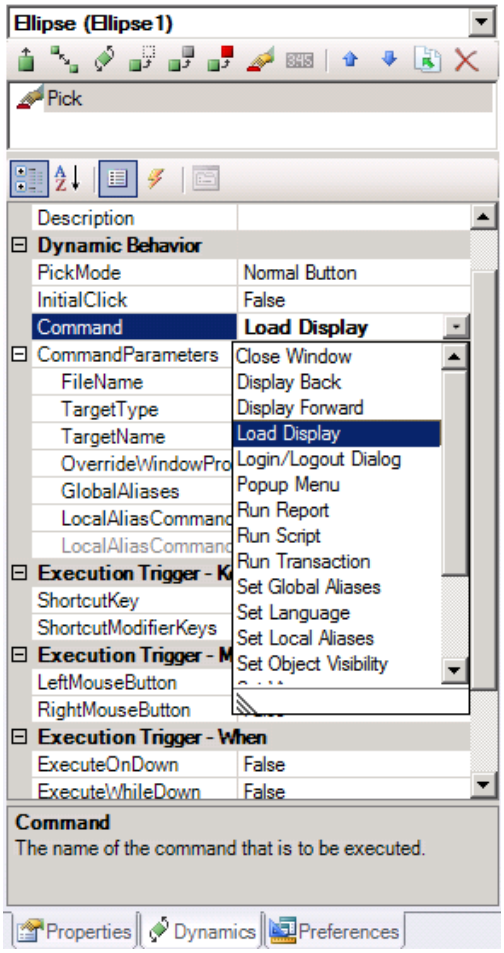


Figure 5.8 - Pick Action Dynamic Properties

Let us look at each Pick action command below.

- The **Close Window** pick action closes the Pick action's window or display.
- GraphWorX64 maintains a history of the last 50 displays. You can navigate through the display history using the pick actions **Display Back** and **Display Forward** command. These commands are also available as OLE Automation methods. The Display History feature is similar to Microsoft Internet Explorer's Back/Forward feature.
- The **Load Display** pick action opens a window of the type that you specify in the dynamic's properties. Windows can be dependent or independent popups, modal, or embedded. They can even refer to the current display (which is a *refresh* operation). You can specify other parameters, such as what loads in the display. Load Display is the default command for a Pick action.
- The **Login/Logout Dialog** command opens a dialog in which the runtime user can log in or log out.
- The **Popup Menu** pick action allows you to display a collection of pick actions that the runtime user can choose from. You can configure the position of the popup menu.
- The **Run Report** pick action allows you to execute a ReportWorX report during runtime.
- The **Run Script** pick action runs a script that you have created using JScript.NET in the display.
- The **Run Transaction** pick action allows you to execute a BridgeWorX transaction during runtime.
- The **Runtime Menu Command** allows users to access the Ribbon menu when it is not visible. Displays can be configured to embed the commands available in the Ribbon to customize operator options and view.
- The **Set Global Aliases** pick action allows you to set the global alias theme at runtime for the This Display object when the pick dynamic is triggered. This is especially helpful if global aliases are used in your OPC tags.
- The **Set Language** pick action sets the runtime language to a language of your choosing.
- The **Set Local Aliases** pick action sets aliases for data connections in runtime mode.
- The **Set Object Visibility** pick action applies a Hide/Show dynamic to an object based on the condition and using the trigger you specify.

- The **Set View** pick action takes the runtime user to a specified view in the display. Think of a view as a location or detailed close-up in an especially large display. To help runtime users navigate large or complex displays, you can create views that animate a zoom or scroll to areas of detail that runtime users need access to. This command lets runtime users access those views quickly and easily. We will talk more about views in the next chapter of this course.
- The **Start Application** pick action launches a specified application or document in runtime mode. In addition to launching executables, you can launch various documents, including Microsoft Word documents, Microsoft Excel spreadsheets, HTML files, and text files. The registered application is automatically started when the file is launched.
- The **Toggle Value** pick action is used to toggle between two specified values or states during runtime mode using an action that you specify.
- The **Update Database** pick action updates an OLE DB data source with the current values of tags that you specify based on the condition or action that triggers the pick action.
- The **Write Value** pick action writes a value that you specify or the value of one tag to another tag.

5.2.4. Button Objects Preloaded with the Pick Action

The Pick action is a dynamic action that can be applied to any shape. However, GENESIS64 gives you four button objects that are pre-loaded with the Pick action so that you do not have to create buttons from scratch. The same commands that are available for the Pick action are also available with the button objects.

To use these objects, go to the Buttons section of the Dynamics ribbon. Figure 5.9 shows them on the ribbon along with an example of each type. The simple, clickable *button* object displays a text prompt. The *checkbox* object lets runtime users click to add a checkmark. The *radio button* object can be lined up with other radio button objects to give runtime users a choice among multiple options. A *graphical button* displays the miniaturized image of another GraphWorX64 display. All allow you to specify the trigger that executes the Pick action command that you configure for it.

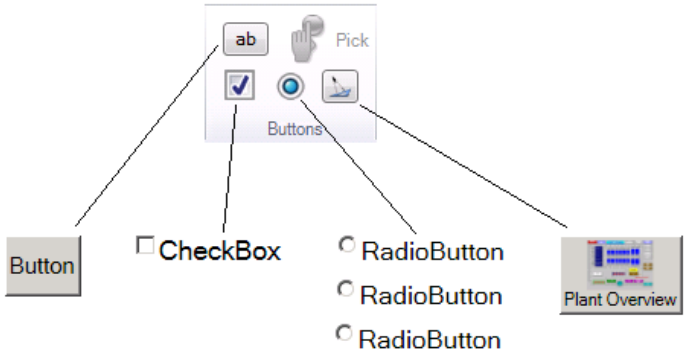


Figure 5.9 - Button Objects that Are Preloaded with a Pick Action

5.2.5. Function Key Action for the This Display Object

The Function Key action, available in the This Display section of the Dynamics ribbon, is nearly identical to a Pick Action, but it is applied to the This Display object only and is initiated by a keystroke. Function Key actions are similar to application keystroke macros that you assign in a document. The same commands that are available for the Pick action are also available for use with the Function Key action.

5.3. Object Count

As you create a display, you'll find that some objects seem to hide when you look at the display because objects overlay each other or they are grouped. If you want to see the count of objects in a display, their types, the number of data connections, or the number of dynamic animation types defined, you can click the Object Count button, which is in the Misc section of the View ribbon.

If no object is selected when you click on the button, you will see a list of all objects in the display. As you can see in Figure 5.10, the Object Count dialog counts the objects, as well as giving you other more information about your display.

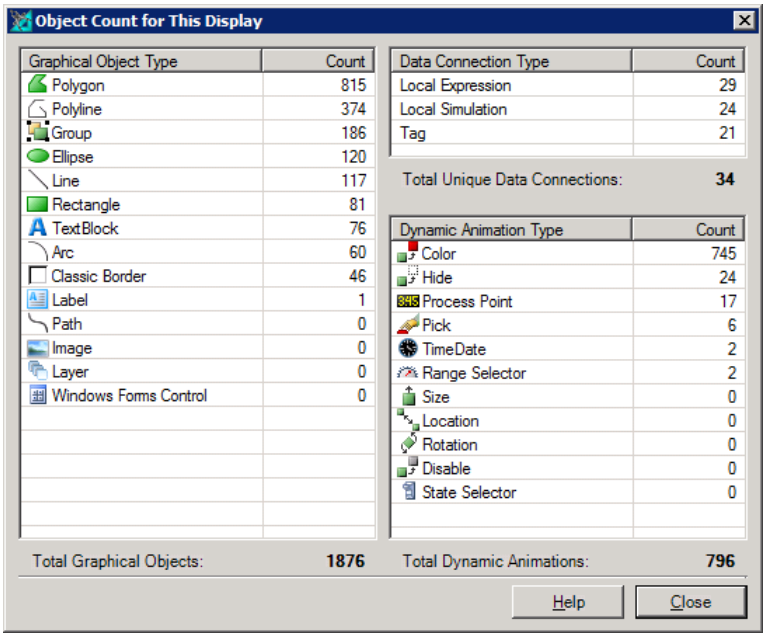


Figure 5.10 - Object Count Dialog

5.4. Layers

When you create a new GraphWorX64 display, any object that you draw or add to the work surface is placed on a primary layer of the display. You can think of that primary layer as providing the same capability as a background would in a paint program; the layer always exists — but is not shown in the object hierarchy of objects, groups, and layers that appear in the Explorer pane. As you add objects to the primary layer, those objects are drawn in an order from front to back such that the last drawn object is the top object. This allows you to work on any newly added object without interference from objects on the design surface from your previous work.

The following figure show four different objects and illustrates the concept of order in a layer. You can control the sequence of objects using the arrange commands for front and back. Note that the Layer object also shows up in the Explorer; if you only intend to use one layer, then there is no need to add a layer. Add layers only when you need more than one. (If you don't see the Explorer pane, bring it back into view by enabling the Explorer check box found in the Show/Hide tab group of the ribbon for the View menu.)

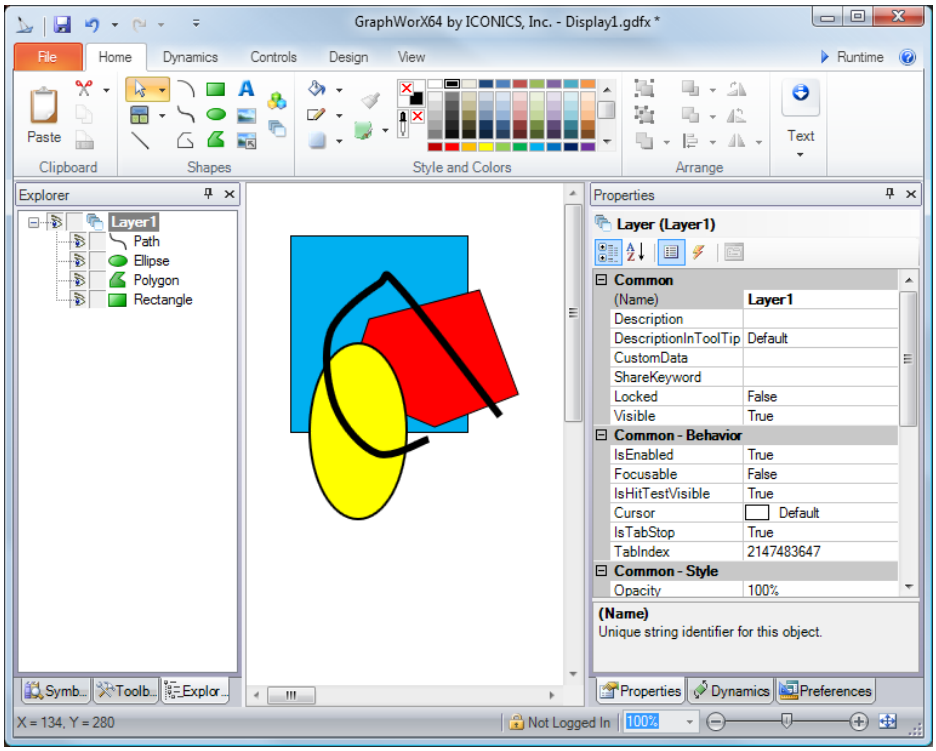


Figure 5.11 - Object Order is Shown in the Explorer Pane

Note that the layer has its own properties displayed in the Properties tab on the right. The Layer's properties are different than the properties of the This Display object because a display can have multiple layers. If you intend to use layers, you can set default values for layer properties on the Preferences tab. For more information, refer to New Layer Default Settings.

You can do the following things with layers:

- Layers can be **renamed** in the Explorer. However, names must be unique.
- Layers can be **selected** and multi-selected. When grey highlighted, they are active, and when blue highlighted, they are selected.
- Layers can be **hidden.**
- Layers can be **locked**.
- Objects and groups can be **drawn** on a layer in the work area
- Objects can be **moved into a layer** by dragging the object in the Explorer.
- If you use objects' ShareKeyword property to be able to maintain uniformity among identical objects in your GraphWorX64 displays, you can use the Update Shared Objects feature to update components in all layers in a display.

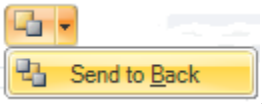
To **show/hide** an object:

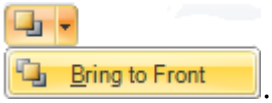
- Enable or disable the **Show object** check box (the eyeball) for the object in the Explorer pane

To **lock/unlock** an object:

- Enable or disable the **Lock object** check box (lock) for the object in the Explorer pane. A locked object will not display selection handles when you click on it.

To **move an object order in a layer** (the Z-order), do one of the following:

- Click the icon in the Arrange tab group of the ribbon for Send Object Backwards , Bring Object Forward , Send to Back 

, or Bring to Front 

.
- Cut an object and paste that object to move it from any position in the Z-order to the front.
- Click and drag the item in the Explorer pane up or down slowly; when the insertion bracket appears in the correct location release the mouse button. The figure below shows this operation.

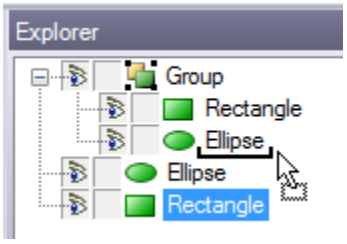


Figure 5.12 - Changing the Order of an Object in Explorer

Tip

Tip. Drag an object slowly as there is a slight delay in placement in order to allow GraphWorX64 to position the object correctly. If you want to move an object into a group, **pause under the group name** and wait for the group to open before you position your moving object in the group at the location desired.

Layers are useful when you want to organize collections of objects, but still return the ability to access each object in the layer individually. In a display that shows a collection of gauges you could use layers to hide a gauge when the condition is appropriate. Layers can also be used as an organizational unit when you have a complex display with a large number of objects.

To add a layer to a display:

- Click on the **Home** menu, then click on the **Layer** button in the Shapes tab group on the ribbon.
- The new layer is added to the top of your drawing, no matter what the currently selected object is and numbered sequentially Layer n, where n=1, 2, 3 and so forth.

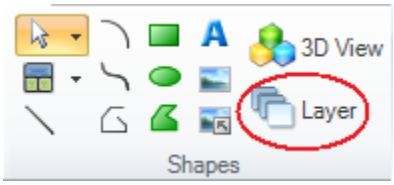


Figure 5.13 - The Add Layer Button

To **move a layer** up or down in the Z-order:

- Click and **drag** that layer object in the object Explorer to the new position, then release the mouse button.

To create a sublayer:

- Select the layer that will contain the sublayer, or an object contained inside that layer, then click the Add Layers button
- Or, drag a layer in the Explorer to the position in the hierarchy that you want the sublayer to occupy.

5.5. Application Mode

GraphWorX64 comes in three different user-selectable configuration modes: Basic, Standard, and Advanced. Depending on your comfort level and engineering requirements, you can select different modes that best suit your needs and preferences while in configuration mode.

- **Basic Configuration Mode** limits the features of GraphWorX64 to a "beginner-level" configuration for relatively simple applications. In basic mode, most advanced features are hidden from view.
- **Standard Configuration Mode** is appropriate for configuration and development of most typical applications. In standard mode, some advanced features are hidden from view.
- **Advanced Configuration Mode** is recommended for high-level configuration and powerful development capabilities for the most complex applications. In advanced mode, all GraphWorX64 features are available. As a power user of GraphWorX64 you will most probably use the advanced mode.

To change modes, click the Application Mode button on the View ribbon.

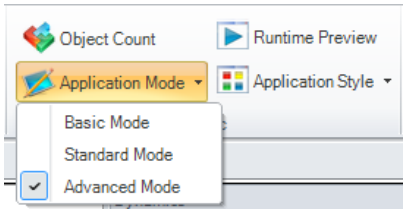


Figure 5.11 – Choose a Configuration Mode

To gain an appreciation of the differences between the three modes, consider Figure 5.15, which shows the Properties explorer for a Button object in each mode. *Basic* mode hides all properties except a small collection with the key properties of Text (label), Fonts, Colors, and Scaling. In *Standard* mode, you see about 80% of all the properties, which is sufficient in most cases. Finally, *Advanced* mode shows all properties that you can control in configuration mode.

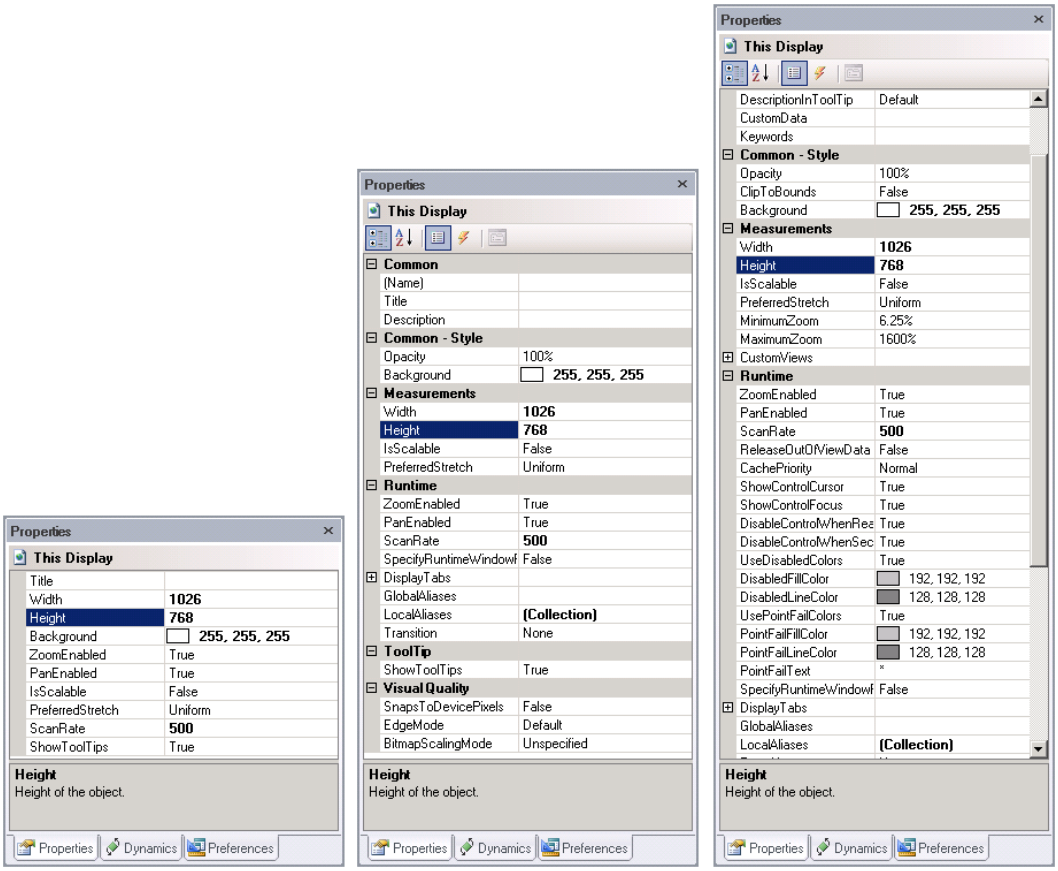


Figure 5.12 – Basic (Left), Standard (Middle), and Advanced (Right) Modes

5.6. Display Password Protection

This application note provides a guide to password protect your screens so no one else can make changes to them in design mode. This can only be done by selecting Application \ Advanced Mode when designing screens in GraphWorX64 like was described in previous chapter.

When you have set the Advanced mode of your GraphWorX64 and go to properties of created display, you should see Protection property in Properties tab, like is shown in the following figure.

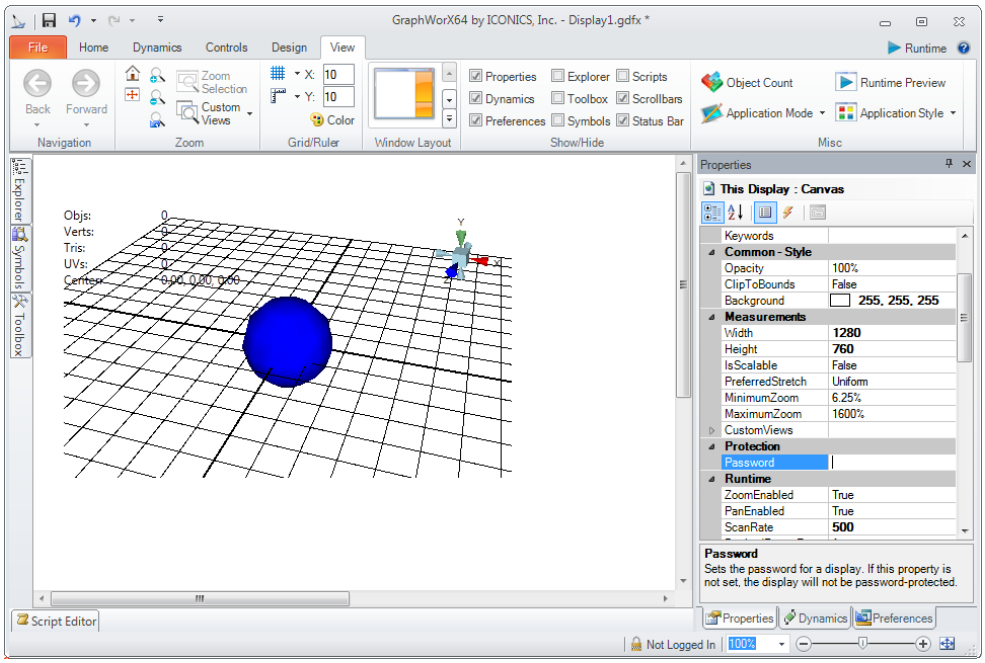


Figure 5.13 – Protection Property - Password

There you simply write your password by which you wish to protect your display. When you open now your display in configuration mode, the Display Password window will be opened and you will not be allowed to do anything without putting right password on it. In case you forgot the password the Challenge tool is placed in same dialog to you will be able to reach display using technical support.

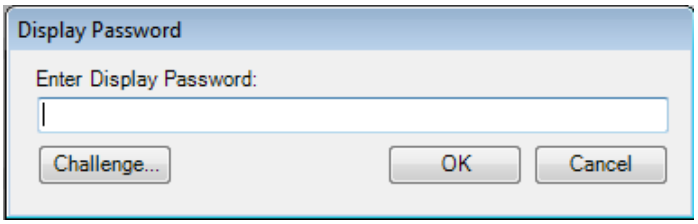


Figure 5.14 – Display Password

5.7. New Settings

In the File menu for GraphWorX64, you have the option of selecting the **New Settings** button, as shown below.

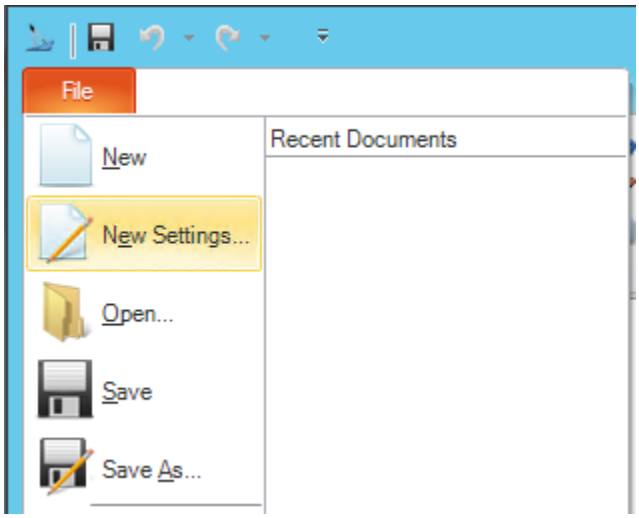


Figure 5.18 - New Settings Button in GraphWorX64's File Menu

This opens the New Display window, as shown below.

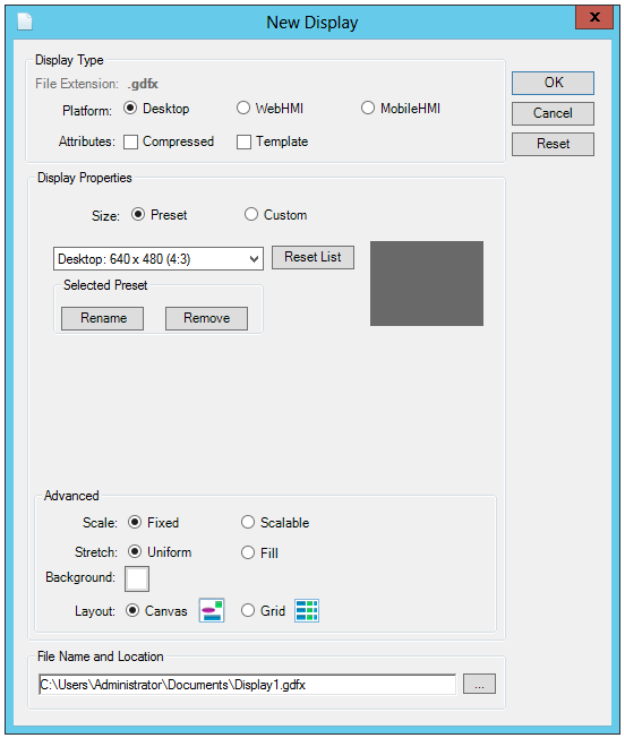


Figure 5.19 - New Display Window

The New Display window allows you to change the properties of the current GraphWorX64 display, including:

Display Type

The **File Extension** will change according to the Platform and Attributes you set.

- **Platform** - You can select from either **Desktop** (.gdfx), **WebHMI** (.gdfxs) or **MobileHMI** (.gdfxp).
- **Atributes** - Depending on the Platform, you'll be able to select whether the display you are creating will be **Compressed** or a **Template**. Note that these selections also affect the File Extension.

The Display Type settings will then affect the Display Properties that are shown within the New Display window.

Display Properties

- **Size** - You have the option, via radio buttons, of either selecting a **Prese**t or setting a **Custom** size. The options available are dependent on the Display Type. For instance, if you selected the Desktop platform and Preset, you would be able to select from a number of Desktop sizes and ratios [680x480 (4:3), 800x600 (4:3), etc.]. You would also be able to Rename or Remove the selection from the pulldown list. A graphic representation of your selection appears to the right of the menu items. If you were to select Desktop and Custom, you would be able to enter in the size specifications directly, as well as click the Lock Ratio button and Save as Preset (to add to the pulldown list). The WebHMI Platform options are similar to the Desktop.

  The **MobileHMI** options for Preset allow you to choose from popular mobile devices. Selecting a device means integrating the GraphWorX64 display with its 'Faceplate'.

  - **Faceplate** - When the MobileHMI platform has been selected, as well as a Preset size, you have the option of removing your highlighted device from the menu via the **Remove Selected** button. You can also **Remove All Custom** devices.

- **Gallery -** You can choose to **Export** the menu of devices (as a CSV file), which comes in handy if you have created additional devices, or **Import** an existing list. The Recover Defaults button allows you to revert back to the original device listing (in case any were removed), while still retaining any custom devices you added to the list.
- **Faceplate Visible -** When creating a display for a mobile device, you have the option of whether or not to include a graphical representation of the actual faceplate (the 'bezel' or 'frame') of the device within the GraphWorX64 display screen.

  The remainder of the MobileHMI Display Properties is auto-filled (Size, Manufacturer, Ratio) by your selected mobile device.

Advanced

- **Scale -** You have the option of selecting **Fixed** (where the display scale does not vary) or **Scalable** (where the display scale varies).
- **Stretch -** You have the option of **Uniform** (where the display content is resized to fit in the destination screen's dimensions while preserving the display's native aspect ratio) or **Fill** (where the display content is resized to fill the destination screen dimensions but the aspect ratio is NOT preserved).
- **Background -** Click the square to open the Color picker window, which provides multiple options for your selected display's background including Solid Colors, Gradients, Images and Global Colors.
- **Layout -** You can choose from **Canvas** (which defines an area within which you can explicitly position objects by using coordinates that are relative to the area) or **Grid** (which defines a flexible grid area that consists of columns and rows. The display size and aspect ratio are automatically adjusted to fit either viewport area [Desktop and Web displays] or the Faceplate screen area [mobile displays]).

  Note: This option can also be changed within the display's Preferences, in General Settings, in the DefaultNewRootObjectType setting, as shown in the following image.

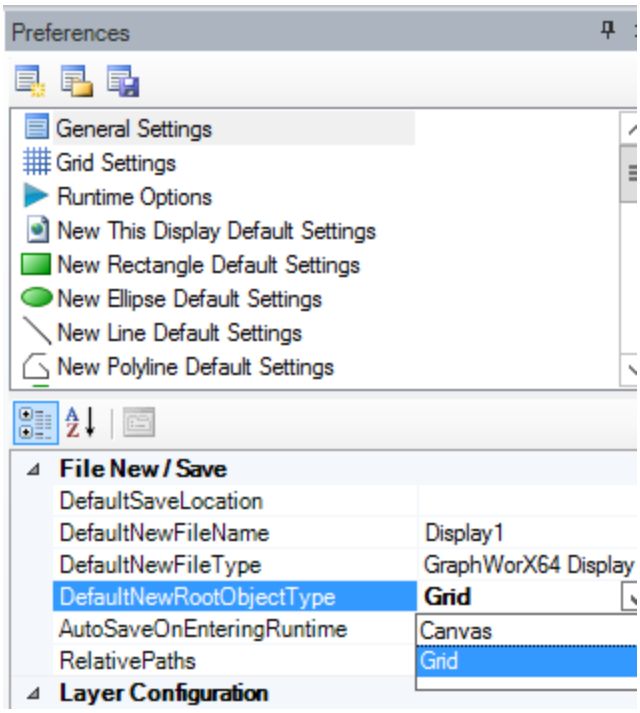


Figure 5.20 - Changing the Default New Root Object Type in GraphWorX64's Preferences (General Settings)

Lab: icTonics Monitor Display *L5A*

5A.1.1 Lab Overview

In this lab, we will create a display for icTonics' operators to use to control the mixer tank, as well as provide some graphics that indicate what is happening on the plant floor. This will allow the operators to control what to make and how to make it with a few easy clicks.

Your completed display should resemble the figure below.

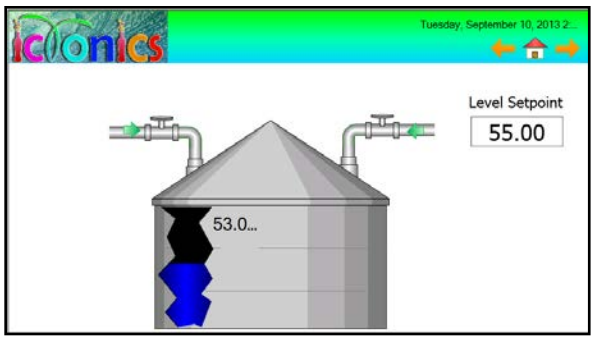


Figure L5A.1 – icTonics Tanks Monitor Display

Estimated time to complete this lab: 40 minutes

5A.1.2 Task Checklist

In this lab, you will complete the following tasks:

- Create a display that monitors the drink mixer tank.
- Use Location dynamics to indicate the direction of flow.
- Use a Size dynamic to show the tank level.

5A.1.3 Support Files

To complete this lab, you will need the following file(s):

- icTonicsTemplate.gdfx
- GENESIS64TrainingSymbols.sdfx

5A.1.4 Monitor Display

For the tank monitoring display, you need to build a mixer tank. This tank has two valves to allow water and certain syrups to flow into the tank for mixing. We will build this tank, as well as add animations to it to make the display more dynamic.

1. In the following steps, we will add a template to the GraphWorX64 template gallery. Open GraphWorX64.
2. Go to the **Design** tab in the ribbon and click on the down arrow in the **Templates** section, and then select "**Insert Templates to Gallery**".
3. Click on the "**Add Files**" button in the **Edit File List** dialog box.
4. Browse to the **C:\Training\icTonicsTemplate.tdfx** file, select it, and click **Open**. Then click OK.
5. You will now see the **icTonicsTemplate** template in the **Templates section**. It looks like a small green bar.
6. Click on the **icTonicsTemplate** template to apply it to the display.
7. Save the display in the C:\Training folder as "**icTonicsTankMonitor.gdfx**".
8. From the GENESIS64TrainingSymbols Symbol library, insert a "**BaseTank**" and two "**Pipes**". Also, from the **_General → Tanks → 2D_Tanks** library, insert the "**Jagged Cut-Away 2**". Arrange the objects to look like the following image.

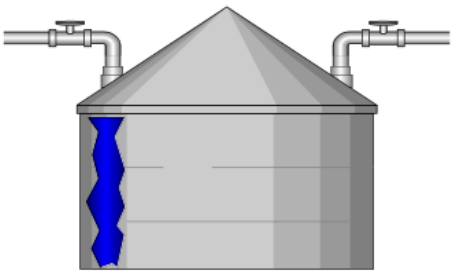


Figure L5A.2 - Mixer Tank

9. On the left, select the Explorer tab next to the Symbols tab. In the Tree Explorer, you should see a "JaggedCutAway2" group. Drill into this group and select the "**Jaggedcutaway4"** text. This is the blue polygon and if you look in the Dynamics explorer, on the right, it already has a size dynamic attached to it.

10. Change the DataSource of the Size dynamic to our Tank1 Level tag. You can do this by clicking in the DataSource field, then click on the "Browse" (ellipse) button to bring up the Data Browser.

11. In the Data Browser, select the OPC UA tab if it is not already selected. Then go to **OPC Classic Servers → My Server → ICONICS.IconicsOPCUAServer.V5 → icTonics → Tanks → USA → Foxboro → Tank1 → TankLevel**. Click on "OK" to choose the TankLevel tag and close the Data Browser.

12. Set the **LowLimit** in the Size dynamic to **0** and the **HighLimit** to **100**. Place the mouse cursor into any white space in the display and click the left mouse key until the JaggedCutAway is de-selected.

13. From the **Dynamics** tab on the ribbon, in the **Text Objects** section, select a **Data Entry**. Place the data entry to the right of the JaggedCutAway symbol. Link the DataSource to the same Tank Level tag as you selected previously.

14. In the Dynamics properties of the object, find the **PostfixLabel** property (*If you can't see it in the Dynamics, go to the View tab in the Ribbon, click Application Mode in the Misc section, and select Advanced Mode*) and add the percentage sign (%) in the field.

15. Select everything that you have created thusfar, then click on the Group Objects button in the Home ribbon's Arrange section.

Note: You can still edit the individual pieces of the object by double-clicking on the pieces. You can also select the objects that you want to edit in the Object Explorer.

16. In the Symbols library, browse to GENESIS64TrainingSymbols and drag the "RightArrow" into the display.

17. Select the Dynamics tab. Note that there are two dynamics (hide and location) already associated with the arrow. We will edit these dynamics in the following steps.

18. Resize the arrow so that it fits inside the pipe on the left.

19. In the Dynamics toolbar, select the Hide dynamic.

20. Click on the ellipsis [...] on the right side of the DataSource field and use the Data Browser to define the tag below as the data source:

*@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.**SyrupValveStatus**.Value*

21. Using the drop down list, change the **HideWhen** property to "data == 0".

Select the Location dynamic, and then click on the DataSource field to set it to *@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.* ***SyrupValveStatus****.Value*

22. Go to the Path property. Using the dropdown list, select the "**Edit Path On-Screen**" option. Notice that a red path appears on the pipe.

23. Drag the end of the path to the end of the pipe and drag a point in the middle of the path to the elbow of the pipe. Your path should look similar to Figure L5.3.

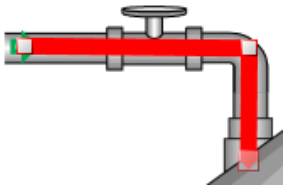


Figure L5A.3 - Location Dynamic

24. Set the Location dynamic's **AutoRotate** property to "True". Change the Duration to "3000" (3 seconds) and the **RepeatCount** to "Infinite".

25. With only the arrow selected, use Ctrl-D to duplicate the arrow. Place the duplicate on the pipe on the right. Change the DataSource in the Hide and Location dynamics to use the **WaterValveStatus** tag and reset the Path of the Location dynamic.

26. Select the Explorer tab on the left. Drill into the Group object to select the valve on the left. With the valve selected, add a pick action by clicking on the "Pick" icon under the Dynamics tab.

27. From the Properties tab on the right, change the **Command** for the pick action to "Popup Menu".

28. Scroll down to the MenuItems property, and click on the "Browse" button to bring up the **Edit Menu Items** dialog box.

29. Click on the "Add" button to add a menu item. You will then see a Properties menu similar to the one in GraphWorX64.

30. Change the **Command** to "Write Value". **Expand** the **CommandParameters** section and change the OnUpValue to 1.

31. Change the **MenuText** property value to "Open" and set the data source to the SyrupValveStatus.

32. Add a second Menu Item. This second one will be similar to the first, except the **MenuText** should be set to **Close**. Next, change the **OnUpValue** to **0**. Your finished configuration should look similar to the following image.

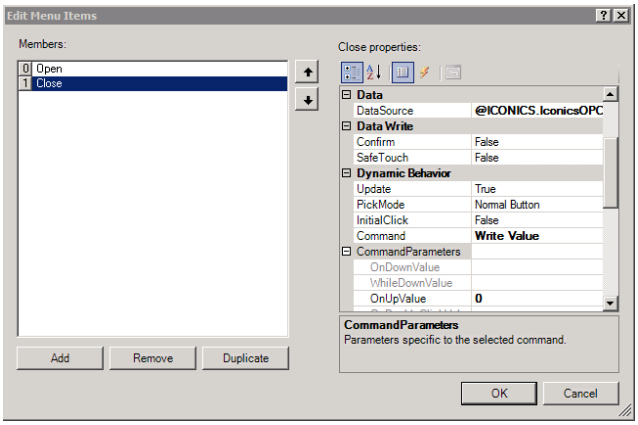


Figure L5A.4 - Popup Menu Configuration

33. Click on **OK** to save the configuration and close the dialog box.

34. Repeat steps 18-25 for the valve on the right-hand side of the tank. (Except, change the data source to **WaterValveStatus**.)

> ***Tip!*** You can copy an object and right-click on a destination option to choose "Paste Dynamic" to paste dynamics from one object to another.

5A.1.5 Add a Level SetPoint Data Entry Field

1. For the steps in this section, refer to the first figure in this chapter as a reference.

2. From the **Dynamics** tab in the **Text Objects** section, select the **Data Entry**. Place the data entry toward the upper right corner of the display.

3. From the Data Browser select:

   @ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.LevelSetPoint.Value

4. From the **Home** tab **Shapes** section click on the **Draw Label** icon (capital A),

5. Place a label above the **Data Entry** field and change the **Text** property (under the Content section) to **Level SetPoint**.

6. **Save** the display and go into **Runtime**.

7. Enter a value of **55** into the **Level SetPoint** data entry field and hit Enter.
8. If the **Tank Level** is **less than** the **Level SetPoint**, opening the valves should fill the tank. We will add a way to drain the tank in a subsequent lab.

This concludes this lab.

Lab: Layers and Dynamics *L5B*

5B.1.1 Lab Overview

Now that we have created a Welcome page, icTonics would like everyone to see this page first. Personnel with proper credentials should be able to navigate to other pages, as well. Furthermore, they should have the ability to look at detailed trend information for the mixer tank. We will create a popup display that exhibits such information.

Estimated time to complete this lab: 20 minutes

5B.1.2 Task Checklist

In this lab, you will complete the following tasks:

- Create a secured layer.
- Add a Scale Control.
- Add a Draining hide dynamic.

5B.1.3 Support Files

To complete this lab, you will need the following file(s):

- icTonicsTemplate.tdfx
- icTonicsHome.gdfx
- icTonicsTankMonirot.gdfx

5B.1.4 Adding a Layer

We will add a secured layer in this section so that once a user with the proper credentials logs in, the user can navigate to other displays from the home display. The layer you will add in this section will not actually be secure until we incorporate a security configuration in Chapter 16.

1. Open GraphWorX64, if you closed it from the previous lab.
2. Open the **icTonicsHome.gdfx** display in a new tab for editing.

   Note: You can do this from within GraphWorX64 by selecting the File menu tab. Then you can select it from the Recent Documents in the menu, or click on Open to navigate to it and select it.
3. In the ribbon, go to the **Home** tab. In the **Shapes** section, click on the **Layer** button.
4. In the **Object Explorer**, you should now see a new object called **Layer1**. **Rename** this layer **SecuredLayer**.
5. Go to the **Properties** explorer of the **SecuredLayer**, and find the **HideWhenSecurityDenied** property in the **Declutter** section and change this property value to **True**.
6. Go to the **Dynamics** tab. In the **Buttons** section, click on the **Butto**" icon and then click on the GraphWorX64 design surface to add a button to the lower left-hand corner of the display.
7. Leave the button's Command property as "**Load Display**".
8. In the Dynamics explorer, under the **CommandParameters** section, in the **FileName** property field, click the down arrow to show the drop-down list and select the "Browse Files" option.
9. In the **Open File** dialog box, browse to C:\Training and select the icTonicsTankMonitor.gdfx file. Click on "Open" to select the file and close the dialog box.
10. Since we want to use a relative path, delete the file path in the FileName field so that it only reads "icTonicsTankMonitor.gdfx".
11. Go to the button's Properties explorer and, in the **Content** section, change the Text of the button to "Tank Monitor".

12. In the **Measurements** section, set the button Width to 170 and the Height to 70. Confirm that the button is placed in the viewable area in the lower left part of the display.

13. Save the display.

5B.1.5 Add a Scale Control

1. Open the icTonicsTankMonitor display in configuration mode.

2. In the GraphWorX64 ribbon, go to the **Controls** tab and select **Scale Control**. The cursor will turn to cross hairs. While holding the left mouse key down, place the scale control to the right of the tank. Go to the Properties explorer of the scale control and locate the **ScaleType** property in the **Scale** section. Set it to **Radial**. Your display should now look like Figure L5B.1.

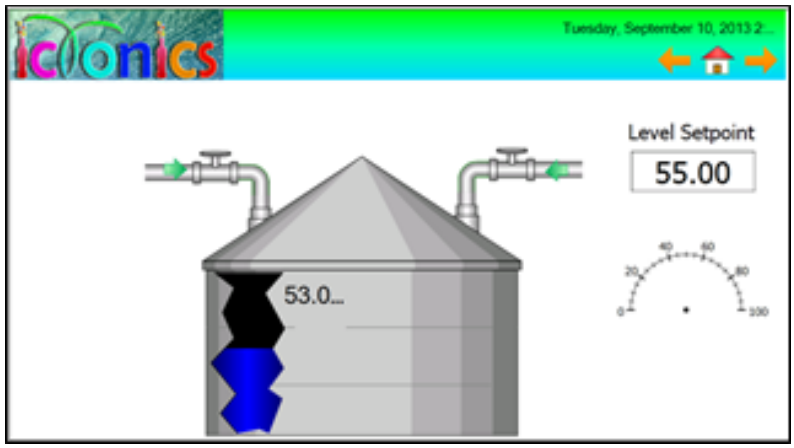


Figure L5B.1 - Scale Control

3. Now we will add a pointer to this gauge. Go to the Home tab in the ribbon. Add a **Rectangle** in the gauge and resize it to make it look like a pointer.

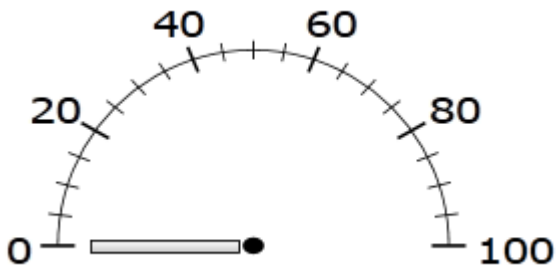


Figure L5B.2 - Gauge with Hand

4. Add a **Rotation** dynamic to the pointer. Click on the ellipse in the DataSource field to launch the **Data Browser**. Define the **DataSource** as **@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.TankLevel.Value.**

5. In the **Data** section, set the **LowLimit** to 0 and the **HighLimit** to 100. In the **Dynamic Behavior** section, change the **StartAngle** to 0 and the **EndAngle** to 180.

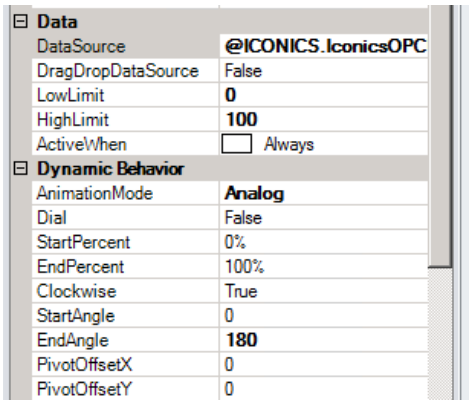


Figure L5B.3 - Rotation Dynamic Settings

6. With the pointer selected, click on the **Edit Dynamic On-Scree**" link at the bottom of the **Dynamics** explorer. Move the red pointer to the center pivot point of the gauge.

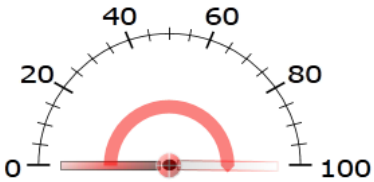


Figure L5B.4 - Rotate Path

7. In the **Object Explorer** Tree on the left-hand side, hold the **CTRL** key and select **Rectangle1** and **Scale Control** in the Arrange Group under the **Home** Tab, then click **Group Objects**.

5B.1.6 Add a Churning Blade Button

Now we'll add a button to toggle the churning blade on and off.

1. From the **Dynamic** tab in the **Buttons** section, select a **Button**.
2. Place the button above the tank and center it on the two pipes.
3. In the **Content** section of the **Properties** explorer, change the button **Text** to "**Churning Blade On / Off**".
4. Select the **Dynamics** tab and set the **Command** to **Toggle Value.**
5. Under **Command Parameters**, set **ValueOne** to 1 and **ValueTwo** to 0.
6. In the **Dynamics** explorer, under the **Data** section, set the **DataSource** to:

   @ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.ChurningBladeStatus.Value.

5B.1.7 Add a State Field

1. From the **Dynamics** tab in the **Text Objects** section, select the **Process Point**. Place the Process Point below the tank.
2. From the **Data Browser** select:

   @ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.ChurningBladeStatus.Value

3. In the **Measurements** section of the **Properties** explorer, set the **Width** to **320** and the **Height** to **40**.
4. In the **Format** section of the Dynamic explorer, type "Churning blade is" in the **PrefixLabel** field. (Make sure you turn on the "Advanced Mode" in the Application Mode under View Tab).
5. In the **StateField** section set **StateField** to "True". Click on the ellipsis [...] in the States field. In the "**Edit Process Point States**" dialog box, click Add. Under the **Data** section, set the **LowLimit** to 0 and the **State Text** to "Off". Click on "OK".
6. Click Add again, then, under the **Data** section, set the **LowLimit** to 1 and the **State Text** to "On". Click on "OK".
7. Your finished display should be similar to the following figure.

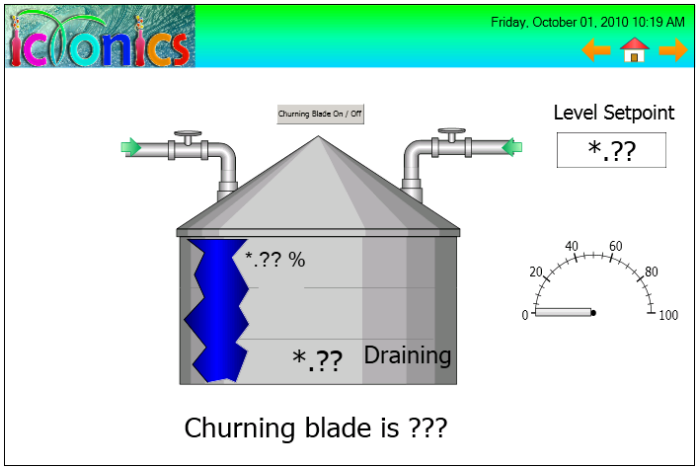


Figure L5B.5 - icTonicsTankMonitor

5B.1.8 Add a Text Object with a "Hide" Dynamic

1. Next, we will add a text object with an associated **Hide** dynamic.
2. From the GraphicWorX ribbon, click on the **Home Tab**.
3. Under the **Shapes** section, select the **Text** (Draw Label) tool. This is represented by a capital 'A'.
4. By holding the left mouse key, **draw and size** the text object in the lower right-hand corner of the tank. Size this object however you see fit. We will be adding a Hide dynamic, so this text will only be visible when the tank is draining.
5. Click on the **Properties Tab**. From within the **Content Section**, change the **Text** to **Draining**.

   Note: Verify from the View menu on the Ribbon in the Misc section that the Application Mode is set to Advanced Mode.
6. Click on the **Dynamics Tab** and select the **Hide** dynamic from the top of the Dynamics explorer.
7. From the Data Browser, set the **DataSource** to:

   @ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.PumpStatus.Value
8. In the **Data** section, set the **HideWhen** field to **data == 0**.
9. Your final configuration should resemble the following figure.

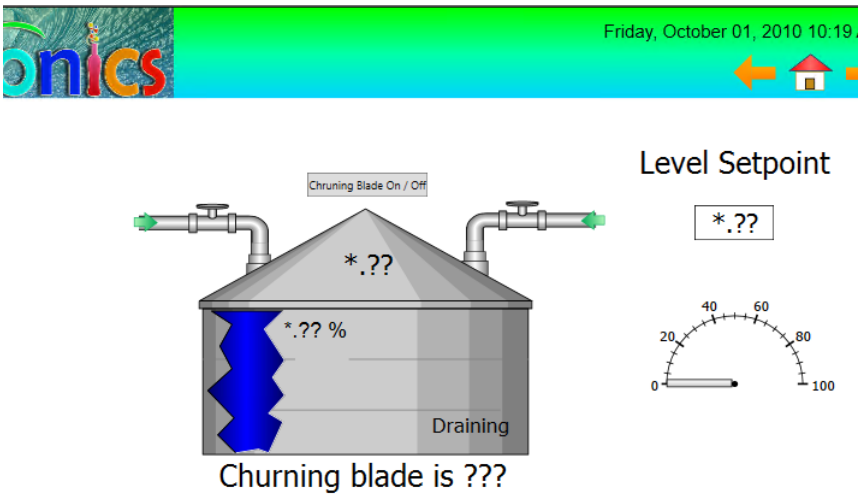


Figure L5B.6 - icTonicsTankMonitor with Level SetPoint and Draining Dynamics

This concludes this lab.

GraphWorX64 Tools 6

6.1 Objectives

In the last chapter, we discussed some basic dynamics available in GraphWorX64. Besides visible animations and dynamics on an object, you can also use controls. In this chapter, we will concentrate on how GraphWorX64 uses controls to retrieve data.

After completing this chapter, you should know how to:

- Add controls.
- Arrange objects in a display.
- Work with layers.
- Work with the Search and Replace feature.
- Add views.
- Use the Runtime ribbon and menus.

6.2 GENESIS64 Controls

If you are familiar with GENESIS32, you should be familiar with ActiveX. GENESIS64 no longer uses ActiveX. Instead, there are Controls, which are containers that you can insert into your GraphWorX64 display to show different information such as alarms, trends, etc. There are several controls in the Controls ribbon and the Toolbox panel, as shown below, which you can insert into a display.

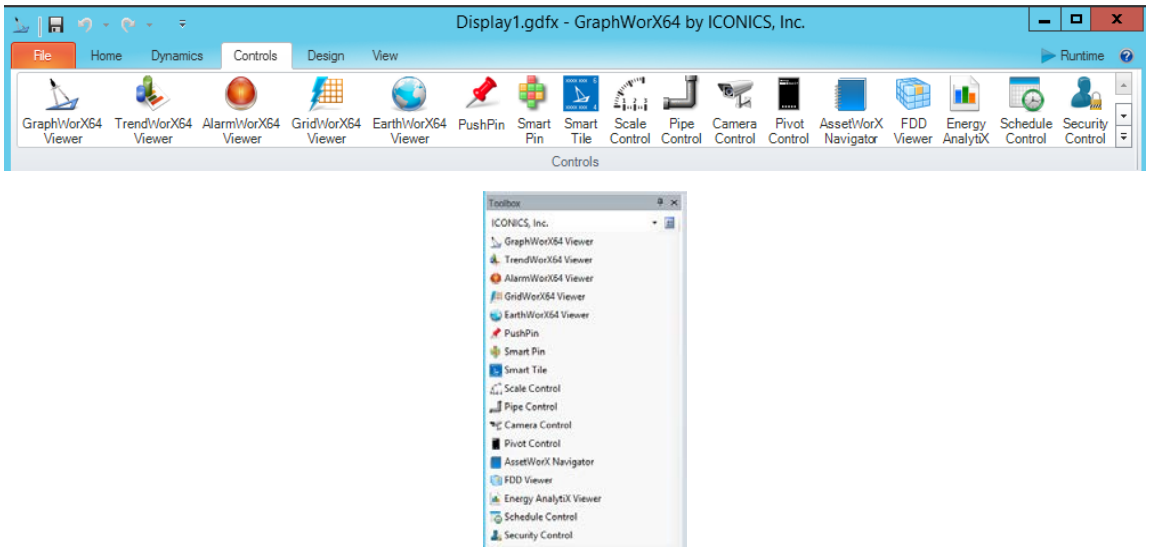


Figure 6.1 - Controls Ribbon (Above) and the Toolbox (Below)

From the Toolbox, you can drag a control to the content area. From the Controls ribbon, you can click on the, and then click on the content area. This creates a control at the default size, which you can resize in the content area.

> **Note:** The Toolbox is often docked at the left side of the configuration window. You can show or hide it using the Show/Hide tab group on the View ribbon. The Toolbox can be pinned as a tab to a side of the display or it can float freely when you unpin it from its docked state.

Some of the controls are ICONICS viewers and others are complex objects that serve a specific purpose. One control lets you add third-party control. All can be added to and used in a display.

6.2.1 ICONICS Viewer Controls

Viewers for ICONICS containers provide a portal into viewing information that comes from files that are external to the display. By adding a GraphWorX64 Viewer control, you can include a separate GraphWorX64 display inside the current display you are configuring. By adding a GridWorX64 Viewer, you can utilize GridWorX64 and create a grid inside the current display. By adding an EarthWorX64 Viewer, you can utilize EarthWorX64 and create a map inside the current display. The same is true for including a TrendWorX64 Viewer and an AlarmWorX64 Viewer. Once you add a viewer to a display, you can work inside the viewer to create a new display in the portal.

6.2.2 EarthWorX

EarthWorX64 is a GENESIS64 provider that incorporates high-resolution maps into a GraphWorX64 display. An EarthWorX64 map can be added to any GraphWorX64 display as an added layer. You do this by adding an EarthWorX64 Viewer to the display from the GraphWorX Controls ribbon, which opens a map to which you can then add useful GraphWorX64 features. Using an EarthWorX64 map is helpful for monitoring geographically disbursed sites, not only on a global scale, but also on a local scale. Some of the features you can take advantage of include:

- Using a worldwide map or a local, regional map.
- Using SmartPins for reporting statuses and warning conditions at a glance.
- Using PushPins that mark significant points and their statuses on the map.
- Creating views that let runtime users "fly" over long distances.
- Displaying actual land features on your maps
- Confining or expanding the zoom level of the map.

- Configuring Pick actions that let runtime users act based on conditions that they see unfolding before them
- Importing GPS tracks and routes from a .GPX file.
- Monitoring logistical traffic using GPS input
- Using GraphWorX features as part of your interactive map, including shapes, 3D views, and layers
- Access to multiple Map Systems

6.2.2.1 Adding EarthWorX64 Control to a Display

To start using EarthWorX64, you will first need to launch GraphWorX64. Once the new display is ready to work with, go to the "Controls" ribbon and select the "EarthWorX64 Viewer" control to add it to the display.

Figure 6.2 - Adding the EarthWorX Viewer Control to a Display

Alternatively you can also use the Toolbox to access the same functionality.

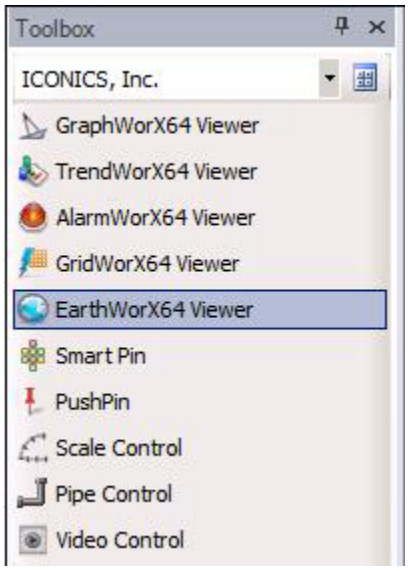


Figure 6.3 - Accessing EarthWorX64 from the Toolbox

Once the control has been added to the display, a warning message pops up to inform you that the display is not using the default EarthWorX64 size and will provide the choice to automatically resize the display. The reason for this choice is due to the EarthWorX64 world map having a default size of 512x512 pixels at its minimum zoom level. If your display is bigger than that, then you might end up having white areas around the map. However, it should be noted that if the final map will be zoomed in to a particular region or country, you can use another display size without any white space around your selected map.

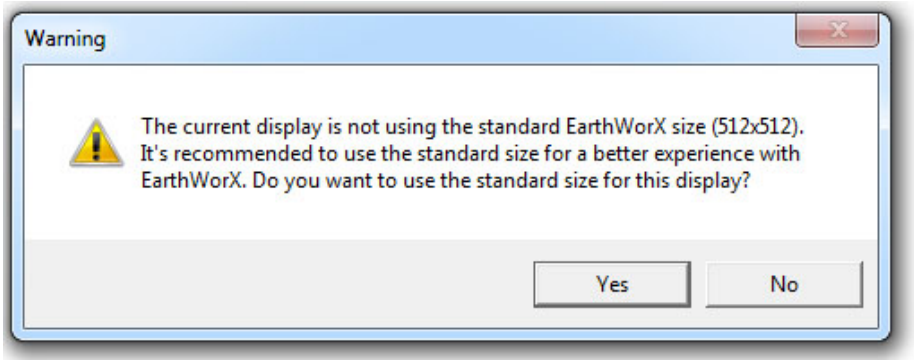


Figure 6.4 - Warning Message about Display Size

This example will use a default size display; therefore, select Yes to the above question. Once the display is resized, another Warning will come up.

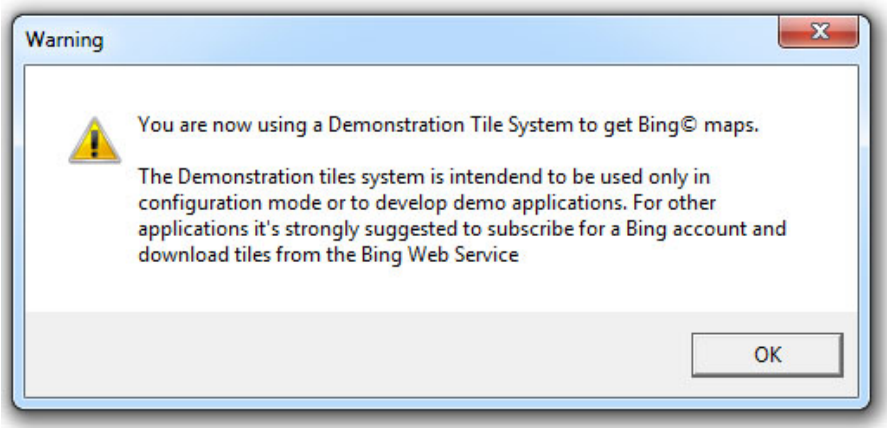


Figure 6.5 - Warning Informing about Bing Maps License Restriction

The above warning message informs you that you are now using the demo version of Bing Maps. Microsoft allows you to use the maps with some limitations. However, for real applications, you should obtain a valid license from Microsoft. For the purpose of this example, you can continue using the demo tiles to evaluate the functionality of the EarthWorX64 control. After you click “OK”, the display will contain the EarthWorX64 map and you are ready to start working with it.

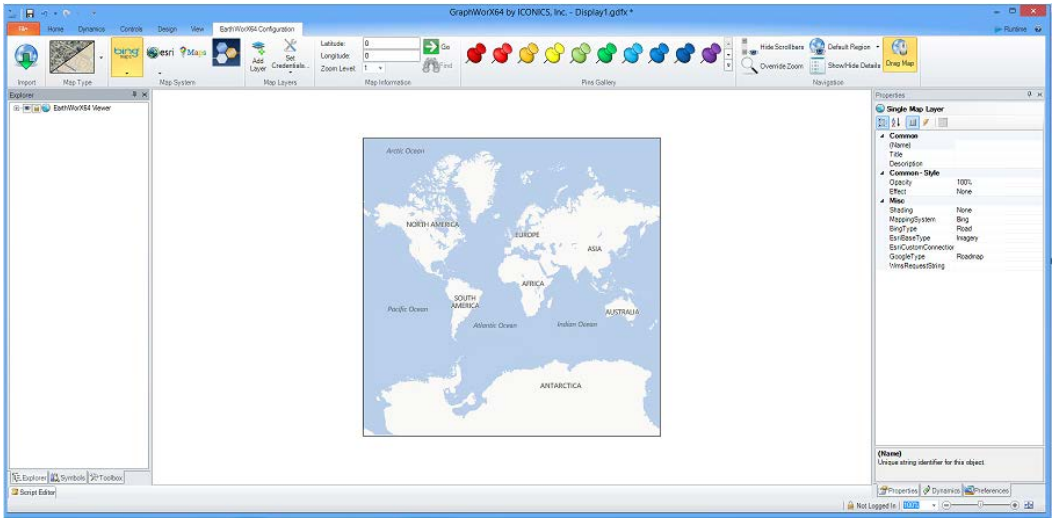


Figure 6.6 - EarthWorX64 Map in the Display

Start the map interaction by zooming in on it as you would do in a regular GraphWorX64 display. The map will load additional details as needed while zooming and panning over it. Alternatively, you can also use the commands provided in the EarthWorX64 Configuration ribbon to perform other operations, including changing the map type, jumping to a specific location, import additional data, adding pushpins and much more. To change the map type, click on the "Map Type" button in the "EarthWorX Configuration" ribbon, and select your preferred map type.

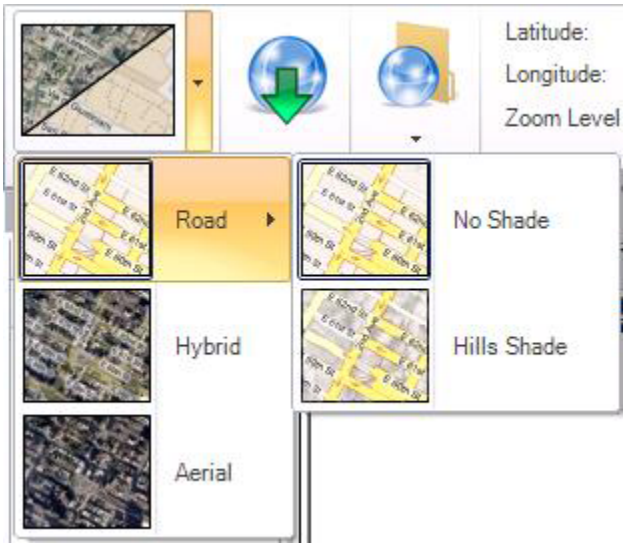


Figure 6.7 Available Map Types

6.2.2.2 Adding Objects to the Map

Generally speaking, you use EarthWorX64 to keep track of geographically dispersed assets, normally by adding objects on the map to represent those assets.

Adding a Pushpin

In this example, you will add a Pushpin to the map. [See the following section for more information on PushPins.] To do this, click on one of the Pushpin icons in the "EarthWorX64 Configuration" ribbon in the "Pins Gallery" section.

Figure 6.8 - Pins Gallery

After clicking on a Pushpin icons, click on a location on the map. In the example below, the user clicked on Rome, Italy, to position the Pushpin in that location; this adds a new object over the map. You can easily relocate the object by dragging it around, and you can resize it, as needed. For more help, refer to the PushPins topic.

Figure 6.9 - A Pushpin on the EarthWorX64 Map

The pushpin's Properties tab shows several properties for the object, which you can change as required.

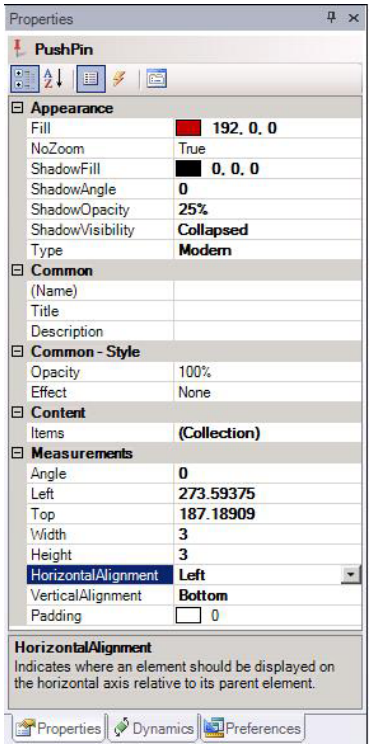


Figure 6.10 - Changing Properties for the Pushpin

Adding Polygons

Pushpins are not the only objects you can put on a map. They are basic shapes that are easy to access, and for that reason may be suitable for many applications. But you may need to use other shapes to achieve what you're trying to do with EarthWorX64.

An alternative to Pushpins would be to highlight a specific geographic area and change its color depending on some values, for example to monitor your company sales activity in a region and to change the color if sales meet the expected target.

To do this, select the Polygon icon from the Shapes box in the “Home” ribbon, highlighted in the following figure.

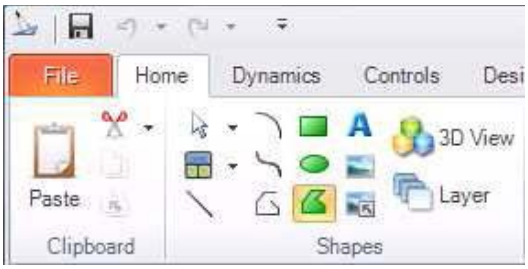


Figure 6.11 - Selected the Polygon Command

The mouse cursor will change to indicate the polygon drawing mode. Now, click on the points of the map that represent the border of the desired region. In this example, the border of the state of Massachusetts has been drawn.

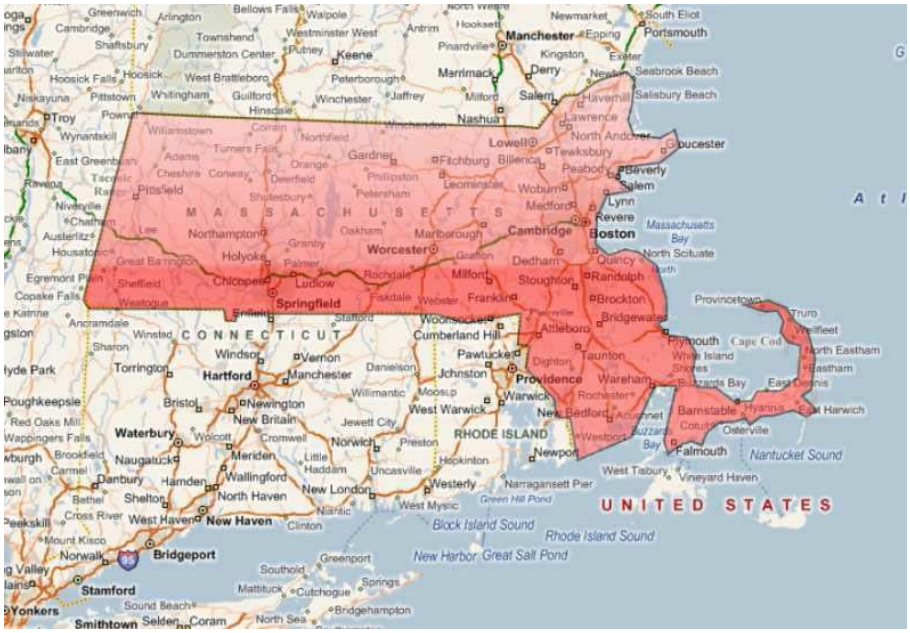


Figure 6.12 - A Polygon Drawn on the Map

The polygon object is a regular GraphWorX64 object. You can add dynamics or a pick action to it, for example to change its color depending on a data value or expression, or add a pick field to open a new display with that area's details when the polygon is clicked. Using the same method you can create additional polygons to enclose two other U.S. states as shown in the following example to complete this example. For additional information, refer to the Dynamics topic, as well as the Shapes topic.

Figure 6.13 - Some More Polygons Added

6.2.3 PushPins

The PushPin is a simple shape with complex features, which you can add to an EarthWorX map or a GraphWorX64 display for identifying locations or assets. Runtime users can click a PushPin to zoom to a different level of the display. A PushPin can have any number of data values associated with it. Each value can come from a data source, and if you add multiple data values, each value has its own key. The key can be accessed by Pick actions or scripts in the display, allowing you to use PushPins for a purpose of your own design. For example, you can use data values and aliases in the PushPin's tooltips so that runtime users can easily access information about the location that the PushPin identifies.

PushPins can be created using different colors and shapes (shown in Figure 6.14), and you can even use your own image files. Your ability to customize the look makes it easy for your runtime users to find and understand the PushPin images in a map or display.

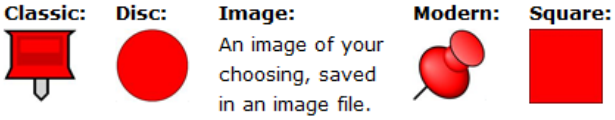


Figure 6.14 - A Few PushPin Shapes

6.2.4 Smart Pins

The Smart Pin is a collection of squares called SmartIcons that form a set of indicators. Each square's location in the grid is meaningful. You strategically arrange SmartIcons and attach them to data sources to create a color scheme that allows runtime users to monitor the status of multiple data sources, all at the same time.

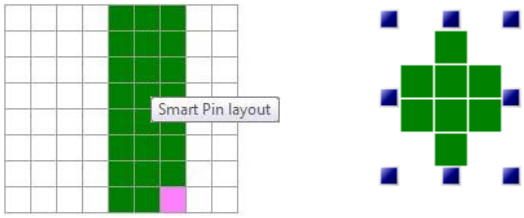


Figure 6.15 - Smart Pin Configuration Layout (Left) and a Selected Smart Pin in a Display

A Smart Pin provides an effective visual indicator for dense data in an overview for an EarthWorX64 map or a GraphWorX64 display. For example, you could use Smart Pins throughout a geographically dispersed system; by making use of color and blink control, you can give users instant access to changing conditions.

When you enable a Smart Pin's tooltips, it becomes possible for users to easily drill down to underlying data and address time-sensitive issues quickly. Smart Pins are ideal for monitoring underlying conditions in a dense area. Examples include monitoring patients in a hospital, water pipes in a vast water system, or toxic gas levels at numerous isolated locations.

6.2.5 Smart Tiles

Smart Tiles are useful, at-a-glance graphic visualization tools that provide real-time information similar to Live Tile technology found in Microsoft Windows 8, Windows RT, and Windows Phone operating systems. The difference is that ICONICS Smart Tiles, created through the Smart Tile control in GraphWorX64, are applicable within HMI screens, whether those are PC-based or for mobile devices (phones, tablets, etc.).

Figure 6.16 - Smart Tile Examples

Smart Tile Features Include:

- **Shows Live Process Values**
- **Use in GraphWorX64 and the Mobile-based AppHub** - In GraphWorX64, Smart Tiles use/share GraphWorX64's existing data management components to get runtime data and handle updates. In the AppHub, Smart Tiles instantiate their own shared data management components. The data management components are disposed when all instantiated smart tiles are unloaded or disposed.
- **Easy Configuration and Flexibility**
- **Lightweight Tool** - when needing to show lots of tiles simultaneously
- **Can Run in Windows Presentation Foundation (WPF), Silverlight, Windows RT or in HTML5**

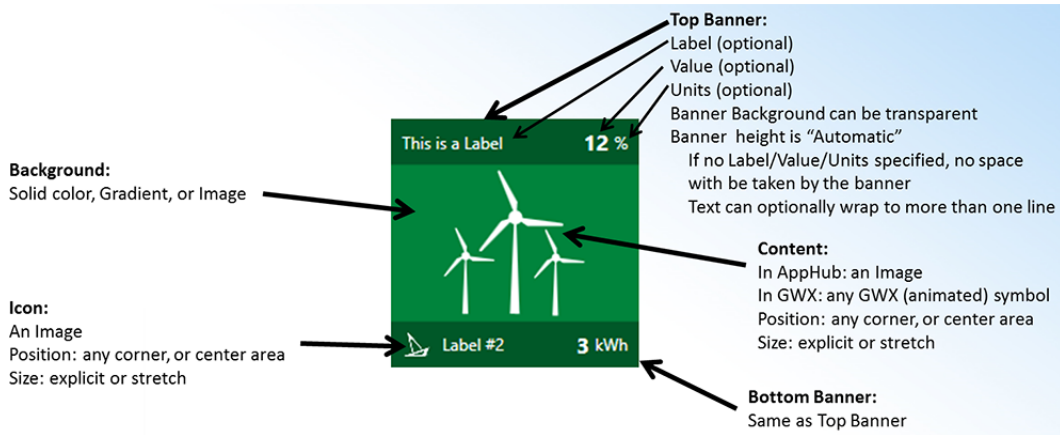


Figure 6.17 - Smart Tile Example with Area Descriptions

You can open a new display in GraphWorX64, then select the **Smart Tile** control from the 'Controls' ribbon, as shown below.

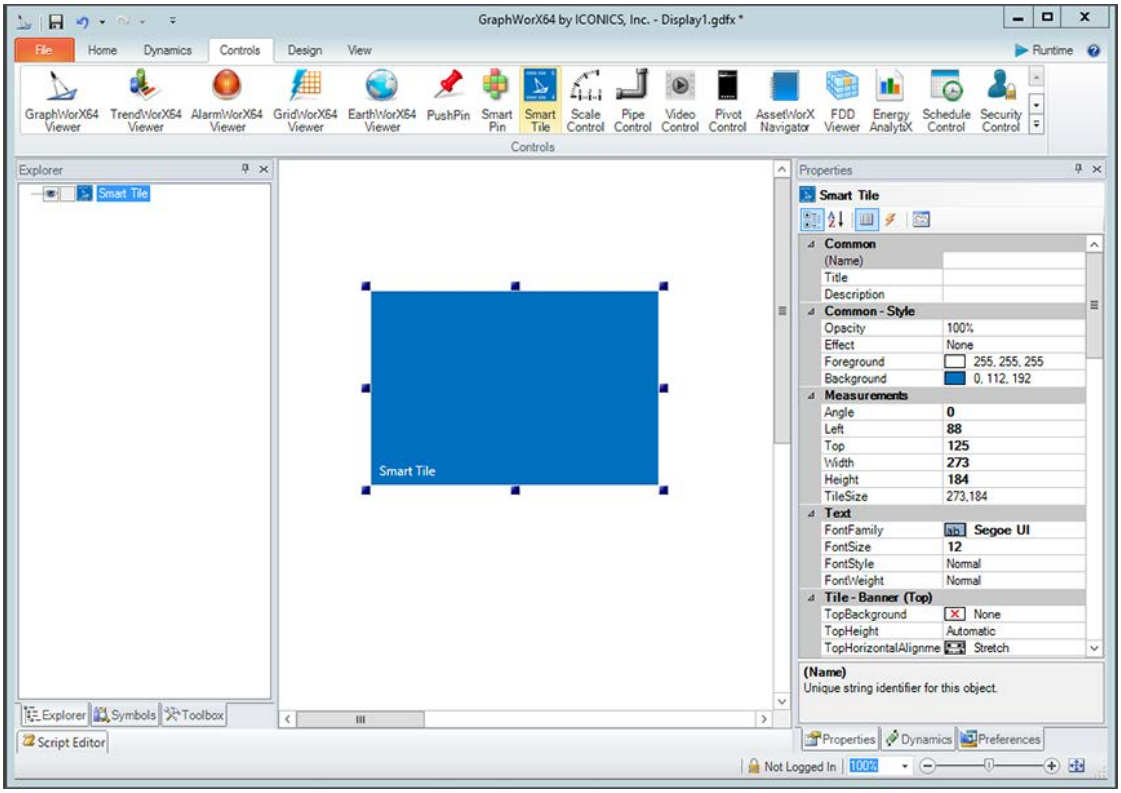


Figure 6.18 - Creating a New Smart Tile Within GraphWorX64

A default Smart Tile shape will appear in the GraphWorX64 canvas. Configuration can be done either through GraphWorX64's Properties grid or by double-clicking the Smart Tile to access the popup **Smart Tile Configuration** dialog, shown below. The Smart Tile Configuration dialog has several tabs, including:

- **General**
- **Top Banner**
- **Bottom Banner**
- **Icon**
- **Content**
- **States**

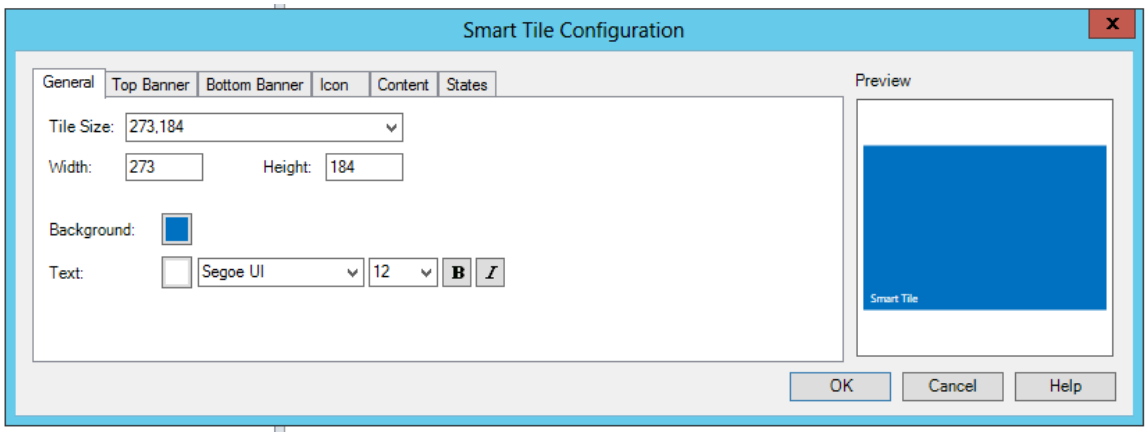


Figure 6.19 - Smart Tile Configuration Dialog

Once you have finished configuring the Smart Tile, it will be added to your GraphWorX64 display canvas.

6.2.6 The Scale Control

When drawing a gauge or a scale, arranging the face of its dial can be cumbersome: spacing the tick marks evenly, and adjusting the marks and numbers can be tricky. GraphWorX64 now provides a preset Scale Control that you can use instead. The purpose of a scale control is to provide a shortcut to creating a symbol or object that has a dial or ruler, such as a gauge, a thermometer, a scale, a clock or watch, a meter, a speedometer, or a visual counter.

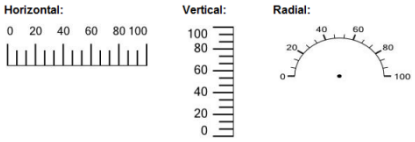


Figure 6.20 - The Scale Control

6.2.7 The Pipe Control

The Pipe Control makes it easy to create pipes and elaborate plumbing schemes in a GraphWorX64 2D display by allowing you to add sections of pipe to a display, and then bend and cap those sections. A handy feature of the Pipe Control is that you can easily animate an object so that during runtime, it moves along the path of a 2D pipe.

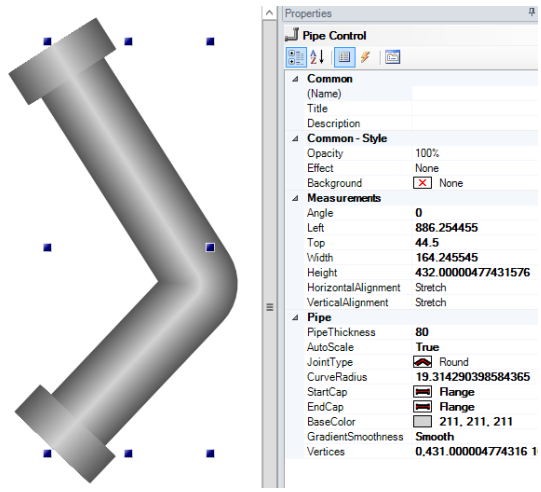


Figure 6.21 - The Pipe Control

6.2.8 Camera Control

The Camera Control in the GraphWorX64 viewer allows users to include output from a networked camera within their display. To use this item, select the **Camera Control** icon from the **Controls Ribbon**. Your cursor will now become a cross hair. Use the cross hair to draw the perimeter of the **Camera Control** on the display. Your Camera Control will now be visible.

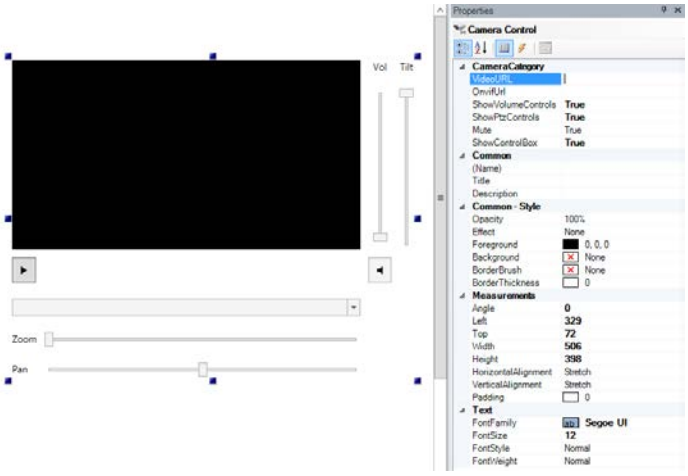


Figure 6.22 - Camera Control Added

The right side of the screen will now display the **Camera Control Properties**. Camera Controls have a number of standard properties such as Measurements and Text, but also have a number of unique properties listed under Camera Category, as shown above.

CameraCategory

- **VideoURL** - The Video Source URL. This must point to a RTSP or MJPG stream.
- **OnvifUrl** - This must point to a URL where the ONVIF on the camera is listening.
- **ShowVolumeControls** - In Runtime mode, 'True' means the volume controls will be shown next to the video feed.
- **ShowPtzControls** - In Runtime mode, 'True' means the Pan/Tilt/Zoom controls will be visible with the video feed.
- **Mute** - In Runtime mode, 'True' means the audio from the control will be muted by default.
- **ShowControlBox** - In Runtime mode, 'True' means the playback controls will be shown under the video feed.

6.2.8.1 Camera Control in Runtime

Figure 6.23 - Camera Control in Runtime

In your GraphWorX64 display utilizing a Camera Control, once put into Runtime Mode, you will see the live feed from the VideoURL you entered in the control's properties in Configuration mode. Also, if you set the additional properties to 'True', you will see those specific settings around the video feed, as shown above. The ability to manipulate the various sliders, pulldown menus and buttons will correspond to the camera model/network at the location set via the VideoURL setting.

6.2.9 Pivot Control

The Pivot Control creates a simple menu infrastructure that includes *pages* of information. Each *page* is a GraphWorX64 canvas and can include any other control, object or dynamic. *Pages* can be added via the contextual ribbon menu items or from the buttons at the bottom of the Property Grid.

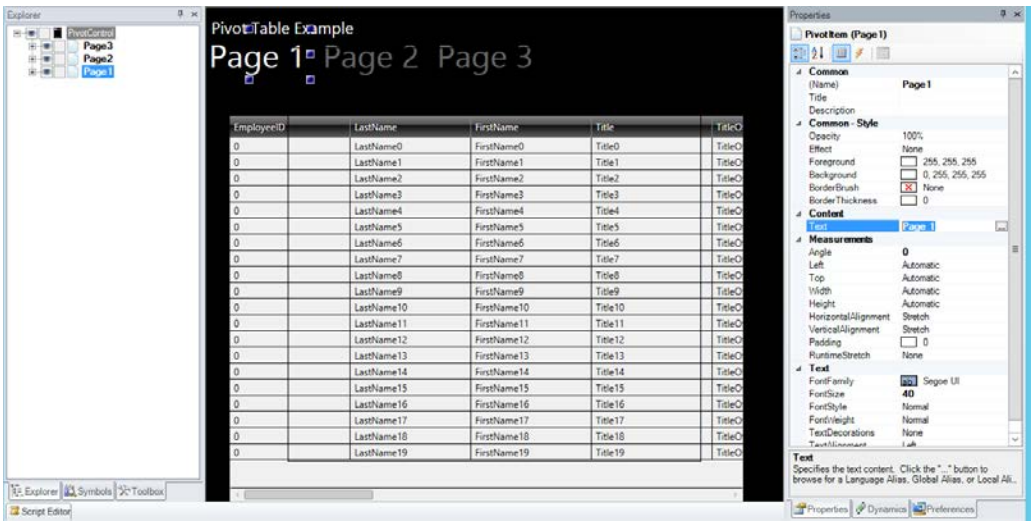


Figure 6.24 - Editing 'Page 1' within the Pivot Control

6.2.10 AssetWorX Navigator

The Asset Navigator Control in GraphWorX64 ties to the AssetWorX provider in Workbench-SL, which allows users to create a tree-based representation of an organization's assets in order to visualize data, perform commands and analysis and more. It can be used in conjunction with additional controls (including AlarmWorX64 Viewer, Energy AnalytiX Viewer, FDDWorX Viewer, GridWorX Viewer, GraphWorX64 Viewer, TrendWorX Viewer, etc.) within the same GraphWorX64 display to allow users to perform asset-based commands automatically.

To Add an Asset Navigator Control in GraphWorX64

1. In GraphWorX64, click on the Controls ribbon and select the Asset Navigator Control.

2. Draw a box that will hold the connected asset tree.

Tip: A vertical box will make things easier later on as compared to a more horizontal one.

The Asset Navigator control will show a default tree, but not from the default database within the AssetWorX provider in Workbench-SL. You'll notice the distinction in that the top level of the tree is labeled as "Root" with a sub-item as "Company" and a further sub-item as "Factory". You will need to connect to an active AssetWorX database in order to utilize any configured data in any additional control you wish to add to this same GraphWorX64 display.

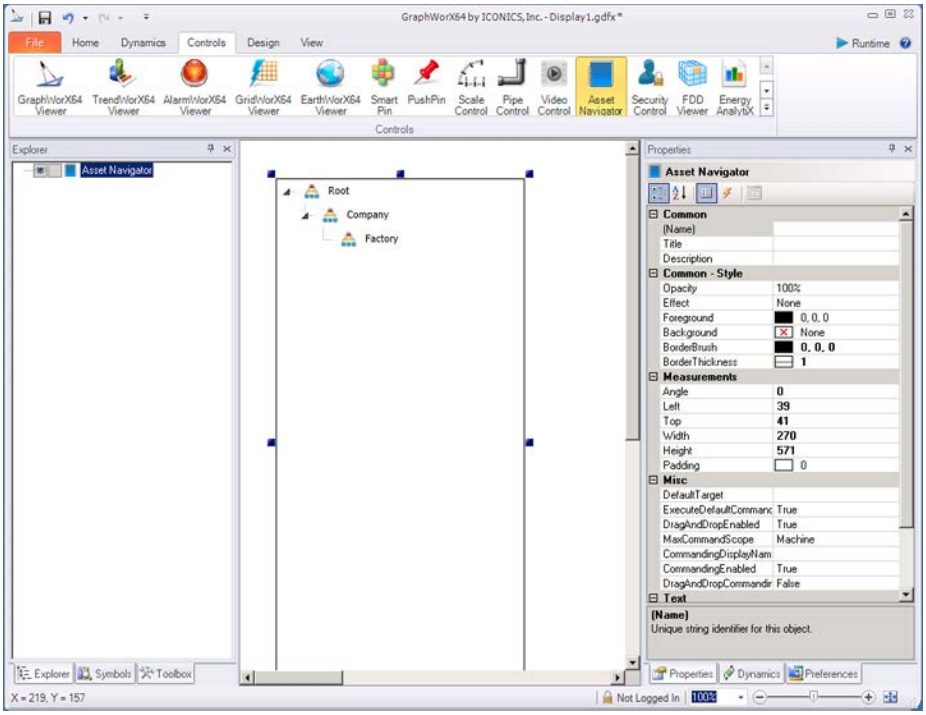


Figure 6.25 - Adding an Asset Navigator Control in GraphWorX64

6.2.11 Enabling Commands through the Asset Navigator Control in GraphWorX64

The latest version of GENESIS64/GraphWorX64 allows you to run commands from a tree navigation control into other controls in the display. This is done by utilizing the asset catalog structure set up through the AssetWorX provider in Workbench-SL (the Web-based, Silverlight-integrated management tool installed as part of the main GENESIS64 installation).

The following is an example of how to utilize an Asset Navigator Control within a GraphWorX64 display to initiate a command for an additional control within the same display (in this example, a GraphWorX64 Viewer).

1. Open GraphWorX64. From the Start menu > All Programs > ICONICS > GENESIS64 > GraphWorX64 > GraphWorX64.

2. Select the Asset Navigator control from the Controls ribbon, as shown below.

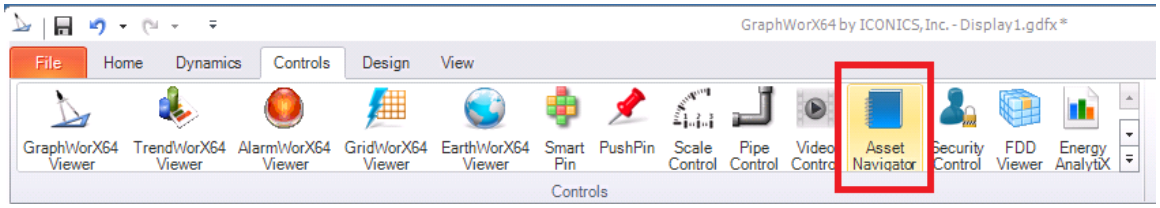


Figure 6.26 -Selecting the Asset Navigator Control in GraphWorX64

3. Draw a box in which to place the Asset Navigator control. Since a tree navigation control typically expands vertically, a more vertical box is appropriate. Once you've placed the control, you'll notice the asset tree has branch placeholders including "Root", "Company" and "Factory". These will be replaced during runtime if you have previously set up an asset database within the AssetWorX provider in Workbench-SL. For more information on how to accomplish this, see the GENESIS64 Silverlight Help included with this GENESIS64 installation.

4. Next, select the GraphWorX64 Viewer control and draw another box in which to place that control. Your GraphWorX64 display should closely resemble the following image.

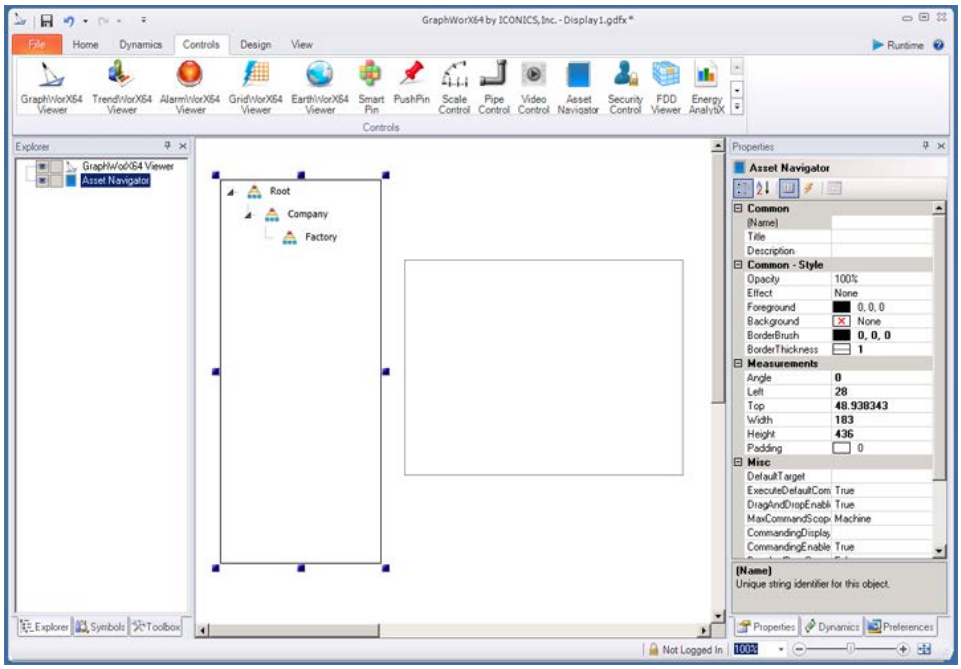


Figure 6.27 - Asset Navigator and GraphWorX64 Viewer Controls Added

5. At any point prior to including these two controls within a GraphWorX64 display, you should have already created an asset catalog database within the AssetWorX provider in Workbench-SL.

The image below shows the AssetWorX provider within Workbench-SL. The host machine, 'localhost', contains our asset catalog database (also named 'AssetWorX'), that contains a sample asset that we've named 'Test Asset' (highlighted in the red box on the left).

When you double-click on the asset (in our example, 'Test Asset') its properties will appear in the form on the right. Click on the 'Commands' tab (highlighted in the red box in the top middle) to set a specific command.

In our specific example, we will select the 'Load Graphics Display' from the Command pulldown menu. We've also named the command as 'Load Display' so as to recognize this specific command selection during runtime later on. We've made sure its 'Visible' as well as enabled its 'Drag & drop' ability. We want to make sure that it can be used in GraphWorX64 (as well as the remaining selections). For this example, we will not use any aliases (Local or Global).

For the FileName, we will provide the location of a previously created GraphWorX64 display (in this instance, it is a GraphWorX64 Silverlight display [.gdfxs file]).

For Target, we will enter what the GraphWorX64 Viewer control name will be once we return to the GraphWorX64 display we started creating (for our example, we've named it "TestControlCommandTarget").

Click 'Apply' or 'Apply & Close' to save these settings.

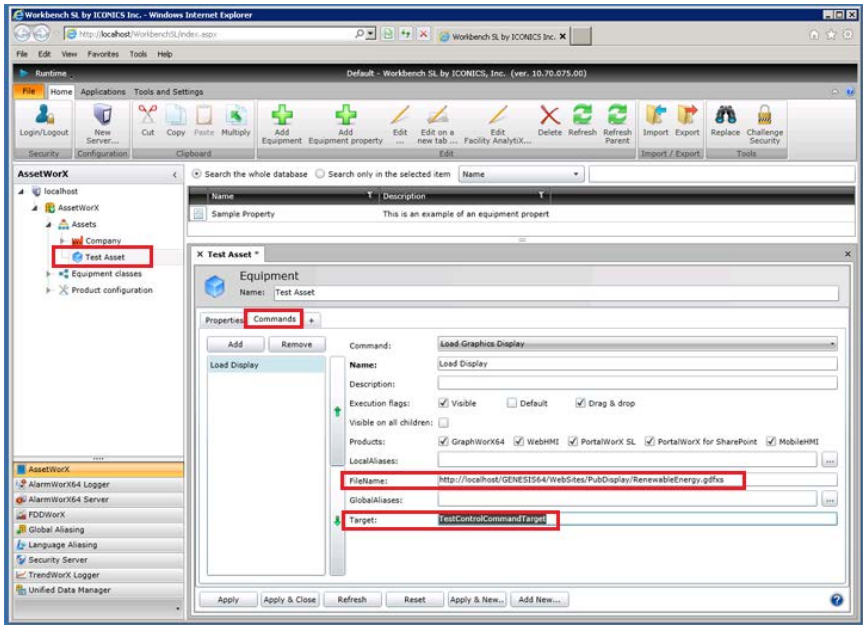


Figure 6.28 - Setting Commands Properties for an Asset in the AssetWorX Provider in Workbench-SL

6. Returning to our GraphWorX64 display, since we wanted to utilize Drag & Drop, we need to ensure each Control is set to use it. Click on the Asset Navigator control's box to select it, then edit the 'DragAndDropEnabled" field in the 'Misc' section of the Properties to the right of the screen, by setting the pulldown to 'True' (as shown in the following image).

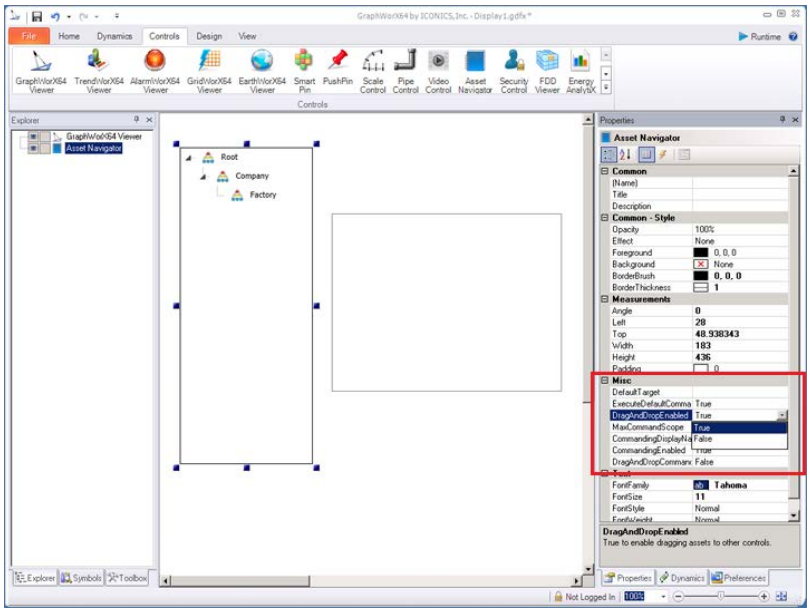


Figure 6.29 - Enabling Drag and Drop in the Asset Navigator Control

7. Next, click on the GraphWorX64 Viewer control to select it, then edit the DragandDropCommandingEnabled field in the Misc - Commanding section of the Properties to the right of the screen, by setting the pulldown to 'True' (as shown below).

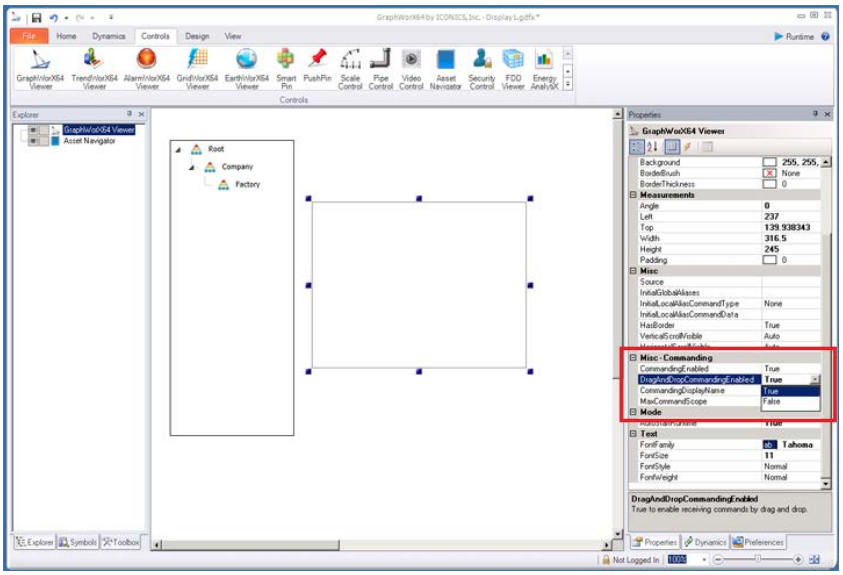


Figure 6.30 - Enabling Drag and Drop for the GraphWorX64 Viewer Control

8. At the same time, now that we have the GraphWorX64 Viewer control selected, we will give it the name we previously entered in the 'Target' field of the Commands tab of the properties for the 'Test Asset' in AssetWorX (in Step 5 above). We'll enter 'TestControlCommandTarget' in the Name field in the Common section of the Properties to the right of the screen, as shown below.

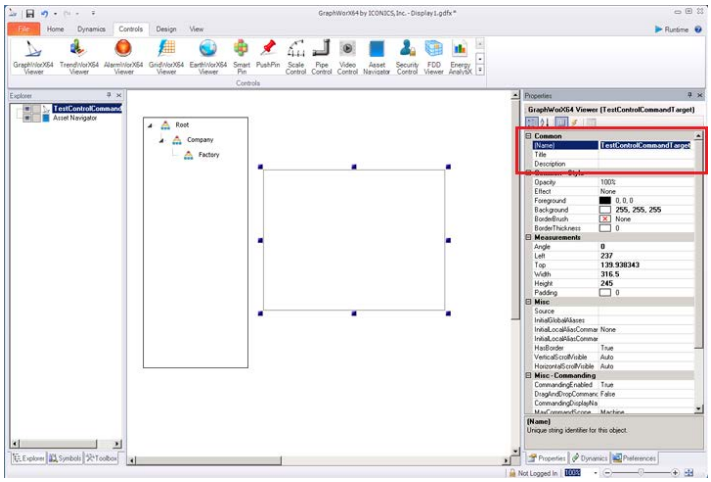


Figure 6.31 - Naming the GraphWorX64 Viewer Control

9. We can now put the display into Runtime (by either clicking on the Runtime button in the top right of the screen or using 'Ctrl-M'). Our example display will resemble the following iamge. You'll notice that the Asset Navigator control no longer has the placeholder 'Root>Company>Factory' branches and that it now shows the top level of the asset catalog database you created in the AssetWorX provider in Workbench-SL (in our example, the top level is 'Assets'), as shown below. You'll also notice that the GraphWorX64 Viewer control is presently blank.

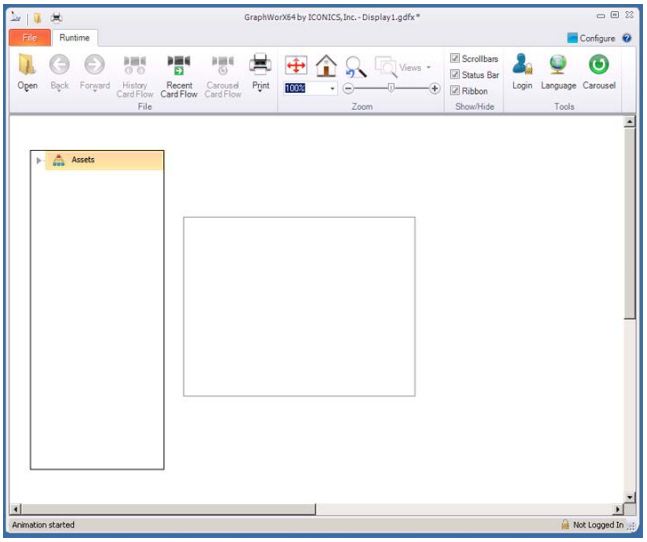


Figure 6.32 - Initial Runtime View of Asset Navigator and GraphWorX64 Viewer Controls

10. Expand the asset tree within the Asset Navigator control. You'll see the 'Test Asset' we created within the AssetWorX provider in Workbench-SL. Right-click on the 'Test Asset' branch and you'll see the 'Load Display' command we created and named, as well.

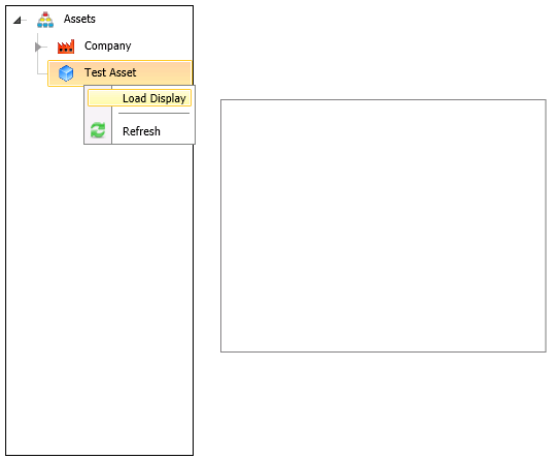


Figure 6.33 - Expanded Asset Tree in Asset Navigator with Associated Command

Since we also enabled 'Drag and Drop' for both controls, instead of right-clicking on the 'Test Asset', you could also left-click on its icon and drag it directly into the GraphWorX64 Viewer control. You'll see the cursor change to include a plus sign [+] to signify that the control will accept a dragged item.

11. The GraphWorX64 Viewer control will now show the successfully sent command from the Asset Navigator [which is the GraphWorX64 file you set in the 'FileName' field of the Commands tab of the properties for the 'Test Asset' in AssetWorX (in Step 5 above)] (see image below).

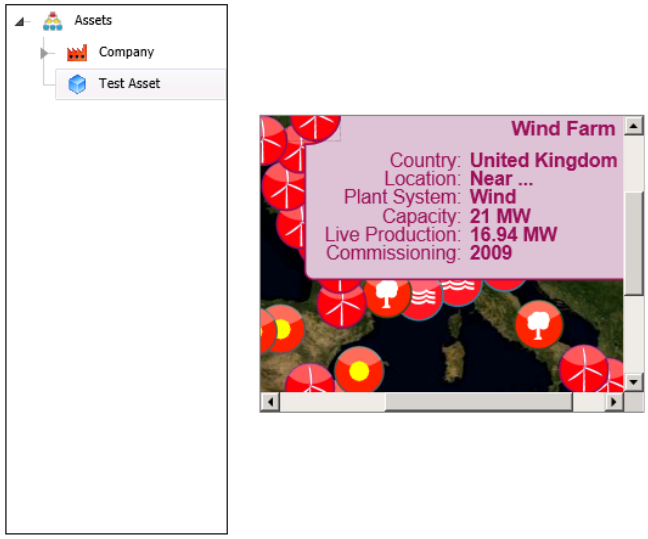


Figure 6.34 - GraphWorX64 Viewer Control with Successful Command Sent from Asset Navigator Control

6.2.12 FDD Viewer

The FDD Viewer allows you to configure and view a display containing information about faults that occur within the assets that you have configured in AssetWorX within the Workbench-SL. With this display, you can detect and diagnose faults within your assets and identify strategies for reducing the chances of these faults occurring in the future.

The options on the FDD Configuration Ribbon allow you to customize the viewer. To customize how faults are detected and diagnosed within FDDWorX itself, however, you need to open Workbench-SL and navigate to the Facility AnalytiX control.

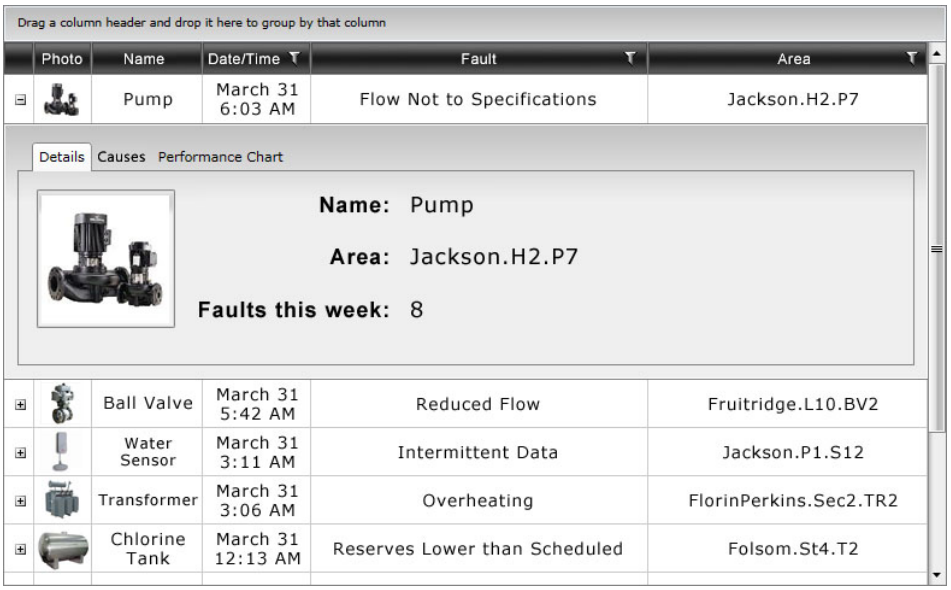


Figure 6.35 - FDD Viewer in Runtime in GraphWorX64

6.2.13 Energy AnalytiX Viewer

The Energy AnalytiX Viewer allows you to configure and view a display containing information about the energy consumption, energy-related costs, and carbon emissions of the assets that you have configured in AssetWorX within the Workbench-SL. With this display, you can determine the energy performance of your assets and identify strategies for using more energy-efficient methods.

The options on the Energy AnalytiX Configuration Ribbon allow you to customize the viewer. To customize how energy consumption, costs, and carbon emissions are calculated within Energy AnalytiX itself, however, you need to open Workbench-SL and navigate to the Energy AnalytiX control.

6.2.14 Schedule Control

The Schedule Control allows users to insert a schedule into a GraphWorX64 2D display.

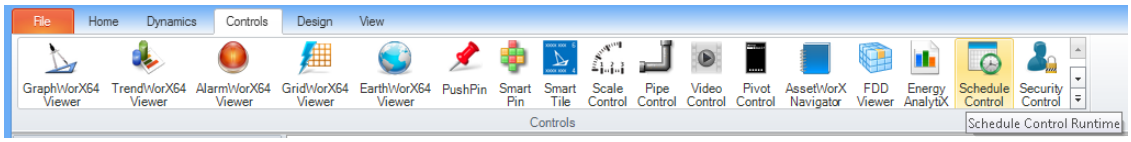


Figure 6.36 - Selecting the Schedule Control from the Controls Ribbon in GraphWorX64

After you have created a new display in GraphWorX64, you can insert a Schedule Control by selecting it from the Controls ribbon (as shown above) or from the Viewer Menu of the Toolbox.

Your cursor will turn into a '+', which allows you to set both the size of the control and its position within the display's canvas. The Schedule Control will then automatically size to the area you have created, as shown in the following image.

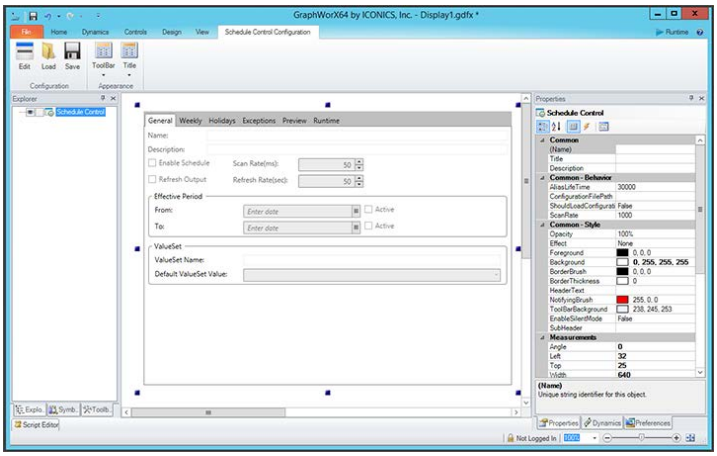


Figure 6.37 - A Newly Created Schedule Control in a GraphWorX64 Display Canvas

Note that the Schedule Control Configuration ribbon simultaneously appears at the top of the screen, as shown below.

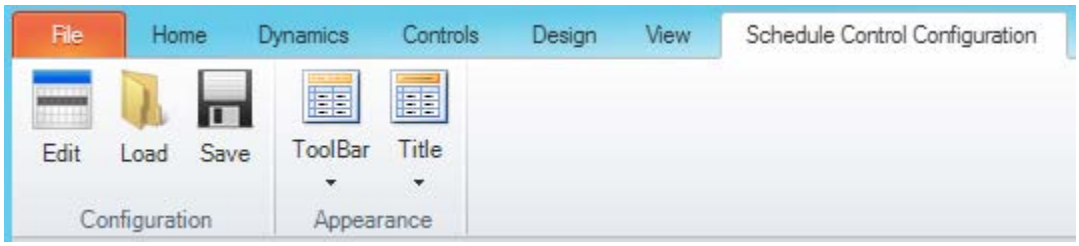


Figure 6.38 - Schedule Control Configuration Ribbon

The ribbon's buttons are used only in a Schedule Control that has been added to the GraphWorX64 display. Each button on the ribbon, as well as the configurator that the ribbon opens, is described below.

- The **Edit** button within the Configuration section of the Schedule Control Configuration ribbon opens the 'Configure your Control' dialog box, where you can add schedule views. (The Save button allows you to save an in-progress configuration and the Load button allows you to retrieve saved configurations.)

  In the configurator, you can add tabs to the control, and schedule views to each tab. This configuration dialog in the GraphWorX64 display configuration has the following components:

  - For the **Control**:
    - The **Appearance** tab lets you configure the control's overall appearance.
    - The **Advanced** tab gives you access to the control's properties. Helpful tool tips that appear on the tab describe selected properties.

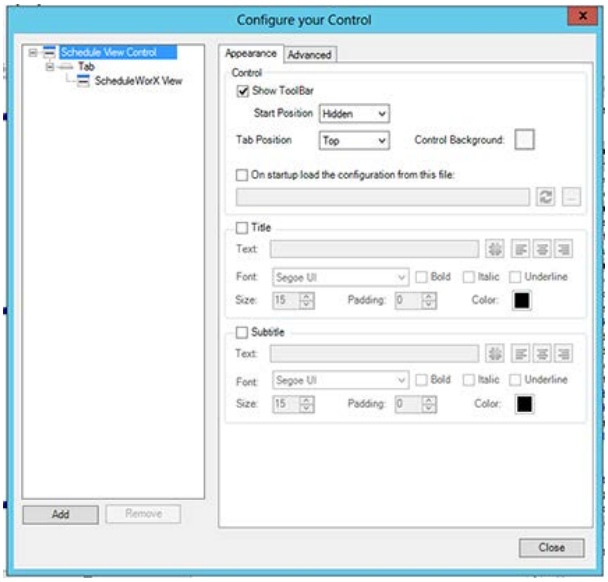


Figure 6.39 - Configure your Control Dialog Box - Appearance Tab

You can right-click on the 'Schedule View Control' item in the 'Configure your Control' dialog to add new Tabs - or you can select the 'Schedule View Control' and click on the 'Add' button in the bottom left.

- For each **Tab**:
  - The **Appearance** tab lets you configure the tab's appearance.
  - The **Advanced** tab gives you access to the tab's properties. Helpful tool tips that appear on the tab describe selected properties.

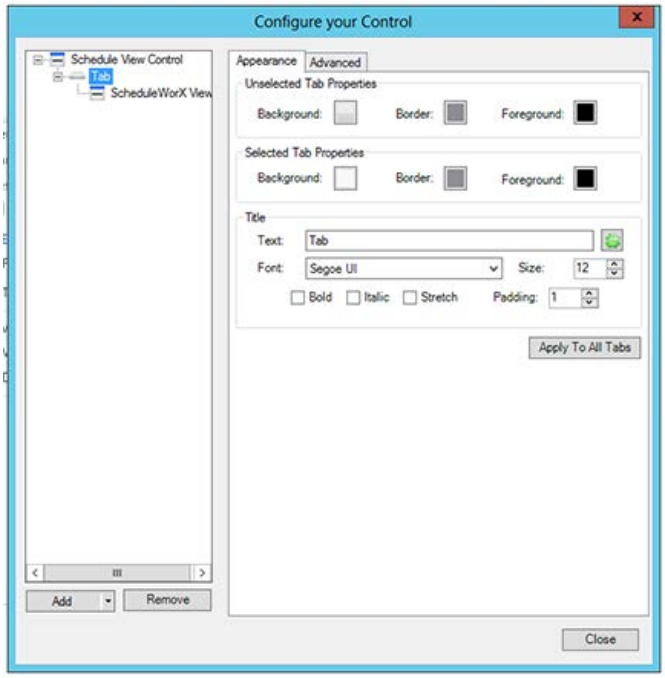


Figure 6.40 - Configuring Your Tab Settings

You can right-click on a Tab in the left-side navigation pane in the 'Configure your Control' dialog to add:

- a new **ScheduleWorX View**, or
- a new **BACnet Schedule View**, or
- a new **BACnet Calendar View**.

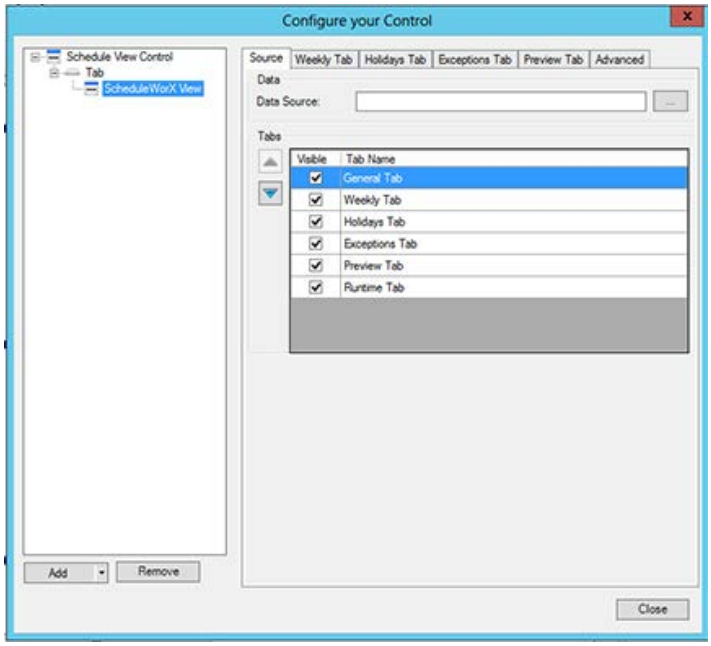


Figure 6.41 - Configure your Control Dialog Box - View Settings

When you have finished configuring your new **ScheduleWorX View**, **BACnet Schedule View** or **BACnet Calendar View**, you can see the results in Runtime, as shown below.

Figure 6.42 - A Weekly Calendar View in Runtime

6.2.15 Security Control

The Security Control in the GraphWorX64 viewer is an embedded version of the Genesis64 Security Server. Creating a Security Control allows the user to password protect specific content in a viewer or control. A Security Control itself does not possess any secure properties without a **Security Server**.

To create a Security Control, select the **Security Control** icon from the **Controls Ribbon**.

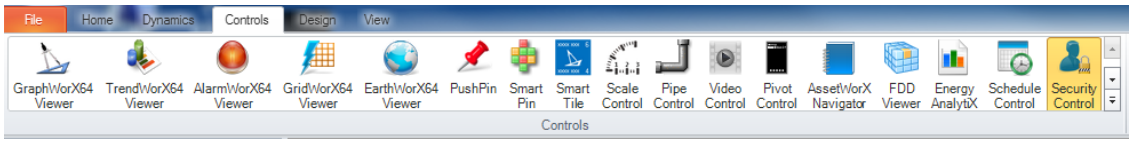


Figure 6.43 - GraphWorX64 Controls Ribbon

Your cursor will now become a cross hair. Use the cross hair to draw the perimeter of the **Security Control** on the display. Your Security Control will now be visible.

Figure 6.44 - Security Control

The right side of the screen will now display the **Security Control Properties**. Security Controls have a number of standard properties such as Measurements and Text, but also have a number of unique properties listed under Miscellaneous (Misc).

Security Control Properties

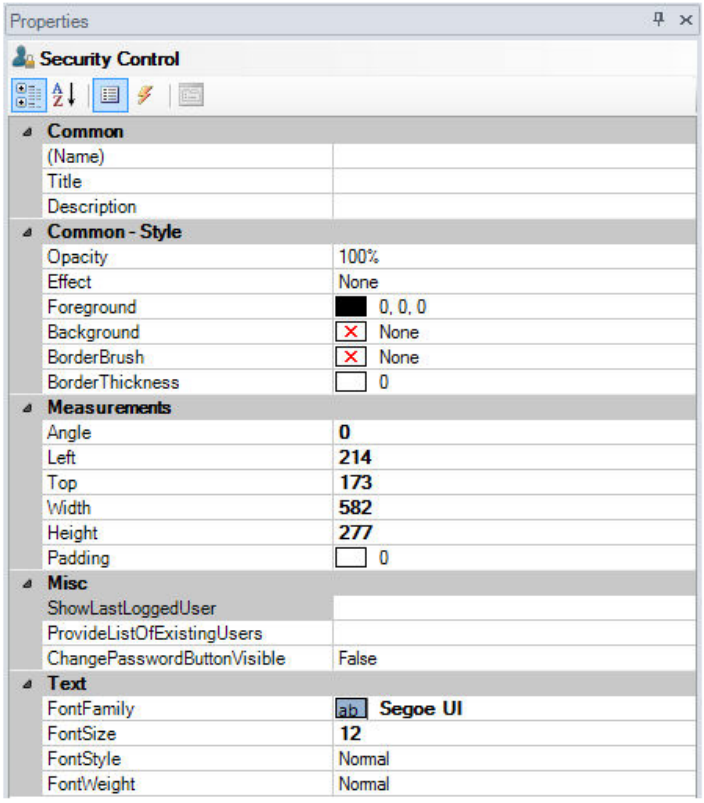


Figure 6.45 - Security Properties

Misc

- **ShowLastLoggedUser** - Determines whether or not to show the last logged in user in the User Name field (no value to use the global settings).
- **ProvidesListOfExistingUsers** - Determines whether or not to show a list of all available user names in the drop-down field (no value to use the global settings).
- **ChangePasswordButtonVisible** - Determines the visibility of the Change Password button.

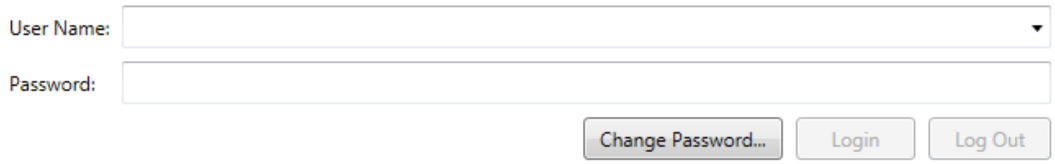


Figure 6.46 - Active Security Control within GraphWorX64 Display

6.2.16 Third-Party Controls

In addition to the ICONICS controls, you can use any other control that someone else creates if these controls are in the following categories:

- Windows Presentation Foundation (WPF) Controls
- Windows Forms .Net Controls
- Web Browser Controls
- 64-bit ActiveX

To insert a third-party control, click on the Toolbox drop-down list and select the type of control you want to use. Notice that this option is available only in the Toolbox.

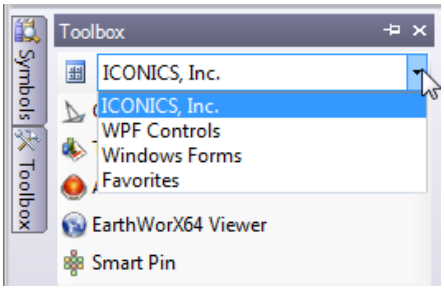


Figure 6.47 - Select Between Different Control Types

6.3 Search and Replace

While creating a display in GraphWorX64, or after creating one, you might want to change some text fields or the OPC tag connected to an object. This can easily be done by using the Replace option; you can find it in the Home tab inside the Text section.

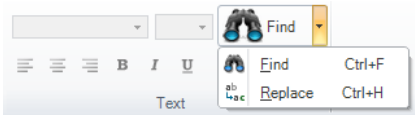


Figure 6.48 - Find/Replace

With this option, you can replace text, data sources, names of objects, titles, descriptions, and more. You can also replace text in the current display, or in multiple displays. If you find a typing error or you need to change the name of a certain object throughout many displays, this handy tool will do the trick. You can even use wildcard characters in this dialog.

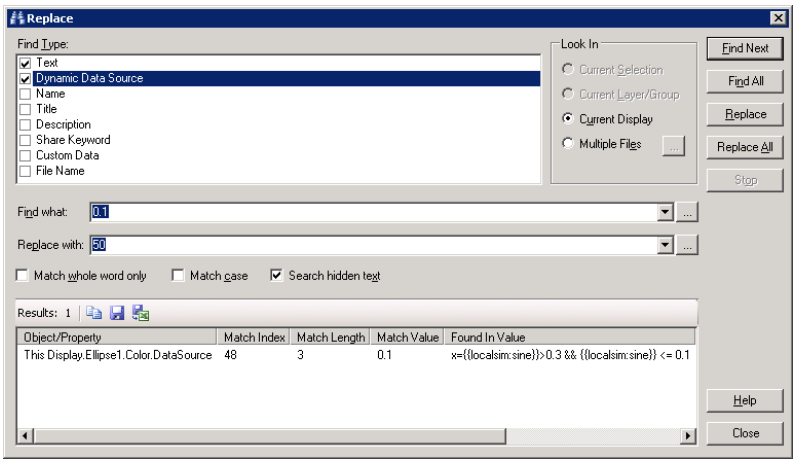
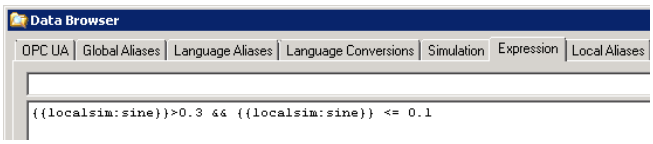


Figure 6.49 - Replace Dialog

Figure 6.39 shows an expression before and after the replacement illustrated in Figure 6.38. The expression originally evaluated values greater than 0.3 and less than 0.1. After a few replacements, the expression evaluates values greater than 30 and less than 50.

Before:



After:

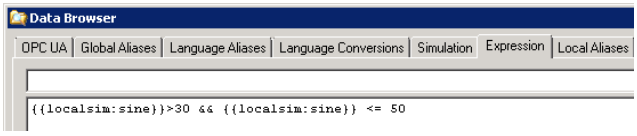


Figure 6.50 - Expression Before (Top) and After (Bottom) Replacement

6.4 Arrange Controls and Objects

When you have many objects and controls in a display, you'll probably want to arrange them in an orderly way that's visually appealing. There are tools to help you arrange objects in the 2D space and in the 3D space. And keep in mind that controls like the Alarm Viewer or the Trend Viewer shown in Figure 6.51 are objects, too. They, too, can be arranged.

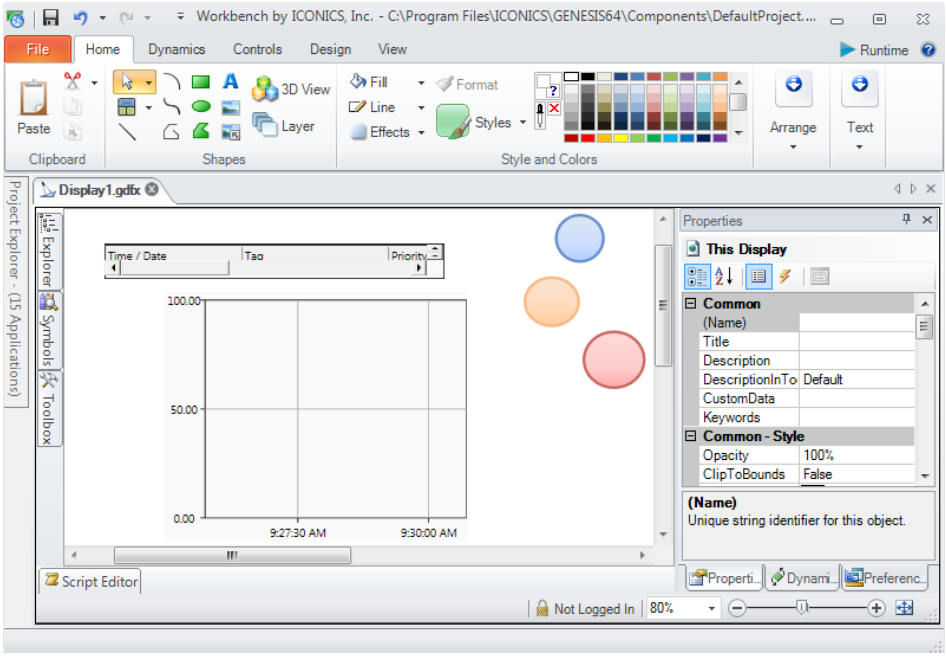


Figure 6.51 - A Display with Objects and Controls

To arrange objects in the active layer, simply select the objects you want to arrange, then select how you want to align them. Note that the last object you select becomes the *reference object*, as shown in Figure 6.52. All other objects are arranged in relation to the reference object.

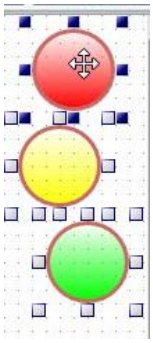


Figure 6.52 - The Top-Most Circle is the Reference Object

6.4.1 Aligning Objects

In the Arrange section of the Home tab, you can choose the alignment you want to use. When using options in the Arrange section, you can actually *change* some attributes, such as size, in relation to another object, and align objects to each other.

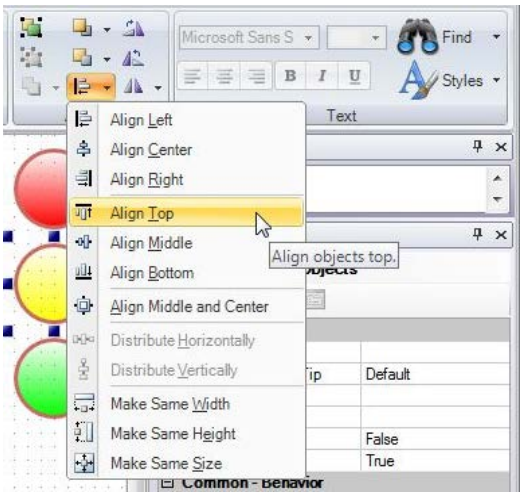


Figure 6.53 - Align Options

When working in a 3D workspace, you can also align objects to each other, and even stack them along an axis you want.

6.4.2 Changing an Object's Z-Order

As you add objects to your display, those objects are added in order from back to front – this is their Z-order. The object drawn last is the top-most object, both in the content area and in the Object Explorer, as shown in Figure 6.54 where the Rectangle object is on the bottom (or in back of the other objects).

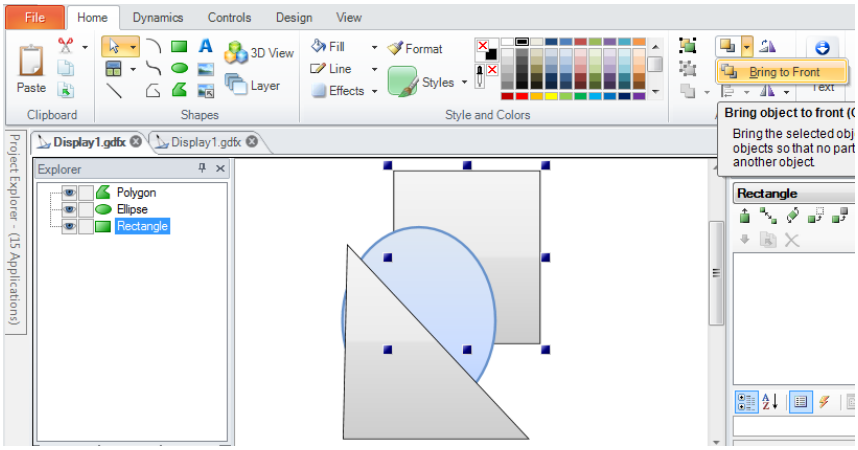


Figure 6.54 - Z-Order of Objects in a Layer

You can change the Z-order of the objects by using options in the Arrange section of the Home tab. In the following example, the selected rectangle is being brought to the front from the back. A different way of changing the Z-order would be to cut and paste the Rectangle in the Object Explorer, or drag and drop the Rectangle up to a higher spot in the Object Explorer. Instead of using the Home ribbon, you can right-click on the object and select the appropriate function from the pop-up menu, as shown in Figure 6.55.

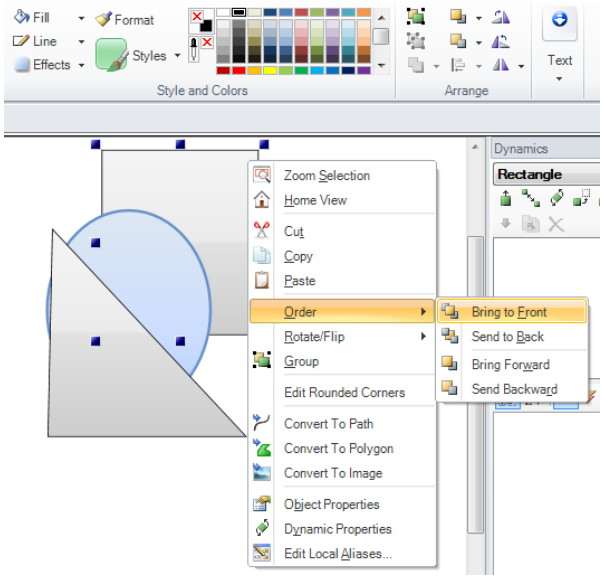


Figure 6.55 - Arrange Objects with Right-click Options

6.5 Views

Once you have completed a GraphWorX64 display, you may find that it is too large or complex, or difficult to navigate easily in runtime. Maybe a display shows a worldwide map created inside an EarthWorX64 Viewer that runtime users need to be able to move around on easily; or a display shows a large campus with detail that extends inside buildings; or a dashboard has detailed areas that runtime users want to be able to zoom easily.

To help runtime users navigate through displays, you can create *views*, which are pre-set scenes or snapshots inside a GraphWorX64 display. In configuration mode, you can navigate to desired destinations within the display and create a view for each destination. As a result, runtime users can access these views, giving them easy access to these areas of detail.

To create views in 2D, you go to the View ribbon and use the options in the Zoom section, shown in Figure 6.45. To create views in a 3D viewport, you go to the Home ribbon and use options in the View section. In this section we'll focus on 2D views.

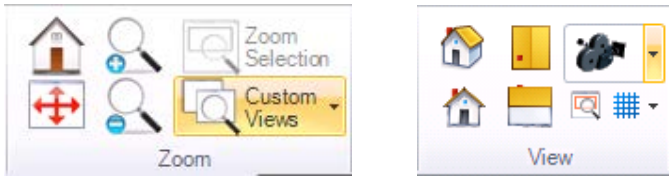


Figure 6.56 – Tools for Creating Views in 2D (Left) and 3D (Right)

To create a 2D view, you must position the GraphWorX64 display so that your work surface shows exactly what you want the view to look like. This may involve zooming in or out, or scrolling up, down, left, or right to position the display. From the View ribbon, click the "Custom Views" button, then select "Add Current View" from the drop-down menu. The **Custom Views** dialog box displays, as shown in Figure 6.57. You can give the view a name that runtime users can easily recognize in the dialog.

During runtime, users can right-click the 2D display to see the list of views and then click on a view to go directly to it. Alternatively, you can create buttons or other objects that use a Pick action, and add them to the display for easy access at runtime.

These same pre-set views that you create for runtime users are also available to you during configuration. In configuration mode, you can see a 2D display's views by right-clicking the display and selecting Custom Views, or by clicking the Custom Views button on the View ribbon.

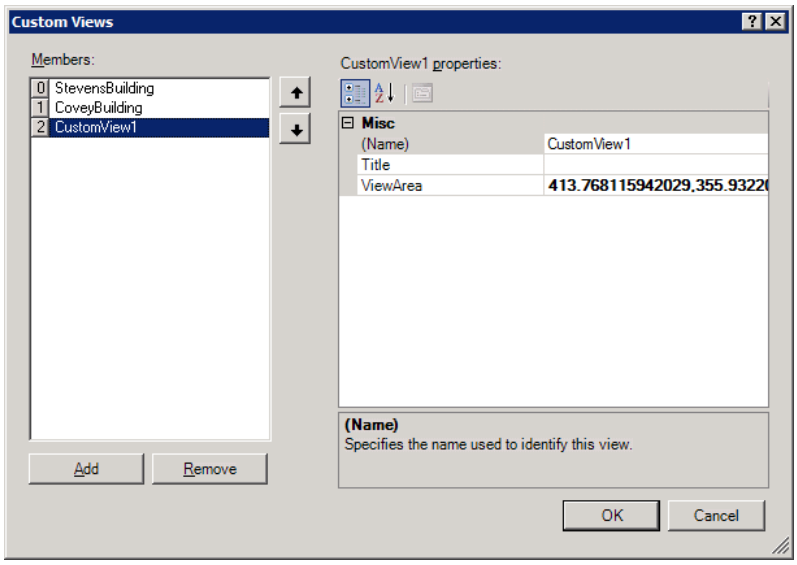


Figure 6.57 - Naming a View

6.6 The GraphWorX64 Runtime Ribbon and Menus

Runtime mode is an environment that populates the GraphWorX64 display objects in memory, draws them on your screen, and updates them with data in accordance with the properties you set in Configuration mode. There is also error tracking in Runtime mode, which can help you troubleshoot your display if needed, and a separate collision detection test for 3D displays.

You can preview Runtime mode using Runtime Preview, which creates and draws the objects but which uses sample data in place of real or historical data drawn from data sources. Or you can enter Runtime mode by clicking the Runtime button above the Configuration toolbar, or pressing Ctrl+M.

In Runtime mode, GraphWorX64 provides runtime menus and runtime ribbons. Using these, runtime users can:

- Magnify areas of the display by zooming in and out
- Access predefined views
- Load a file based on a URL or open a file using the file system
- Browse forward or back in the browse history
- Print a display
- Display interface features such as: the menu, scroll bars, status bar, different sized icons
- Open the Diagnostics utility
- Login or logout of a display
- Open the Carousel to view a sequence of displays
- Go to pre-set views (refer to Animating 3D Views at Runtime and Creating 2D Views for Runtime Users)
- Go to the Card Flow view to preview previously-opened displays

During GraphWorX64 runtime, the **File**, **View**, and **Tools menus** are visible if you choose to show them. You must hide the runtime ribbons in order to gain access to the menus.

> **Note:** The menus are not available if the display has an EarthWorX map in it.

The **ribbon** may be easier to use, though. There are several tabs on the Runtime ribbon. A GraphWorX64 display shows its own GraphWorX64 runtime ribbon, but if the display has Viewer controls for EarthWorX64, TrendWorX64, or AlarmWorX64, *additional* ribbons may also be available. The GraphWorX64 runtime ribbon looks something like Figure 6.58.

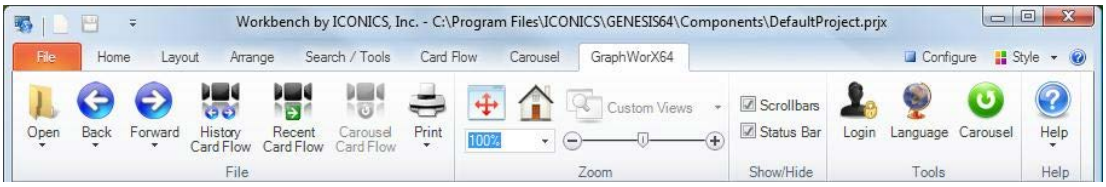


Figure 6.58 – GraphWorX64 Runtime Ribbon

To show the Runtime ribbons:

- Right-click the display to show the pop-up menu and then select Show Ribbons. This shows the GraphWorX64 runtime ribbon and, if there is an EarthWorX map in the display, the EarthWorX64 ribbon.
- To show the TrendWorX64 ribbon, click on a trend chart.
- To show the AlarmWorX64 ribbon, click on an alarm or a chart of alarms.

Lab: Smart Tiles

L6A

6A.1. Lab Overview

In this lab, you will learn how to add and configure Smart Tiles. You will learn about adding process points, as well as adding symbols from a library.

Estimated time to complete this lab: 30 minutes

6A.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Adding and configuring Smart Tiles.
- Learning to use alignment.
- Learning to build ducts using symbols from a library.
- Learning to edit Dynamics in a Smart Symbol.

6A.1.2. Support Files

You do not need any additional supporting files to complete this lab.

6A.2. Creating an AHU Display

1. Open the **AHU_Lab.gdfx** file.
2. Save the display as **AHU**.
3. Select the **Controls** tab.
4. Select the **Smart Tile** control, then click and drag it into in the canvas. Any size will do, as we are going to resize it to match the other set points for the AHU.
5. **Double-click** on this new Smart Tile to enter the Smart Tile configurator.

6. From the **General** tab:
   - Change the **Width** and **Height** to 150 by 150.
   - Select the **Background** color, then enter the following numbers for:
     - Red= 192
     - Green= 80
     - Blue=77.
7. From the **Top Banner** tab, set:
   - Banner Height = 46
   - Label = Discharge Cooling Setpt (Make it Bold)
   - Font Size = 14

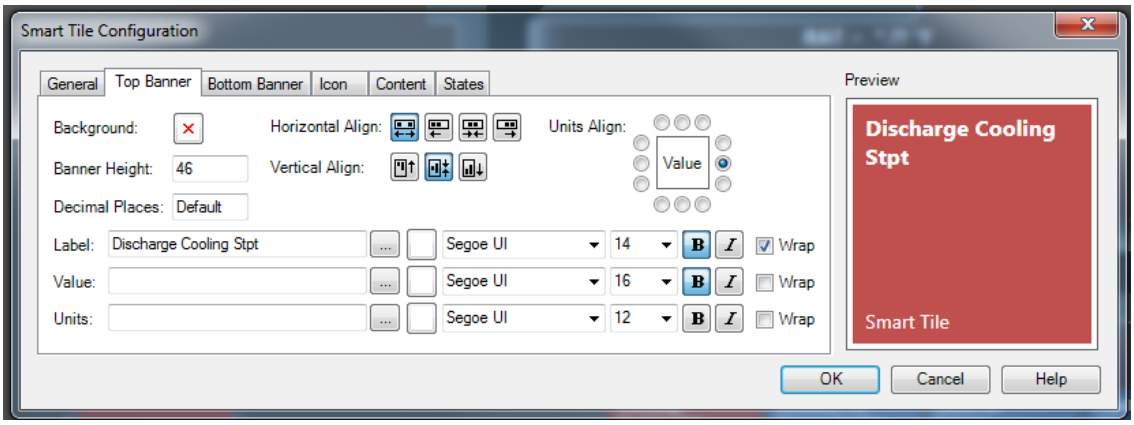


Figure L6A.1 - Smart Tile Top Banner Configuration

8. From the **Bottom Banner** tab:
   - Place the cursor in the Units field.
   - Hold the **Alt** key and enter **167** in the number pad, then release the Alt key.
   - You should see the º symbol. Type **F** after the symbol.
   - Set the **Units** font size to **13** and make it **Bold**.

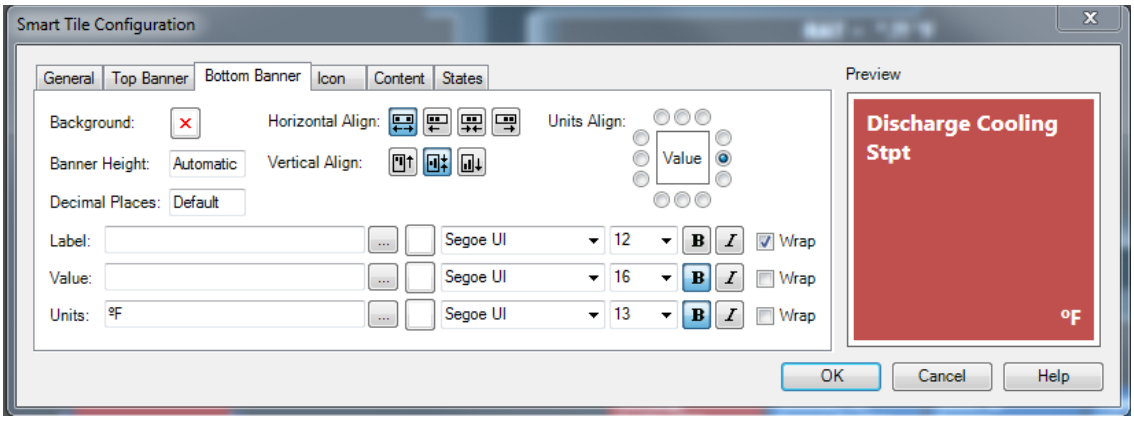


Figure L6A.2 - Smart Tile Bottom Banner Configuration

9. Click **OK**.

10. From the **Dynamics** tab, in the **Text Objects** section, select **Process Point**.

11. Place the **Process Point** on the screen. Any size is fine, as we will resize it later.

12. Using the **Data Browser** navigate **AssetWorX→ IcoUniversity→ North Campus→ Engineering Building→ HVAC 01** then select the **ThermostatSetPoint_opc** tag.

13. Click **OK.**

14. In the **Dynamic** properties of the **Process Point,** set:

- **Data Entry** to true.
- **DecimalPlaces** = 1

15. Then, under the **Properties** tab set;

- **Foreground** = White or 0,255,255,255
- **Width** = 110
- **Height** = 66
- **Padding** = 0
- **FontSize** = 48

16. Select the **Explorer** tab to expose the object explorer.

17. We will move the **Label1** tree node beneath the **Smart Tile** tree node. This will add the Process Point into the Smart Tile.

18. Select Label1. While holding down the left mouse key, **drag** the **Label1** tree node **underneath** the **Smart Tile** and release the mouse key. The result should resemble the figure below.

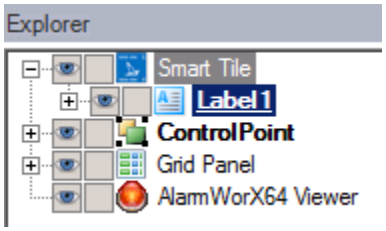


Figure L6A.3 - Process Point Added to the Smart Tile

Note: This feature works with anything in GraphWorX64. You can drop in a different control such as a Trend Viewer or Alarm Viewer. You could even create custom symbols and drop them into a Smart Tile.

19. Now, drag the Smart Tile into the **Control Point Group**.

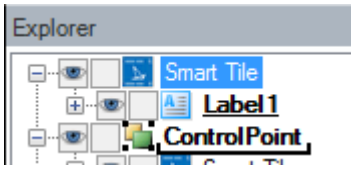


Figure L6A.4 - Smart Tile Dragged into the Control Point Group

20. Now we will use the **Arrange** tools to align the Smart Tile.

21. With the Smart Tile you just dragged into the **ControlPoint Group** selected, hold down the **Ctrl** key and select the **Discharge Heating Setpt** Smart Tile. It should look like the following image.

Note: The selected **Discharge Heating Setpt** smart tile should have blue handles. Blue handles indicate this is the focused object and the arrange function will order objects in relation to the focused object. If necessary, just left-click on another object to change the focused object.

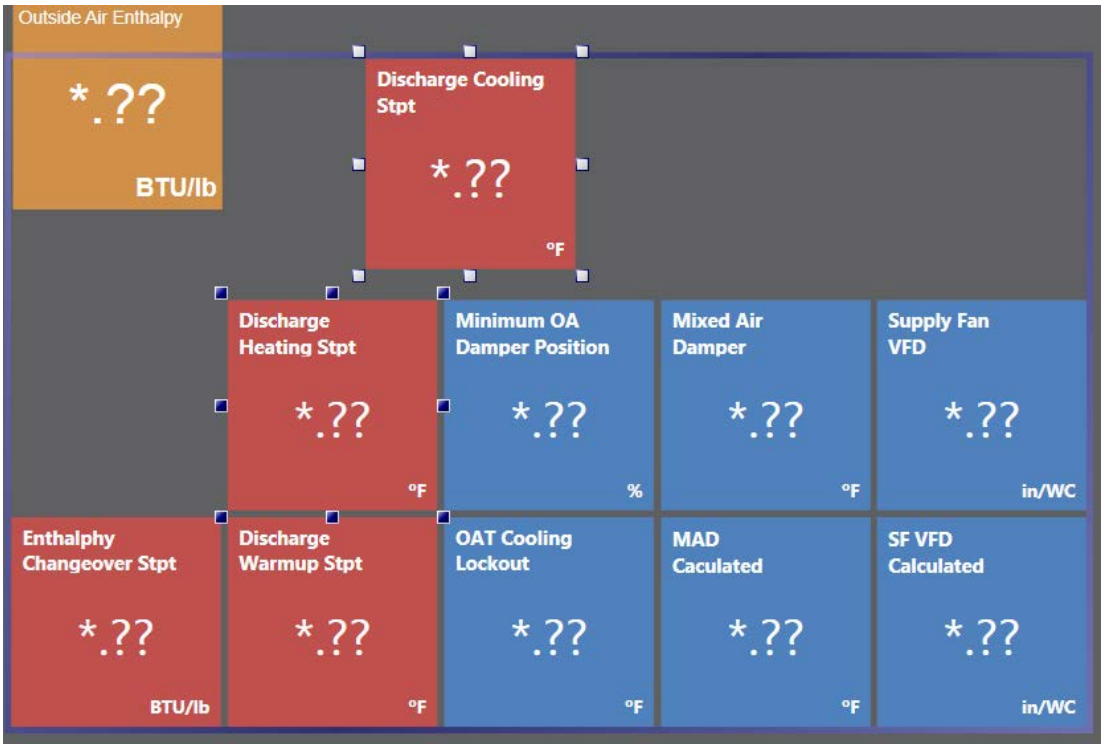


Figure L6A.5 - Selected Smart Tiles

22. Then, in the **Home** tab, select the **Align** button in the **Arrange** section. Select **Align Middle**.

23. Then, select only **Discharge Cooling Setpt** and **Enthalphy Changeover Setpt** with the blue squares (focus) over Enthalphy Changeover Setpt and **Align Center**.

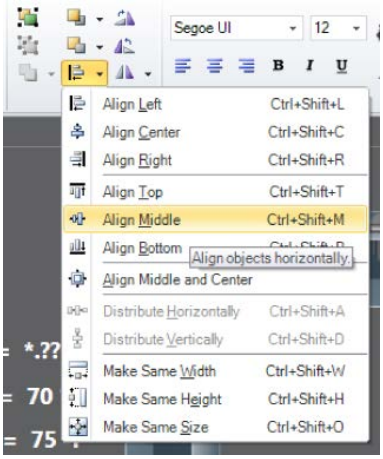


Figure L6A.6 - Alignment Options

When you have properly aligned the tile with the others, you will have something that looks like this.

Figure L6A.7 - Aligned Smart Tiles

24. Click in the gray area of the display with the left mouse key until you see **This Display : Canvas** at the top of the **Properties** section.

25. Now, from the **SI_BA_Training Symbol Library**, select the **AHU Diagram** drag and drop it in the upper frame (gray area).

26. Drop the **Duct – Smart Fan** and **Vent** and **Horizontal Duct Left End Cap** symbols onto the canvas.

27. Now, move them to complete the duct work, as depicted in the following image.

Note: With an object selected on the display canvas, the arrow keys will perform a fine adjust of the location.

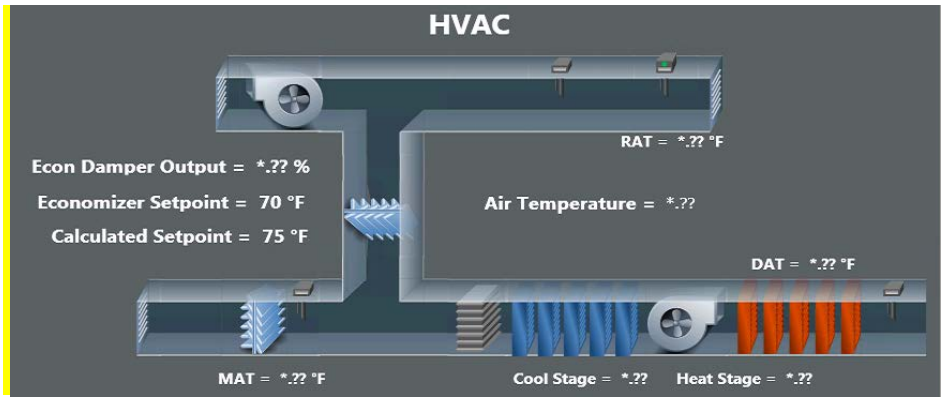


Figure L6A.8 - Duct Diagram

28. In the object **Explorer**, click on the + sign to expand the **Fan** tree.

29. Drill down and select **fan_blades1**.

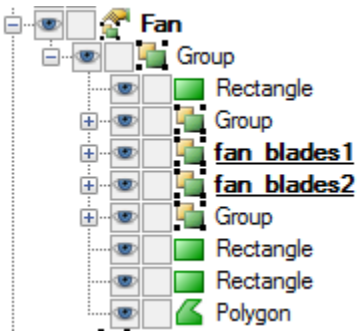


Figure L6A.9 - Selecting components of a Smart Symbol

30. Select the **Dynamics** tab. Select the **Rotation** dynamic.

31. Set the following properties:

- **AnimationMode** = Discrete.
- **Duration** = 500
- **RepeatCount** = Infinite.

32. Again, from the object explorer, select the **Fan**. Now select the **Properties** tab and set the data sources as described below.

- **DataSource**= *ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/CoolBlowerStatus_opc*
- **DataSource2**= *ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/CoolBlowerStatus_opc*

33. Save the display.

34. Go into **Runtime**.

35. Select the **Data Entry** field you added to the **Discharge Cooling Setpt** smart tile.

Note: The Discharge Cooling Setpt is clipped between 55 and 90.

36. Enter a value + or – 2 degrees from the **Air Temperature** value.

37. If the system is cooling, the top fan will animate. If heating, the bottom fan will animate.

This concludes this lab.

Lab: EarthWorX64 *L6B*

6B.1 Lab Overview

In this lab, you will learn how to create a display with EarthWorX. You will also learn how to maneuver through maps and integrate them with Smart Pins.

Estimated time to complete this lab: 30 minutes

6B.1.1 Task Checklist

In this lab, you will complete the following tasks:

- Adding an EarthWorX Control to a GraphWorX64 Display.
- Working with Smart Pins.

6B.1.2 Support Files

You do not need any additional supporting files to complete this lab.

6B.2 Creating a Display with EarthWorX

When this lab is complete, your display should resemble the figure below.

Figure: L6B.1 – Completed EarthWorX Display

1. Launch a **Second Instance** of GraphWorX64.
2. Select **File → Save As**… and name the display **EWX**.
3. From the **Controls** tab, select the **EarthWorX64 Viewer**.
4. **Click and drag** to create a viewer. (It doesn't matter what size, because it will revert to 512x512.)
5. You will receive the following prompt. Select "**Yes**".

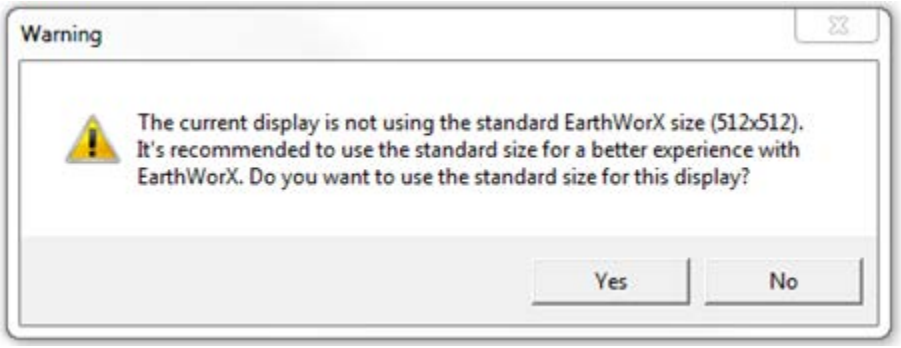


Figure: L6B.2 - Notification Popup

6. That will be followed by another prompt about using a Demonstration Tile System. Click "**OK**" on that prompt as well.
7. From within the object **Explorer**, expand the **EarthWorX Viewer** tree and select **Single Map Layer**. The EarthWorX64 Configuration tab will be selected.
8. From within the Map Information section, set the following properties:

Latitude	42.36623
Longitude	-71.12578
Zoom Level	15

9. You should see the city of Boston in your viewer.
10. In the **Navigation** section click on "**Default Region**" then select "**Set Default starting region**". You will be prompted with another message. Click "**OK**". You now have set the default region.
11. With the **EarthWorX64 Configuration** tab selected, from within the **Map Type** section, click on the chevron (circled in the following figure) to open the **Drop Down** list and select **Hybrid**.

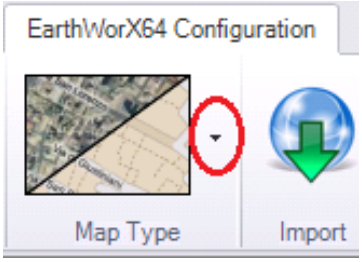


Figure L6B.3 - Select the Hybrid Map Type

12. Now, you can make out that you are over a campus.

13. We will **Zoom** in to focus on the Baker Library Bloomberg building.

14. Hold the **Alt key**. Using the **Left Mouse Key**, click and drag on the map to outline the Baker Library/Bloomberg Center building. Your box should start from near the top left of the "H" in Harvard, way down, and right to the dirt path that looks like a wishbone. You may consider using the mouse wheel to zoom in or out or left and right.

Tips in EarthWorX: Mouse wheel + (after zooming in)

- Ctrl key moves map Up and Down.
- Shift key moves map Left and Right.
- Alt key zooms In and Out.

Note: If you get lost, select "Single Map Layer" again and enter the following coordinates into the Map Information in the ribbon.

Latitude	42.36642
Longitude	-71.12283
Zoom Level	19

15. The black square outline in the following figure should help you locate the Baker Library Bloomberg building.

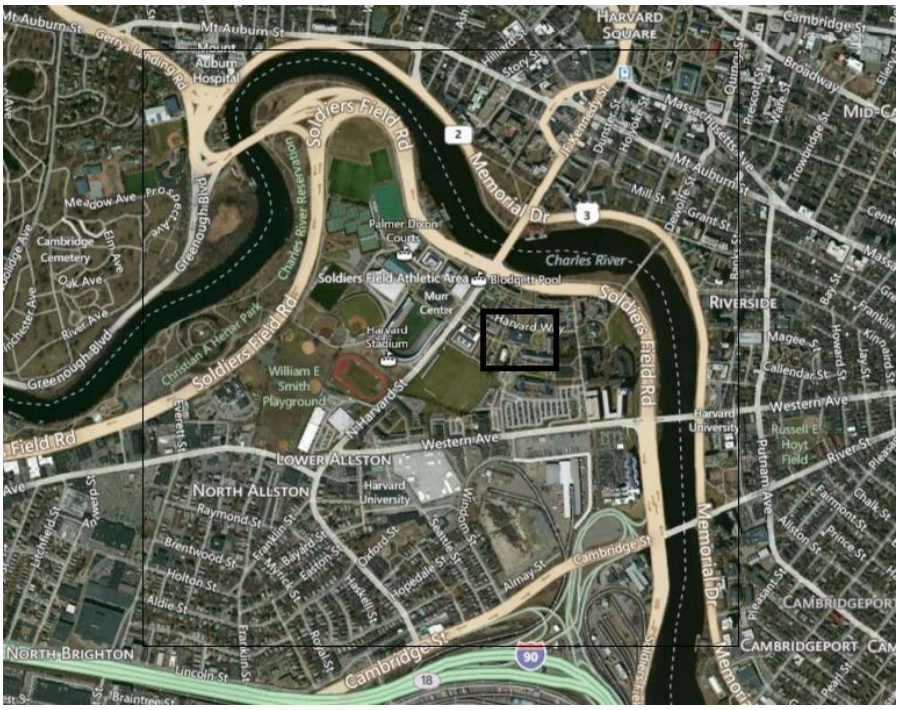


Figure L6B.4 - Zoom In on the Baker Library/Bloomberg Center Building

16. With focus on the Baker Library Bloomberg building, click on the map until the GraphWorX64 ribbon appears.

17. With the **Home** tab selected, from within the **Shapes** section, select **Polygon** .

18. Starting from the **Top Left** corner and working in a clockwise rotation, outline the Baker Library Bloomberg building with the polygon shape.

19. Work your way around the building by clicking on the destination location of the next line segment. A line segment will be drawn between the starting point and the location where you clicked with the mouse (destination).

20. If you completed outlining the building in the previous step(s), then the following step and bullets are just for your information and may be skipped.

21. Learning to outline the building with this second method may take some practice. The following bullets will hopefully get you started.

- Start at the left corner and drag a line to the right corner.
- Grab the handle at the right and drag down to the right-hand corner.
- Grab a section toward the middle of the triangle and continue to draw toward the left hand corner.

22. The completion of the polygon should resemble the figure below.

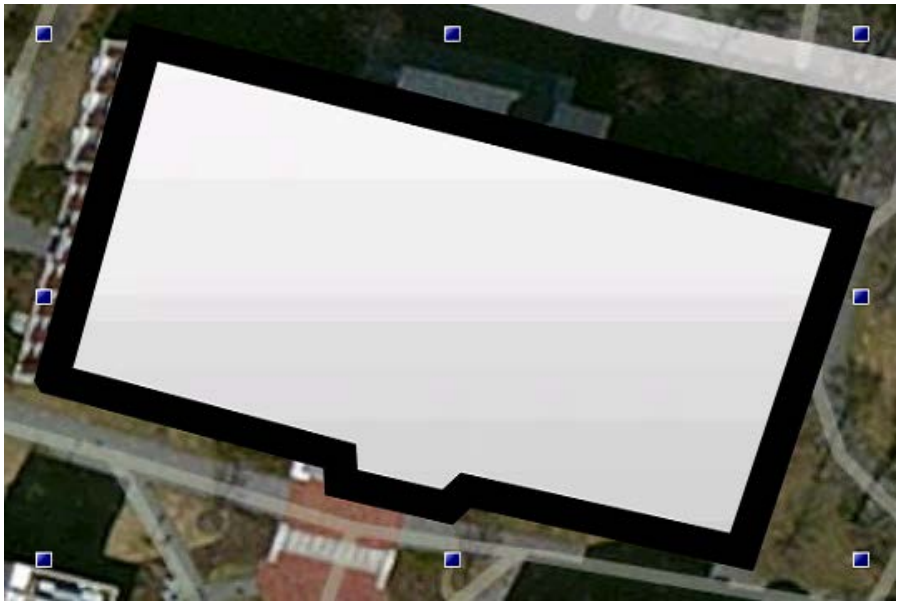


Figure L6B.5 – Outlined Baker Library Bloomberg Building

23. Right mouse-click when you are done with the outline. The polygon should remain selected.

24. Select the polygon properties tab and change the properties according to the table below. By setting the opacity value to 1, you make the fill transparent, but this allows you to still click on the shape.

Line Width	.5	
Line	255,255,0	Yellow
Fill	1,255,255,255	Opacity = 1

25. Save the display. You may consider saving your display frequently. At any rate, it is good practice to save your display before entering Runtime.

26. Select the **Dynamics** tab at the bottom right of the screen.

27. The polygon should still be selected as indicated by the **blue handles**.

28. Add a **Pick Action** by selecting the pick action from the list of dynamics at the top of the dynamic explorer window.

Note: The handles of the polygon will turn red. This indicates that the object has a dynamic connection.

29. Leave the default action, **Load Display**, and set the following attributes:

FileName	LibraryOverview.gdfx
TargetType	Popup Window (Independent)
OverrideWindowProperties	True

30. After you have set the **OverrideWindowProperties** to **True**, you will see a new attribute line called **WindowsProperties**. Expand it and enter in the following values.

Width	800
Height	600
MenuVisible	False
NavigationBarVisible	False
StatusBarVisible	False

31. When your changes are complete, the **WindowProperties** should resemble the figure below.

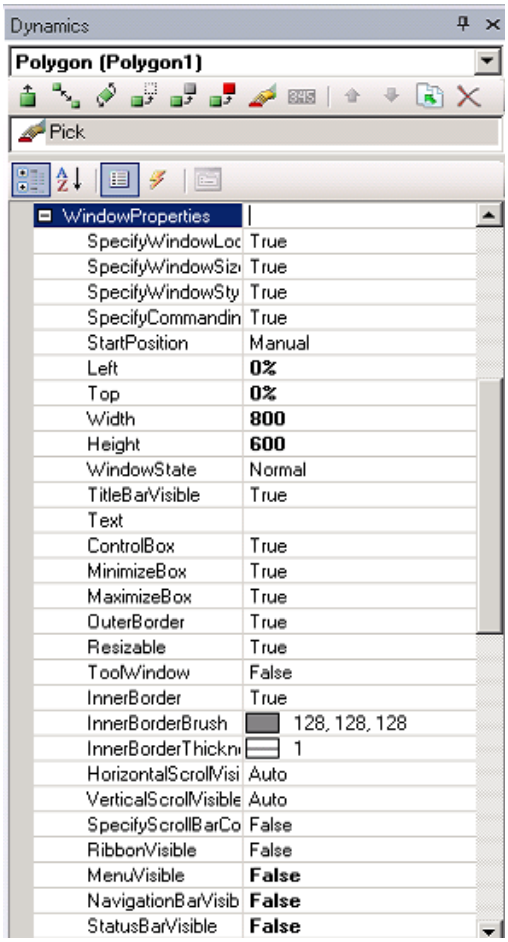


Figure L6B.6 - WindowProperties

32. Select the **View** tab in the GraphWorX64 menu.

33. From within the **Zoom** section, click on **Custom Views**. Then, **Add Current View**.

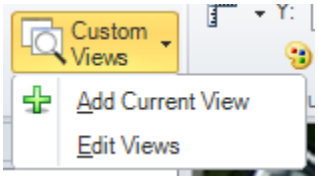


Figure L6B.6 - Adding a Custom View

34. Change the (Name) from "**CustomView1**" to "**Baker**". Click **OK**.

35. Right mouse-click on the map and select **Home View**. Then, zoom in until you are positioned similarly to the following figure.

Figure L6B.7 – Display Prepared to Add a Smart Pin

36. Select the **Explorer** tab.

37. Select the **Home** tab from the GraphWorX64 menu.

38. From within the **Shapes** section, click on **Layer**. Notice **Layer1** is added to the object explorer tree.

39. Select the **Controls** tab and select **Smart Pin**.

40. **Add** a **Smart Pin** to the display somewhere **outside** the yellow outline of the Baker Library Bloomberg building.

41. **Hover** over the Smart Pin until you see the cursor turn to **Crosshairs**. Double left mouse-click to open the **Customize Smart Pin** dialog.

42. Remove **Columns** and **Rows** until you have 4 pins. You will use the remove row and remove column buttons.

43. Click on the **Top Right** square and Enter "**Faults**" into the **Tooltip** field.

44. Make the color **Red.**

45. Enter **1000** in the **Blink (ms)** field.

46. Change the **Active When** field to **data == 0**.

47. Place the cursor in the **Data** field and click on the **ellipse**.

48. Select the **Simulation** tab.

49. From within the **Data Browser**, click on the **Define New Variable** >> button.

50. Specify a **Data Type** of **Boolean**, **Name** the variable **Faults** and click **OK**.

51. Your Data field should be populated with **localsim::Faults:Boolean**.

52. Click **OK**.

53. Your completed configuration should resemble the following figure. Click **OK**.

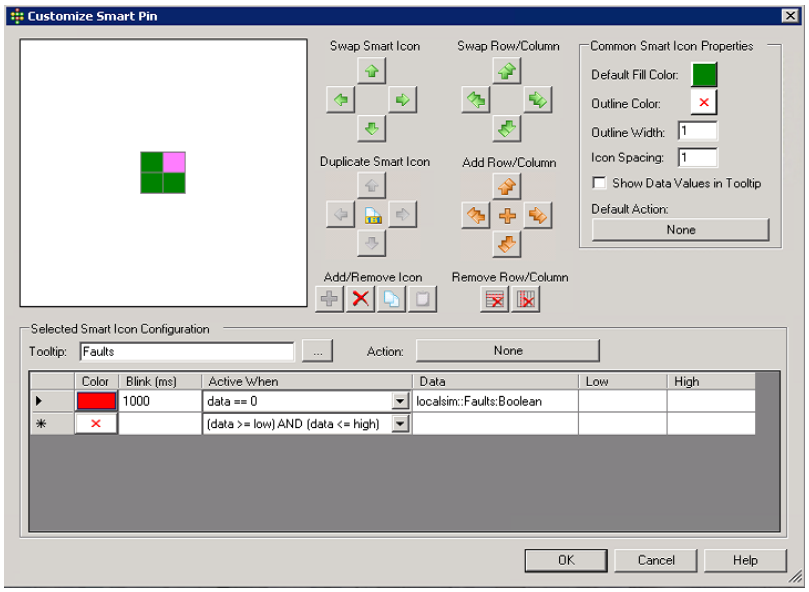


Figure L6B.8 - Customizing the Smart Pin

54. Drag the Smart Pin and place it on top of the Baker Library Bloomberg building **inside** the **yellow** outline of the building.

Figure L6B.9 - Customizing the Smart Pin

55. Click **OK.**

56. Save the display and enter **Runtime**.

57. Hover over the **Red Blinking** Square to see the **Tooltip** message

58. Click on the building away from the Smart Pin (when the cursor is a hand).

59. This will execute the pick action to load the **Popup window**.

60. We will work more with the popup windows in later labs. Close the popup window.

This concludes this lab.

Lab: Creating a Dashboard L6C

6C.1 Lab Overview

In this lab, you will learn how to create a dashboard utilizing both a floor plan and main "base" display. This lab will tie some previous labs' concepts together.

Estimated time to complete this lab: 30 minutes

6C.1.1 Task Checklist

In this lab, you will complete the following tasks:

- Create a complete dashboard.
- Link previously created campus display for more detail.
- Learn to use Commanding in GraphWorX64.
- Add color dynamics to elements in your displays (e.g. "rooms").

6C.1.2 Support Files

You need the following support files created in earlier labs:

- EWX.gdfx
- AHU.gdfx
- LibraryOverview.gdfx
- LibraryMap.gdfx

6C.2 Creating a Dashboard

Floor Plan:

1. Launch GraphWorX64 and open **LibraryMap.gdfx**.

2. Select the solid **Polygon** and outline the perimeter of **StateRoom1**, as labeled in the following figure.

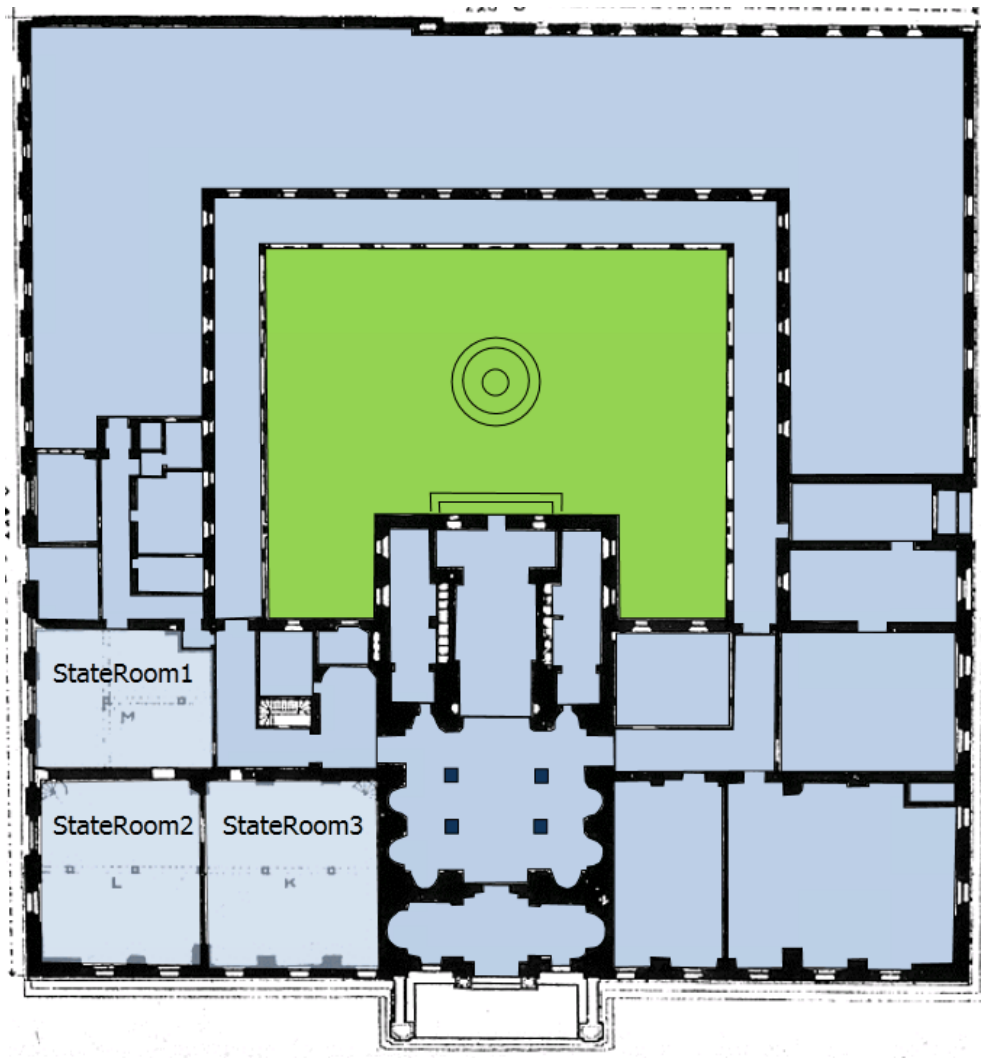


Figure L6C.1 - Adding StateRoom Ploygons

Note: After selecting the Polygon drawing tool, if you click on the upper left corner of StateRoom1, then click on the next location where you want the poly to be drawn, then the next location and so on, the polygon will be drawn to the next location you click on.

3. Label the polygon in the object explorer, **StateRoom1**.

4. Set the color to the blue color you see in the other rooms. **Fill = 184, 204, 228**.

5. From within the object explorer, drag and drop the **StateRooms** into the **Rooms** group.

6. Repeat steps **2** through **6** to create **StateRoom2** and **StateRoom3**.

7. Select the **Rooms** group and copy and paste it. You should see a new entry labeled **Rooms1** at the top of the explorer.

8. In the object explorer, select **Rooms1.** Hold the **CTRL** key and select **Rooms**. Both **Rooms1** and **Rooms** should be **selected**.

9. We will now align **Rooms1** and **Rooms** on top of each other.

10. With the **Home** tab selected, in the **Arrange** section from the **Align** dropdown list, select **Align Middle and Center.**

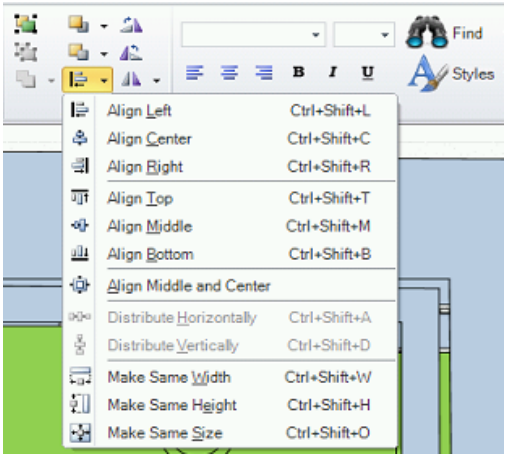


Figure L6C.2 - Alignment Options

11. In the object explorer, expand **Rooms1** and select **StateRoom4.**

12. Click on **Dynamics** tab and add a **Color Dynamic** . Enter these dynamic property values.

(Name)	Red_Dynamic
DataSource	ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/RoomTemperature_opc
AnimationMode	Analog
LowLimit	68
HighLimit	90
EndColor	Red 255,0,0

13. We will add a second color dynamic by duplicating the color dynamic we just added.

14. Select the **Red_Dynamic** color dynamic.

15. From the **Dynamic Explorer** ribbon, click on the **Green Arrow** icon as depicted with the circle in the figure below.

Note: The green arrow icon tooltip displays "**Duplicate Select Dynamics"**.

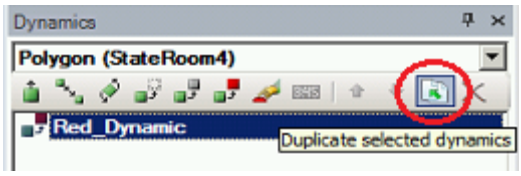


Figure L6C.4 – Duplicate Selected Dynamics

16. The result is a **Red_Dynamic1** color dynamic added to **StateRoom4**.

17. You will continue by editing the **Red_Dynamic1** dynamic properties.

18. Select the **Dynamics** tab and click on the **Red_Dynamic1** and make the following changes.

(Name)	Blue_Dynamic
LowLimit	50
HighLimit	68
UseStartColor	True
StartColor	Dark Blue 0, 0, 255
UseEndColor	False

19. Click on the **Blue Up Arrow** in the dynamic properties ribbon (near the green arrow) to move the Blue_Dynamic to the top of the list.

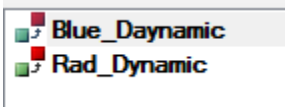


Figure L6C.5 - Reordered Dynamics

20. Click out of the **Rooms1** group.

21. Select the **Home** tab. From within the **Shapes** section, click on **Layer**. This adds a **Layer1** to the display. Rename the layer to **HeatingLayer**.

22. In the Explorer Tree, drag and drop **Rooms1** into the **HeatingLayer**.

23. Select the **Home** tab. From within the **Shapes** section, click on **Layer**. This adds a **Layer1** to the display. Rename the layer to **EquipmentLayer**.

24. In the Explorer Tree, drag and drop the **AHU_01** object into the **EquipmentLayer**.

25. Then, on the **Display Canvas**, drag the **AHU_01** and lay it on top of **StateRoom4**.

26. Select the **Properties** tab for **AHU_01** and set the **FileName** to **AHU1.gdfx.**

Note: The Filename is under the Smart Properties section because AHU_01 is a Smart Symbol.

27. Click on the eye for the **FloorPlan** in the Explorer.

28. Then, click on the square where the eye would be for **BackDrop**.

29. Click on the eye for the **HeatingLayer** in the Explorer. Your Explorer Tree should look like this when you are done:

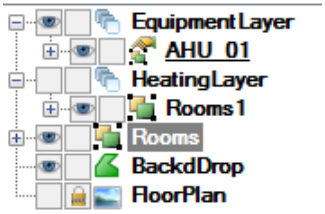


Figure L6C.6 - Explorer Tree Example

30. File →Save

6C.1.6 Adding the Floor Plan

1. Open the **LibraryOverview.gdfx** display.
2. Select the **Floorview** in the Tree Explorer.
3. In the **Properties**, under **Misc**, set the **Source** to **LibraryMap.gdfx**.
4. Select the **Heatmap** Smart Tile under the **TopButtons** group in the **Object Explorer Tree.**
5. Add a **Pick Action** Dynamic, then change its properties to match the following:

Command	Set Visibility
ObjectName	HeatingLayer (Type Manually)
Target	Floorview (Type Manually)

6. Select **File →Save**.

6C.1.7 Create the Base Dashboard Display

1. Launch another instance of GraphWorX64.
2. With a **Blank** graphic, click **File→ Save** As and name the display **Main.gdfx**.
3. When you complete the steps in this section and the Main.gdfx display is complete, it should resemble the figure below.

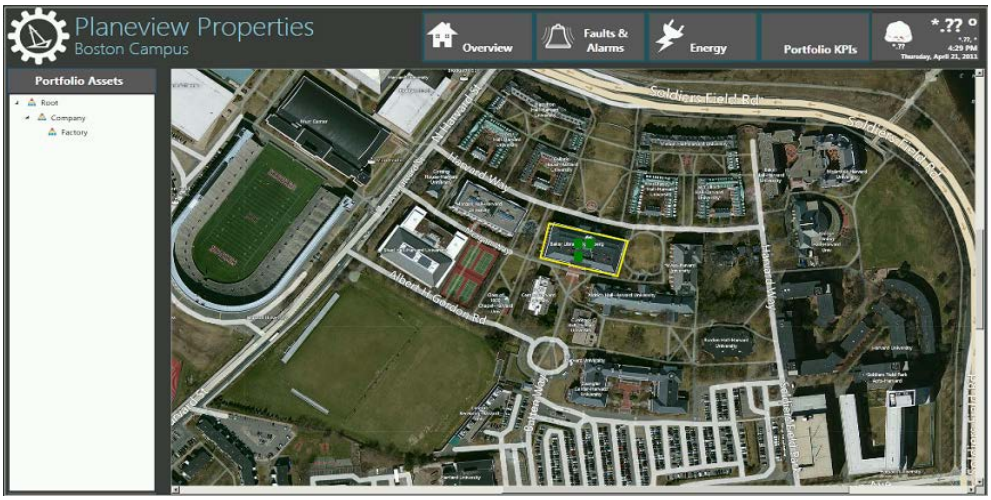


Figure L6C.7 - Complete Main.gdfx Display

4. Select the **Properties** tab in the lower right section of the GraphWorX64 application and enter the following properties.

Section	Property	Value
Common – Style	Background	63, 63, 63
Measurements	Width	1920
Measurements	Height	1040
Measurements	IsScaleable	True

Note: If the properties and symbol tabs are not available, select the View tab and verify that the Properties and Symbols checkboxes are selected under the Show/Hide section of the ribbon.

5. Zoom out until you see the white frame outlining the display area.

6. Click on the **Symbols** tab.

7. Click on the dropdown list of the Symbol library and select the **Dashboard Symbols** category listed. This was added in a previous lab. If you don't see this library, execute the following two steps.

   - Click on the **Symbol Library** commands menu" icon at the top of the Explorer and select **Open Existing Category** from the popup menu.

   - In the **Open** dialog box, look for the **C:\Training\Dashboard_Symbols.sdfx**. Click on "**Open**" to add the library.

8. Using the **CTRL** key, select the **Asset_Smart_Symbol, CompanyLogo** and **Navigation_Buttons**.

9. With the three symbols selected, use the **Right** mouse key to select then **Drag** and **Drop** the symbols into the display framed area.

10. Organize the symbols as seen ion the figure below.

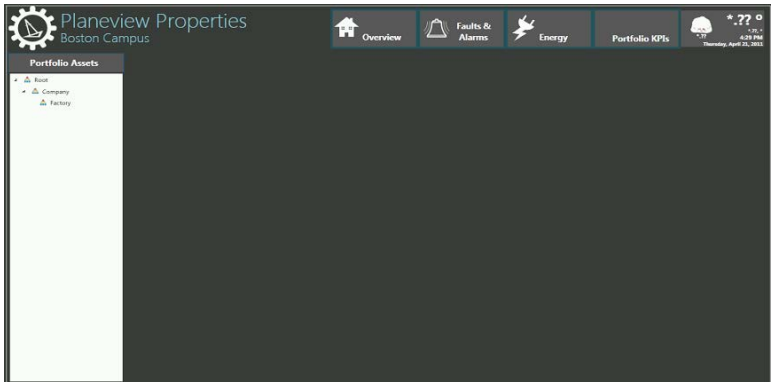


Figure L6C.8 - Symbols Only Added to the Main.gdfx Display

11. The **CompanyLogo** should be in the top left corner.

12. The **Asset_Smart_Symbol** should be along the left-hand side.

13. The **Navigation_Buttons** should be on the same line as the logo but on the right-hand side.

14. From the **Controls** tab, select the **GraphWorX64 Viewer**.

15. Click and drag to create a viewer to fill the white space to the right of the **Portfolio Assets** symbol.

16. With the **GraphWorX64 Viewer** selected, click on the **Explorer** tab in the lower left.

17. Rename the **GraphWorX64 Viewer** tree node to **Content**.

18. Now, in the properties of the **GraphWorX64 Viewer**, set the source to **EWX.gdfx**.

19. File →Save As Main.gdfx.

20. Enter **Runtime** and click on the **Overview** selection in the dashboard ribbon. This is the only active button at the moment. The other button could be edited if needed.

Note: You may have to zoom out by holding the Alt key and scrolling with the mouse wheel.

This concludes this lab.

AlarmWorX64 Server 7

AlarmWorX64 is a distributed enterprise-wide alarm and events management system. Available in the standard GENESIS64 suite of applications, or as a stand-alone Open Series component, AlarmWorX64 offers the tools you need to deliver real-time alarm information throughout your system. AlarmWorX64 is a family of modular alarming products, including the Alarm Server, the Alarm Logger, the Alarm Viewer Control, and the Multimedia Server.

In the next few chapters, we will discuss the major parts of AlarmWorX64. Before we can discuss any other components in AlarmWorX64, we must first understand and configure an alarm server. This will be the source from which we obtain alarm and event information. After completing this chapter, you should be familiar with the following:

- AlarmWorX64 Server and how to launch it.
- The different types of alarms.
- Configuring alarm tags individually or using the Tag Import Wizard.
- Configuring and using an alarm tag template.
- Grouping alarm tags by area.

7.1. AlarmWorX64 Server

The AlarmWorX64 Server receives field data from your OPC-compliant Data Access servers and performs alarm detection and reporting on that data. You use the AlarmWorX64 Server interface to create and maintain a database configuration of alarm tags.

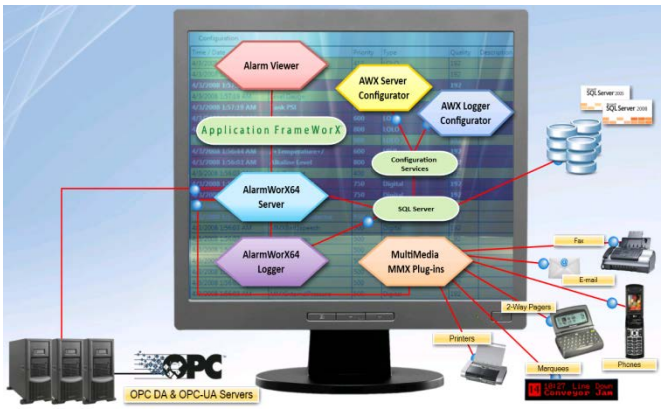


Figure 7.1 - Overview of AlarmWorX64

All alarm detection and reporting conforms to OPC Alarm and Events standards. Event notifications generated by the AlarmWorX64 Server are sent to OPC UA clients (such as, AlarmWorX64 Viewer and AlarmWorX64 Logger) that subscribe to it.

AlarmWorX64 Server can be run as a service. The server reads its configuration information from a Microsoft SQL Server database file (which by default is AWXSVRCONF.MDF). During runtime, the server polls the configuration database for changes, allowing on-the-fly configuration change without stopping the server.

To start AlarmWorX64 Server, go to **Start → All Programs → ICONICS GENESIS64 → AlarmWorX64 → AlarmWorX64 Server Configurator**. The AlarmWorX64 Server Configurator opens in the Workbench. You can also launch the configurator in the Workbench from the "AlarmWorX64 Server" program icon at the bottom of the Project Explorer as shown in Figure 7.2.

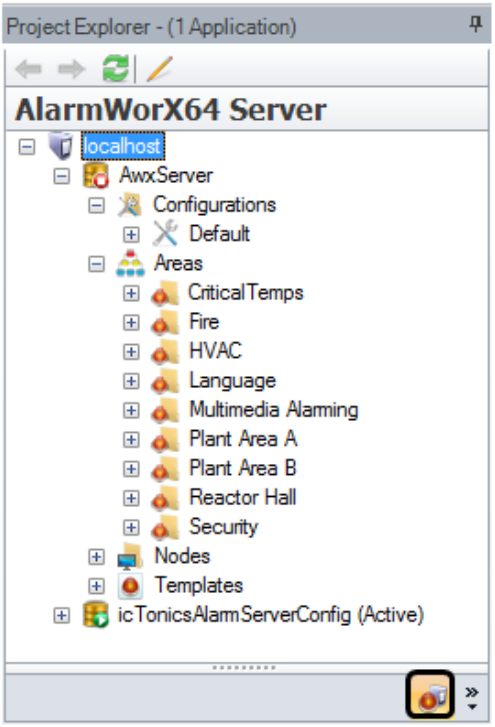


Figure 7.2 - AlarmWorX64 Server Configurator

7.2. Alarm Tags

An alarm tag is an OPC tag to be monitored along with the value ranges at which alarms should trigger. In a typical scenario, the AlarmWorX64 Server receives a value periodically for each OPC tag and determines if the incoming OPC value is in an alarm condition. If it is, the AlarmWorX64 server generates an alarm. The alarm client will then be able to display the condition so that nearby operators can rectify the situation.

For example, you might want to create an alarm tag for an OPC tag for the speed of a cooling fan so that an alarm is triggered when the cooling fan's speed rises above or falls below an acceptable range. As a result, an operator can investigate or make adjustments to rectify the problem before damage can occur to goods or to the equipment. You might also want an alarm to be triggered when a secured door is opened or when a pressure gauge reading drops rapidly.

For each alarm that you configure, you may require an operator to acknowledge the alarm. You can even require an operator to acknowledge an alarm that has returned to its normal state.

Remember that you do not have to limit your alarms to adverse or critical conditions. For example, you can configure an alarm that provides instructions for a manual step at a key point in a process, or you can configure a series of alarms on a piece of equipment to provide automated training for new operators.

AlarmWorX64 provides six types of alarms:

- A **Limit Alarm** occurs when the incoming reading exceeds a ceiling or floor limit that you configure.
- A **Digital alarm** occurs when the value of the OPC tag or expression equals the Alarm State Value. Since this is a digital alarm, the alarm state values can only be 1 or 0; the other value is the normal state.
- A **Deviation alarm** occurs when the absolute value of the difference between two OPC tags exceeds a ceiling or floor limit that you configure.
- A **Rate of Change alarm** occurs when the amount of change between the last two readings exceeds a limit that you configure.
- A **Rate Limit alarm** occurs when the amount of change exceeds the high or low limits specified in the alarm tag. A **Trigger Limit alarm** reports when the tag's value changes, and will not reset until after a runtime operator acknowledges it. With this alarm, there is no normal condition; any change in the value triggers the alarm. This type of alarm is useful for a tag whose value rarely changes.

These types of alarms are available for each alarm tag that you create. You can also configure any or all of these alarms in one alarm tag. Each type comes with its own conditions that you can choose from in order to configure it for an OPC tag. Each type has its own distinct configuration.

7.3. Configuring Alarm Tags

You can configure any number of alarms for an OPC tag, and in this section we will discuss how you can configure them.

> **NOTE:** Each alarm that you create resides in a configuration database. Therefore, you must create a configuration database for the alarms before you can add alarms. You must also make sure that the configuration database is active before running the alarm server.

In AlarmWorX64, you can configure alarms one at a time, or you can import several OPC tags and generate alarm tags for them *en masse* using an import wizard. In either case, you can create alarm tags from scratch or you can create templates in advance which you can use as the basis for creating new alarm tags.

7.3.1. Creating Alarm Tags One at a Time

Let's start by looking at how you create an alarm tag. At the most basic level, you can create alarms one at a time. To do so, in AlarmWorX64 Server right-click on your database configuration, then select **Tag** from the menu. This opens the alarm tag configuration form with the **General** tab on top, as shown in Figure 7.3.

Give the alarm a **name** and, in the **OPC Input** field, specify the tag whose value you want to use for the alarm. For example, if the alarm is monitoring water pressure, you want to use pressure readings from the pressure gauge. You can click on the ellipsis button to the right of the OPC Input field; this opens the Data Browser where you can navigate to and select the appropriate tag.

You can also specify a **Template** to be used for prefilling some or all of the tag's fields. Templates are a useful tool in both creating and maintaining your alarm tags. We will talk about templates later in this chapter. But for now, it is important that you know that you can change the template to be used for a tag at any time. If you are not sure about the content of a template, clicking the **Jump to Template** button will open the template for you so you can review it before using it for a tag.

The Name, OPC Input, and Template fields always appear regardless the tab you are on in an alarm tag configuration. There are five different tabs in the alarm tag configuration: General, Alarms Limit/Digital, Alarms Deviation/Rate of Change, Alarms Rate Limit/Trigger Limit, and Related Values. We are going start by looking at the General and Related Values tabs. Then we'll look at the six types of alarms that are available to you on the remaining three tabs.

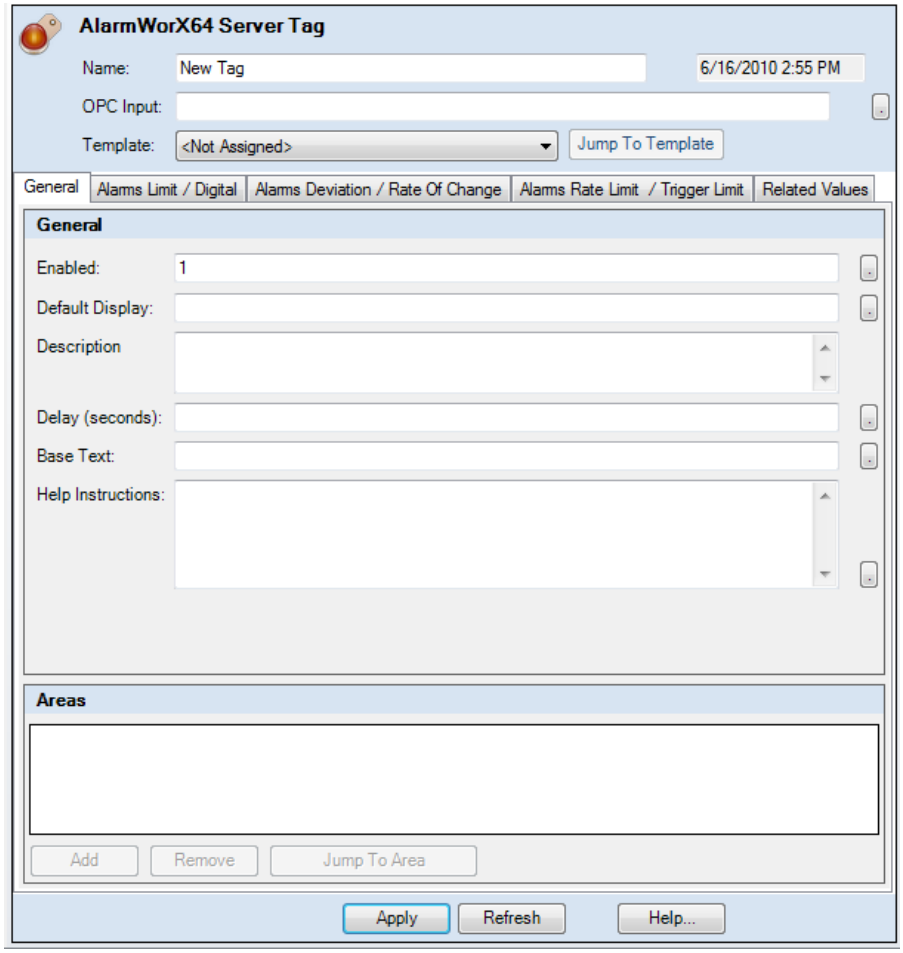


Figure 7.3 - Alarm Tag Configuration

7.3.1.1. General Tab

On the General tab, shown in Figure 7.3, you can configure some basic information for the alarm. Most of the fields in this tab are optional, except for the Enabled field, which is set to true by default. You have the following fields in the General tab:

- **Enabled**: By default, an alarm is enabled when it is initially created (a 1 in the Enabled field means that the alarm is enabled). However, you may prefer to enable and disable the alarm based on a condition. For example, you may not want to monitor water pressure when the valve is shut off because the drop in pressure would trigger the alarm. In this case, you can specify the tag for the valve's reading in the Enabled field such that when the valve is open (1) the alarm is enabled, but when the valve is closed (0) the alarm is disabled.
- **Default Display**: Once you have set up an AlarmWorX64 Viewer or GraphWorX64 display where the alarm has been added so that it can be monitored by an operator, you can identify that display as the **Default Display** for the alarm. Click the ellipsis button to navigate to the file and select it. Note that the alarm can be added to other displays, too.
- **Description**: Add a description for the alarm.
- **Delay (seconds)**: When an alarm condition exists, the server generates the alarm immediately. You can enter a **delay** that postpones the alarm's generation for a few seconds to wait for conditions to return to normal. If the alarm condition still exists after the delay, the server generates the alarm. You may not want to use a delay for every alarm, but it is helpful for offsetting readings that fluctuate wildly or sensors that sometimes return faulty readings. You can also use it with equipment that typically returns to normal quickly.
- **Base Text**: For each alarm condition, you may want to add a message that indicates the alarm state. In the Base Text field, enter information that is required for each of the states; the text in this field is added before the message text for each alarm condition.
- **Help Instructions**: Additional aid for your users comes from any text you enter in the **Help Instruction** field where you can provide the steps to resolve or acknowledge the alarm; you can enter information directly into this field or paste it from the Clipboard. Information entered in this field can display as a tooltip in the alarm viewer when users select and mouse-over the alarm.
- **Areas**: Once you have saved a tag, you can use the bottom of the General tab to add the tag to areas quickly and easily. We'll talk about areas later in this chapter.

7.3.1.2. Related Values Tab

The **Related Values** tab, shown in Figure 7.4, identifies as many as twenty additional values you want to capture when an alarm condition occurs. Related values can be static text strings, OPC tags, or expressions. Capturing additional readings can help you diagnose a problem later.

For example, following an alarm that reported a drop in water pressure on an outtake line, you might want to review the tank's water level and the intake valve. As long as you have added the OPC tags for the water level and intake valve as related values for the alarm, you may log the data and review it at a later day.

Now that we have reviewed the general options available for any alarm tag that you configure, let us look at the details of each of the six types of alarms (Limit, Deviation, Digital, Rate of Change, Rate Limit, and Trigger Limit) you can configure in an alarm tag. Note that you can configure any of the alarms described here, and can even combine them into one alarm tag configuration.

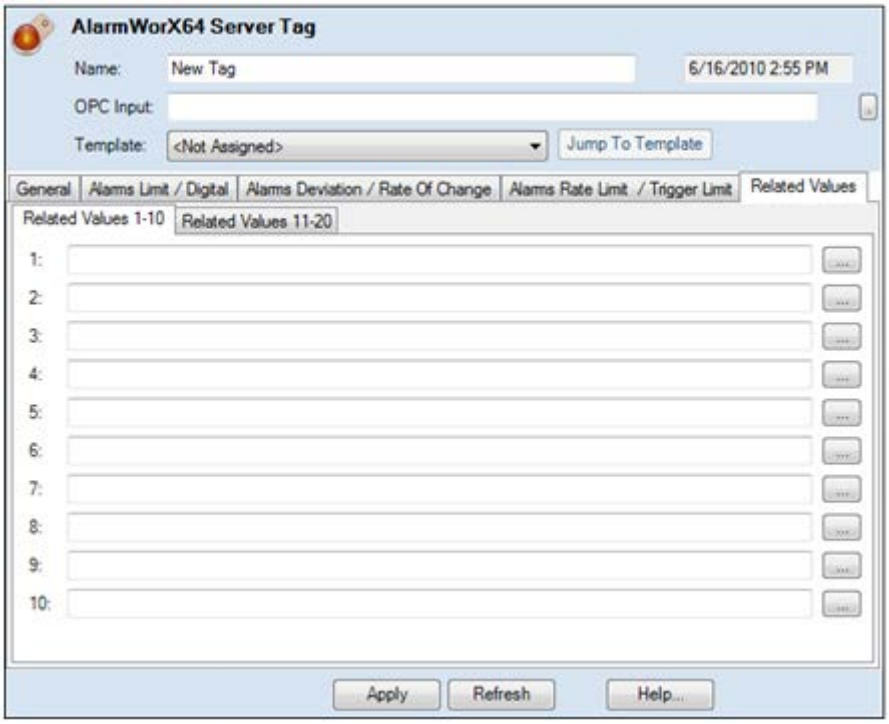


Figure 7.4 - Related Values tab

7.3.2. Limit Alarm

If you go to the alarm tag's Alarms Limit/Digital tab, in the **Limit** pane, shown in Figure 7.5, you can configure an analog **Limit alarm** for the OPC tag. A Limit alarm reports an incoming reading that exceeds a high or low threshold that you have configured. Use this type of alarm for OPC tags whose readings have static limits that you do not want exceeded such as temperature, counters, pressure gauges, etc.

By default, this alarm reads the values of the OPC tag you specified in the OPC Input field. For the purpose of setting an alarm limit, you can override this tag by adding a different tag to the **OPC Override Input** field in the Limit pane.

Let's skip the Deadband value for now, and take a look at the **Value** fields in which you provide the acceptable limits of the tag's readings. You can set one, two, three, or four limits, each with its own warning or alert text, severity level, and acknowledgement requirements. The values that you enter are readings from the tag in the **OPC Override Input** field, if any, or the **OPC Input** field at the top of the configurator.

You can add **Lo** (low value), **LoLo** (very low value), **Hi** (high value), or **HiHi** (very high value) limits. A tag value that is at or below the LoLo value is in an alarm condition; as a result, the alarm generates with the message and severity configured for it, and an operator's acknowledgement of the alarm is required if the **Req. Ack.** value is **1**. Values that are at or below the Lo value do the same, as do values that are at or above the Hi and HiHi values.

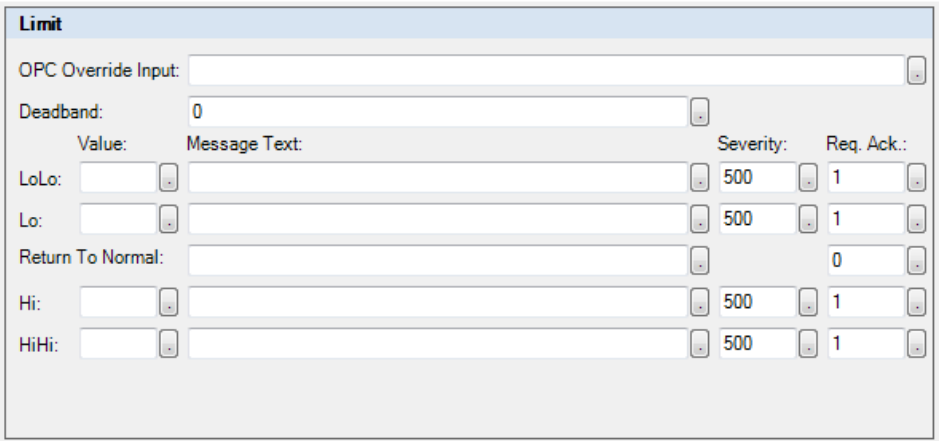


Figure 7.5 - Limit Alarm Configuration - Alarms Limit/Digital Tab

There's a lot of flexibility in your ability to configure any of these limits. For example, you can use the Lo limit as a warning level and LoLo as an alert. You can tie **Message Text** directly to each value that creates an alarm condition. The **Severity** is the OPC-defined value for alarm priority; the OPC severity range is 0 (lowest) to 1000 (highest).

On the **Return to Normal** line, you can also provide the message text that appears when the tag's value returns to normal from an alarm condition and you can require the operator's acknowledgement of a return-to-normal condition. All values between the Lo and Hi limits, exclusively, are assumed to define the normal range.

Let us go back to the deadband value. By providing a value in the **Deadband** field, you identify a buffer zone around alarm limit values that you have entered. Applied to converted analog values, the deadband value is germane to borderline cases in which readings *seesaw* or *blink* into and out of an alarm condition. The alarm server applies the deadband to each limit value; it ignores any reading inside the deadband limits and will not generate an alarm. This is helpful especially if the operator is required to acknowledge any change in conditions. You certainly do not want operators distracted with repeatedly having to acknowledge a condition that is toggling in a borderline condition.

Take a look at the example below in which the high limit is 101. A Deadband of 1 prevents an alarm from being reported on readings of 100 and 102. Were the Deadband 0, these readings would report an alarm.

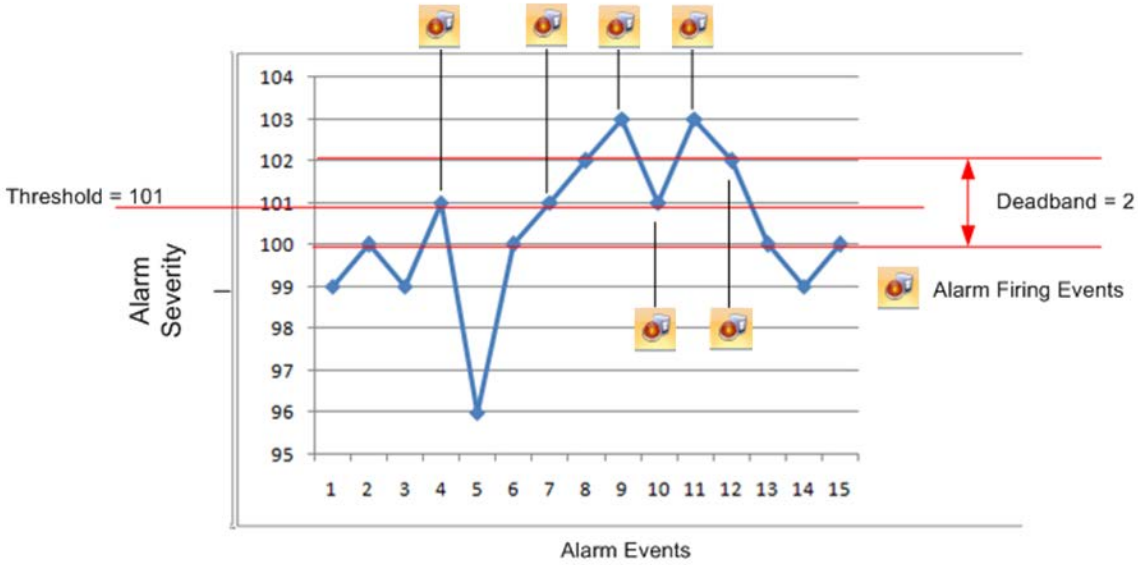


Figure 7.6 - Deadband for Alarms

7.3.3. Deviation Alarm

Similar to the Limit alarm is the **Deviation alarm**, which you configure using the **Deviation** pane on the Alarms Deviation/Rate of Change tab, shown in Figure 7.7. The analog Deviation alarm occurs when the absolute value of the difference between the **OPC Input** tag and the **OPC Input 2** tag falls below or exceeds predefined values. The **OPC Input 2** field in the Deviation pane is required for setting up a Deviation alarm, and is used to calculate the deviation from the OPC Input field. The alarm is triggered if the difference between the two values falls above the high limits or below the low limits specified in the configuration.

All other fields in the **Deviation** pane work in the same way they work for the Limit alarm, but with *one significant exception – the **Value** field*. Instead of entering the *value* of a tag that will set off an alarm, you enter the ***delta*** (the difference) between the two input values that will set off an alarm.

For example, you are creating a Deviation alarm that compares today's ongoing water level readings to yesterday's final water level reading. You have a tag that holds the value of yesterday's final water level, in centimeters; you enter that tag in the **OPC Input 2** field. The **OPC Input** tag at the top of the configurator contains the tag of today's current water level. These two tags are compared.

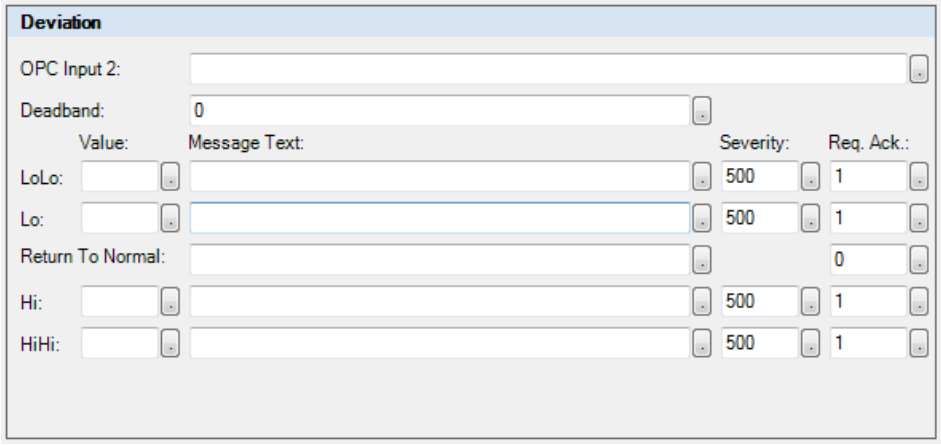


Figure 7.7 - Deviation Alarm Configuration - Alarms Deviation/Rate of Change Tab

Then you enter the delta values at which you want an alarm to generate. For example, you want to be notified if the water level drops or rises more than 2 centimeters compared to yesterday's final value. You would enter a Hi value of 2. You also want to know if it drops or rises 5 centimeters or more. In this case, you would enter a HiHi value of 5. When the difference between the two OPC tags is 2 to 4 it will generate a Hi alarm, and when it is 5 or more it will generate a HiHi alarm.

If yesterday's reading was 50 centimeters, and today the water falls to 48, the server generates a Hi alarm. When the water drops to 45, the alarm server generates the HiHi alarm.

7.3.4. Digital Alarm

If you go to the alarm tag's Alarms Limit/Digital tab, you can configure a **Digital alarm** for the OPC tag in the **Digital** pane, which is shown in Figure 7.8. A Digital alarm occurs when the tag's value goes into a state that you specify.

This alarm reads the values of the OPC tag specified in the **OPC Override Input** field if supplied in the Digital pane, or the OPC Input field at the top of the configuration.

In the **Alarm State Value** field, type the value of the state that triggers the alarm. Since this is a digital alarm, the valid state values for this alarm are limited to 1 and 0. If there are multiple states that can trigger the alarm, you can incorporate those states into an expression. However, the result of this expression must equal 1 or 0. The value that is not the alarming state is considered to be the normal state.

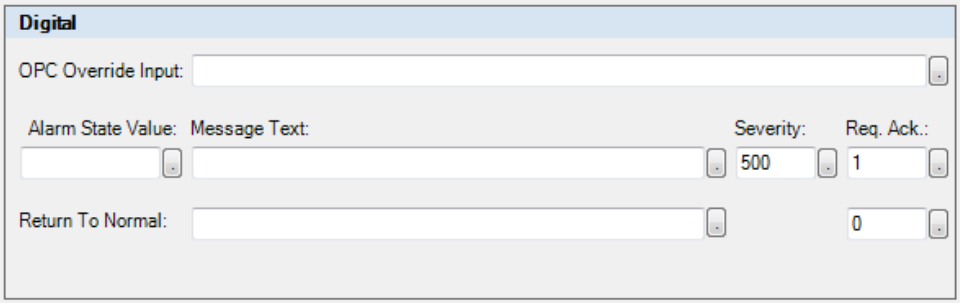


Figure 7.8 - Digital Alarm Configuration - Alarms Limit/Digital Tab

Like all other alarms, you can specify a message and a severity and you can require an operator to acknowledge the alarm. In the **Return to Normal** field, you can specify the message to display when the alarm returns to normal and indicate whether an operator is required to acknowledge a return-to-normal condition.

7.3.5. Rate of Change Alarm

If you go to the alarm tag's Alarms Deviation/Rate Of Change tab, you can configure a **Rate of Change alarm** for the OPC tag in the **Rate of Change** pane, which is shown in Figure 7.9. A Rate of Change alarm occurs if the rate of change in the OPC tag's values is more severe than allowed by the alarm's configuration.

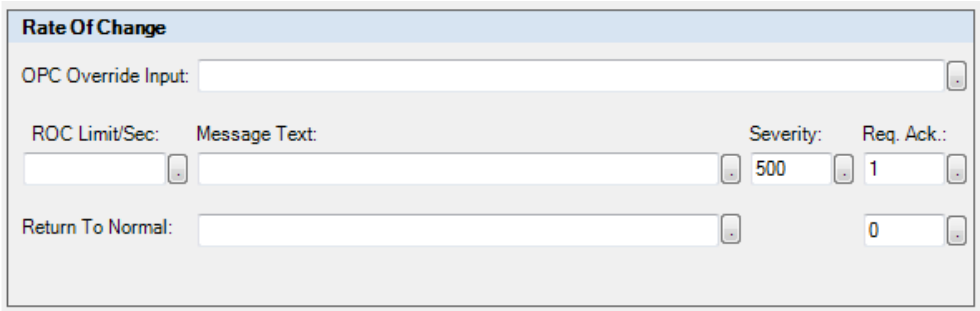


Figure 7.9 - Rate of Change Configuration - Alarms Deviation/Rate of Change Tab

This alarm reads the values of the OPC tag you specified in the **OPC Override Input** field in the Rate of Change pane (if any), or the **OPC Input** field at the top of the configuration.

In the **ROC Limit/Sec** field, specify the rate of change per second that must trigger the alarm. Following our earlier example, you can set up a Rate of Change alarm so that if the water level drops more than 2 centimeters per second, the alarm will report.

The rate of change is calculated by taking the *absolute* value of the last two OPC values and dividing it by the difference of the timestamp from these two values. When entering a rate of change, keep this calculation method in mind.

Like all other alarms, you can provide message text, a severity level, and you can require operator acknowledgement of the alarm. In the **Return to Normal** field, you can specify the message to display when the alarm returns to normal and indicate whether an operator is required to acknowledge a return-to-normal condition.

7.3.6. Rate Limit Alarm

A **Rate Limit alarm** is much like the Rate of Change alarm except that the change is not an absolute number; it is expressed as a positive or negative value. The rate of change is calculated *per second* by taking the increase or decrease in value of the last two OPC values. Using the two values' timestamps, the increase or decrease over the length of a second (that is, the rate) is calculated, then compared to the high and/or low limits defined in the alarm tag. If the rate exceeds one of the limits, the alarm reports.

You configure this alarm using the **Rate Limit (RLM)** pane on the Alarms Rate Limit/Trigger Limit tab, shown in Figure 7.10.

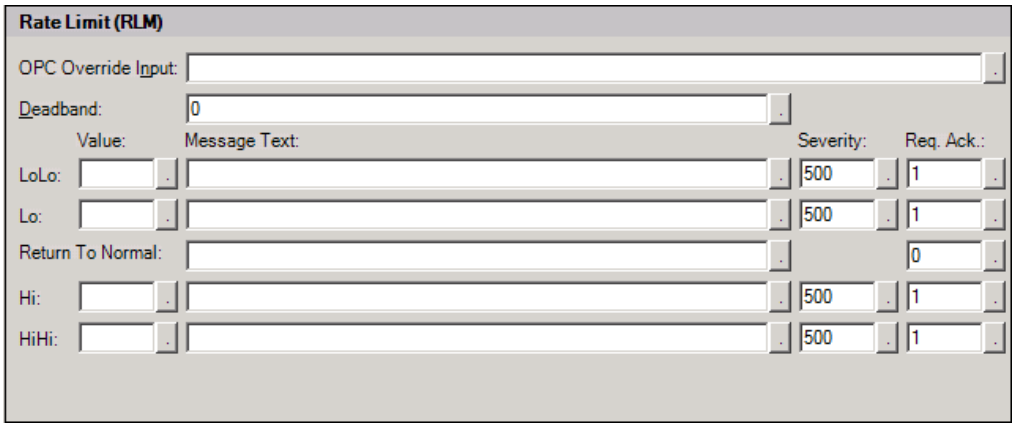


Figure 7.10 - Rate Limit Alarm Configuration - Alarms Rate Limit/Trigger Limit Tab

This alarm reads the values of the OPC tag you specified in the **OPC Override Input** field in the Rate Limit pane (if any), or the **OPC Input** field at the top of the configuration.

In the **Deadband** field, specify a buffer amount surrounding a limit in which the alarm will not signal. The deadband value is required It works the same way here as it does for the Limit and Deviation alarms; it is calculated on borderline alarming limit values to prevent repeated alarm cycles.

Enter values in the **Value** fields of **LoLo**, **Lo**, **Hi**, and/or **HiHi**. The values that you enter are compared to the rate. The alarm is triggered when the OPC tag's rate exceeds the high or low limits. Unlike the Rate of Change alarm, this alarm’s rate is measured as a *real number*, not as the rate's absolute. This lets you set LoLo, Lo, Hi, and HiHi limits for the alarm.

For example, the value -1 is returned and then .5 seconds later a value of 1 is returned for a difference of +2. The difference is applied to the entire second, therefore the rate of change per second is +4. The alarm's Hi limit is set to 5, so no alarm is reported.

Then .5 seconds later a value of -1 is returned for a half-second difference of -2, making the rate of change per second -4. The alarm's Lo limit is set to -2, so an alarm is reported.

As with other alarms, for each level you can provide message text, a severity level, and you can require operator acknowledgement of the alarm. Furthermore, in the **Return to Normal** field, you can specify the message to display when the alarm returns to normal and indicate whether an operator is required to acknowledge a return-to-normal condition.

7.3.7. Trigger Limit Alarm

The **Trigger Limit** alarm reports when the OPC tag's value changes and requires a runtime operator's acknowledgement. This type of alarm is useful for an OPC tag whose value rarely changes, such as tag that reports a state. When the value changes, the alarm will report and will not reset until after a runtime operator acknowledges it. With this alarm, there is no normal condition; any change in the value triggers the alarm.

You configure this alarm using the **Trigger Limit (TLA)** pane on the Alarms Rate Limit/Trigger Limit tab, shown in Figure 7.11. By default, this alarm reads the values of the OPC tag you specified in the **OPC Input** field. You can override this tag by specifying a different tag in the **OPC Override Input** field in the Trigger Limit (TLA) pane.

This alarm is different in that you can disable and activate it. To activate it, put a check mark in the **Enable** check box.

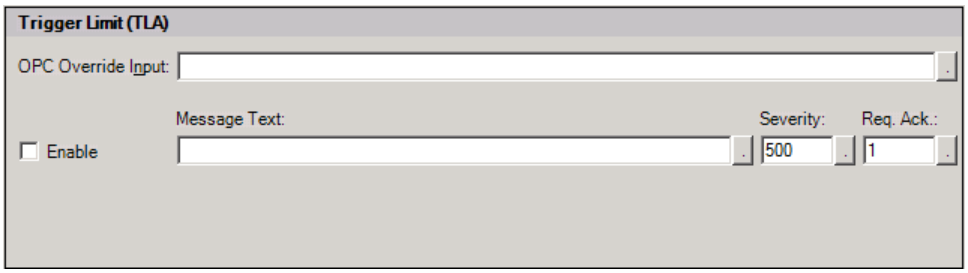


Figure 7.11 - Trigger Limit Alarm Configuration - Alarms Rate Limit/Trigger Limit Tab

Provide message text and a severity level. Then enter **1** in the **Req. Ack.** field. Because by definition this alarm requires an operator to acknowledge it, ***1*** *is the only value you should be entering in this field.* (Although you can enter other values, no other value is supported at this time.)

7.3.8. Alarm Tag Templates

A configuration in the AlarmWorX64 Server database exists for the purpose of holding alarm tags defined for OPC tags. There can be hundreds or thousands of alarm tags for a configuration, and creating them one by one takes time as well as attention to detail.

You can, however, create these tags using templates. Templates contain the settings that are typically used by certain types of OPC tags. You can use templates to define individual alarm tags (which we just looked at), or for defining multiple alarm tags using a wizard (which we'll look at next).

Not only does this save you time in creating alarm tags, it also makes it easier to maintain alarm tags as time passes. Why? Because after you use a template to create an alarm tag, when you change the template, the alarm tags continue to reference the template; changes that you make to the template are also made to the alarm tags that reference the template.

7.3.8.1. Creating a Template for OPC Alarm Tags

The steps for defining a template are the same as for defining an individual alarm tag. The form for creating a template is nearly identical to the form for creating an alarm tag.

To create a template for an alarm tag, in AlarmWorX64 Server, in the Project Explorer, right-click **Templates** in the AlarmWorX64 Server navigation tree, then select **Template**. The form that opens is nearly identical to the form for creating an alarm tag but with one major difference – an additional tab that we will look at soon. Use this form to define the values that are shared by the OPC tags you will be creating alarm tags for. The fields are nearly identical to those we looked at for individual alarm tags, earlier in this chapter.

7.3.8.2. Creating Alarm Tags Using a Template

To use a template in the creation of alarm tags, select the template's name from the **Template** field. Then create the tag and save it.

When you create or maintain an alarm tag created using a template, you'll see that these tags look different in the AlarmWorX64 Server Tag configurator than alarm tags created without one. Values that the template populates are highlighted with a pink background. If you type a different value, the highlighting disappears. Fields highlighted in pink can be maintained from the template and will change if they are changed in the template. Once you change a tag's value causing the pink highlighting to disappear, the field can no longer be maintained from the template.

7.3.8.3. Maintaining Alarm Tags from a Template

If OPC alarm tags were created using a template, the alarms still reference the template. Instead of modifying each OPC alarm tag individually, you can maintain the alarms uniformly from the template. When you change a value on the template, the value is essentially "pushed" to the alarms that reference the template, allowing you to maintain uniformity and making it easy to update alarm tags.

Before making changes, you may want to remind yourself of the alarms that refer to the template. To do this, go to the template form's **Alarms Assigned** tab, shown in Figure 7.12 where you can see a list of all the alarm tags that reference the template.

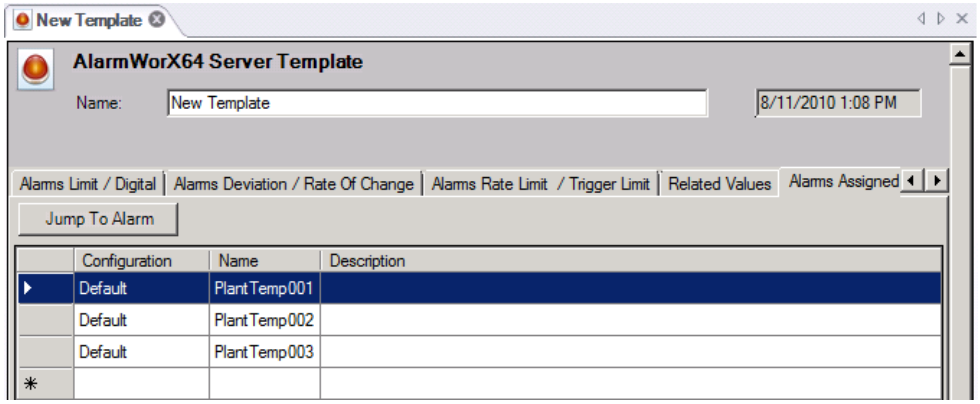


Figure 7.12 – Alarms Assigned Tab for a Template

It is important to note that *not all alarm tag fields can be maintained from the template*. Instead, you must open the alarm tag itself to maintain these fields:

- The tag's **name** and **OPC Input**
- The tag's **Enabled** checkbox
- **Deadband** values in the tag's alarms
- **Severity levels** and **Required acknowledgement** options in the tag's alarms

When maintaining a template's values, keep in mind the following:

- Only those alarm tags that were created using the template reference the template
- Once an alarm tag's field is changed manually, the field's link to the template is broken and that field can no longer be maintained from the template. Even if you restore the field to its original value, the link is broken. However, other unmodified fields on the alarm tag can still be maintained from the template.

7.3.9. Creating Several Alarm Tags at Once

At this point, we now know that an alarm tag is an OPC tag that is configured with one or more alarms with limits that specify when an alarm for the tag will report. We know that using templates helps us to create and maintain alarm tags. And we know how to define alarms one at a time. But it's likely that you have hundreds or even thousands of OPC tags that you need alarms tags defined for, and defining them one at a time will be too time-consuming. When this is the case, you can use the Tag Import Wizard to create alarm tags for multiple OPC tags.

Before you can use the Tag Import Wizard, you must have a template that you can use as the basis for all of the alarm tags you are about to define. Because templates are defined with specific types of OPC tags in mind, you'll want to plan ahead to make sure you import the right OPC tags using templates that are appropriate for the alarm tags you are creating.

In AlarmWorX64 Server right-click on your database configuration, then select **Tag Import Wizard** from the menu. This opens the AlarmWorX64 Server Import Tags form, as shown in Figure 7.13.

From the **Alarm Template** drop-down list, select the template you want to use for creating alarms for the multiple OPC tags. Optionally, if you want to assign the new alarm tags that you create to one particular area, you can select the area from the **Alarm Area** dropdown list.

Then enter the **Base Item Name**. This is the name that will be given to all of the alarm tags that are created as part of this procedure; for example, you might use PlantTemp as the base name for OPC tags that register temperature readings. A number will be appended to the base name for each alarm tag so that each alarm tag's name is unique. Numbers are increment by 1. If you leave this field empty, the name that gets assigned to each alarm tag is its OPC tag path. Note that you can rename tags later, if you want to.

If you have already created alarm tags using this base name, you can use the **First Number** field to indicate the starting number of the alarm tags that are defined. You can also specify the **number of places** that the number will occupy.

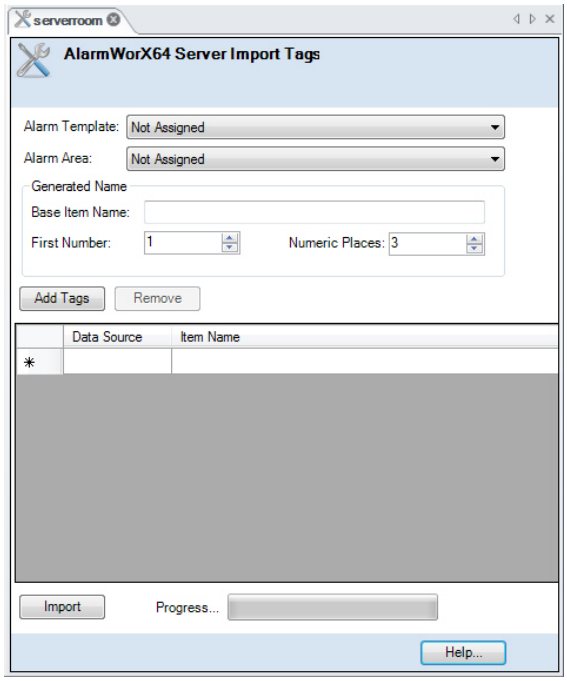


Figure 7.13 - Alarm Tag Import Wizard

Click the **Add Tags** button to open the Data Browser. This is where you will navigate to the OPC tags you are defining alarms for, select them, and click OK. You can do this several times if necessary to add all of the tags you want to include in the creation of alarm tags.

Once you add them to the AlarmWorX64 Server Import Tags form, the tags appear in the **Data Source** column. Each alarm tag's **Item Name** is the Base Item Name plus a number. Be aware that after you have added OPC tags to this list, any changes you make to the Base Item Name will not be reflected in the list; the list shows the alarm tag names exactly as they will be created. You can remove items from the list by selecting them and clicking the **Remove** button.

When you are ready to create the alarm tags, click the **Import** button. When the progress meter at the bottom of the form is full, all of the alarm tags have been created. The Results dialog box opens and lists the tags that failed because of errors and the tags that were successfully crated. You can review the new alarm tags in the Project Explorer. At this point, you can modify any of the tags or use them in AlarmWorX64 Viewer and GraphWorX64 displays. Remember to set up protection for alarms by assigning them to users or groups in Security Server, which we will be looking at later in this course.

7.4. Group Alarm Tags by Area

To organize the myriad of alarm tags that you create, you can group alarm tags into areas. An area is nothing more than a folder that you create in AlarmWorX64 for a physical area in a plant, a category of sensor, or a grouping of machines or types of equipment. It can be any category into which you want to classify your alarm tags. Not only do areas provide a way to organize, they can be used by clients for filtering.

You can include an alarm tag in any area you like and multiple areas if appropriate. Each area can have sub-areas, and sub-areas can overlap into other areas. For example, you can create an area for Alkaline Sensors, another for Security Alarms, and another for the Baltimore Plant that has sub-areas defined within it. Tags for security alarms in the Baltimore Plant area are also categorized into the Security Alarms area. Tags for some of the Baltimore Plant's alkaline sensors are categorized into the Alkaline Sensors area.

Figure 7.14 provides an example of areas in the Project Explorer pane; the Critical Temps area is expanded and one of its alarms displays in the pane on the right.

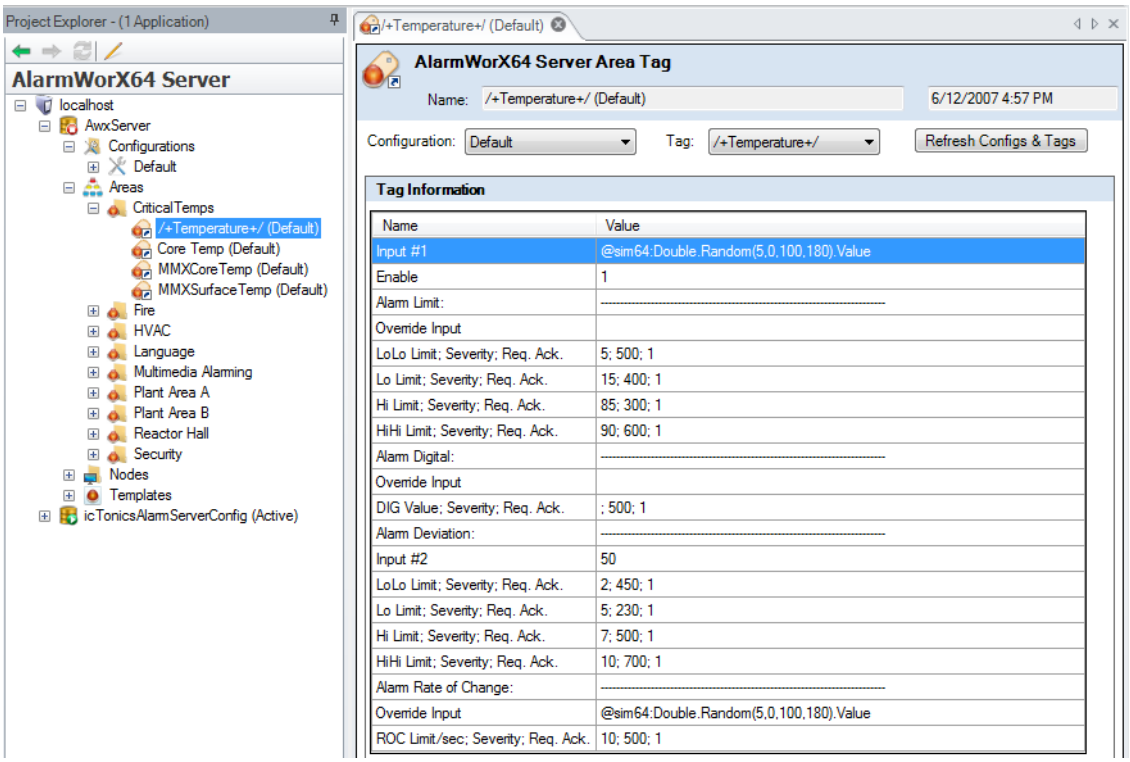


Figure 7.14 - Areas for Grouping Alarms

7.4.1. Adding an Area

To add an area, right-click on the **Areas** node, then select **Area** from the popup menu. This provides a very simple form in which you provide a name for the area and a description.

You can also add a sub-area using a similar method. Right-click on the area where you want to create the sub-area, then select Area from the popup menu. You will get the same configuration interface.

7.4.2. Adding an Alarm Tag

Once you define the new area or sub-area, you can add tags to it: right-click on the area and select **Area Tag** from the popup menu, which displays the configurator illustrated in Figure 7.15. After you pick the tag's database configuration, you can select the alarm tag from the **Tag** dropdown list.

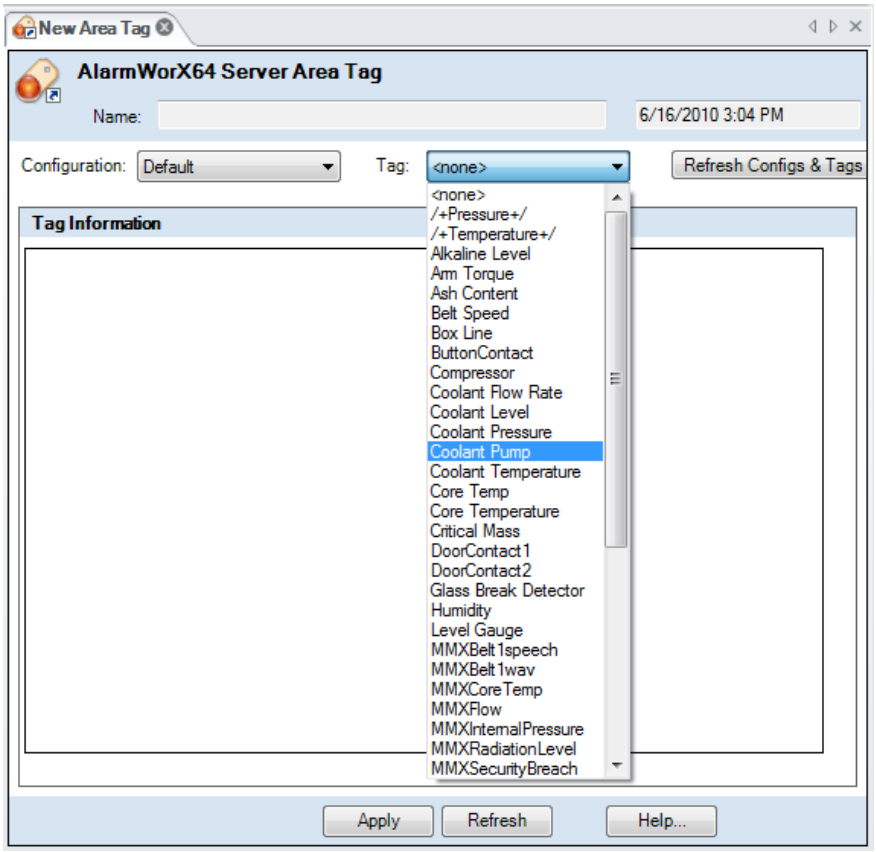


Figure 7.15 - Adding an Alarm to an Area

Once you select the alarm tag, the alarm's information displays in the **Tag Information** box.

If you browse back to the alarm, you should see the area listed in the **Areas** section of the alarm tag. You can also add or remove areas to the alarm in this section by clicking on the Add or Remove buttons.

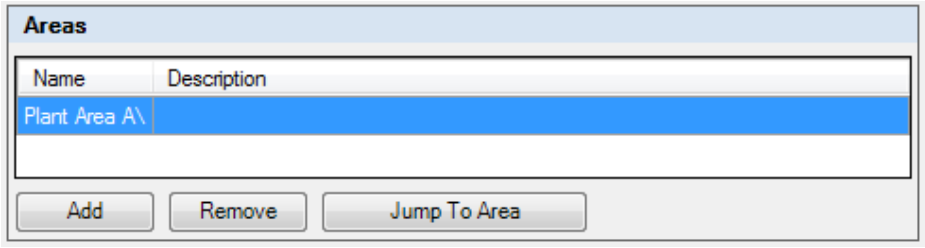


Figure 7.16 - Areas Section in an Alarm Tag

If you click on the Add button, the Select or Enter Area name dialog comes up. You can browse for the area and select it in this dialog to add it. Make sure that the area you want to add is in the text field at the top of the dialog, otherwise, the OK button will be grayed out.

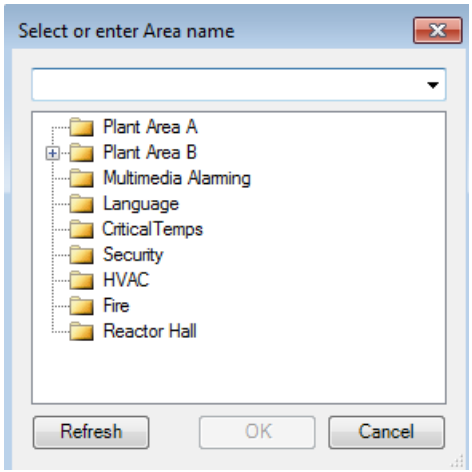


Figure 7.17 - Select or Enter Area Name Dialog

You can also remove an area from the alarm by selecting the area, and click on the Remove button.

7.5. Importing and Exporting Components

All of your alarm tags are created inside an AlarmWorX64 Server database configuration. In the lab, you will see how easy it is to create a database configuration, and then you will add AlarmWorX64 Server components to it. Alternatively, you do have the option of using an existing configuration database as a starting point if you have such a configuration database available. GENESIS64 provides the ability to export an Alarm Server database or individual components to .XML, .CSV or Excel Workbook files. This enables you to import those components into other AlarmWorX64 servers or new configurations. You can use the import to create new components or to update existing components. You can also use the export feature for the purpose of backing up an Alarm Server or its components.

In AlarmWorX64 Server, the components you can export and/or import are: a database, the Configurations folder, an individual configuration, the Areas folder, an individual area, the Nodes folder, and the templates folder. But AlarmWorX64 Server is not the only GENESIS64 product in which you can import and export components.

As you proceed through this course, keep a watch for the Import and Export options in components' right-click menus. The options are available throughout the GENESIS64 Workbench. The import and export features work the same for all components in the Workbench, and are available to help you expedite the configuration of your data. Whether you are using these features to move data, to copy existing data and then update it, or to back up data, importing and exporting components can make your data creation quicker and easier.

7.5.1. Exporting Alarm Server Components

The export copies a specified component and all of its sub-components to any of the supported file types. For example, if you export the Area folder, all areas and the alarm tags that make up that folder are exported. You might export a component so that you can import it elsewhere; or you might export simply to make a backup copy.

To export a component of the AlarmWorX64 server, right-click the component you want to export (for example, right-click the Configurations folder), then select **Export** from the menu. In the dialog box that opens, navigate to the destination or folder where you want the exported (e.g., .XML) file to be saved, and provide a name for the file. Specify a file name, and click OK. The component and all levels beneath it are exported to the file.

7.5.2. Importing Alarm Server Components

When you import components, you copy them from a file to a location of your choice. When you import a file into AlarmWorX64 Server, you can import new items only, or existing items only, or both. This lets you use the import not only *to create new items* in the alarm server, but to *update existing items*, too.

To import a component from an exported (e.g., .XML) file, right-click the component you want to import, then select **Import** from the menu. In the Import dialog box that opens, specify how you want import to happen. If there are components in the file that don't exist in the destination location, specify whether you want these components to be added. To add them, put a checkmark next to **Insert New Items**.

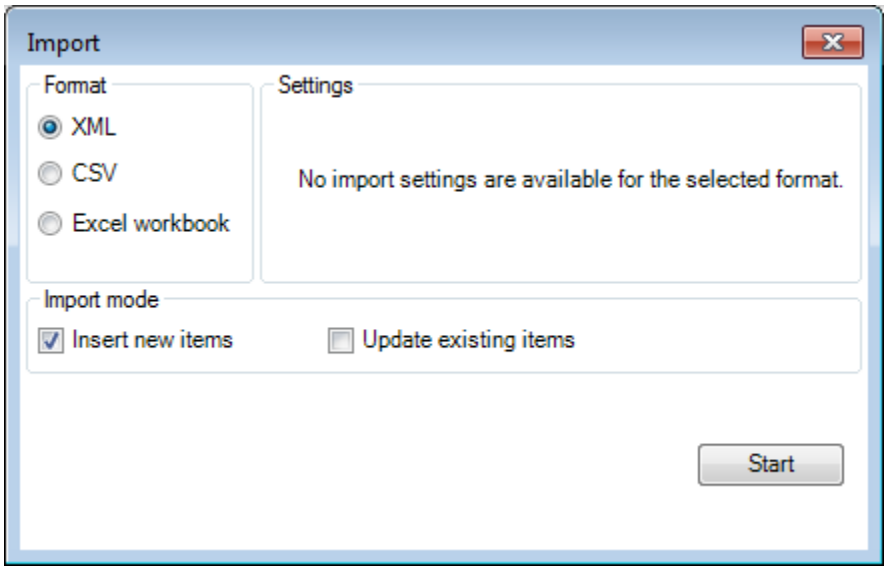


Figure 7.18 - Import Options

If there are components in the file that already exist in the destination location, specify whether you want the components to update the components in the destination location. To update them, put a checkmark next to **Update Existing Items**.

Click **Start Import**. When the import is done, you can look in the destination location for the imported component or components and confirm that they were imported as planned. Once components are imported, you can modify them in accordance with the alarm requirements of the configuration you imported them to.

Lab: AlarmWorX64 Server L7

7.1. Lab Overview

In this lab, we will create alarms that will alert us when the drink-mixer-tank level is too high or too low. We will also create an alarm that alerts us when the turner-blade in the tank stops turning. We will view these alarms in the AlarmWorX64 Viewer in the next section.

Estimated time to complete this lab: 20 minutes

7.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Create a new alarm server configuration.
- Create limit and digital alarms.
- Create areas for different alarms.
- Associate your alarms to the appropriate areas.

7.1.2. Support Files

You do not need any supporting files to complete this lab.

7.2. Alarm Configuration Database

1. In order to receive alarm notifications, we will need to first configure our alarm server. In this section, we will go through the steps to create a new configuration file for our icTonics beverage company project.

2. Open the **Workbench-SL** if you closed it since the previous lab.

3. Expand the provider list in the left-hand tree control and select the AlarmWorX64 Server. You could also select the AlarmWorX64 Server by clicking on this icon at the bottom of the tree control window.

   Note: When your mouse hovers over each icon, you should see a tooltip saying which provider the icon relates to.

4. Expand the AlarmWorX64 Server tree under the localhost. Notice the green icon next to the (Active) configuration database. We will create our own configuration database by right-clicking on **localhost → New Database**.

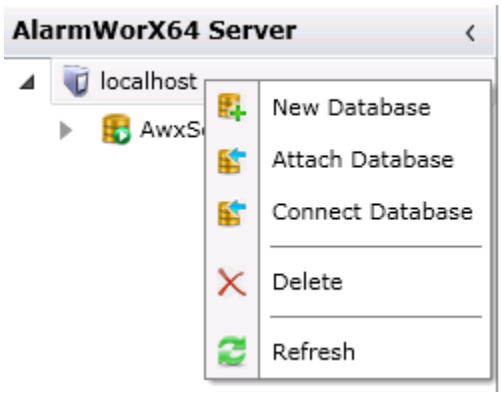


Figure L7.1 - Creating New Alarm Server Configuration Database

5. The **Create a new Database** dialog opens.

6. **Uncheck** the "**Include sample data**" checkbox, if it is checked, and change the **Database name:** to **icTonicsAlarmServerConfig**, Click **OK**.

7. Once the database is successfully created, you will see the icTonicsAlarmServerConfig below the AlarmWorX64 Server localhost. Notice the icon to the left of the icTonicsAlarmServerConfig database is red, indicating that it is not currently an active configuration database.

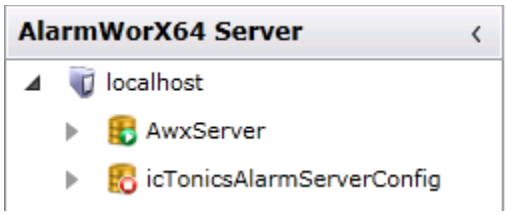


Figure L7.2 - New Deactivated Configuration

8. Expand the icTonicsAlarmServerConfig database. You will see four folders underneath it: **Configurations, Areas, Nodes, and Templates**.

9. Since everything will be local to this computer, we will not worry about the Nodes. However, in the next few sections, we will create different Areas and a Configuration that will contain your alarms. As we proceed with our configuration, adding description information is optional.

7.2.1. Alarm Areas

1. Right-click on the **Areas** folder and select **"+ Add Area**".

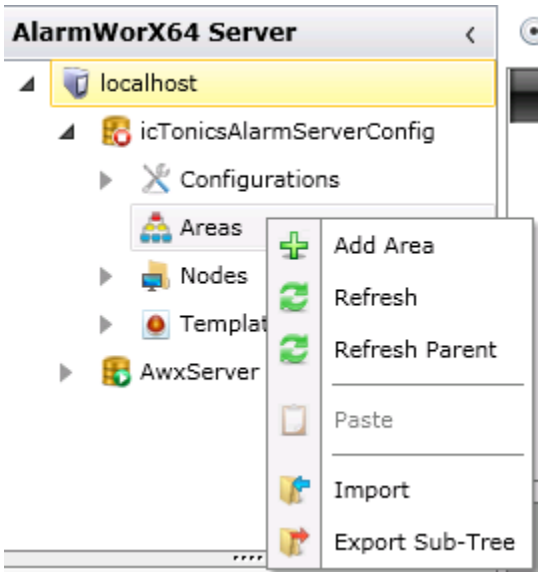


Figure L7.3 - Adding an Area

2. A new Workbench tab opens that allows you to create a new Area. **Name** the Area, "**USA**". Click **Apply & Close**.

3. Create a sub-area by right-clicking on the area called USA and select "+ **Add Area**". We'll name this area "**Foxboro**", Click on "**Apply & Close**".

4. Create another sub-area under Foxboro called "**Tank Levels**". Click "**Apply & Close**".

5. When you are done, your areas should look like the figure below.

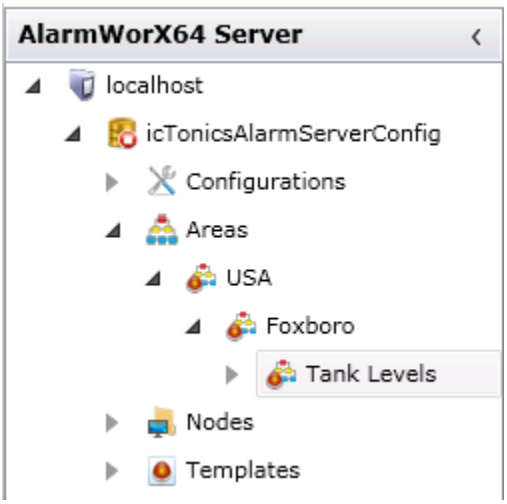


Figure L7.4 - Alarm Areas

7.2.2. Alarm Configurations

1. Right-click on Configurations and select "+ **Add Configuration**" to create a new alarm configuration.

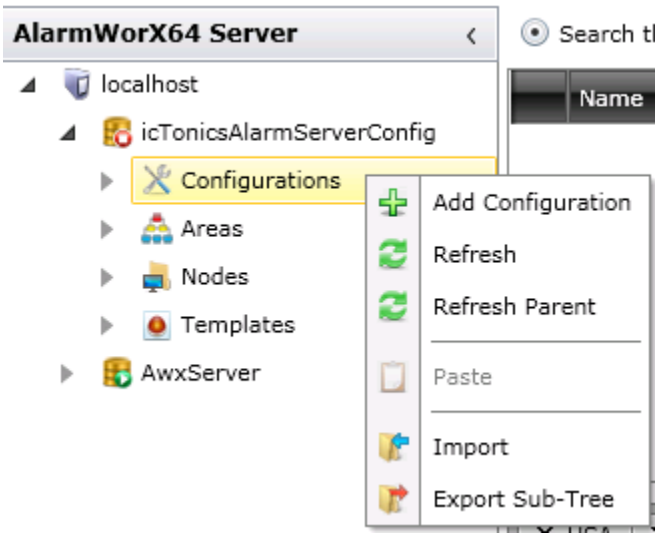


Figure L7.5 - Inserting Alarm Configuration

2. **Name** this configuration "**icTonicsAlarms**" and put a checkmark in the "**Default (Active) Configuration**" checkbox to make this configuration active upon startup.

3. Click on "**Apply & Close**" to save changes.

4. Right-click on the **icTonicsAlarms**, under the Configuration tab, and select "+ **Add Tag**" to add an alarm tag.

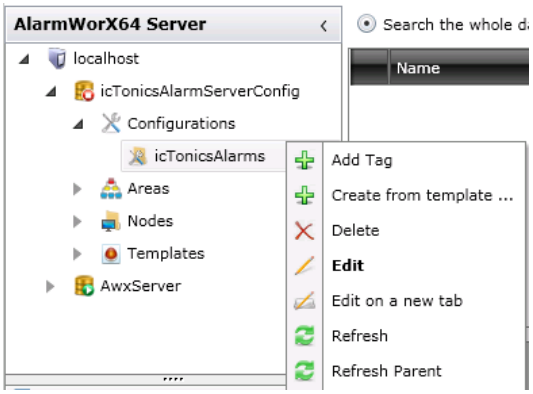


Figure L7.6 - Adding Alarm Tags

5. A new tab opens with alarm tag properties. Give this alarm tag the name "**Tank1 Level**".

6. In the OPC Input: field, click on the ellipse button to the right of the text box.

7. In the **Data Browser**, locate the tag:
@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.TankLevel.Value.

8. Click **OK.**

9. In the **Base Text** field, with the **General** tab selected, enter the text "**Tank1 level is**".

10. Click "**Apply**" to save the tag.

11. In the **Areas** pane, near the bottom of the dialog, click on the "**Click here to add new item**" entry.

12. In the Select Area name dialog, expand the tree and select **Tank Levels.**

13. **Click OK.**

14. Click **Apply**.

15. Select the **Alarms Limit / Digital** tab. In the Limit section, configure the alarm properties as shown in the table below.

Limit Alarm Values

Condition	Value	Message	Severity
LoLo	10	very low	800
Lo	20	low	500
Hi	80	high	500
HiHi	90	very high	900

16. In the **Return to Normal**: message field, enter "**normal**". Your Limit section should look like the Figure L7.below.

17. Click on "**Apply**" to save changes.

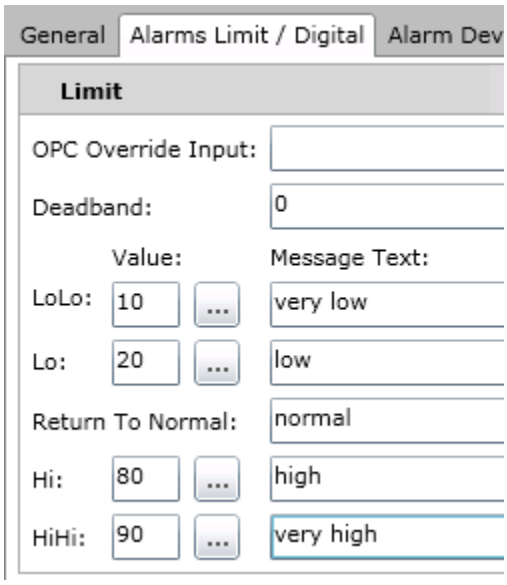


Figure L7.7 - Limit Alarm Configuration

18. Using a similar procedure, **add** another **Tag** under **icTonics Alarms**. The configuration will differ slightly since this will be a Boolean tag. Under the **Alarms Limit / Digital** tab, in the **Digital** section fill the entries according to the chart below. When configured completely, this tag will alarm if the churning blade1 has stopped moving.

Digital Alarm Details

Name:	Churning Blade1 Status
OPC Input:	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.ChurningBladeStatus.Value
Base Text:	The churning blade in Tank1
Alarm State Value:	0
Message Text:	has stopped moving
Return To Normal:	is moving

19. We are now done configuring the alarm server. However, there is one important step left. We need to make **icTonicsAlarmServerConfig** the **Active** database and confirm the alarm Service starts properly.

20. As we perform the activation procedure, monitor the Start/Stop light on the side menu. Right-click on the **icTonicsAlarmServerConfig** database and select "**Make Active**". Make sure that you have activated your configuration database so that it shows (Active) and there is a green indicator. Also, the AlarmWorX64 Service light on the ribbon should be Green.

7.3. Alarm Tag Multiply

1. Now we will add similar alarms for Tank2 and Tank3. For this, we can use the Multiply function, which makes it easier to create similar alarms.

2. In the upper section of the split window, right-click on the "**Tank1 Level**" alarm tag and select "Multiply".

3. Set the **Number of copies** to "**2**", the **First number** to **2** and the **Numeric Places** to **1**.

4. Click the **Apply to all** button.

5. In the **Modify** column, select the **Checkbox** for the **Base Text**, **Name** and **OPC Input** fields.

6. Fill in the values of the selected fields according to the table below.

Note: The {0} is a place holder that will be replaced with the number generated by the multiply feature.

Multiply Values

Base Text	Tank{0} level is
Name	Tank{0} Level
OPC Input	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank{0}.TankLevel.Value

7. When your dialog resembles the figure below, Click on "**OK**".

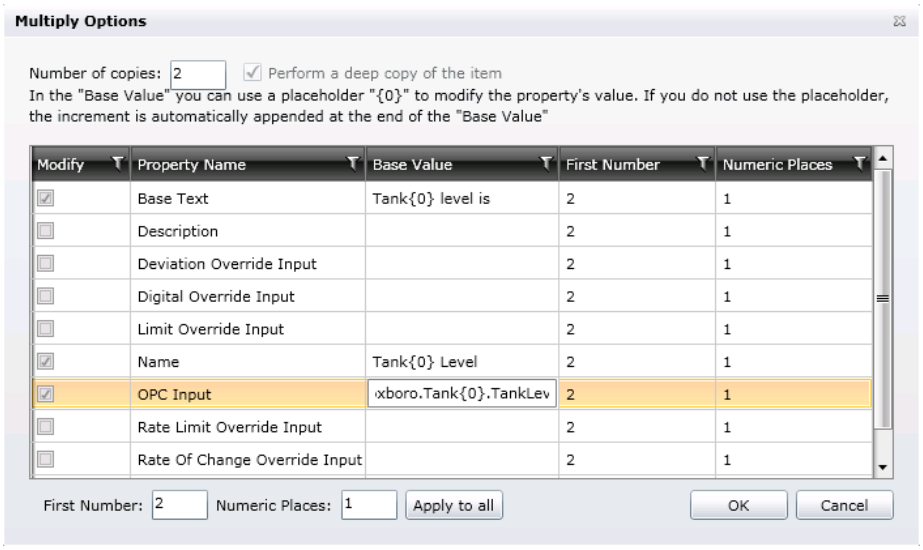


Figure L7.8 - Multiply Options Dialog Box

Note: As an alternative method, you could Copy and Paste to create multiple alarm tag entries.

8. From within the upper section of the split window, left-click on the "**Churning Blade1 Status**" alarm tag and select **Copy**.

9. Right-click on "**icTonicsAlarms**" (under Configurations) in the tree control and select **Paste**. Click **OK** to close the Warning dialog.

10. Again, right-click on "**icTonicsAlarms**" (under Configurations) in the tree control and select **Paste**. Click **OK** to close the Warning dialog.

11. Manually update the two new entries as follows.

Name	Churning_Blade2 and Churning_Blade3
OPC Input	Change 1 to 2 and 3 respectively
Base Text	Change 1 to 2 and 3 respectively

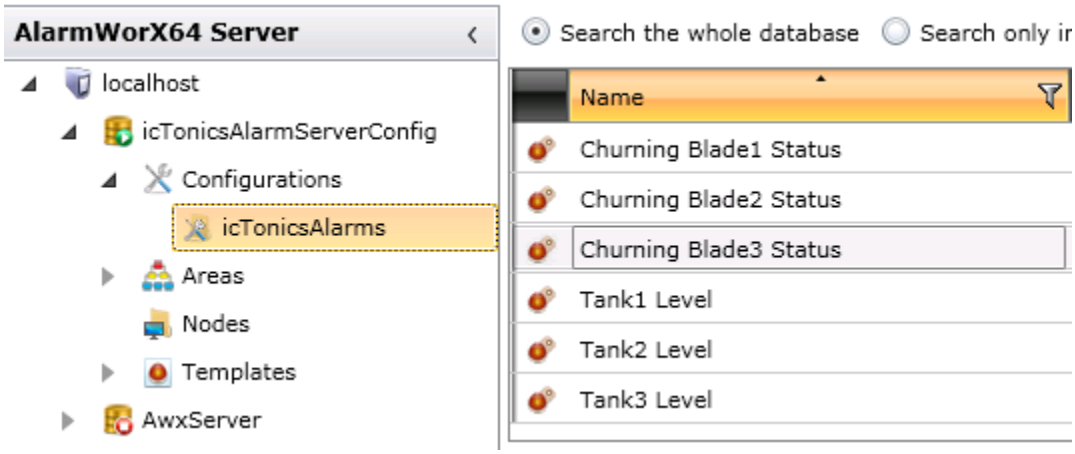


Figure L7.9 - IcTonicAlarms after Multiply and Copy / Paste

This concludes this lab.

AlarmWorX64 Viewer 8

The AlarmWorX64 Viewer is client application that provides real-time and historical alarm information within the GENESIS64 product family. Alarm information displays in a grid-like view similar to how it worked in GENESIS32.

The viewer connects to OPC UA servers and the legacy OPC AE servers to provide alarm display and management features based on the connections to the data source that you specify.

In AlarmWorX64 Server, you control how often a client can access the server for data (polling rate). In the AlarmWorX64 Viewer, you determine:

- Which alarms display on the screen
- What the alarm display looks like
- How the alarms are grouped and sorted

The AlarmWorX64 viewer, as indicated by its name, can be used to view alarms, like those shown in Figure 8.1. You can also use it to acknowledge alarms and do simple alarm analysis. You can add an AlarmWorX64 viewer inside the Workbench or you can add the AlarmWorX64 control onto a GraphWorX64 design surface. You can also insert the AlarmWorX64 viewer into any .NET Framework form.

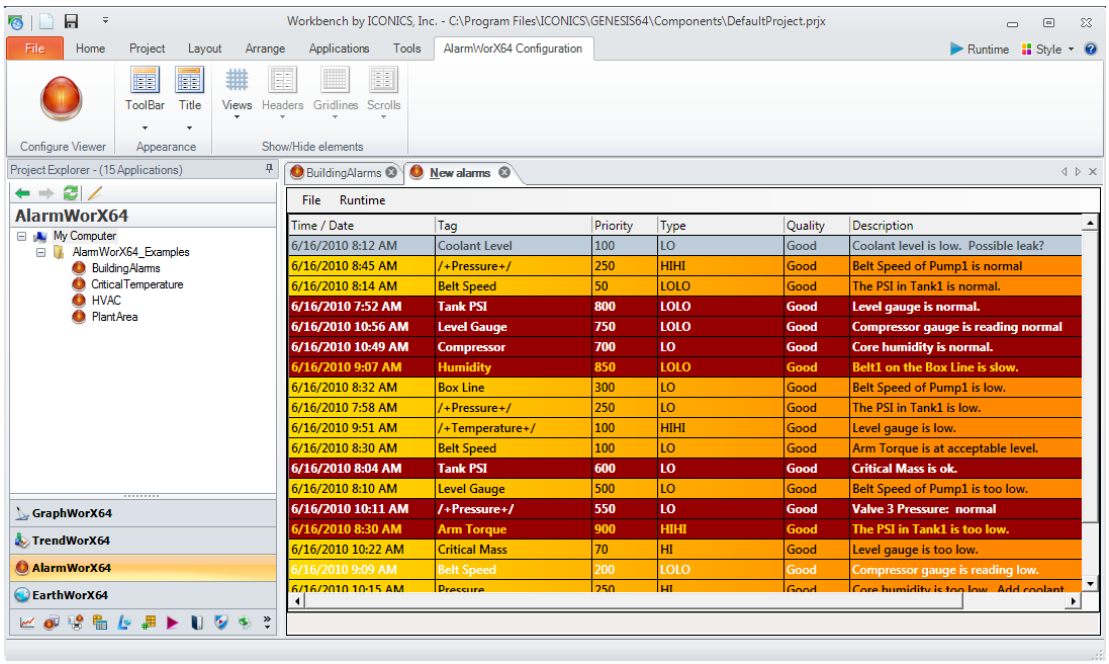


Figure 8.1 - AlarmWorX64Viewer Inside the Workbench

If you like, you can display alarms in a chart or grid, like the one shown in Figure 8.2, which provides a summary or aggregate view of alarms organized by the criteria you specify. Each AlarmWorX64 viewer can have multiple tabs and each tab can be connected to multiple grids and charts.

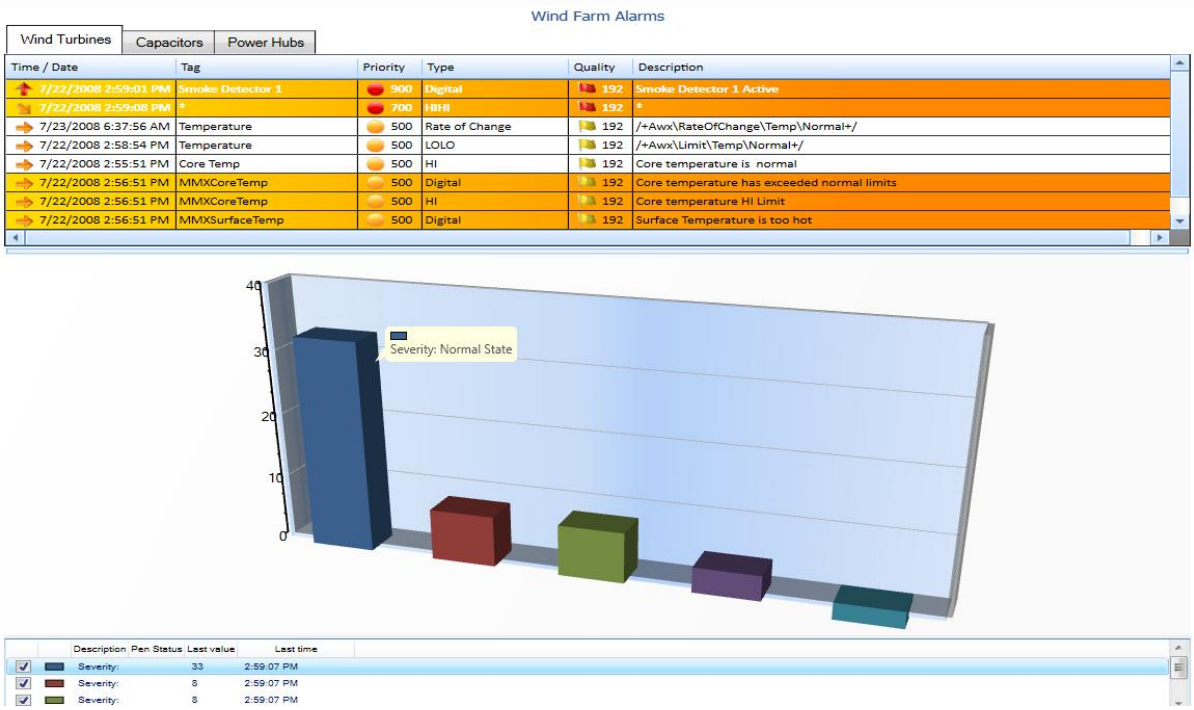


Figure 8.2 - AlarmWorX64 Viewer with a Summary Chart

By the end of this chapter, you will be familiar with the following:

- The alarm viewer control.
- Tabs, grids, and charts in the alarm viewer.
- Grid Configuration control.
- Sources, appearance, and behavior.
- Status indicators and text translators.
- Grouping ranges and grouping.
- Columns and conditions.
- Alarm viewer runtime options.

8.1 Configuring the Viewer

AlarmWorX64 Viewer can be configured in the Workbench. To open the configurator, you click the Configure Viewer button on the AlarmWorX64 Configuration tab or double-click on the AlarmWorX64 object in a GraphWorX64 display.

The AlarmWorX64 Viewer configurator appears as shown in Figure 8.3 below. The configurator is divided into two parts: on the left is a tree view of tabs, grids, and charts; on the right are properties for the selected item. AlarmWorX64 automatically adds at least one tab and one grid to the display. You can alter the display of the viewer, tab, or grid objects; but only the grid object and chart object can connect (or *subscribe*) to an alarm event source.

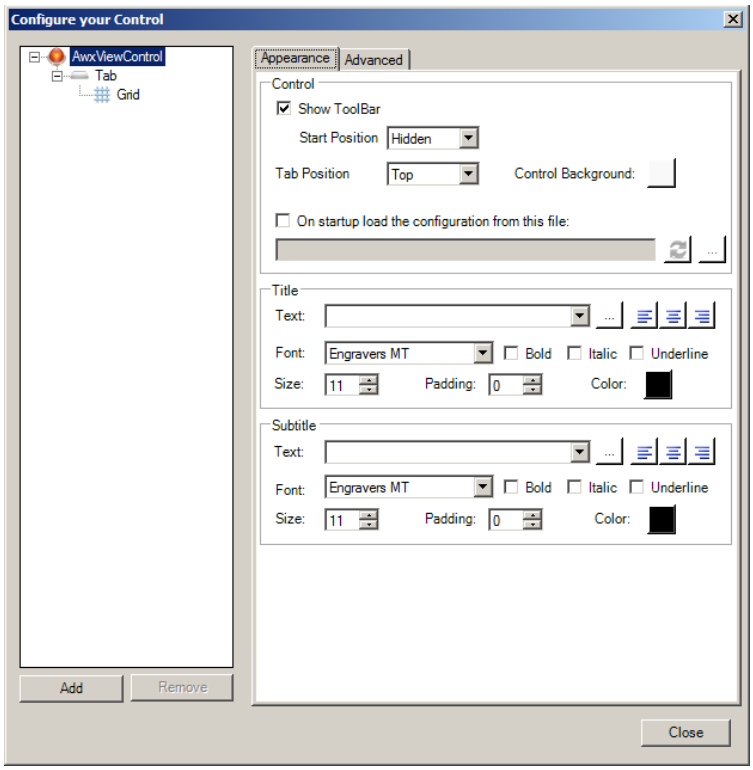


Figure 8.3 - Configuring the Viewer's Appearance Tab

In Figure 8.3, the viewer is selected in the navigation tree, making its Appearance and Advanced tabs available on the right. On the viewer's Appearance tab, you can:

- Control the viewer's appearance.
- Dock the toolbar to the top, bottom, right, and left, as well as float the toolbar (these operations are available in runtime as well).
- Enter and format a name for the viewer.
- Add a subtitle as a second line below the title and format it.

The Advanced tab lists other properties for the viewer. Note that all items in the navigation tree have an **Advanced** tab that lists additional properties for the item.

8.1.1 Adding a Tab

To add a tab to the viewer, select the AlarmWorX64 Viewer in the tree control, and click on the "Add" button at the bottom. (Alternatively, you can right-click on the AlarmWorX64 Viewer, and choose Add → Tab as shown in Figure 8.4.) Then you can edit the tab properties in the tab's Appearance and Advanced tabs on the right.

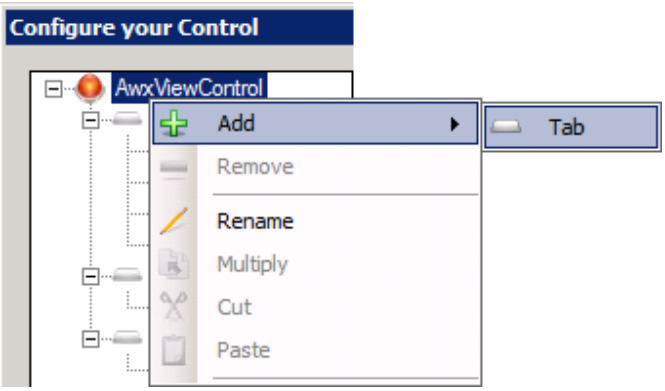


Figure 8.4 - Configuring AlarmWorX64 Viewer

Using the tab's Appearance tab, shown in Figure 8.5, you can customize the title that appears in the tab at runtime and specify the tab's properties when it is selected and unselected. Notice the ellipsis button next to the title's Text field. Clicking the ellipsis button opens the Data Browser where you can assign a language alias (letting you translate tabs for a multi-lingual user base) or expression. You can also apply these property values to all of the tabs in the AlarmWorX64 Viewer.

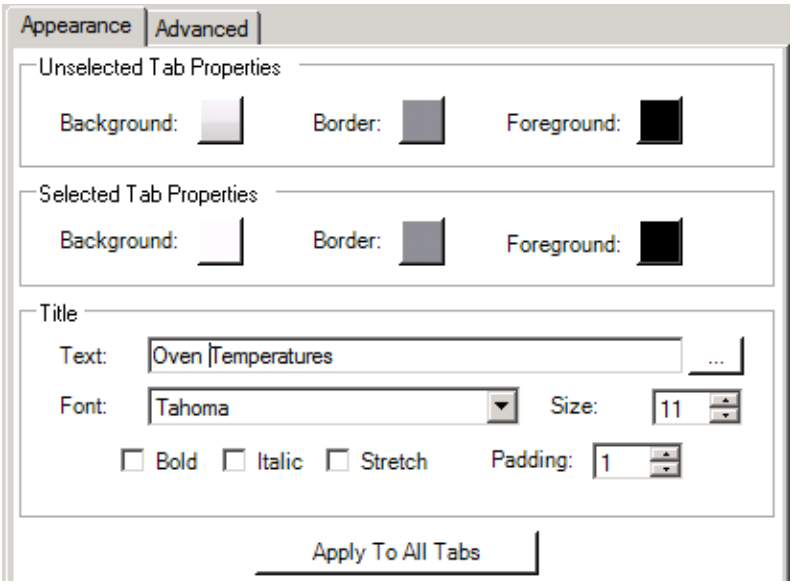


Figure 8.5 - Configuring AlarmWorX64 Viewer

8.1.2 Adding a Grid or Chart to a Tab

To add a grid or chart, in the navigation tree you can select the tab that will contain the grid or chart. Then, click on the "Add" button at the bottom and select "Grid" or "Chart" from the dropdown list. Alternatively, you can right-click on the tab in the navigation tree, and select Add → Grid or Add → Chart as shown in Figure 8.6.

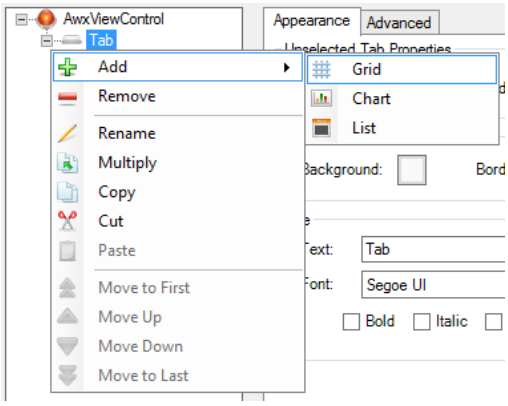


Figure 8.6 - Adding a Grid or Chart to a Tab

Adding a chart is like adding a grid, but with fewer options. The chart properties are shown in Figure 8.7. Because charts and grids are similar, and because grids offer many more options, this chapter will describe AlarmWorX64 Viewer using grids as an example. However, keep in mind that grids and charts are configured in much the same way.

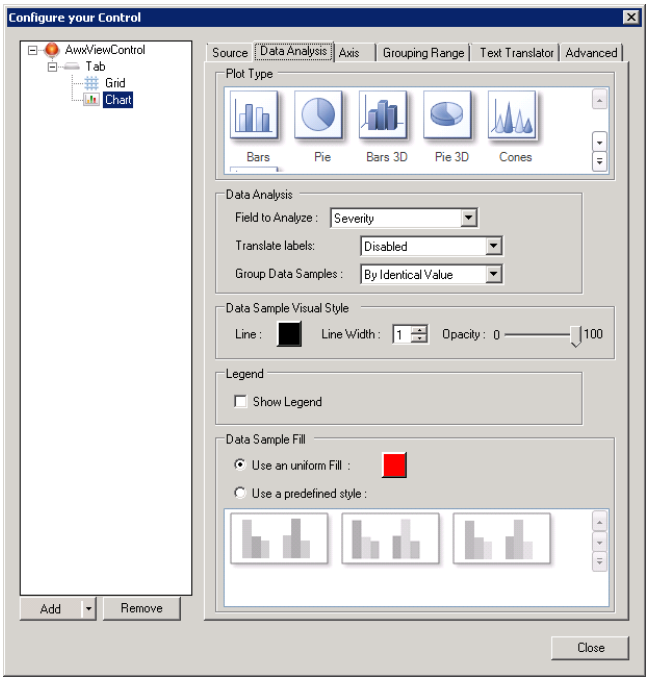


Figure 8.7 - Chart Added to a Tab in AlarmWorX64 Viewer

8.1.3 Adding an Alarm Subscription to a Chart or Grid

Charts and grids are the AlarmWorX64 Viewer component where you add the OPC tag alarms that you want the display to monitor. When you add an alarm, the chart or grid is said to *subscribe* to the alarm. Once you have added a subscription, the AlarmWorX64 Viewer gets alarm updates from real-time alarms connected to an alarm server, which is the source of our alarms.

To make this connection, you must specify the alarm source. To configure the alarm source, click on the grid or chart object in the tree control. As a result, the **Source** tab, shown in Figure 8.8, displays in the source properties where you define the alarm source.

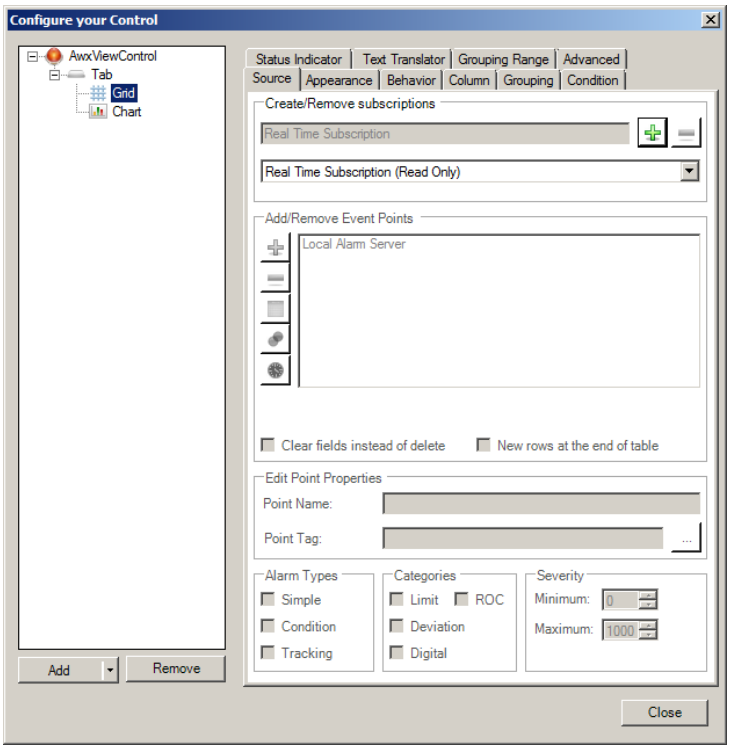


Figure 8.8 - Real Time Alarm Subscription

To add an alarm subscription, first use the **Create/Remove Subscriptions** section at the top of the Source tab to create a new subscription list. Click the "Add" button, you will get a popup menu list beside the button. From the menu list, you can choose "real Time Subscription", "Historical Subscription" or "Alarm Subscription Wizard". Next to this selection, you can name your new subscription in the upper text bar. You will notice that the lower the content in the lower text bar will change correspondingly when you rename your subscription. You can also click the down arrow to change your subscription type.

Then select the OPC servers that you want to subscribe to in the **Add/Remove Event Points** section. Click on the "Add" button in this section to bring up the Data Browser as shown in Figure 8.9.

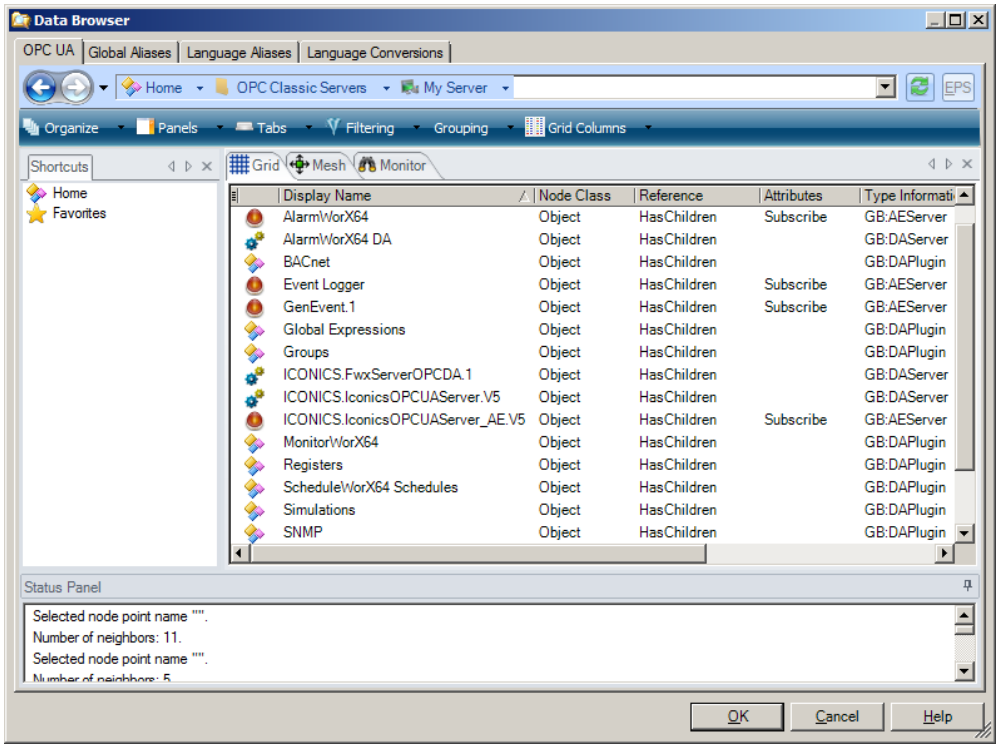


Figure 8.9 - Browsing for an Alarm Subscription

As you can see, there are many OPC servers in the list. You will be able to subscribe to a legacy alarm server (AlarmWorX32 Server) if you have it installed. In addition, as shown in Figure 8.9, part of the GENESIS64 Alarm Server is also a DA server. Make sure you select the AE Server (the one that reads AlarmWorX64 instead of AlarmWorX64 DA) for this subscription.

> **Note:** You can also browse for a historical alarm that will replay a timeframe of your choosing. If you select the Historical option, you will also need to specify the time range for the data to be replayed.

Once you have added a subscription, you will see it in the Add/Remove Event Points section. You can then select the subscription and click on the "Edit" button to add or remove fields for the alarm subscription, using the **Add/Remove fields from the subscription** dialog box shown in Figure 8.10.

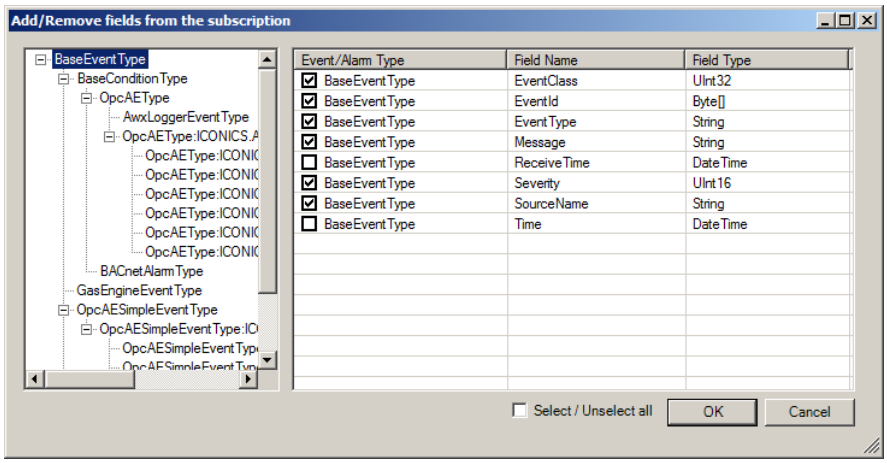


Figure 8.10 - Add or Remove Fields in an Alarm Subscription

8.1.4 Configuring a Grid

The remainder of this chapter describes how to format a grid on an AlarmWorX64 Viewer tab. There are many tabs containing different options that allow you to personalize the alarm grid. We will go through most of these tabs and their properties.

8.1.4.1 Appearance Tab

Use the grid's **Appearance** tab, shown in Figure 8.11, to configure the appearance of the grid. Each grid can have its own style and features. You can also select the elements to show or hide in the grid. To achieve uniformity in appearance among all of your grids, you can even apply your style choices to all grids in the tab, or all grids in the viewer.

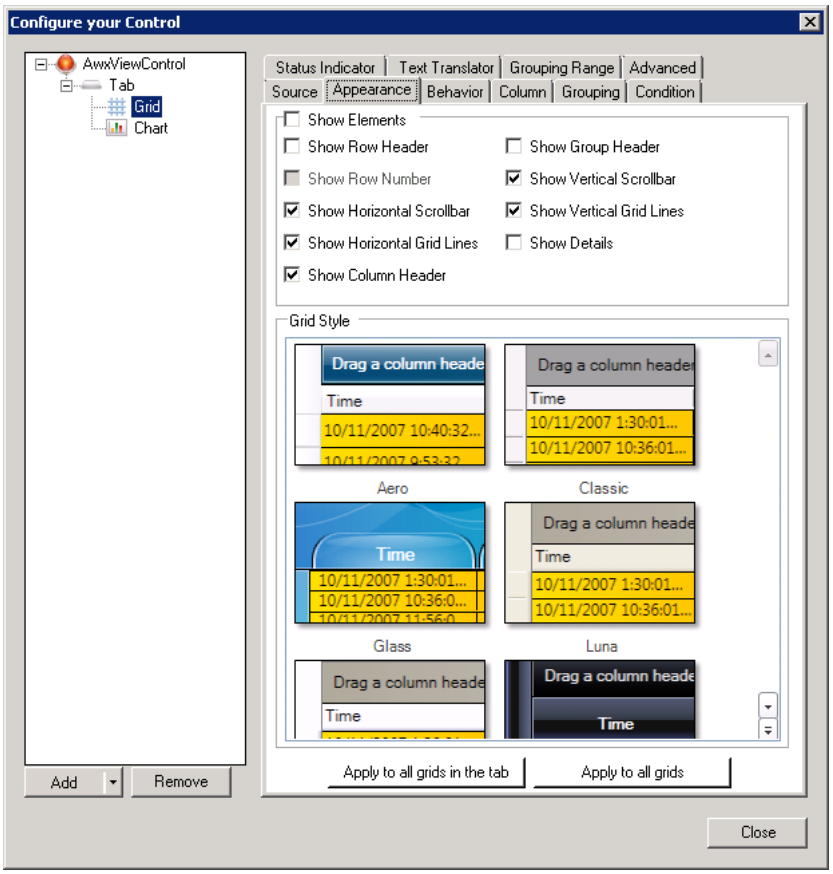


Figure 8.11 - Appearance Tab for a Grid

8.1.4.2 Behavior Tab

The grid's **Behavior** tab is shown in Figure 8.12. On this tab are options for runtime features.

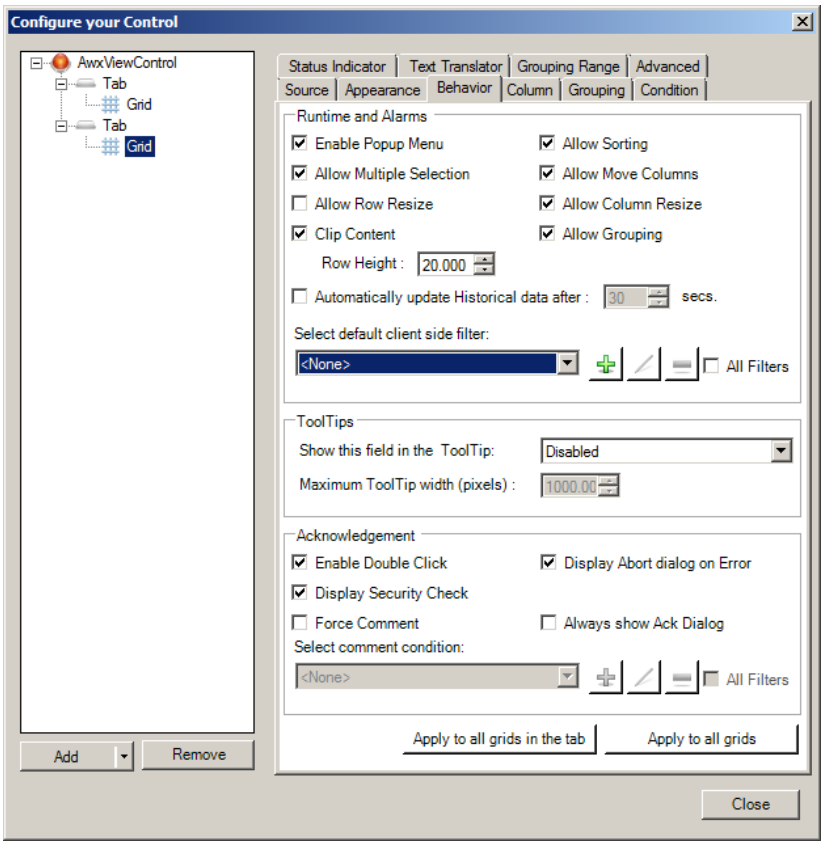


Figure 8.12 - Behavior Tab for a Grid

In the **Runtime and Alarms** section, use the options to configure what runtime users are allowed to do in the viewer. You can also create client side filters, which help you to limit the alarms shown in the grid, making it easier for users to find a particular alarm. For example, you can limit the display to alarms that have higher priority or alarms within a certain area.

You can create your client-side filters in the Behaviors tab. Click on the "Add" button next to the "Configure Client side filter" label to bring up the **Configure Alarm Filter** dialog. Click on button to edit the existing filter. Click to delete selected filter. In the Configure Alarm Filter dialog, you can create your own client side filter. The dialog is intuitive. To create a filter, you need to first specify the name of the filter in the top textbox. Then, you can specify your alarm state, type, sub conditions and category in the radio box.

You can also customize the alarm severity, tag, message, etc by clicking the check box first. The button beside each row can help you define the global aliases and the language aliases. Figure 8.13 shows an example of a filter. Any filters you create within this dialog are usable throughout this instance of the control.

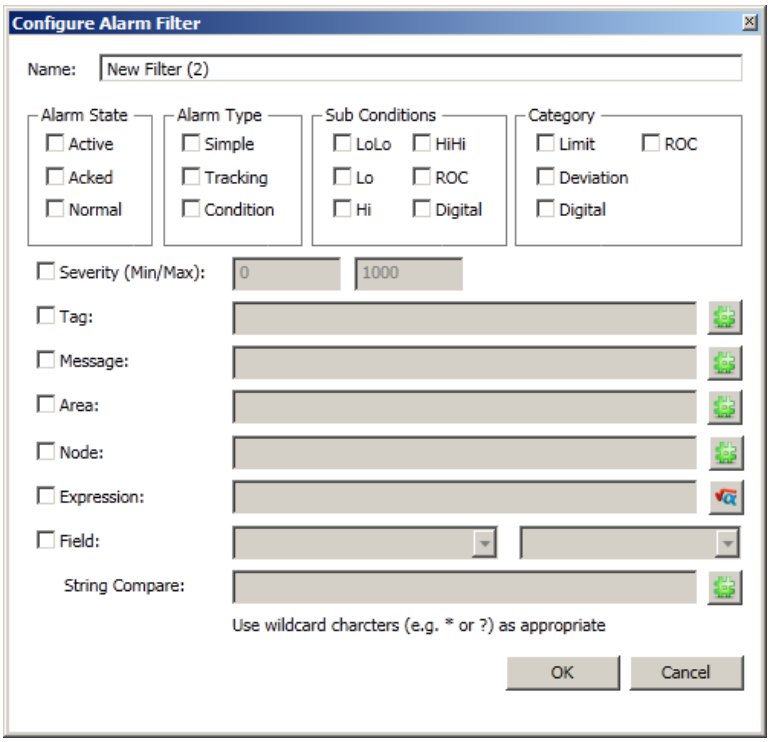


Figure 8.13 - Filter in the Edit Shared Filter Dialog

You can also enable **tooltips** for alarms. Remember that you can create help text in the alarm server. You can enable tooltips that display the help text configured in the alarm server to guide the operator when an alarm occurs.

You also specify alarm **acknowledgement** controls, including whether comments are required when an operator acknowledges an alarm. You can also apply the properties that you set for this grid to other grids.

8.1.4.3 Status Indicator Tab

The **Status Indicator** is a special feature of AlarmWorX64 Viewer that shows key performance indicators (KPIs) in the AlarmWorX64 Viewer grid. Status icons are a good way of providing a quick way for operators to gauge the alarm conditions that they see on a display.

A status indicator consists of a set of icons you configure for the indicator, such as a set of arrows, flags, faces, symbols, and anything else you want. During runtime, these icons swap in and out to give the operator an indication of an alarm's state. For example, as an alarm becomes more severe, the display shows a red arrow. As the alarm becomes less severe, the arrow displays first a yellow arrow and then a green one.

Each icon set is called a **dictionary**. In addition to the predefined dictionaries of status indicators, you can import additional sets.

As shown in Figure 8.14, each status indicator consists of a set of filters that define the levels of severity. Each filter is assigned its own image (that is, an icon from the selected dictionary) and a Show Value checkbox which, when checked, shows the original value of the cell together with the image.

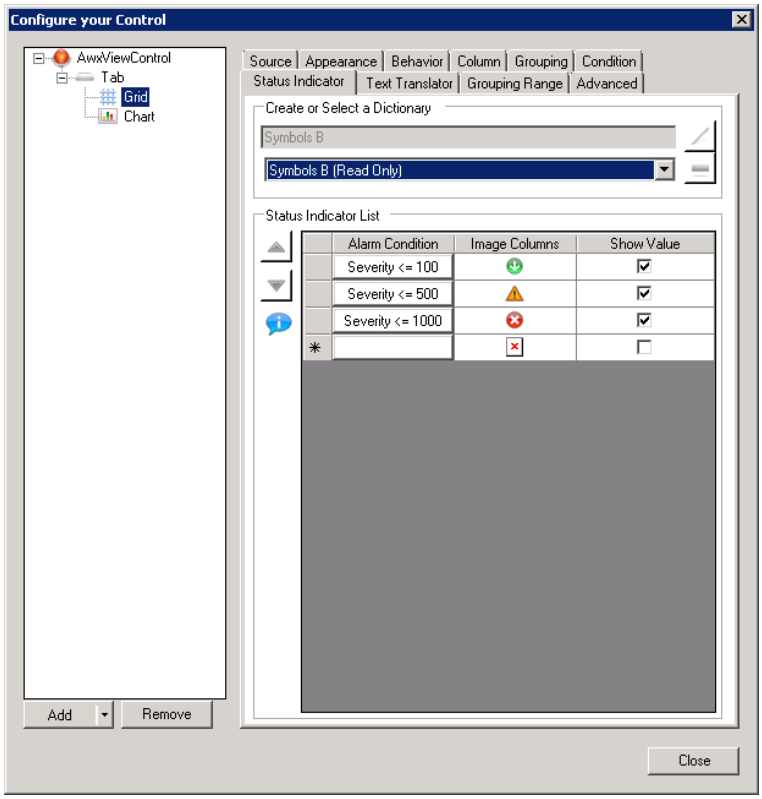


Figure 8.14 - Status Indicator Tab for a Grid

You can define different images to display using different conditions. You can define a condition by clicking on a cell in the **Alarm Condition** column. This brings up the **Edit Shared Filter** dialog as shown in Figure 8.13. In here, you can define the conditions required to display the indicator. When you are defining a condition for a status indicator, keep in mind that you can use any alarm attribute. For example, one filter could be **Severity > 100 AND Tag = 'Temperature'**. In this case, the filter's image will display for any alarm whose severity is higher than 100 and whose alarm tag name is 'Temperature'.

Once you have created a status indicator, you can go to the **Column** tab, as shown in Figure 8.15, to apply the status indicator to any column.

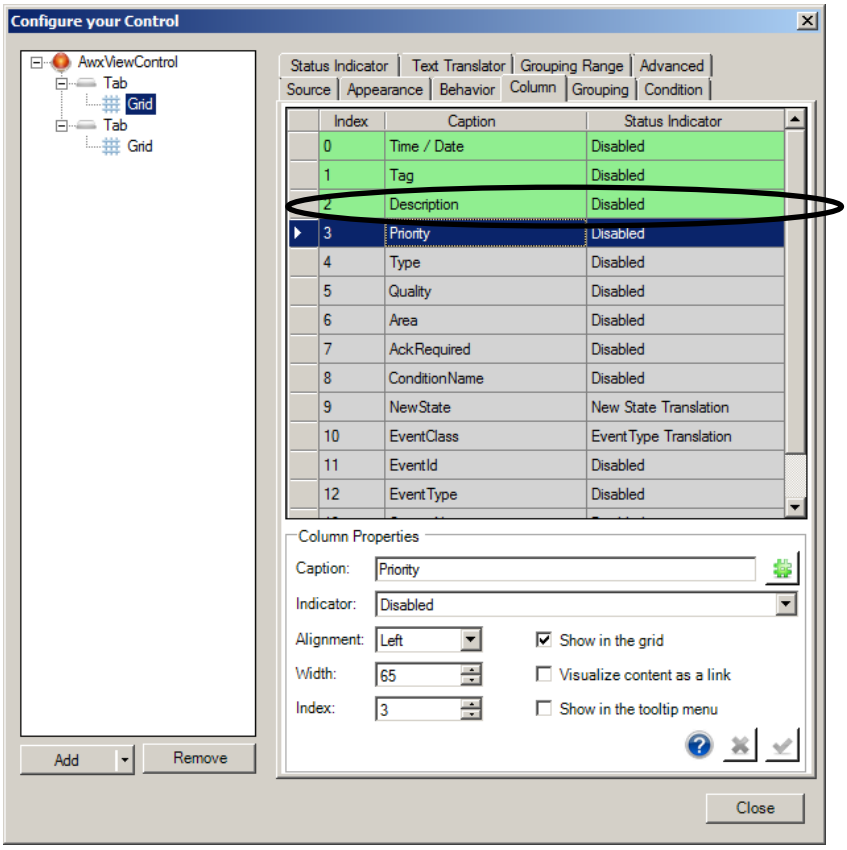


Figure 8.15 - Column Tab Showing a Column's Status Indicator

The result is shown in Figure 8.16. The images are applied to the cells of the column when the condition is true for the whole row.

Time / Date	Tag	Priority	Type	Quality	Description
10/4/2010 3:24 PM	**Tank PSI**	**625**	**LOLO**	**Good**	**The PSI in Tank1 is too low.**
10/4/2010 3:23 PM	**Scale**	**700**	**LOLO**	**Good**	**Scale: Reading is low.**
10/4/2010 3:23 PM	Radiation Level	800	HI	Good	No Radiation detected. System ok.
10/4/2010 3:23 PM	ROCTrigger	500	Rate of Change	Good	ROC on Analog1
10/4/2010 3:23 PM	Pump1	450	LOLO	Good	Pressure in pump1 is too low
10/4/2010 3:24 PM	Pressure	600	HI	Good	Valve 3 Pressure: normal
10/4/2010 3:24 PM	MMXVatLevel	500	HI	Good	fluid in vat number 1 HI Limit
10/4/2010 3:24 PM	MMXVatLevel	500	Digital	Good	fluid in vat number 1 is too high
10/4/2010 3:24 PM	MMXTankOverflow	500	Digital	Good	The main storage tank is overflowing
10/4/2010 3:24 PM	MMXSurfaceTemp	500	Digital	Good	Surface Temperature is too hot
10/4/2010 3:24 PM	MMXStructuralIntegrity	500	HI	Good	Structural Integrity HI Limit
10/4/2010 3:24 PM	MMXStructuralIntegrity	500	Digital	Good	Structural Integrity has failed
10/4/2010 3:24 PM	MMXSecurityBreach	500	HI	Good	HI Limit
10/4/2010 3:24 PM	MMXSecurityBreach	500	Digital	Good	Possible Intruder in section 7-G
10/4/2010 3:24 PM	MMXRadiationLevel	500	HI	Good	Radiation Level is HI Limit
10/4/2010 3:24 PM	MMXRadiationLevel	500	Digital	Good	Radiation Level is too high

Figure 8.16 - Status Indicator in Runtime

8.1.4.4 Column Tab

The grid's **Column** tab, shown in Figure 8.17, allows you to select the columns or alarm attributes to display in the grid. When you select a data source for a grid, you automatically populate the grid with all of the attributes that are defined for that data source in the tab. Notice the labels listed in the Caption column – if you click on any of these fields, an ellipsis button becomes visible so you can browse for language aliases to be used, if you need to make the grid language sensitive for runtime operators.

The checkbox in the first column lets you show or hide the column in the grid. You can also change the order that the columns that appear in the grid. The top-to-bottom sequence of rows in this dialog box indicates their left-to-right sequence as columns in the grid. You can select a row, then click the up or down arrow to move it to its new position.

Also in the Column tab, you can edit any column's title, width, and status indicator. When you are done editing, be sure to click on the "Apply" button to update the grid. If at any point you are not sure of what to do, you can mouse over the "information" icon to get help.

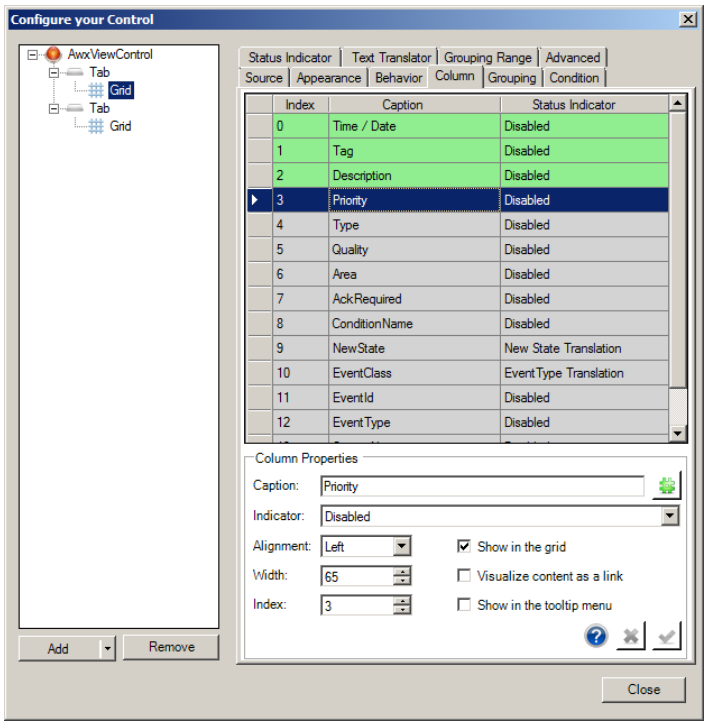


Figure 8.17 - Column Tab for a Grid

8.1.4.5 Grouping Range Tab

When there is much information in the viewer, you may want to group similar data so that it can be found it easily. To apply grouping, you will first need to set up how you want to group the alarms. The grid's **Grouping Range** tab (shown in Figure 8.18) allows you to set up a set of filters that you can apply to a column later, for proper grouping.

By default, there is one group range configured in the grid called "Severity Range" – it is a read-only range that you cannot modify. The items in this grouping range are filters that determine the severity of the alarms. In it are five different filters for alarms with different severity ranges to accommodate the different needs.

To create your own group range, you must select "New" in the dropdown list, and then you can type the name of the range in the Create or Select a Range textbox and click on the "Add" button. In the new Criteria List section, you can click in the Alarm Condition column to open the Filter dialog. You can use this dialog to create your filter; it is the same filter dialog used for status indicators, as shown back in Figure 8.13.

Once you create each filter, in the Caption column you can give a descriptive name for the filter. Add as many filters as you need.To apply your grouping range, you will need to go to the Grouping tab, which we will discuss next.

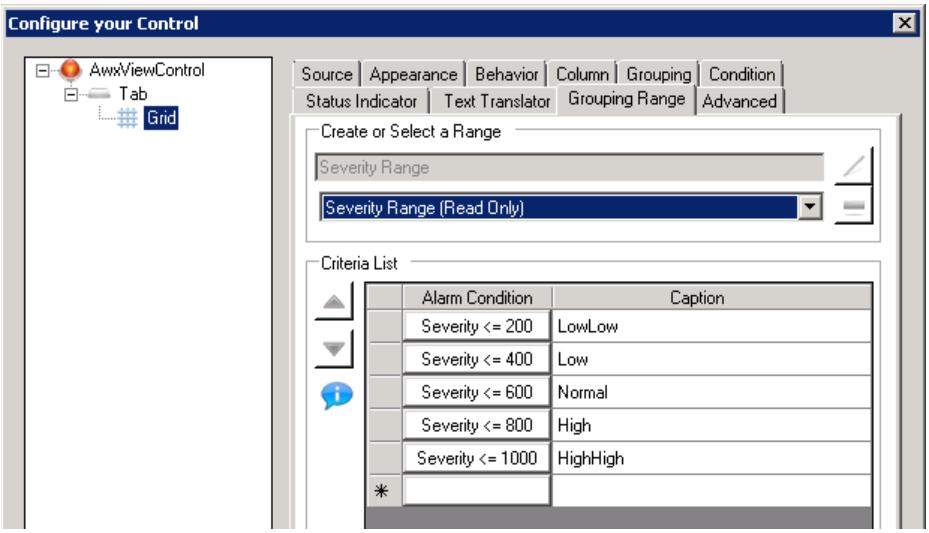


Figure 8.18 - Grouping Range Tab

8.1.4.6 Grouping Tab

Options on the grid's **Grouping** tab organize your alarms by values contained in the column that you apply the group function. Grouping allows you to view your alarms in a hierarchical view, which is helpful when analyzing alarms.

It is possible to create groups on more than one grid column. Grouping applies from the top down of the list on this tab. Following the example in Figure 8.19, the grid will first group by the Source Name of the alarm, then by the Time/Date, and lastly by the Event ID. You can change the order of the grouping by selecting an item in the list, then clicking on the up or down arrow.

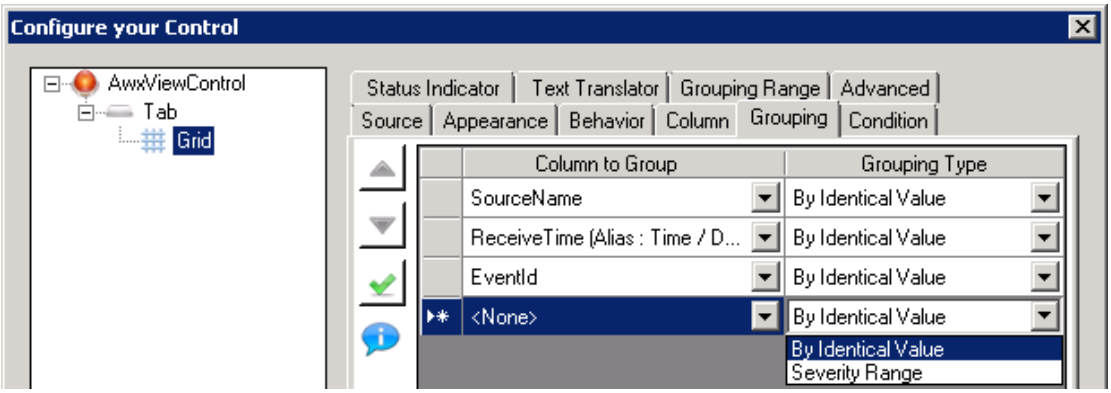


Figure 8.19 - Grouping Tab

Once you decide on *which* columns to group, you need to decide *how* to group the columns. In the Grouping Type section, you can choose how to group the columns. For example, in Figure 8.19, we are grouping the SourceName column by Identical Value (which is a default grouping type). Therefore, by default you have two grouping types: By Identical Value and Severity Range. You can also select other grouping types that were defined using Grouping Range tab.

When you are done editing, be sure to click on the "Apply" button to update the grid. If at any point you are not sure of what to do, you can mouse over the information icon to get help.

8.1.4.7 Condition Tab

In the grid's **Condition** tab, you can configure each alarm based on a condition. The most popular way to use this is to filter on the alarm priority (which is OPC-defined to have a value from 0 to 1000). An alarm that rises above a certain priority may require immediate action and you might want such an alarm to appear with a bold color, while other alarms that fall below a certain priority can be ignored and you might make the background of those alarms use lighter colors.

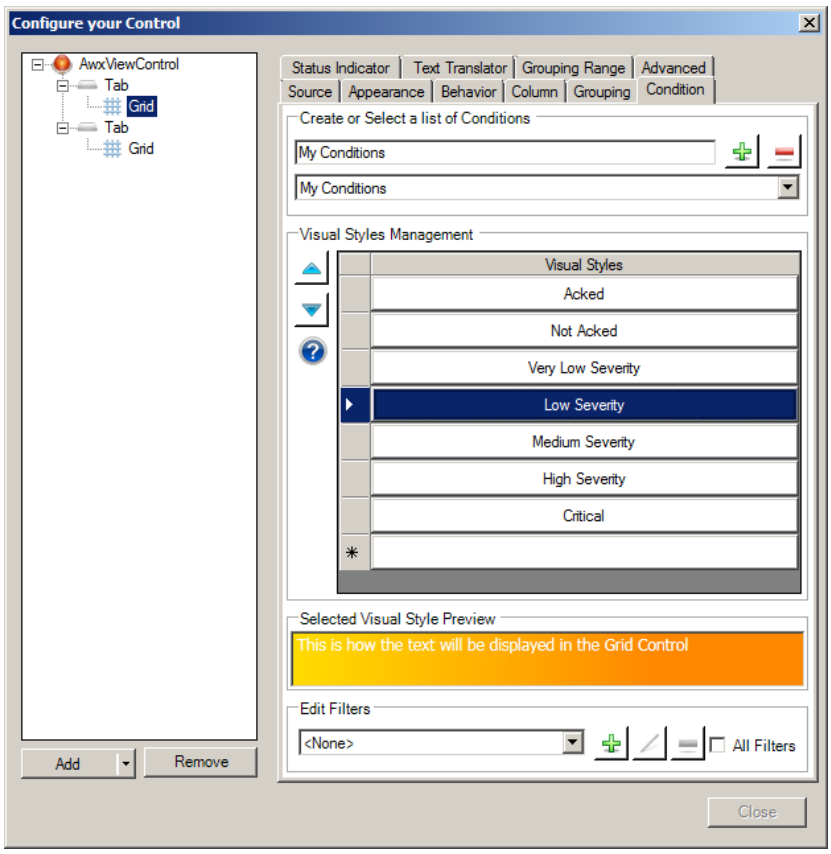


Figure 8.20 - Condition Tab

A condition is made up of a filter and a visual style. In runtime, if the filter is true for a row, then the related visual style is applied to the row. You can create as many conditions as you have filters and visual styles. You choose what the values are, what the condition level is named, and how alarms are displayed in the grid at runtime.

You can select a list of conditions or create a new list of conditions. Once you select a condition, the **Visual Styles Management** section lists the different conditions. If you create a new condition list, this section will be empty.

Clicking on a cell in the Visual Styles column brings up the Configure Styles dialog. There are two tabs in here: the Alarm Condition tab and the Visual Style tab. We will not show the Alarm Condition tab here for it looks exactly like Figure 8.13. The Visual Style tab, shown in Figure 8.21, provides options for color, blinking, and beeping – all ways to get the runtime operator's attention when an alarm condition occurs.

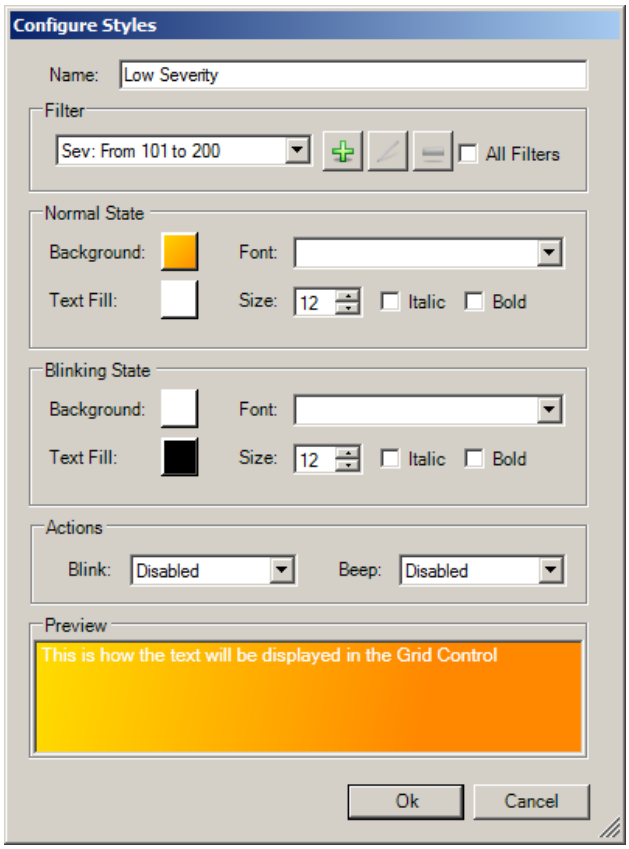


Figure 8.21 - Configure Styles Dialog for Conditions

8.1.4.8 Text Translator Tab

Alarm grids and charts created using AlarmWorX64 Viewer display values that may or may not make sense to the runtime operators who will be working with alarms. To make values more meaningful, you can translate them into words using the **Text Translator** tab, shown below. A set of translated values is called a *dictionary*. You can use translation dictionaries so that translated text appears in alarm grid columns and in chart labels.

ICONICS provides predefined, read-only translation dictionaries that define meanings for New State field values, Event Type field values, Category field values, and Quality field values. For any other field values, you must define your own dictionary using the grid's Text Translator tab, shown in Figure 8.22.

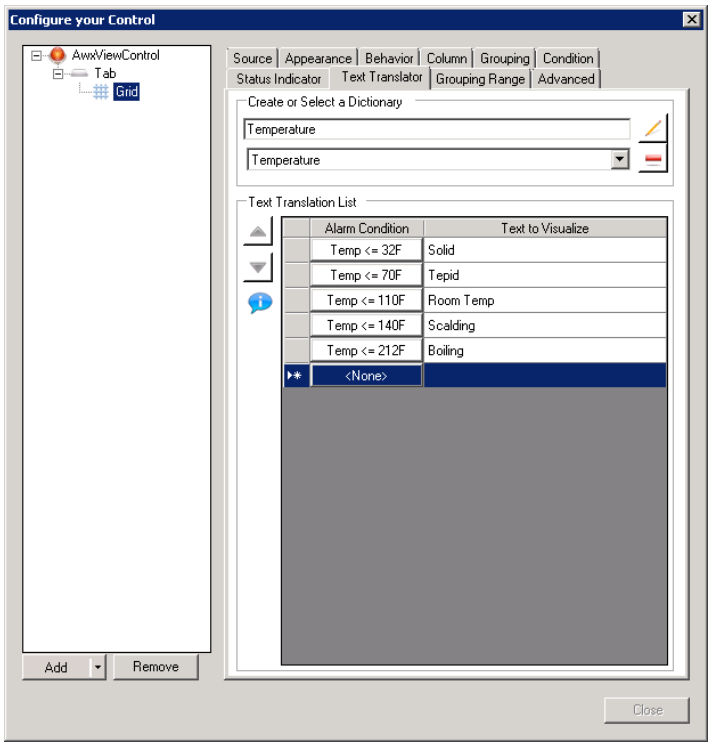


Figure 8.22 - Text Translator Tab

When creating a new dictionary, plan the values you will be creating with the dictionary. Then in the AlarmWorX64 Viewer Configurator, select the grid or chart from the tree and go to the Text Translator tab. You can select an existing dictionary, but you cannot modify the read-only dictionaries that are provided to you by ICONICS. To create a new dictionary, in the Create or Select a Dictionary box, select "New" from the dropdown list. In the same box, go to the field above your New selection and type the name of the new dictionary. Give it a name that aptly describes its use and the values it translates.

Now you can enter translated text for each alarm condition you want to put into the dictionary. A condition is a value or range of values that you want to translate into a word or words. To add a condition you click the empty box under Alarm Condition, which opens the Filter dialog box that you are now so familiar with (the one shown in Figure 8.13). When you return to the Text Translator tab, next to the filter you can enter text that the runtime operator will see.

8.2 Alarm Viewer Runtime Options

Once you are done configuring the AlarmWorX64 Viewer, you can go into runtime and view your alarms with all of the conditions, behaviors, styles, and other properties you have applied. There are a few tools that runtime operators can use to control which alarms display.

If you right-click on the alarm viewer in runtime, you will see a menu like the one shown in Figure 8.23. Depending on your alarm subscription of real-time alarms or historical alarms, different options may be available for use.

At a basic level, this menu lets runtime operators acknowledge alarms, sort columns, and filter data if the grid is displaying real-time data. If you are viewing historical data, you may have options to refresh the data, create a condensed alarm report or a detailed alarm report, and change the time range of the data that shows in the grid.

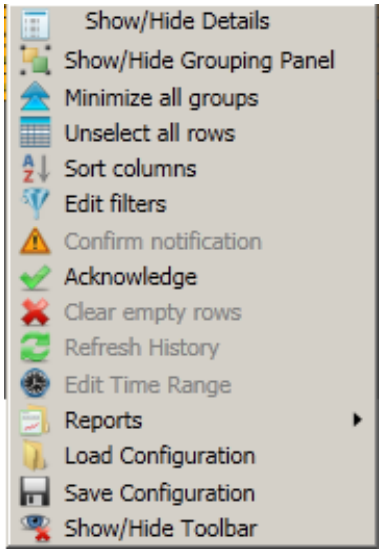


Figure 8.23 - Alarm Viewer's Right-click Runtime Menu

At the top of this menu, you have an option to Toggle Toolbar Visibility. If you click on this option when the toolbar is invisible, a runtime toolbar that comes with the alarm viewer will appear.

This toolbar, shown in Figure 8.24, can be free floating or docked within the alarm viewer. The toolbar gives many options such as sorting and filtering alarms like the right-click menu.

Figure 8.24 - Alarm Viewer Runtime Toolbar

Runtime operators can use either the right-click runtime menu or the runtime toolbar to configure the view of the alarm viewer.

Lab: Viewing Alarms L8

8.1 Lab Overview

In the previous lab, you created some alarms that indicate the status of the churning blade and the tank level for each of the tanks. These alarms are meaningless unless someone can see them when they go into an alarm state. icTonics would like a display in which an operator can easily spot important alarms and manipulate (or acknowledge) them.

Estimated time to complete this lab: 20 minutes

8.1.1 Task Checklist

In this lab, you will complete the following tasks:

- Set up a simple alarm file in the Alarm Container.
- Set up an alarm control in GraphWorX64.
- Configure an alarm subscription.
- Create and apply a client-side filter.
- Add flash to alarms with a condition.

8.1.2 Support Files

To complete this lab, you will need the following file(s):

- icTonicsTankMonitor.gdfx

8.2 Alarm Container

GENESIS64 provides a place where you can view alarms. We call this the AlarmWorX64 Viewer container. You can open this container within Workbench Classic or GraphWorX64.

The alarm control is what you use to view alarms in GraphWorX64. It has the same properties as the Alarm Container. We will talk more about the alarm control in a later chapter. For now, think of it as an alarm container that you can use in GraphWorX64.

1. Open the **icTonicsTankMonitor** display in **GraphWorX64.**
2. Select the **Controls** tab.
3. Select the **AlarmWorX64 Viewer** and draw the control in the bottom of the display.
4. While the AlarmWorX64 Viewer is selected, the ribbon will reflect the **AlarmWorX64 Configuration** menus.

Note: You may have to de-select and re-select the viewer control in order for the AlarmWorX64 Configuration ribbon to appear.

5. With the **AlarmWorX64 Configuration** tab selected, in the **Configuration** section of the ribbon, select **Open**.
6. This launches the **Configure your Control** dialog.

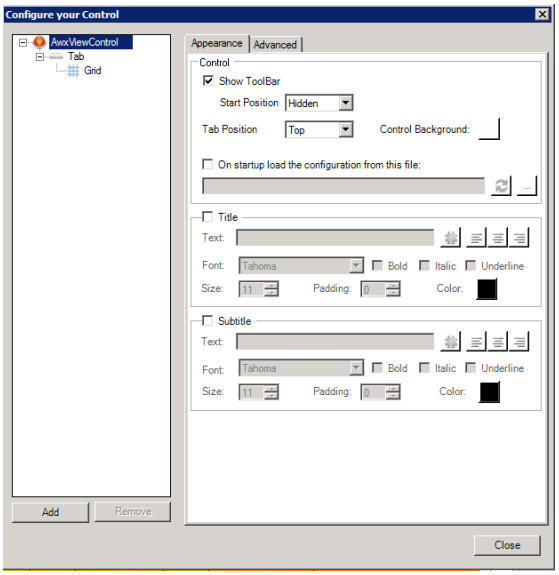


Figure L8.1 - Alarm Viewer Control Configure Dialog Box

7. In the **Configure your Control** dialog box, click on the **Grid** selection in the left-hand pane.

8. In the right-hand pane, under the **Create/Remove subscriptions** section, click on the green plus sign (add button) to create a new **Real Time Subscription**.

9. For this exercise, in the field just below the header, we can leave the name **New Subscription**. Click on **Close**.

10. Click on **Runtime** in the upper right-hand corner. You can easily go back to Configuration mode by clicking the **Configuration** button in the same place.

Note: Ctrl-M is the shortcut to toggle between Runtime and Configuration.

11. With the **icTonicsTankMonitor.gdfx** display in Runtime, we will generate alarms by clicking on the **Churning Blade On / Off** button in Runtime. This will place the churning blade On (no alarm) and Off (alarm).

12. Right-click on the alarms in the viewer and select **Show/Hide Toolbar**. Feel free to experiment by selecting various options (Acknowledge for instance) in the dropdown.

13. Select **Ctrl-M** to go back into **Configuration** mode.

14. Select the **AlarmWorX64 Viewer** control.

15. Click on **Save** icon in the ribbon. Enter the name **icTonicsAlarmViewer** and the **Save as type**: .awxx in the **C:\Training** folder.

16. Expose other **Save as** types: by clicking on the down arrow. Notice how there are two other file types: **Silverlight** (.awxxs) and **Mobile** (awxxp).

8.3 Extended Alarm Control Configuration

8.3.1 Apply the Display Template

In this section, you will create a display to view alarms, as well as customize the control to suit the project.

1. From within **GraphWorX64**, select **File → New**. You should have a blank canvas.
2. Save the display in the C:\Training folder and name the display **icTonicsAlarms.gdfx**.

   Note: You should save your work periodically as you progress through the lab.
3. We will proceed to apply the Template, you added to the gallery in lab1, to this display.
4. Apply the template to this display by clicking on the **Design** tab and selecting the **icTonicsTemplate** (it is a green header) template.

8.3.2 Configure the AlarmWorX64 Viewer

1. Go to the **Controls** tab of the ribbon. Click on the **AlarmWorX64 Viewer** and draw the viewer into the GraphWorX64 workspace. You can resize the viewer to take up the majority of the empty space in the display below the template.

   Note: The zoom control is in the lower right section of the GraphWorX64 configurator. You may want to zoom out to see the entire frame of the display.
2. Double-click on the AlarmWorX64 viewer control to bring up the **Configure Your Control** dialog box.
3. In the **Configure your Control** dialog box, click on the **Grid** selection in the left-hand pane.
4. In the right-hand pane, under the "**Create/Remove subscriptions**" section, click on the green plus sign (add button) to create a new **Real Time Subscription**.
5. In the field just below the header, replace the **New Subscription** text with **icTonicsAlarms**.

6. Notice the **Local Alarm Server** definition in the **Add/Remove Event Points** section. This confirms that the Local Alarm Server event point is already inside this subscription.

7. Select the **Appearance** tab, and then in the **Grid Style** section, select the "**Glass style**".

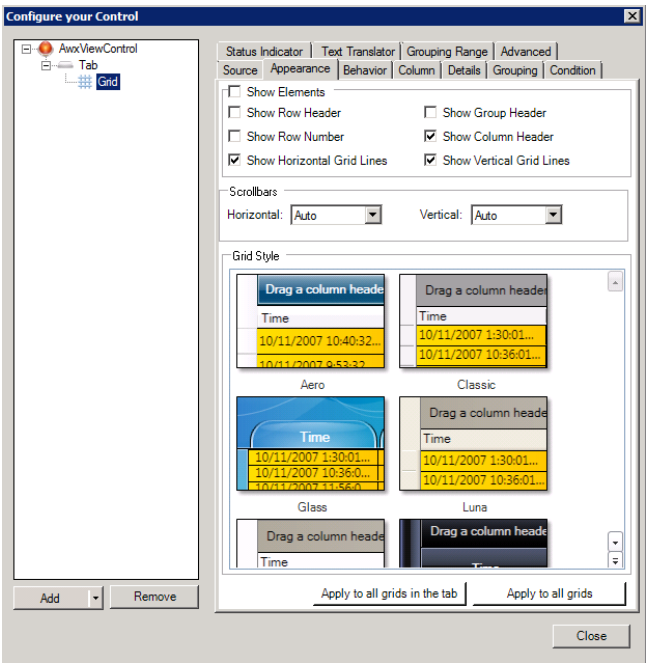


Figure L8.2 - Selecting a Style for the Grid

8. Go to the **Column** tab and move the **Description** field to just below the **Tag** field. You can do this by selecting the Description field row, and changing the **Index** number to 2. Also, change the **Width to 250** and click on the **Apply the changes** button to save the changes you have made.

9. For the **Type** and **Quality** fields, uncheck the property **Is Visible** and apply these changes. These two fields will change to a grey color. Your Column tab should resemble the following figure.

   Note: Until you apply the changes, the Close button at the bottom of the dialog box may be grayed out.

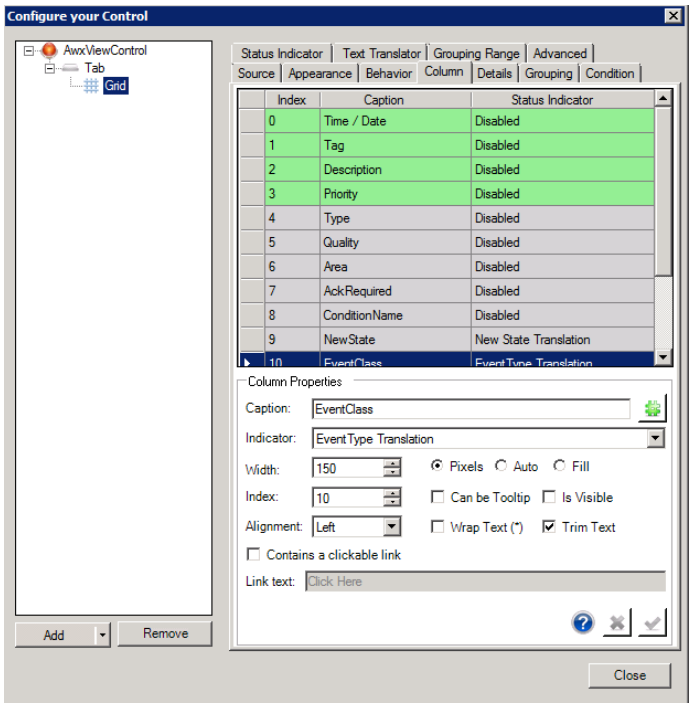


Figure L8.3 - Alarm Viewer Configuration: Column

10. Click on the **Condition** tab. Notice that there are preconfigured conditions here. We cannot modify these because they are read-only.

11. We will create a new **Alarm Condition** based on a filter for alarms with a **severity of 900** or higher. The conditions are applied from the top down.

12. In the right-hand pane, under the **Create or Select a list of Conditions** section, click on the green plus sign (add button) to create a **New Alarm Condition**.

13. At the bottom of the list (the row with the * in the first column), double click in the **New Style** field and enter the name **icTonics Condition**.

14. Click on the **ellipses** to bring up the **Configure the style** dialog box.

15. In the **Blinking State** section, change the **Text Fill** color to **Yellow** and the **Background** color to a gradient. (Or you can pick your own colors.)

16. In the **Actions** section, change **Blink** to **Slow**.

17. Notice the **Preview** section blinks.

18. When you're done making changes, click **OK**.

19. In the bottom of the dialog, click on the **Add** (green plus sign) button in the **Edit Filters** section. The **Configure Alarm Filter** dialog box will now be displayed.

20. Name the filter **SeverityBelow900Filter**, select the **Severity** checkbox and in the second data entry, then enter a maximum value of **900**.

21. Your **Configure Alarm Filter** dialog should look similar to the figure below.

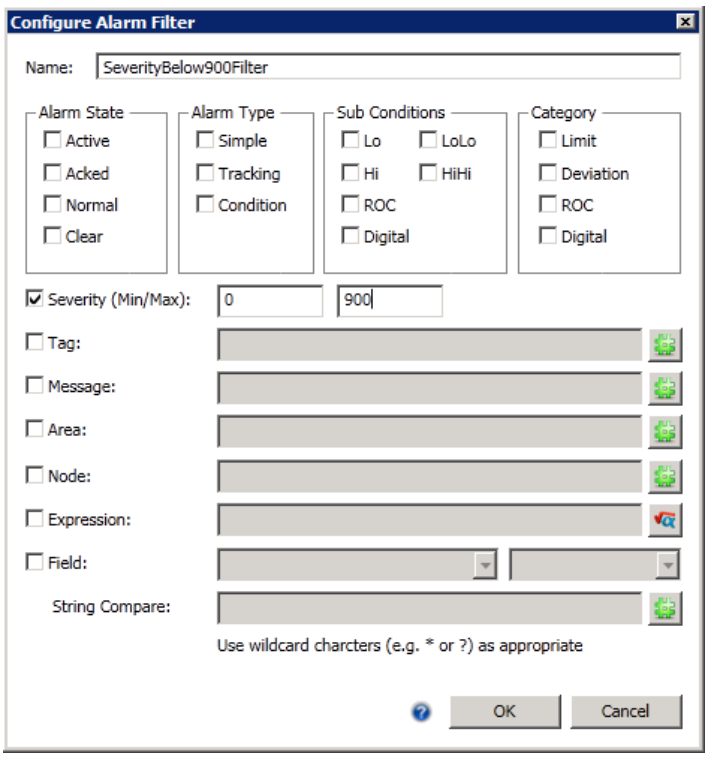


Figure L8.4 - Configure Alarm Filter

22. Click **OK** to commit this filter.

23. In the Alarm Condition column, expand the drop down list and select **SeverityBelow900Filter**.

24. The completed Condition dialog should resemble the following figure.

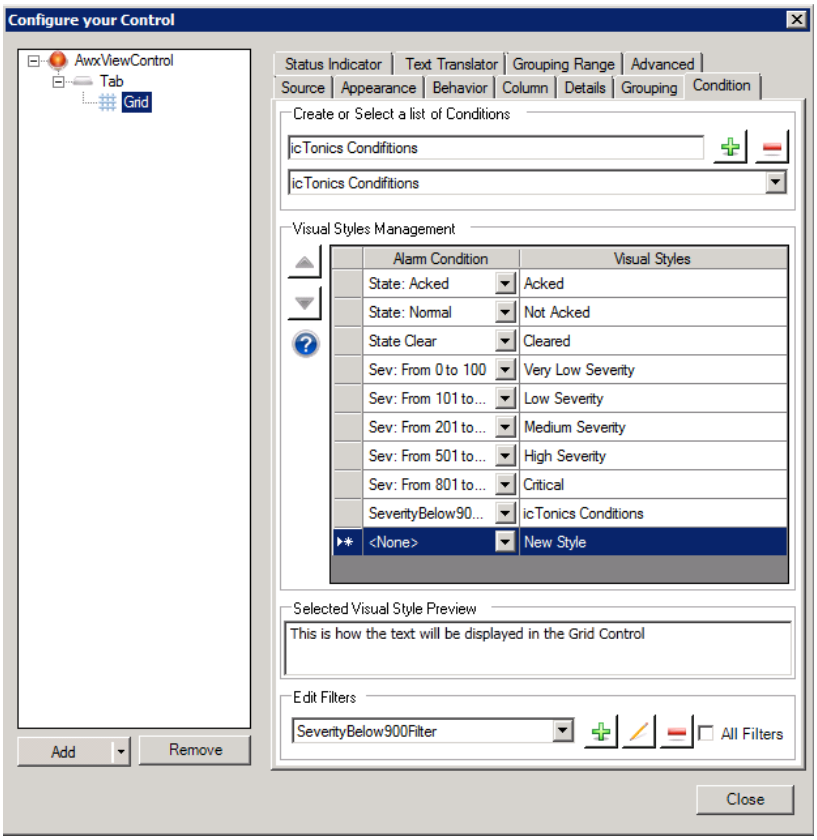


Figure L8.5 – Completed Condition Dialog

25. Using the blue up arrow button on the left side, move the **icTonics Condition** that you have just created to the one below the High Severity condition.

26. Click **Close** to close out of the configuration dialog box.

27. **Save** the display and go into **Runtime**. You may notice that you already have alarms.

28. Right-click on the Alarm Viewer and select **Show/Hide Toolbar** to bring up the toolbar.

29. Click on the **Filter Data** icon. We will now apply a filter to view the Tank level alarms only.

30. Click on the "**Add**" button (plus sign) to create a new filter. In the **Configure Alarm Filter** dialog box, change the Name to **Tank Levels**.

31. Check the **Tag** checkbox and write inside ***Level***. (The word Level is surrounded by the wildcard *.) When this filter is applied, only alarms with the word "Level" as part of the tag name will be visible.

32. Your filter should look similar to Figure below. Click on **OK** when you are done.

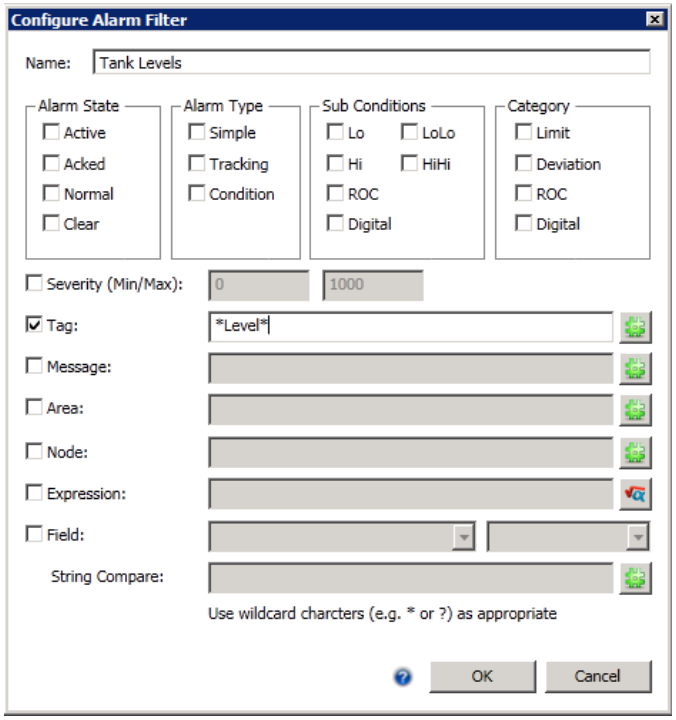


Figure L8.5 - Alarm Filter

33. Select (check) the **Tank Levels** filter and click on **OK**.

    Note: To open a second instance of GraphWorX64 you can right click on the graphworx64 icon in the Windows taskbar and select GraphWorX64.

34. In a second instance of GraphWorX64, open the **icTonicsTankMonitor.gdfx** display.

35. Make sure at least one valve is open.

36. Set a tanks **Level Setpoint** to **99** and hit enter. This will generate a HiHi alarm.

37. Take a minute to experiment and familiarize yourself with the alarm viewer control in runtime.

8.3.3 Tank Monitor Alarm Viewer

In this section we will configure filtering in the icTonicsTankMonitor display.

1. Open the **icTonicsTankMonitor.gdfx** display in GraphWorX64.
2. **Resize** the alarm viewer control so that it fits below the mixer tank.
3. Double-click on the control to open the **Configure your Control** dialog.
4. Select **Grid** in the left-hand pane and click on the **Behavior** tab.
5. Click on the button to the right of the **Configure default client side filter(s)** field.
6. From the **Select a filter from the list** dialog, click on the Plus (+) sign to open the **Configure Alarm Filter** dialog box.
7. Name this filter **Tanks**.
8. Check the **Tag** checkbox and write inside "***<#AlarmFilter#>***" with quotation marks. The syntax signifies that whatever is between the delimiters <# #> is a global alias. We'll elaborate on this in the global aliasing chapter.
9. Click **OK**.
10. Check the **Tanks** checkbox and Click **OK**.
11. Click on **Close** to close the **Configure Your Control** dialog box.
12. **Save** the display. If you go into runtime now only Tank1 alarms will show up. This is because the default <#AlarmFilter#> global alias value is Tank1. We will work with global aliasing in detail later in this training.

This concludes this lab.

AlarmWorX64 Logger 9

The AlarmWorX64 Logger provides a permanent copy (database storage or printed copy) of alarm and event notifications. The alarm and event notifications are generated from any OPC Alarm and Events server, including the AlarmWorX64 Server. AlarmWorX64 Logger subscribes to an OPC Alarm and Events server and stores the information in a database. You can configure the AlarmWorX64 Logger within the Workbench, which also allows starting and stopping of the Logger service. AlarmLogger64 configuration information is stored in SQL Server database.

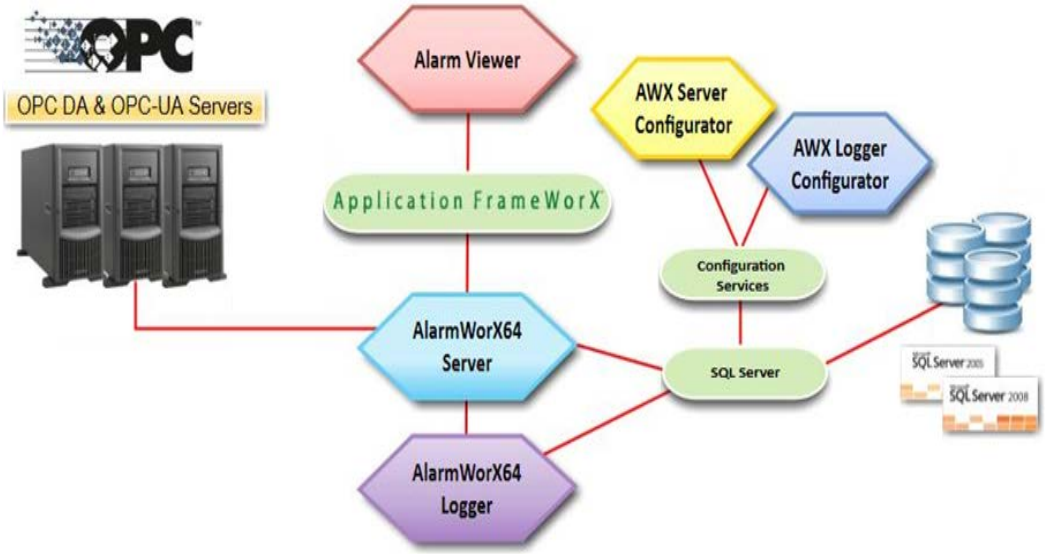


Figure 9.1 - Alarm Logger Architecture

After completing this chapter, you should know how to:

- Start up AlarmWorX64 Logger Configurator and services.
- Configure an AlarmWorX64 Logger database connection to log alarms.
- Add server-side and client-side filters for alarm logging and column definitions.
- Create a node configuration.

9.1. Starting the AlarmWorX64 Logger Configurator

There are two ways to start the AlarmWorX64 Logger configurator:

- From the Windows desktop, click on Start → All Programs → ICONICS GENESIS64 → AlarmWorX64 → AlarmWorX64 Logger Configurator.
- From within the GENESIS64 Workbench, select the AlarmWorX64 Logger button or icon.

Once the AlarmWorX64 Logger configurator and you will see a screen like Figure 9.2.

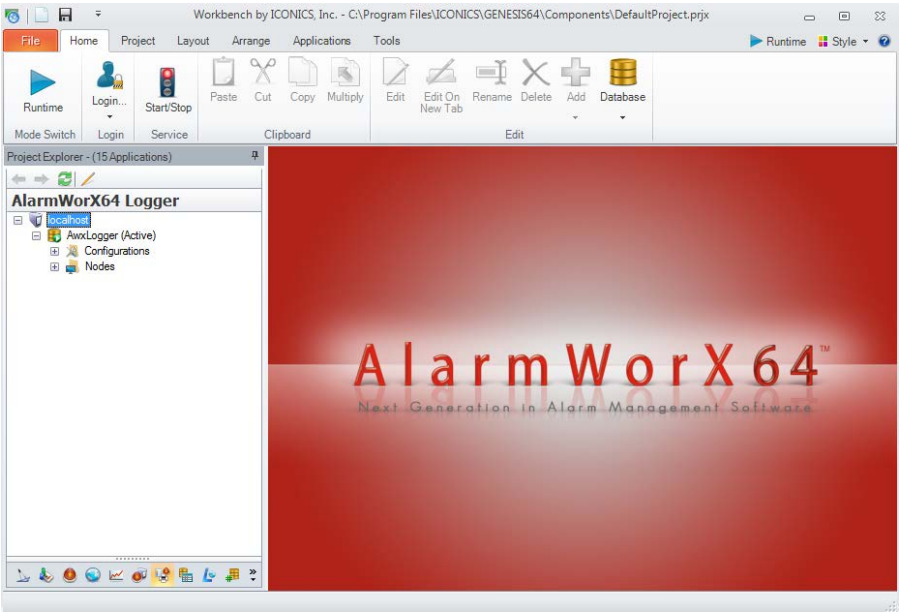


Figure 9.2 - AlarmWorX64 Logger Configurator

9.2. AlarmWorX64 Logger Configuration

Like many of the GENESIS64 applications, the configuration for the AlarmWorX64 logger is stored in an MS SQL database. You can create a new configuration database from the Home ribbon by clicking on the Database drop-down menu and selecting New Database. Alternatively, you can right-click on Localhost in the AlarmWorX64 Logger tree in the Project Explorer and select New Database.

The now-familiar Database Wizard will come up and guide you through the steps of creating your new alarm logger database. During setup of your new configuration database, there is an option in the wizard that allows you to include sample data. This option is checked by default. If you wish to exclude examples from this configuration database, uncheck the option before proceeding with the database creation.

9.2.1. Configurations

The configuration database can host many logging configurations. A logging configuration stores information, such as the database connection, to store the alarm and event data and the subscription to the OPC AE server.

You can create a logging configuration by right-clicking on **Configurations** under your database and then select the Configuration from the pop-up menu. Alternatively, on the Home tab of the ribbon, you can click on the Add button's down arrow and select **Configuration**.

When you do this, AlarmWorX64 Logger opens the Alarm Log Configuration tab, which displays the configuration properties, as shown in Figure 9.3.

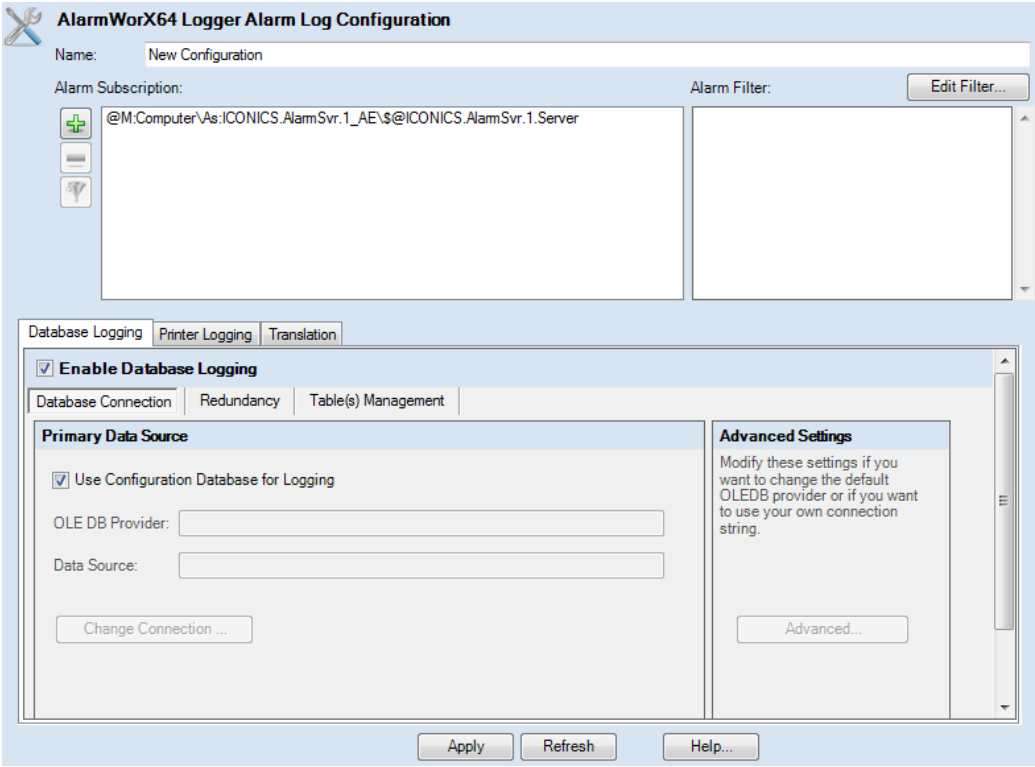


Figure 9.3 - New Configuration in AlarmWorX64 Logger

9.2.2. AlarmWorX64 Logger Subscriptions

Once you create a configuration, by default it is automatically subscribed to the local Alarm Server, as shown in Figure 9.4. If an additional subscription is needed, simply click on the "Add" button to create a new alarm subscription. The Data Browser window will appear, allowing you to select another alarm server and/or area.

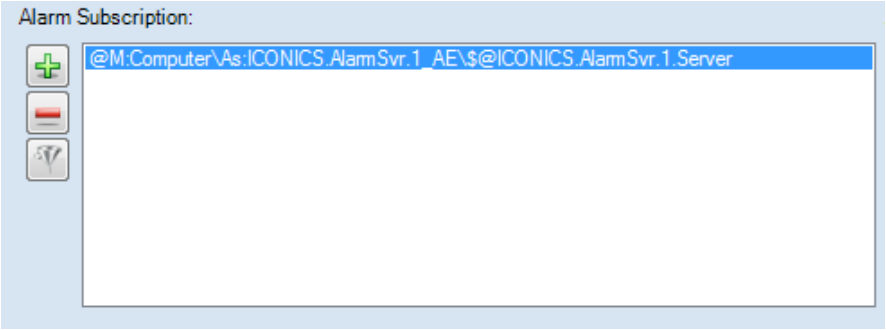


Figure 9.4 - Alarm Subscription

You can delete a subscription by highlighting it and clicking on the "Remove" button.

9.2.3. AlarmWorX64 Server-Side Filter

Once a subscription is created, you may need to edit it so that the subscription can get the data you want. This is called *server-side filtering*. A server-side filter sorts alarm data coming from the alarm server into the logger. Choose the alarm subscription you want to edit, and then click on the "Edit Categories Filter" button to open the subscription's properties dialog, which is shown in Figure 9.5.

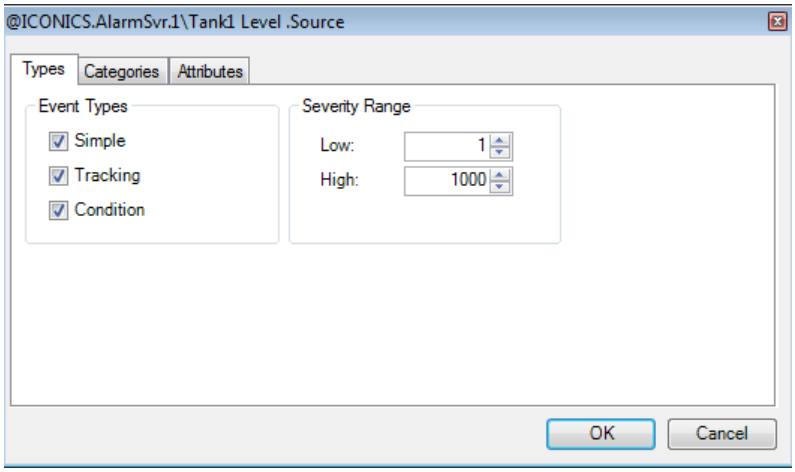


Figure 9.5 - Alarm Subscription Property Window

There are three tabs that are available here: Types, Categories, and Attributes. The **Types** tab allows you to choose or filter the event types and severity range of the alarms and events. The **Categories** and **Attributes** tabs allow you to subscribe to custom categories and to pick the attributes that you want logged. A general rule in the Categories tab is that if nothing is in the subscribed section, you will be subscribed to the available categories. However, if you add any categories to the subscribed side, then you will only receive alarms and event in those subscribed categories.

9.2.4. AlarmWorX64 Client-Side Filter

While server-side filtering restricts the information coming from the alarm server that the logger configuration subscribes to, *client-side filtering* limits the data that is logged into the database once you have data from the alarm server. In AlarmWorX64 Logger, this filter is located next to the alarm subscription, in the text box shown in Figure 9.6.

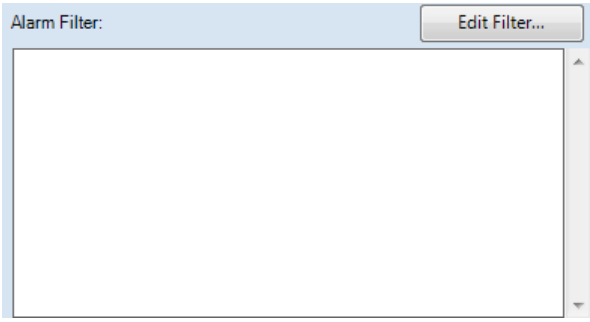


Figure 9.6 - AlarmWorX64 Logger Filter

You can start typing in the **Alarm Filter** box to use the Advanced Expression engine. Or you can click on the **Edit Filter** button to use a Filter Wizard or the Expression Editor.

Why two different types of filters? Use the *server-side filter* to save traffic resources between the Alarm Server and Alarm Logger. Use the *client-side filter* to save space and to restrict how quickly the log database grows. These filters become more important when the alarm server, the logger, and the database are on different machines and the end-user or runtime operator does not want to see all types of data from the alarm server getting logged.

9.2.5. Configuring the Database Connection

When you first create a configuration, the logger is automatically set to log all alarms into its own configuration database file, as shown on the Alarm Log Configuration's Database Logging tab. Figure 9.7 shows this tab with the Database Connection sub-tab on top. Notice that there are two additional sub-tabs: Redundancy and Table(s) Management.

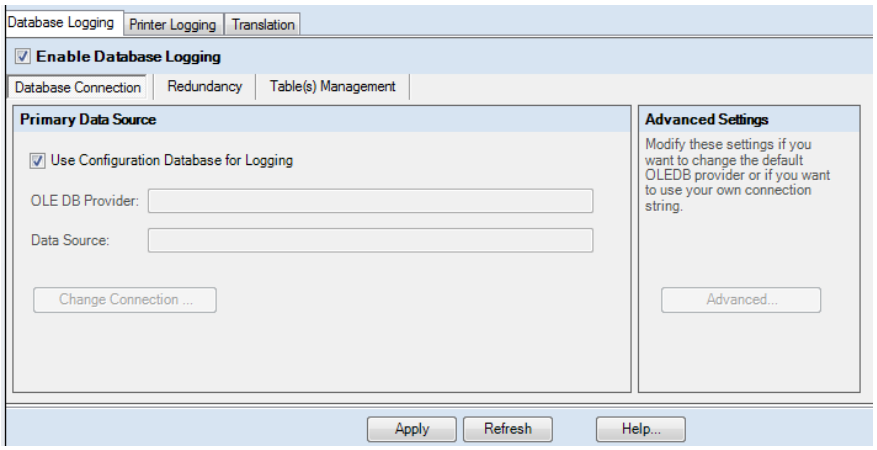


Figure 9.7 - AlarmWorX64 Logger Database Connection

If you want data logged to a different database, you will first need to uncheck the "Use Configuration Database for Logging" checkbox and configure the database connection by clicking on the "Change Connection" button. This opens the **OLE DB Connection** dialog box as shown in Figure 9.8, where you simply select the OLE DB Provider you want to use, its location, and the database to which the alarms will be logged. Click on the "Test Connections" button to make sure you can connect to the destination database successfully. When you have confirmation that the connection is good, click on "OK" to automatically populate the necessary fields on the OLE DB Provider and Data Source.

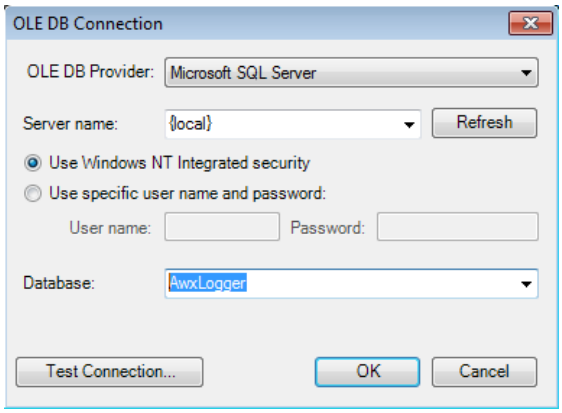


Figure 9.8 - OLE DB Connection

Although the connection string is automatically created when you configure the OLE DB Provider, you can modify it. If you need to modify it or manually create your own connection string to the database where the alarms will be logged, you can click on the "Advanced" button in the **Advanced Settings** section.

9.2.6. Table Management

Alarm data are logged to one master, active table in the database. If there are no restrictions placed on the size of the active table, data are logged to the active table as long as the Alarm Logger is running and there is disk space on the hard drive. You can, however, place a restriction on the size of the active table by using the **Database Logging** tab's **Table(s) Management** sub-tab, shown in Figure 9.9. The active table can be restricted to a maximum size determined by either a number of records or a time interval.

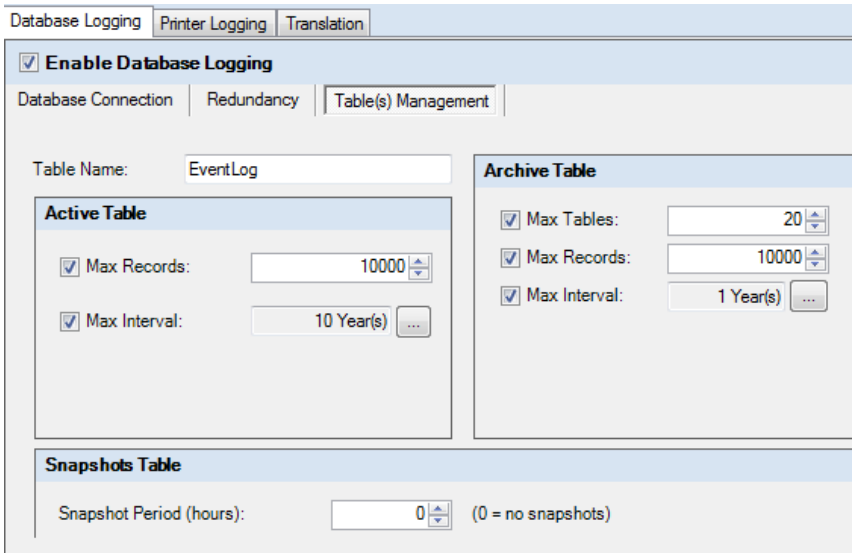


Figure 9.9 - AlarmWorX64 Logger Table Management

If the active table's size is restricted, all incoming data continues to be logged to the active table, but the oldest data that exceeds the restriction will be moved from the active table into an archive table. Archive tables can also have a maximum size determined by either a number of records or a time interval. When one archive table is full, data will be logged to the next archive table. When all archive tables are full, the oldest archive records will be replaced by the newer information. The name of each archive table is the name of the active table followed by the date and time of the first alarm in the table. With this system, the active table always has the most recent alarm data.

During runtime, the Alarm Logger will create the active table if it does not exist and will add any columns to the table if they are missing. The Logger will not create any indexes, but you can use a database administration tool to add indexes to columns that are searched and/or sorted by queries.

You can use the Table Management section of the Database Logging tab to configure the following parameters for the active table:

- **Table Name:** Enter the name of the active table.
- **Active Table:** Specify a limit on the size of the active table by putting a checkmark in one or both of the checkboxes. The limit can be a maximum number of records or a time limit on the age of data in hours, days, months, or years (the interval refers to the time span between the oldest and most-recent items logged). If *both* conditions are checked, when one of the conditions is met, the table is full. If neither item is checked, then archiving is disabled and will never take place.
- **Archive Table:** Specify the quantity of archive tables and a limit on the size for each archive table. These fields work the same way as they do for the active table, but with the following exception: If the **Max Records** and **Max Interval** fields are both left *unchecked*, all archiving will go to *one* archive table of a (theoretically) unlimited size, because the table size is not restricted. In essence, the **Max Tables** field will be ignored.
- **Snapshots Table:** This section allows you to create a "snapshot" table that you can use to replay alarm data. In the **Snapshots Period** field, specify how often (in hours) a snapshot table can be created. A snapshot period value of **0** (zero) means that no snapshot table will be created. For data replay to work with alarms, the value of the snapshot period must be greater than **0**.

  Note: You can print incoming alarm and event messages to a printer in addition to storing them to a database. For configuring the printer setup, see the "Printer Logging" tab. For additional details, please refer to the AlarmWorX64 documentation.

9.2.7. Printer Logging

On the Printer Logging tab, you can configure options for sending alarm events to a printer so that a written record is made of the log files. This works best with a dedicated ink jet or dot matrix printer, which prints one line at a time, rather than a page-oriented printer like a laser printer. Laser printers will still work, but the page will not be ejected until it is full.

Putting a checkmark in the Enable Printing checkbox makes the options available.

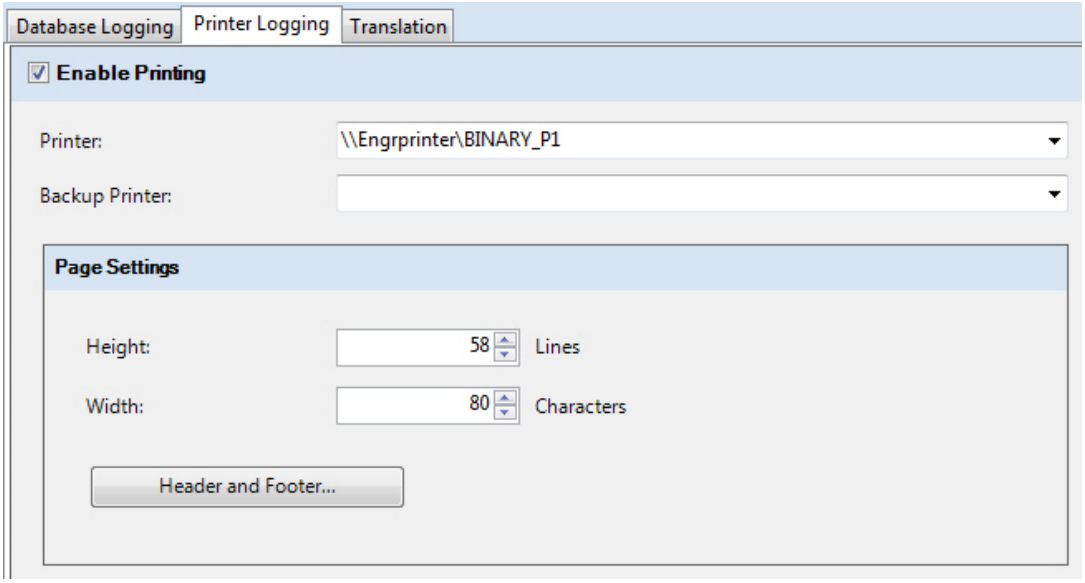


Figure 9.10 - AlarmWorX64 Logger: Printing Logger Events

You can select the primary printer and a back-up to be used if the primary becomes unavailable. Event notifications will print on the primary printer unless an error is detected (for example, if the printer goes offline or is out of paper), in which case the back-up printer will be used. A switchover from the backup to the primary occurs automatically when the error condition is cleared on the primary printer.

You can click the Heading and Footer button to specify a header for the top and/or footer for the bottom of each printed page. You can print using character sets other than the standard 7-bit ASCII codes appropriate for English, too. Instructions for setting up other character sets are provided in the online Help for GENESIS64.

9.3. Column Definitions

In the context of AlarmWorX64 Logger, alarm column definitions are the alarm attributes that the logger should take information from and put into the database. The alarm column definitions that you configure dictate the column headings in the table as well as which attributes of each alarm or event received will be saved in the database.

You can configure columns by right-clicking on the configuration in which you want to add a column for and select the " Column" option. This opens the Column Definition configuration as shown in Figure 9.11.

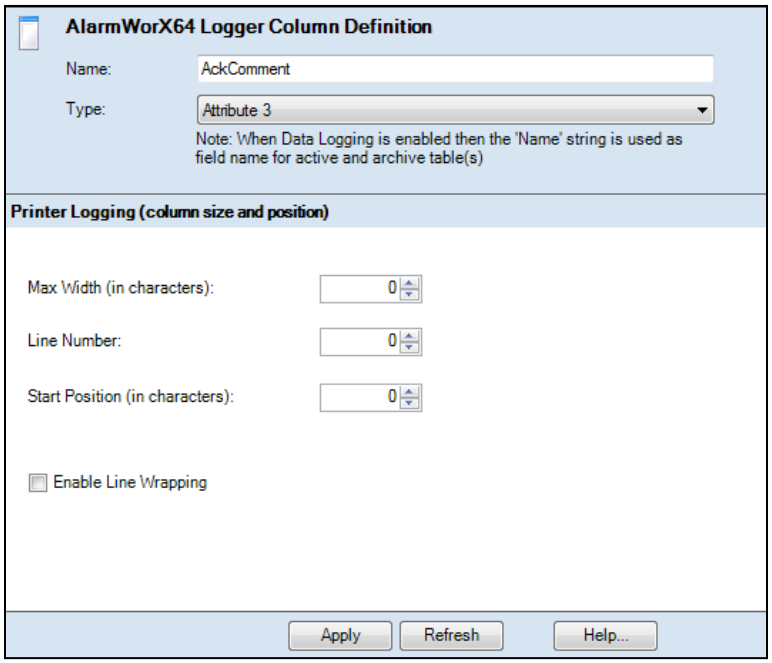


Figure 9.11 - Column Definition

In this interface, you can specify the name of the column, which will become the column name in the logging table. Then choose the alarm attribute from the Type field.

9.4. Nodes Configuration

A node is the PC network name associated with a particular configuration. When the alarm server starts, it checks the database for its node name. Unlike most other GENESIS64 applications, you can run multiple configurations at a time. However, you can have only one active configuration database at a time. It is because of the use of nodes that the alarm logger can run multiple configurations at a time. Any configuration you want to log data to must be associated with a node. You must add the node, and then you can associate the configuration(s) with it.

You can add a node, by right-clicking on **Nodes** and then selecting " Node" from the popup menu, as shown in Figure 9.12.

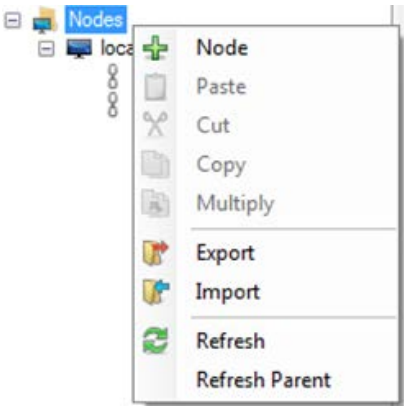


Figure 9.12 - Node Configuration

The New Node tab appears. Type the **Name** of the computer in which you want to use the configuration (which in most cases is your local computer name) or click the ellipsis button to choose it from a list, and then click on "Apply".

To associate a configuration with the node, right-click the node and select " Node Configuration". In the dialog box that appears, select the configuration you want to attach to the node and click on "Apply".

Note that when working locally on your GENESIS64 server, instead of specifying the name of the actual machine, you can use the neutral node name "anonymous" to run one or more alarm logger configurations on the local GENESIS64 node.

Lab: Alarm Logger L9

9.1. Lab Overview

Logging generated alarms can help pinpoint problem areas in production operation. Therefore, icTonics has decided to log the alarms for future evaluation and analysis. Because the AlarmWorX64 server can track both alarms and events, logging operator events such as alarm acknowledgement is also possible.

Estimated time to complete this lab: 20 minutes

9.1.1 Task Checklist

In this lab, you will complete the following tasks:

- Create a new alarm logger configuration.
- Create and connect to a database to log alarms.
- Configure active and archive tables.
- Associate the configuration to a node.
- View historical alarms in the Alarm Viewer.

9.1.2 Support Files

To complete this lab, you will need the following file(s):

- icTonicsAlarms.gdfx

9.2. Alarm Logger Configuration

In order to log the alarms and/or events generated by an alarm server or event server, you will need to subscribe to an Alarms or Events OPC Server and configure the attributes that need to be saved in the logging database.

9.3. Alarm Database Configuration

1. Open Workbench-SL if you closed it from the previous lab and select the **AlarmWorX64 Logger** from the provider list.
2. Right-click on the **localhost** and select **New Database.**
3. From within the **Create a new Database** dialog, name the database **icTonicsAlarmLoggerConfig**.
4. Select the "**Include Sample Data**" checkbox and click "**OK**" to create the database.
5. Expand the icTonicsAlarmLoggerConfig tree. You should see two tree nodes. This is because, when we initially created the database, we left the "Include Sample Data" checkbox checked.
6. Expand the **Configurations** tree and select **Alarms**.
7. Notice that there is already an Alarm Subscription connected to the local alarm server. Rename this configuration **icTonicsAlarms**. Click **Apply**.
8. Select the **Database Logging** tab and uncheck the "**Use Configuration Database for Logging**" checkbox.
9. Click the "**Change Connection**" button.
10. Since we're using a local SQL Server, the **Select the SQL Server** field should contain **(local)\SQLEXPRESS** (this syntax is not case sensitive).

    Note: Depending on how your machine is configured, the (local) string may need to be replaced with either a period "." or the computer hostname.
    E.g. .\SQLEXPRESS or hostname\SQLEXPRESS.

11. From the **Database name:** drop-down list, select the **icToncisAlarmData** database you created in Lab 1. You can test the connection if you'd like. Click **OK**.

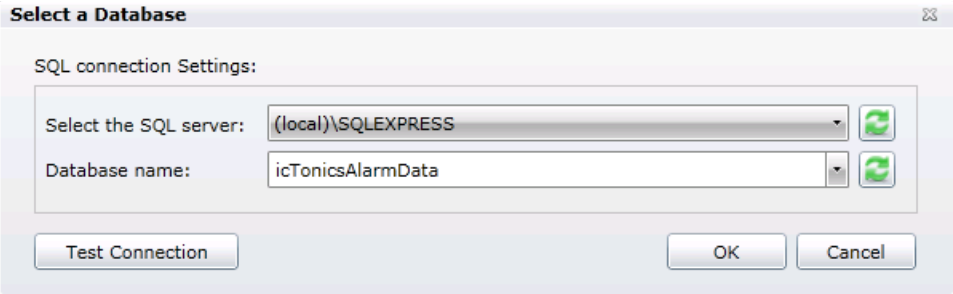


Figure L9.1 - OLE DB Connection

12. Click on the **Table(s) Management** page.

13. In the **Active Table** section, put a checkmark in the **Max Interval** checkbox and change the Max Interval to **1 Day(s)**.

14. In the **Archive Table** section, put a checkmark in the **Max Interval** checkbox and change the interval to **7 Day(s)**.

    Note: This configuration will allow us to keep only one day's record in the active logging table, but archive seven days of alarm records into one table. Your Tables Management sub-tab should look similar to the image below when you are done.

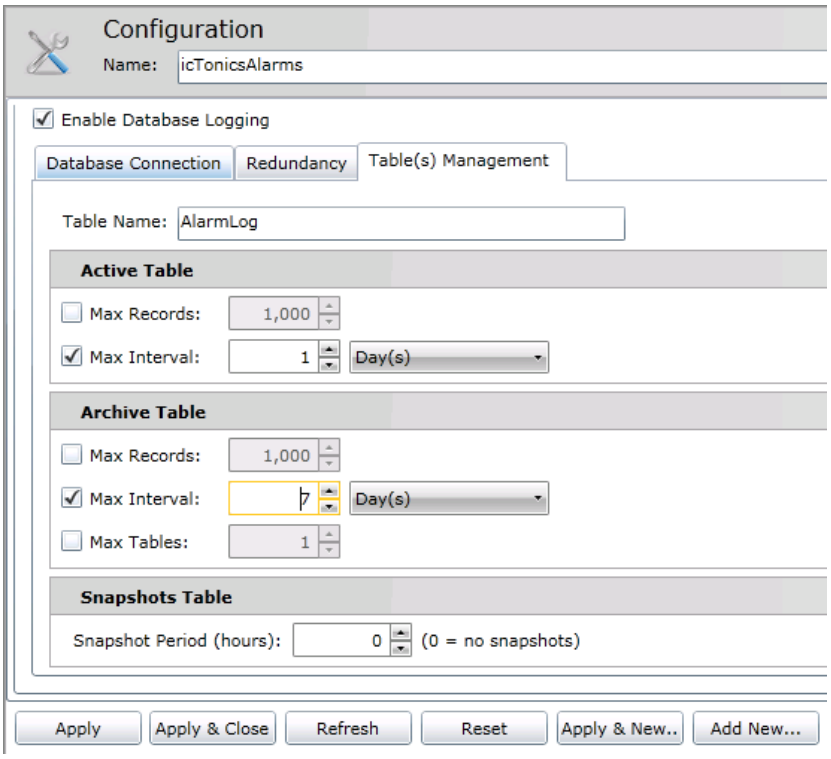


Figure L9.2 - Table(s) Management

15. Click on **Apply** to save your changes.

9.4. Alarm Node Configuration

1. Under the **icTonicsAlarmLoggerConfig** database, expand **Nodes**. Depending on how your computer is set up, you may see your own computer name in the list instead of localhost.

2. Right-click on localhost (or computer name) and select "**Edit on New Tab**".

3. By either selecting from the drop down list or entering the text manually, change the localhost so that it reflects your **Computer Name**. Click on "**Apply**" to save your changes. **Close** the tab.

   Note: From a Windows command prompt, you can type Hostname <enter> to determine your Computer Name.

4. In the tree under the Nodes, right-click on the Computer Name and select **Add Link to Configuration**.

5. Specify **icTonicsAlarms** as the **Configuration Name** and click **Apply**.

6. We will now change the active configuration database. **Stop** the data logging service by clicking on the **Start/Stop traffic light** button in the **Home** ribbon. Wait for the light to turn red.

7. To make **icTonicsAlarmLoggerConfig** the active configuration database, right-click on the icTonicsAlarmLoggerConfig in the project explorer. From the drop-down list, select **Make Active**.

8. Now **Start** the data logging service by clicking on the Start/Stop traffic light button in the Home ribbon. Wait for the service light to turn green.

9.5. Viewing Historical Alarms

Once you have logged your alarms into a database, you can view these logged entries. Of course, you can view it through a database tool, or you can use the alarm viewer control. We will be using the AlarmWorX64 Viewer control in a GraphWorX64 display.

9.6. AlarmWorX64 Viewer Control

1. Open the **icTonicsAlarms.gdfx** display that you created in the previous lab.
2. From within the GraphWorX64 Configuration mode, double-click on the **Alarm Viewer control** to open the **Configure your Control** dialog box.

   Note: As we proceed, you may notice the changes you make during Configuration are immediately reflected in the control.
3. Select **Tab** in the navigation tree on the left. In the **Title** section, change the **Text:** to **Real Time Alarms**.

   Note: Although this is not required, you may want to rename the Tab names in the tree also. **Tab names cannot contain spaces**.
4. Right-click on **AwxViewControl** on the left pane and select **Add → Tab**.
5. Select the new tab and change the **Title** text to **Historical Alarms**. Notice that there is already a grid under this tab.
6. Select the **Grid** under **Historical Alarms**. We are going to set this grid up similarly to the one that you set up in the previous lab.
7. In the **Create/Remove Subscriptions** section, click the green plus button to create a new subscription.
8. Select **Historical Subscription**. In the top text box, replace **New Subscription** with the text **icTonicsHistoricalAlarms**.
9. Notice that the Local Alarm Server is already in the **Add/Remove Event Points** section.
10. Click on **Local Alarm Server** to select it. The detailed information of this Event point will be displayed in the Point Tag field.
11. Click on the **ellipsis** button [...] next to the **Point Tag** to bring up the **Data browser**.

12. Click on **Home** and select **Historical Data** → **AlarmWorX64 Logger** → **icTonicsAlarms** and then double-click on the tag that starts with **@** as shown in the figure below.

13. Click on "**OK**" to exit the data browser.

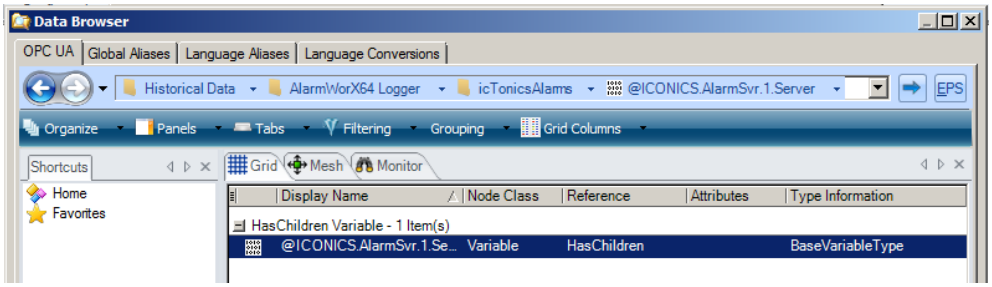


Figure L9.3 - OPC UA Tag for Historical Alarm Server

14. In the **Edit Point Properties** section, change the **Point Name** to **Local Alarm Logger**. Note that this also changes the name under the Add/Remove Event Points Section.

15. In the Add/Remove Event Point section, click on the "**Clock**" button.

16. In the **Edit Time Range** dialog box, select **Today** from the drop-down list. This will limit the alarms to show only today's records.

17. Your Source tab should look similar to figure below when you are done.

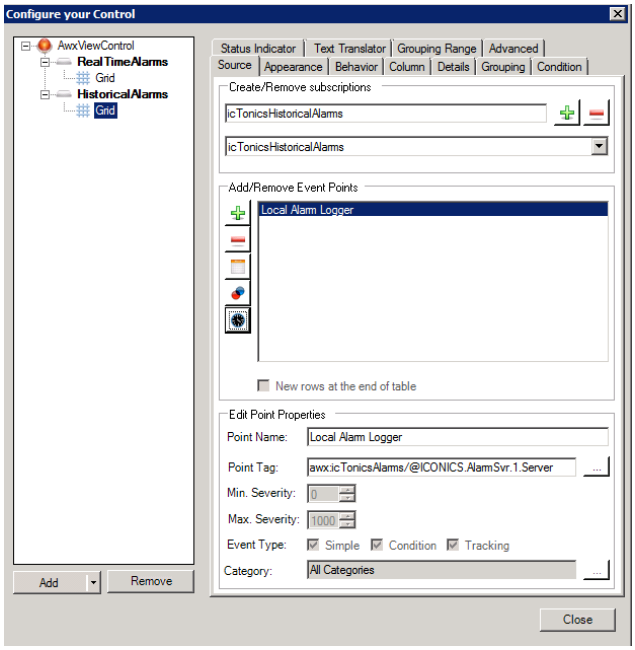


Figure L9.4 - Historical Alarm Sources

18. Select the **Column** tab and uncheck the **Is Visible** option for the **Priority** and **Quality** columns.

19. Click on **Apply** (the green checkmark button) to commit each of the following changes.

20. Click **Close** to exit the configuration dialog box.

21. Go into **Runtime**.

22. You may notice a message like **Operation completed with errors.** This is OK. There may not have been any alarms triggered since we started logging alarms and there is no data to report. Hover over the icons in the lower right section of the viewer. Make a selection as you see fit.

23. From within **Workbench-SL**, view the traffic lights are green for the AlarmWorX64 Server and AlarmWorX64 Logger to verify each of the services are started.

24. Trigger a new alarm by changing a tag value (e.g. turn the churning blade on and off) in the **icTonicsTankMonitor** display. You should see alarms in the Historical Alarms tab of the viewer, like the example in the figure below.

Real Time Alarms | Historical Alarms

Time / Date	Active Time/Date	Tag	Type	Description
3/20/2014 1:31 PM	3/20/2014 1:31 PM	Churning Blade1 Status	Digital	The churning blade in...
3/20/2014 1:31 PM	3/20/2014 1:30 PM	Churning Blade1 Status	Digital	The churning blade in...
3/20/2014 1:30 PM	3/20/2014 1:30 PM	Churning Blade1 Status	Digital	The churning blade in...
3/20/2014 1:30 PM	3/20/2014 1:30 PM	Churning Blade1 Status	Digital	The churning blade in...
3/20/2014 1:30 PM	3/20/2014 1:30 PM	Churning Blade1 Status	Digital	The churning blade in...

Figure L9.5 - Historical Data

This concludes this lab.

TrendWorX64 Logger *10*

TrendWorX64 Logger is a server application that is installed as part of the GENESIS64 suite. It handles data logging and data retrieval as well as multiple types of databases. The logger collects data from an OPC UA and OPC DA real-time data source and sends that data to a SQL server database such as Microsoft SQL Server 2008 or SQL Server 2008 Express Edition. Its basic functions are to collect and log data for analysis and to provide optional data redundancy.

The TrendWorX64 HDA server will connect to a TrendWorX64 Logger database configuration and serve the data contained in that database to HDA clients such as the TrendWorX64 Viewer. You can deploy the TrendWorX64 Logger using the same computer on which the database resides or connect to a database on a different computer on the network. You can configure TrendWorX64 Logger using configuration forms in the Workbench.

Figure 10.1 shows a diagram of how TrendWorX64 fits in with the GENESIS64 product family.

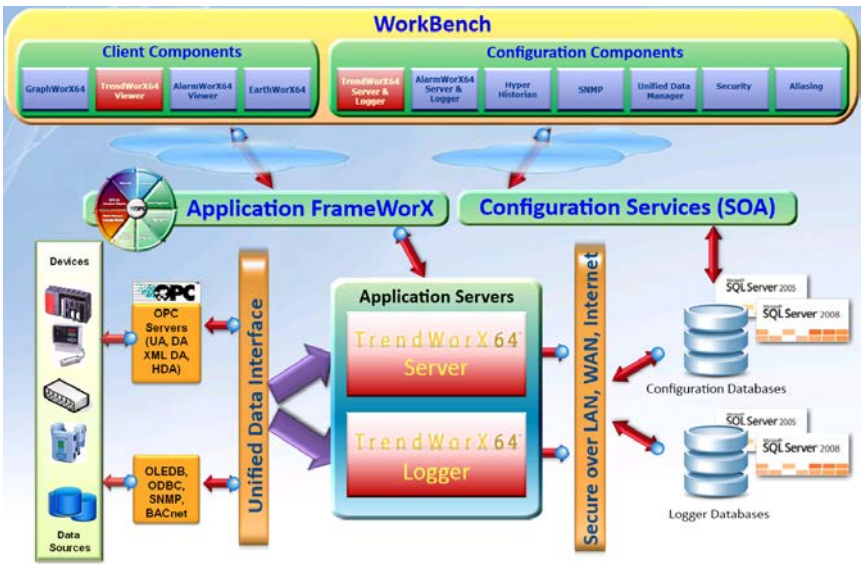


Figure 10.1 - TrendWorX64 Overview

After completing this chapter, you should be familiar with:

- TrendWorX64 Logger and how to launch it
- Database configurations
- Database groups and logging groups
- Tags that collect trend data

10.1. TrendWorX64 Logger in the Workbench

You can control various aspects of the TrendWorX64 Logger's behavior within a set of configuration forms in the Workbench. Using these forms, you can select the database that TrendWorX64 uses, create new databases, modify a database, and create and store configuration(s) that support your trending displays. In the Workbench, you can start and stop logging activities as needed.

To start TrendWorX64 Logger Configurator, go to **Start → All Programs → ICONICS → GENESIS64 → TrendWorX64 → TrendWorX64 Logger**. TrendWorX64 Logger opens in the Workbench as depicted in Figure 10.2. In this configuration, you can set up your database groups, logging groups, and tags, which determines where and what to log when the service starts.

The logging service relies on the FrameWorX64 server to send logging data to the TrendWorX64 Viewer client. In the Windows Task manager, you should see that the FrameWorX64 server process (IcoUAServer.exe) is running.

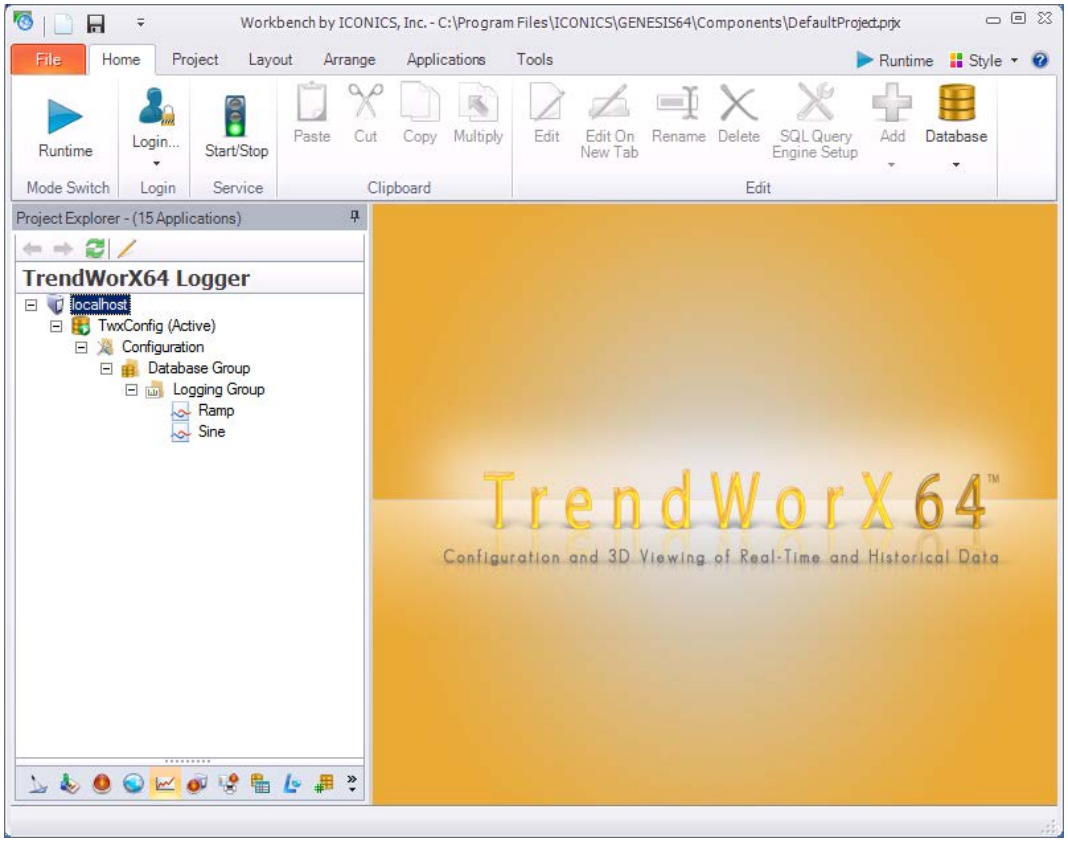


Figure 10.2 - TrendWorX64 Logger in the Workbench

10.2. Database Configurations

To configure the TrendWorX64 logger in the configurator, you need to make sure that you have a configuration database first. The GENESIS64 installation comes with a default configuration database depending on the options you choose during installation. However, you may create additional configuration databases as you wish.

You can create a configuration database by right-clicking on localhost in the Project Explorer and selecting the “New Database” menu item. Alternatively, you can click on the “Database” button in the Home ribbon and select “New Database”.

The database creation wizard will come up and assist you through creating the configuration database. During this setup, you will be given the choice of including sample data. This option is selected by default. If you do not want to include sample data, you can uncheck this option before creating the configuration database.

Once you complete the steps in the wizard, you will see the database in the Project Explorer, with the database’s Configuration node below it in the tree (if you included sample data).

To change the configuration’s settings, double-click on the Configuration node in the Workbench’s Project Explorer. The figure below shows the settings that are available for the configuration.

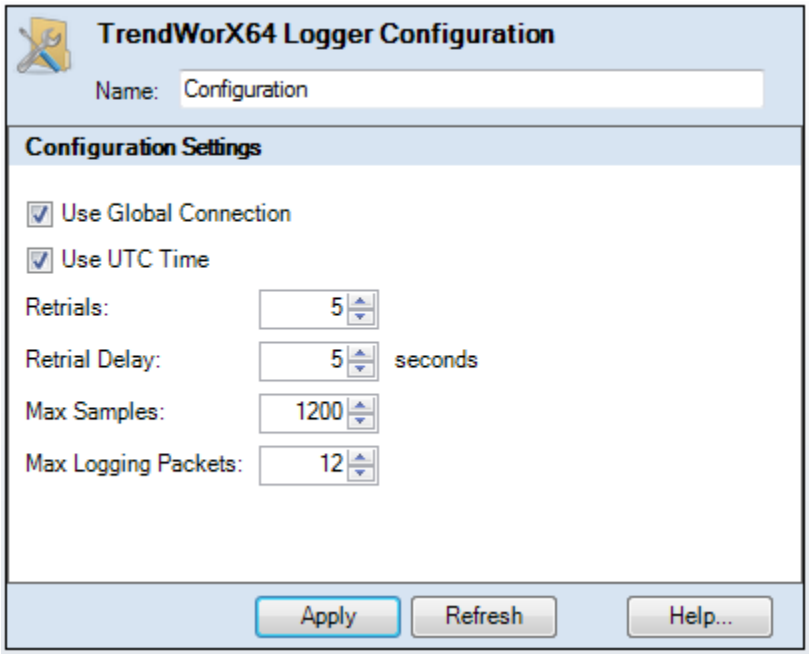


Figure 10.3 - TrendWorX64 Configuration Settings

Only one configuration per computer can be active at any given time; you must make the database active to use its configuration. To make the configuration database active, right-click on the database in the Project Explorer and select “Make Active” from the popup menu.

10.3. Database Groups

In order to log data, you must create a database group that specifies how to connect a database to store the information. You can have one or more database groups for a trend configuration. Each database group acts as a physical connection to the database, and manages data updates and logging activities. It is also a grouping of logging groups.

To create a database group, you can right-click on the database configuration, and then select “Database Group”. The Database Group configurator appears with the Database Connection tab displayed, where you can specify the database connection, as illustrated in Figure 10.4.

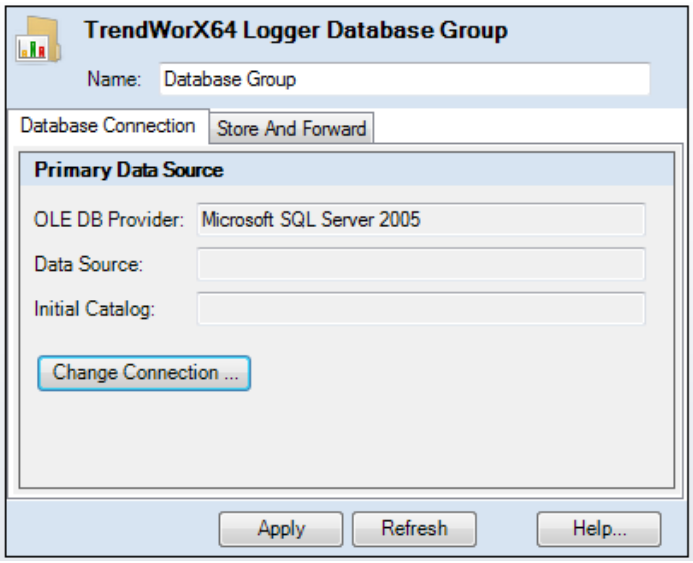


Figure 10.4 - TrendWorX64 Logger Database Group - Database Connection Tab

When creating a database group, enter a name. Then on the **Database Connection** tab click on the “Change Connection” button to open the OLE DB Connection dialog. Enter the connection information for the primary data source, and then click on the “OK” button.

10.4. Adding Logging Groups

It is likely that the TrendWorX64 Logger will be storing data for many different kinds of tags from the data source. Some tags may collect data from light sensors, other tags may collect data from security sensors, and still other tags monitors or control the physical plant. To organize the various types of tags that collect data, you can create as many logging groups as you need for the database group.

Not only does a logging group serve as a folder for tags, it also holds important settings for those tags. With these settings, you can:

- Control data collection rates and refresh rates for the tags
- Automate data collection by specifying the time spans when you want data to be collected from the logging group's tags
- Indicate when you want the collected data to be logged (that is, stored) in the database
- Manage the database tables that contain the logged data

To create a new logging group, right-click on the database group and select "Logging Group" from the popup menu. This displays the logging group configurator with the **Data Collection** tab on top, as shown in Figure 10.5. Let us talk about your configuration options.

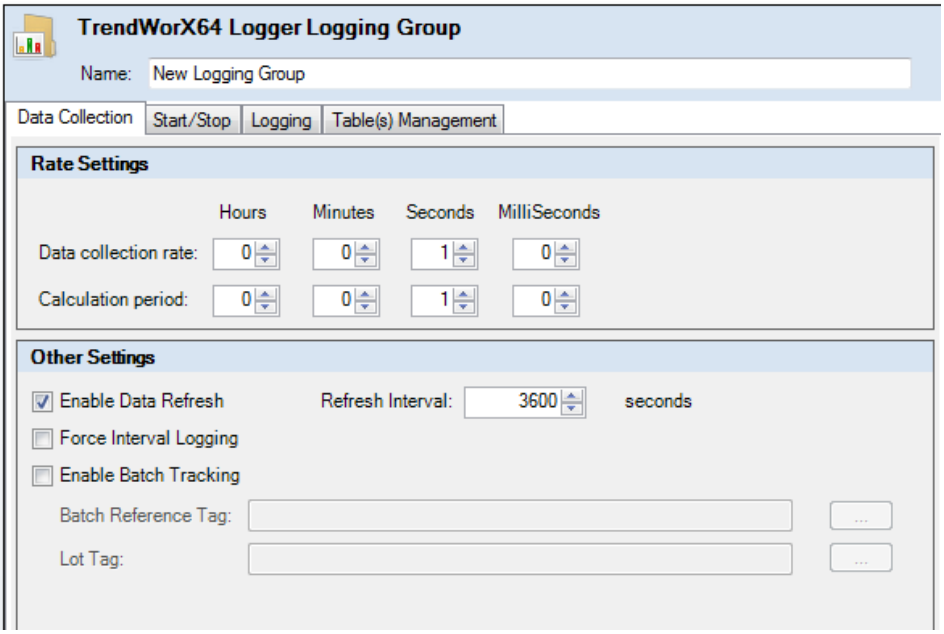


Figure 10.5 - Data Collection Tab for a Logging Group

10.4.1. Data Collection

On the **Data Collection** tab, the **Data Collection Rate** sets the frequency of how often to collect samples for the tags that you will be adding to the logging group. The default is 200 milliseconds, or 5 samples per second. The **Calculation Period** determines how often trending data are calculated for an aggregate function; by default, one update is calculated each second. The data collection rate and calculation period play a major role in consuming TrendWorX64 Logger and data source (SQL server) system resources. If your servers become sluggish, you may have to consider collecting fewer samples or lengthening the calculation period for fewer updates.

Use the "Enable Data Refresh" checkbox to refresh the data used for historical trend logging. This option makes a request to read (refresh) data to get an updated sample timestamp with the most recent value. The **Refresh Interval** must be longer than the data collection rate; this longer interval is necessary for getting responsive historical replay performance.

"Force Interval Logging" uses the TrendWorX64 Logger to force logging even when there is no change in data. Because OPC is change based, if values do not change between collection intervals, the OPC server may not send update to the trend server, causing no logged data. This option allows the server to actively poll data from the OPC server instead, making sure that there are data to log into the database even if there is no change in the tag's value. Having this type of data may be important to you later when you are tracking down values for critical OPC points.

TrendWorX64 supports batch and lot tracking. You can **Enable Batch Tracking** for the logging group and define OPC string signals that store the current **Batch** and **Lot** information. Batch and lot numbers can be retrieved automatically using a bar scanner or they can be entered manually using a display created in GraphWorX64.

10.4.2. Automated Data Collection Times

On the logging group's **Start/Stop** tab, shown in Figure 10.6, you can automate the times or conditions under which you want the logging group's data collection to begin and end. Using this method, you can automatically start capturing data at a certain time or stop collecting data when collection or data no longer needed. Although you are not required to end data collection for a logging group, preserving resources when no data collection is required is a good habit.

> **Note**: This tab dictates times for data collection only. Collected data held in memory is *logged to disk* in accordance with options on the Logging tab.

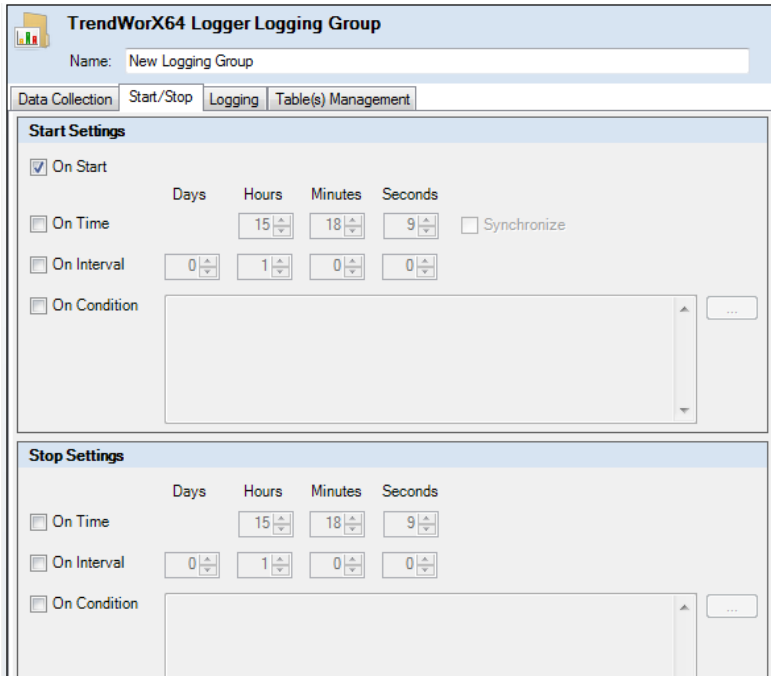


Figure 10.6 - Automated Start and Stop for a Logging Group

In automating start and stop times for data collection, you can:

- Start data collection immediately when the logger starts up by selecting **On Start**.
- Define the exact time at which you want data collection to start and/or stop each day by selecting **On Time**.
- Specify a length of time after which you want data collection to start after stopping, or stop after starting, by selecting **On Interval**
- Create a Boolean expression that evaluates to *True* or *False* to define the start or stop of data collection, in which case you select **On Condition**.

You can use more than one of these options for starting data collection as well as for stopping it. You can also use different methods for starting than you use for stopping; for example, you can start every day at 8:00 AM (**On Time**) and stop when a key piece of equipment shuts off (**On Condition**).

10.4.3. Your Data Logging Strategy

On the logging group's **Logging** tab shown below, you set the times or conditions under which you want all collected data in memory to be logged (that is, stored) in the database.

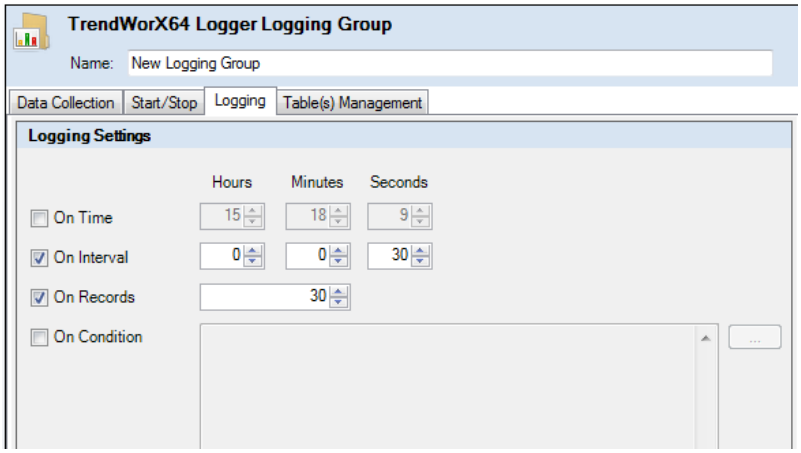


Figure 10.7 - Data Logging Times

The **On Time** option lets you specify the exact time at which data is to be logged each day. All data in memory at that time will be logged. With **On Interval**, you can specify the interval at which data logging occurs (for example, every 30 minutes). With **On Condition**, you can enter a *Boolean expression* that causes data to be logged when the expression becomes true. Finally, with **On Records**, each tag's data will be logged when the specified number of records has been collected. This last option gives you some control over the number of records being held in memory.

10.4.4. Your Table Management Strategy

When data is logged, it is stored in tables. You can set up data logging so that data is stored to multiple tables in a sequential order. Doing this provides you with:

- **Faster access to trend data**. Trend clients can be configured in a way that they can retrieve data from the most-recently-created tables, while the other tables are maintained for reporting and comparison to the data in the most-recently-created table.
- **Database Optimization**. Although historical information is retrieved by combining information from various historical tables, the ability to store data in multiple sequential tables optimizes performance by removing older, unneeded tables.
- **Improved Load Balancing**. It also helps in designing a configuration for system load balancing, as you can write tables to different SQL servers. By controlling the size of each table, you avoid creating extremely large tables that may degrade overall performance. To accelerate data retrieval, SQL Server creates the necessary database schema to maintain updated information with respect to the time interval at which each table logs data.

Use the Table Management tab, shown in Figure 10.8, to specify the number of tables in the database and when to create a new table. Start by giving the table a name.

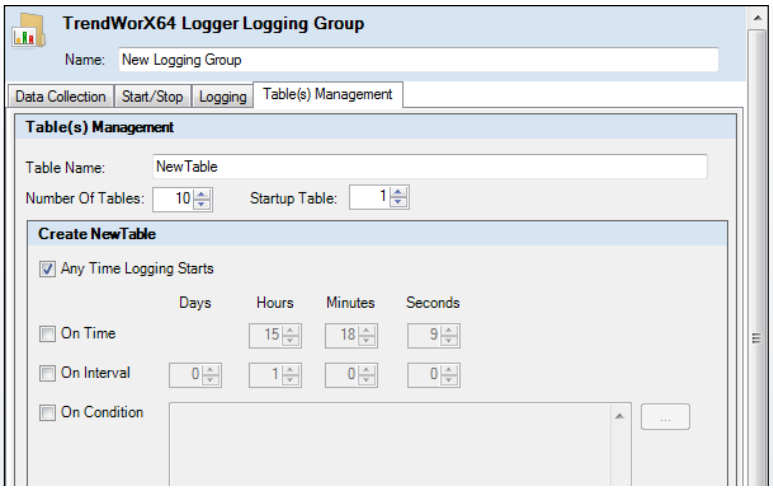


Figure 10.8 - Managing a Logging Table

Start by giving the tables a basic table name. You should also enter a **Startup Table** number to tell the logger how to create the first logging table. The name of the table is the table name appended by the table number starting with the startup table number.

The **Number of Tables** field determines the maximum number of tables that will be created (the maximum is 3,000). This gives you the ability to manage the capacity of the hard drive by limiting the number of tables in the database. When that number of tables is reached and filled, the oldest table will be overwritten with most recent data.

You must also specify the occasion for creating a new table. To create a new table every time data logging begins, select **Any Time Logging Starts**. To create a new table at a set time each day, select **On Time** and specify the time. To create new tables at a predetermined interval, such as every 5 days, select **On Interval** and specify the interval. To create a new table whenever a Boolean expression that you have created evaluates to true, select **On Condition** and then specify the expression.

10.5. Add Tags to a Logging Group

In addition to collection, logging, and table specification, the logging group is a container for the tag or tags it collects and logs data. Tags contain the data that you are collecting and logging for trend analysis. Tag data is collected into memory, and then stored in the active database.

You can add tags one at a time. Or you can add multiple tags using the Tag Import Wizard.

10.5.1. Adding One Tag at a Time

To add a tag to a logging group, right-click on the logging group, and select **Tag** from the popup menu. Then, you can configure the tag in the Tag configurator, shown in below.

Each tag is made up of a data source and the attributes or fields that are collected by that data source. You have control over the attributes and fields that are collected, but the path to the OPC UA or OPC DA tag is fixed to reference the particular tag of interest. In building the tag path, which is referred to as the *signal name*, you can use global and language aliasing to make it easier to create and work with tags. With this in mind, enter the **Signal Name** and a description of the tag.

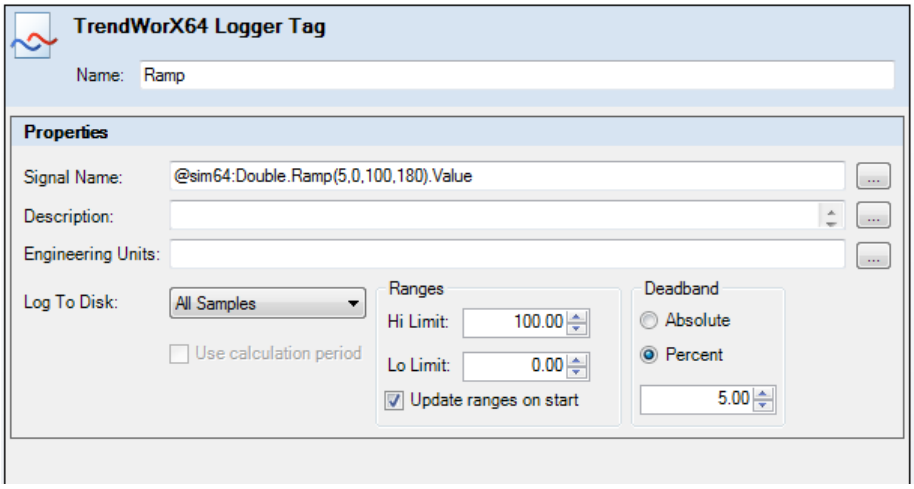


Figure 10.9 - Adding a Tag to a Logging Group

You must also specify which collected samples you want to log to disk. You can log all samples or specify a selected value (such as the minimum, the maximum, the average, and so on) from the **Log to Disk** dropdown list. Selecting the "Use Calculation Period" checkbox forces the database to recalculate aggregates at sub-intervals defined on the logging group's Logging Settings tab and applies to only the Max, Min, Avg, and Std. Dev. functions. Leaving the "Use Calculation Period" checkbox empty means that all aggregate functions are calculated based on the sample values as samples are written to disk.

Other options are also available for limiting the data that is logged. You can set a **range** for the samples and you can also use a **deadband** filter. The online help for TrendWorX64 Logger provides a good explanation of these options; you can navigate to the "Tags" online help topic by clicking on the **Help** icon at the top-right of the Workbench, then from the help's **Content** tab navigate to **TrendWorX64** → **TrendWorX64 Logger** → **Tags**.

10.5.2. Creating Several Trend Tags at Once

TrendWorX64 Logger has a Tag Import Wizard which you can use to create multiple trend tags from your OPC tags. Like the Tag Import Wizard in AlarmWorX64 Server, the TrendWorX64 Tag Import Wizard lets you specify a common naming system for all generated trend tags that is incremented by 1 for each tag. Default values are used for each generated tag, which you can modify after its creation.

To generate multiple trend tags, right-click on the logging group in the TrendWorX64 Logger in the Project Explorer, then select **Tag Import Wizard**. Alternatively, on the Home ribbon click the Add button and select **Tag Import Wizard** from the dropdown menu.

This opens the **TrendWorX64 Logger Import Tags** form shown in Figure 10.10, which is similar to, but simpler than, the form used, by AlarmWorX64 Server. Provide a base name, the first number, and the number of numeric places. Then add all of the tags you want to add to the logging group, and then click the "Import" button.

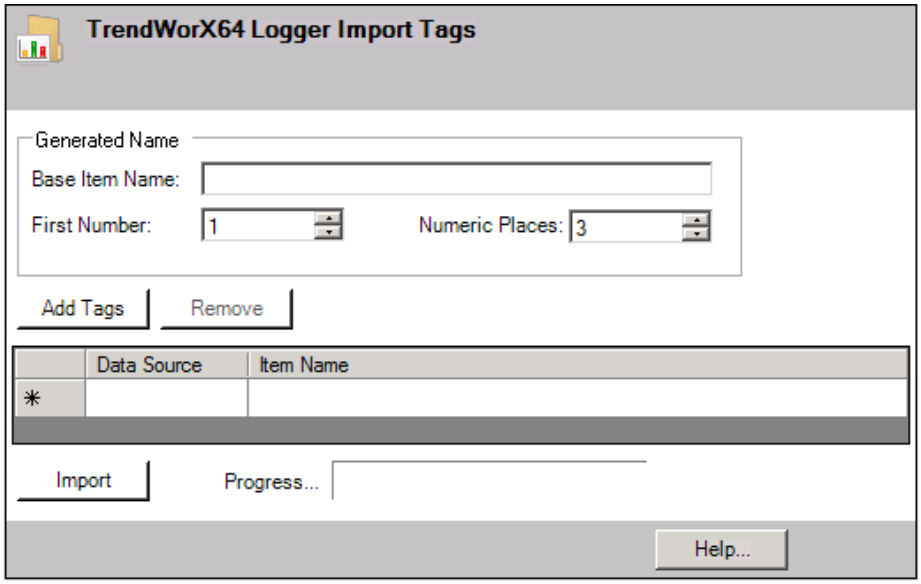


Figure 10.10 - Tag Import Wizard in TrendWorX64 Logger

Lab: TrendWorX64 Logger L10

10.1 Lab Overview

Many companies want to log plant floor data for analysis and icTonics is no different. They have requested that we set up a logging mechanism that allows them to look at older data and analyze it in the future. With this procedure, we will be logging to a SQL Server database. For applications requiring very fast logging for thousands of tags, you should definitely consider using Hyper Historian. Hyper Historian's performance is far superior to SQL Server.

Estimated time to complete this lab: 20 minutes

10.2 Task Checklist

In this lab, you will complete the following tasks:

- Create a new TrendWorX64 configuration database.
- Create a new trend configuration.
- Create a new database group.
- Create a new logging group.
- Make a connection to a logging database.
- Add tags to log.
- View the logged data for the tag.

10.3 Support Files

You do not need any supporting files to complete this lab.

10.4 Configure TrendWorX64 Server

The TrendWorX64 configuration allows you to set up OPC tags whose values you want to log. We will create a configuration that specifies where to log data, how fast to collect data, and how often to write data into the database.

10.4.1 Configure TrendWorX64 Server

1. Open Workbench-SL if you have closed it since the previous lab and select TrendWorX64 Logger in the Provider Explorer.
2. Right-click on localhost and select "**New Database**".
3. This launches the "**Create a new Database"** dialog.
4. The SQL Server should be defined as (local)\SQLEXPRESS.
5. **Uncheck** the 'Include Sample Data' option and name the database "**icTonicsTrendLoggerConfig**".
6. Click **OK** to create the new configuration database.
7. You should see the icTonicsTrendLoggerConfig database under **localhost** in the explorer.
8. Expand icTonicsTrendConfig to expose the **Configuration** folder. This folder will be empty.
9. Right-click on **Configuration** and select "**+ Add Database Group**", as shown in the figure below.

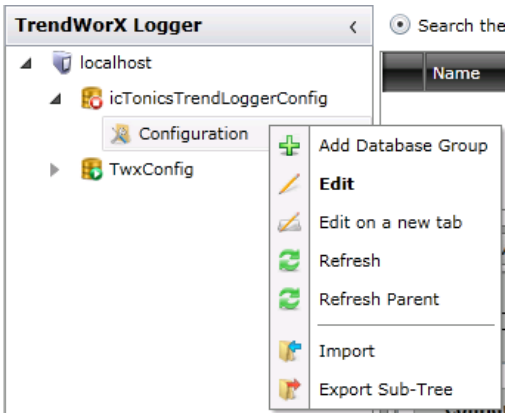


Figure L10A.1 - Adding a Database Group

10. A new tab will open showing configuration properties for the new database group. Name this database group "**icTonicsTrends**". Click **Apply**.

11. Uncheck the "**Use Configuration Database for Logging**" checkbox.

12. Click the **Change Connection** button and click on the **Test Connection** button.

13. From the **Database name:** drop down list, select **icTonicsTrendData**.

14. The finished configuration should look similar to the figure below.

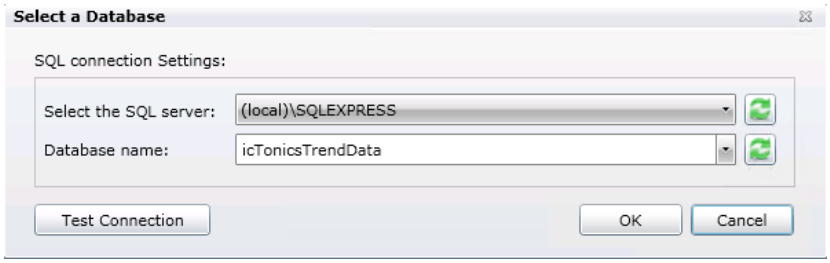


Figure L10A.2 - Database Connection Configuration

15. Click **OK**.

16. You may get a message telling you that changes will not take effect until the logger restarts. Just click on "OK" to close the message box.

17. Right-click on the **icTonicsTrends** database group and select "+ **Add Logging Group**".

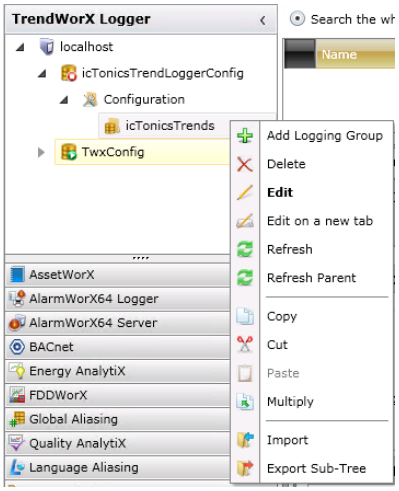


Figure L10A.3 - Adding a Logging Group

18. A new tab should open called [NewLoggingGroup]. Rename this logging group "**Tank Levels**".

19. From the **Data Collection** tab, change the **Data collection rate** and **Calculation period** to **5** seconds. Click **Apply**.

20. Since our data does not change often, let's put a checkmark in the "**Force Interval Logging**" checkbox.

21. Your finished configuration should look similar to the figure below.

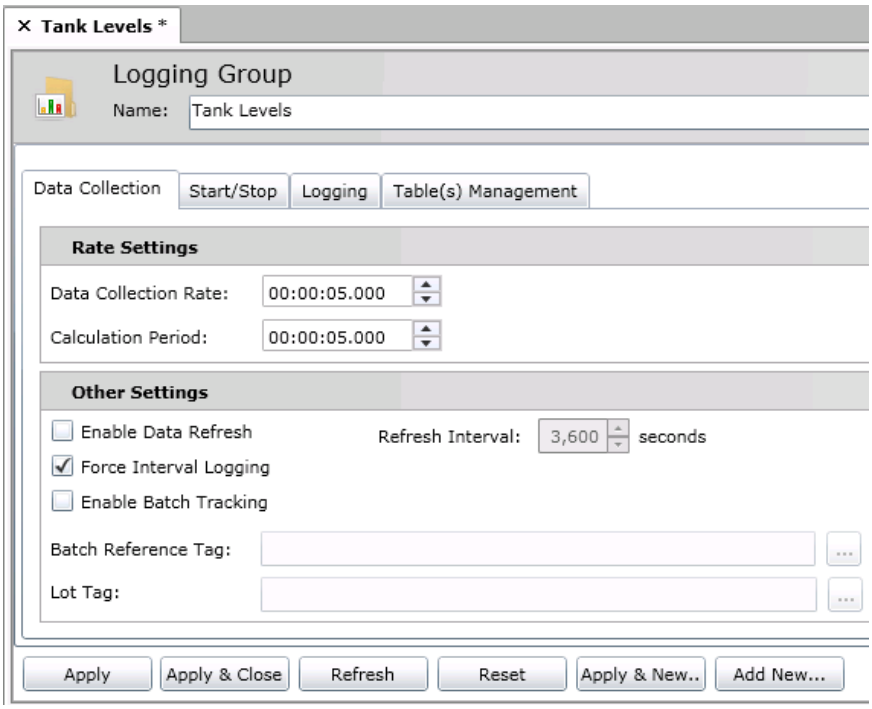


Figure L10A.4 - Data Collection Tab

22. Click on "**Apply**" to save the changes.

23. Select the **Logging** tab. **Uncheck** the "**On Records**" option. We will leave the default logging condition at "**On Interval every 30 seconds**".

24. Select the **Table(s) Management** tab.

25. Change the **Table Name**: to "**TankLevels**".

26. Check the option to create a new table "**On Time**". Set it to 11:00.

27. Your finished configuration should look similar to the following figure.

Note: In the **Table Name**: field, if you enter **Tank Levels** (with a space), data validation may fail. The proper entry is **TankLevels** (no space).

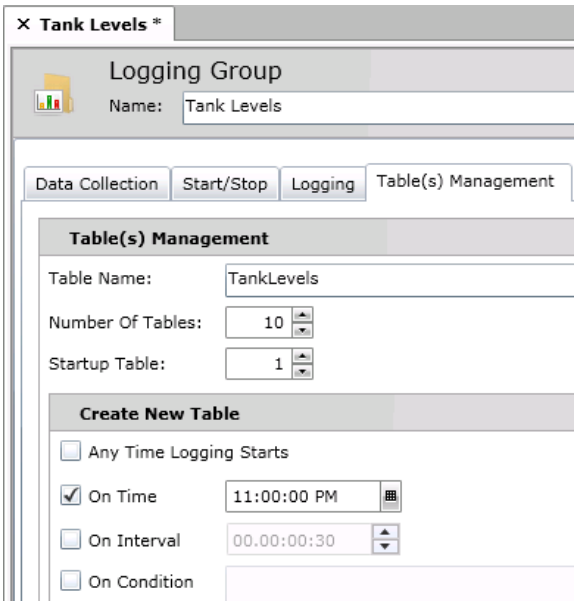


Figure L10A.5 - Table(s) Management Tab

28. Click on "**Apply**" to save the configuration. We will now add the tags to log the data.

29. Right-click on "**TankLevels**" and select "+ **Add Tag**". A new tab will open with tag properties.

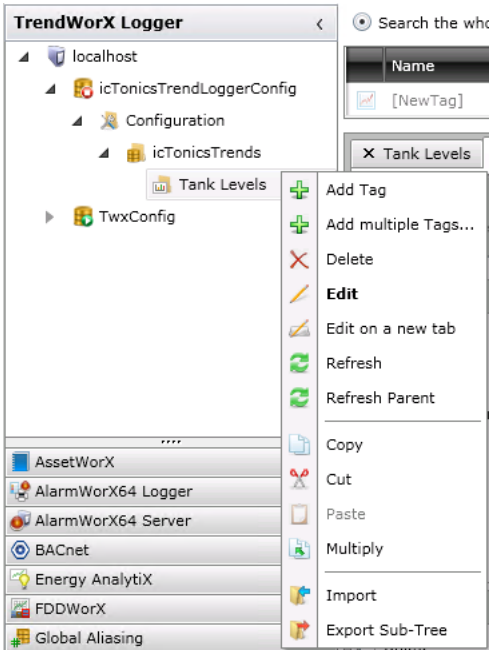


Figure L10A.6 - Adding Trend Tags

30. Name this tag "**Tank1 Level**". Click on the ellipsis button [...] next to the Signal Name field to bring up the **Data Browser**.

31. In the Data Browser, we will look for the following tag:
@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.TankLevel.Value

32. We can leave everything else as the default for the tag configuration. Click on "**Apply**" to save the changes. Your finished tag configuration should look similar to Figure L10A.7.

33. Right-click on "Tank Levels" and select "+ **Tag**". A new tab should open with tag properties.

34. Name this tag "**Tank1 LevelSetpoint**". Click on the ellipsis button next to the Signal Name field to bring up the **Data Browser**.

35. In the Data Browser, we will look for the following tag:
@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.LevelSetPoint.Value

36. Select it and then click on "**OK**" to go back to the **Tag Configuration** screen.

37. We can leave everything else as the default for the tag configuration. Click on "**Apply & Close**" to save the changes. Your finished tag configuration should look similar to the figure below.

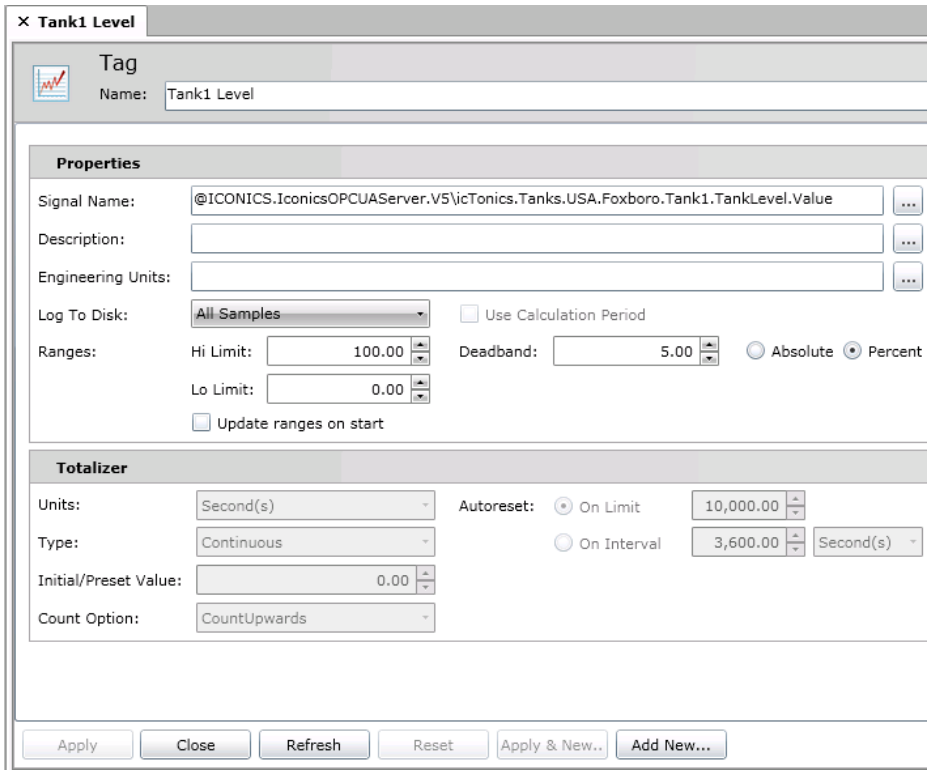


Figure L10A.7 – Tank1 Level Tag Configuration

38. If the traffic light icons are green, click on both of the **Start/Stop** lights icon in the ribbon to **Stop** the data logging service. The lights should turn red.

39. Right-click on the **icTonicsTrendLoggerConfig** database and select **Make Active**. This will make the configuration database that you created active.

40. Click on both of the **Start/Stop** lights in the ribbon again and **Start** the data logging service. The light should turn green.

10.5 Trend Logger Tag Multiply

1. Now we will add similar logging tags for **Tank2** and **Tank3**. For this, we can use the **Multiply** function, which makes it easier to create similar alarms.

2. Right-click on the "**Tank1 Level**" logger tag and select **Multiply** to launch the **Multiply Options** dialog box. You could alternatively select "Tank1 Level" and click on the Multiply icon in the Clipboard section of the ribbon.

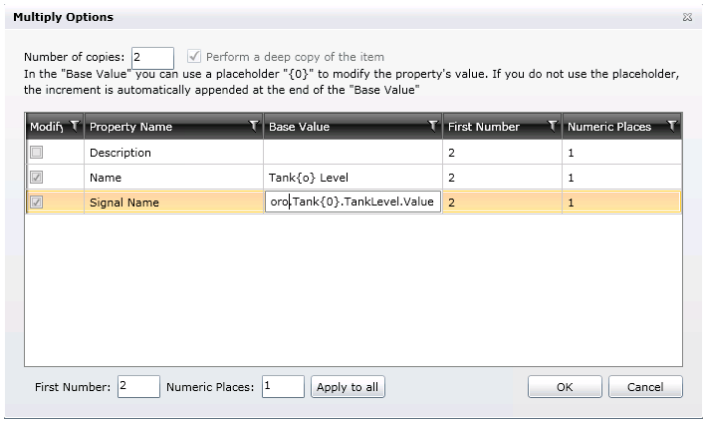
3. Let's use the **placeholder {0}** to auto-generate the **Name** and **Signal Name** field's proper values. See the figure below for more information. Also note that, within the Multiply Options dialog, there is a description of the placeholder {0} functionality.

4. Set the **Multiply Options** as follows:

Field Name	**Value**	**Modify Check Box**
Number of copies	2	
Name	Tank{0} Level	Yes
Signal Name	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks .USA.Foxboro.Tank{0}.TankLevel.Value	Yes
First Number:	2	
Numeric Places	1	
Be sure to click the "**Apply to all**" button.		

6. Deselect the **Description** checkbox.

7. When your configuration resembles the following figure, select **OK**.



L10.8 - Multiply Options Dialog Box

<u>This step is very important as it will affect your alarm functionality for the rest of the training session</u>. Carefully review and edit, if necessary, each of the newly created logger tag's **Name** and **Signal Name** properties.

Take a moment and check to make sure they resemble the following tag syntax:
@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.TankLevel.Value
@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank2.TankLevel.Value
@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank3.TankLevel.Value

8. Repeat the steps that you've learned to add the following three tags to the **Tank Levels** logging group.

@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.LevelSetPoint.Value
@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank2.LevelSetPoint.Value
@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank3.LevelSetPoint.Value

Your finished configuration may look like the following figure:

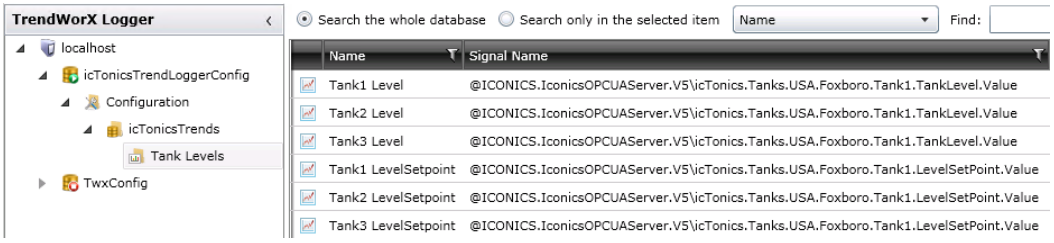


Figure L10A.9 - Advanced TrendWorX64 Configuration

9. In the next chapter, we will add a TrendWorX64 viewer to a GraphWorX64 display, allowing us to view both real-time and historical data.

This concludes this lab.

TrendWorX64 Viewer Control 11

The ICONICS TrendWorX64 Viewer, shown in Figure 11.1, is a client application that provides real-time and historical data trend displays within the GENESIS64 product family. The viewer communicates to OPC UA, OPC DA, and OPC UA HDA servers to provide trend displays based on the connections to the data source that you specify.

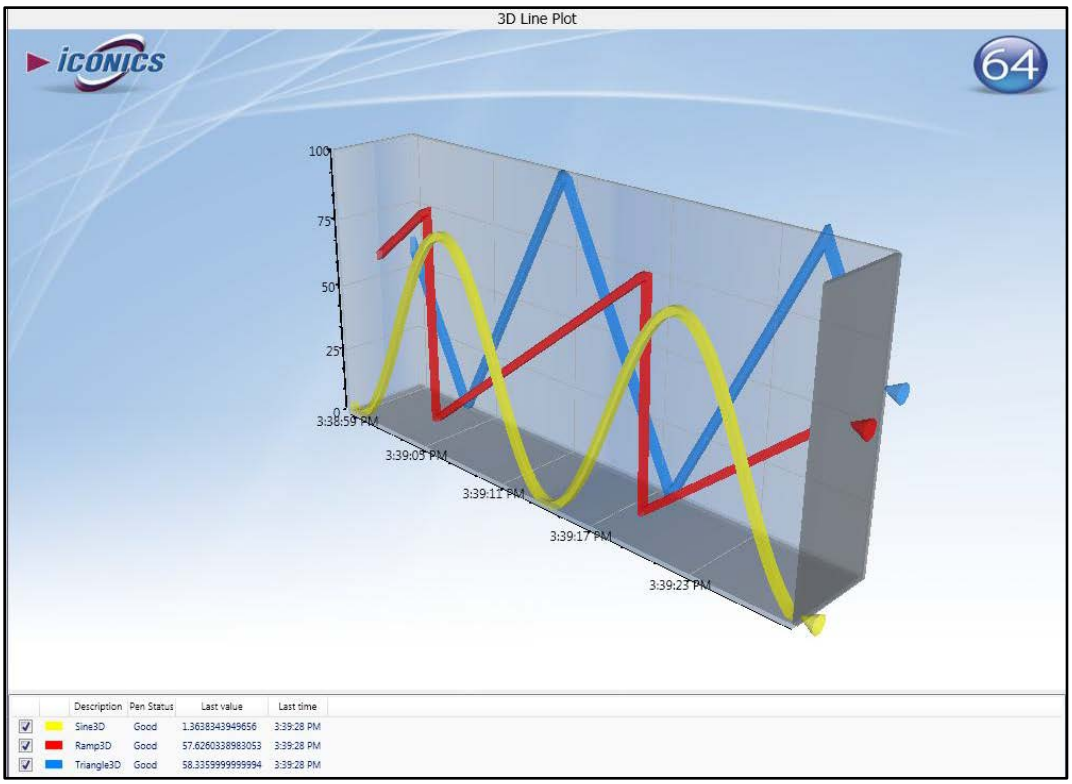


Figure 11.1 - TrendWorX64 Viewer

Features of the TrendWorX64 Viewer include:

- Real-time data displays
- Historical data displays
- Data utility functions
- Sophisticated, multi-threaded data buffering to guarantee data integrity with support for customer-configurable data collection rates

With TrendWorX64 Viewer you can use the following features and more:

- 3D visualization
- A side panel
- Multiple tabs with multiple charts
- Multiple pens and a runtime legend that identifies them
- A Toolbar for changing the Trend Period
- Plots that can swap the Y and X axes
- A summary view
- Ability to modify and customize the display at runtime

By the end of this chapter, you will be familiar with the following concepts:

- TrendWorX64 Viewer properties and different kinds of modes
- Chart options
- The side panel
- Tabs, plots, and pens
- Time and rates
- Runtime operations
- Workbench vs. GraphWorX64 displays

11.1. TrendWorX64 Viewer Modes

The TrendWorX64 Viewer has three different modes: Configuration mode, Runtime mode, and Freeze mode.

Configuration mode is design for changing the properties. In Runtime mode the data is collected and displayed and the chart updates according to the data received from the OPC servers. During runtime, you can freeze the display and examine the data in it. The data still collects, but the display stops updating with current data until you leave freeze mode.

11.2. TrendWorX64 Viewer Properties

The TrendWorX64 Viewer Properties dialog, shown in Figure 11.3, is the trend configuration interface, which is accessible from Workbench or GraphWorX64. It is more appropriate to describe it as a "control", which is itself a container that can contain additional objects. To open this dialog, simply click on the "Configure" button in TrendWorX64 Viewer Configuration ribbon.

When you first open the dialog for a new trend, the Viewer control contains two configurable items in the tree structure on the left: a side panel and a tab that has a chart in it. It looks something like the tree in Figure 11.2.

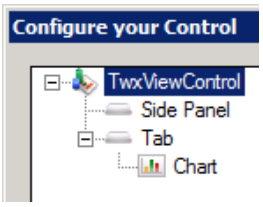


Figure 11.2 - Default Structure of Objects in the TrendWorX64 Viewer

Clicking on TrendWorX64Viewer (or TwxViewControl) in the tree offers general options such as whether there is a border or if the runtime toolbar appears as well as header, title and subtitle options. Figure 11.3 shows the Appearance tab (with the Advanced tab behind it) for the TrendWorX64Viewer tree items.

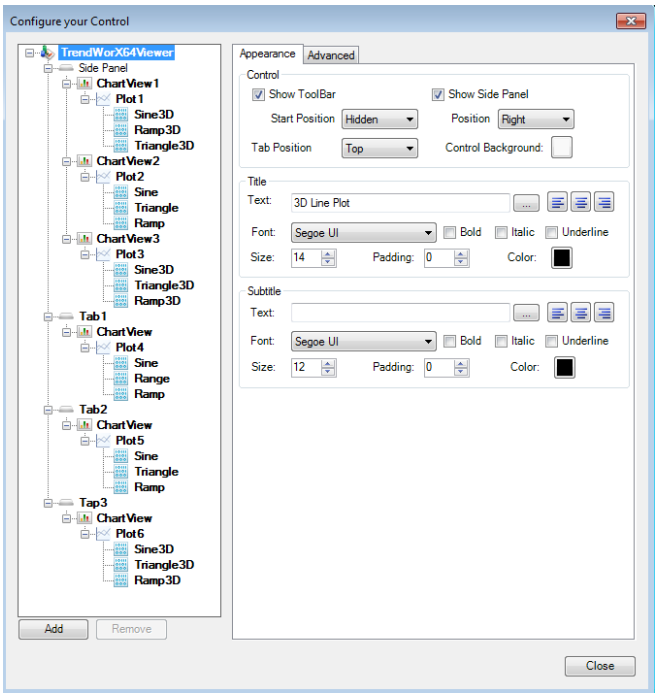


Figure 11.3 - TrendWorX64 Viewer Properties

Note: Not all of these configuration options are within the scope of this class. For more information about TrendWorX64 Viewer properties, please refer to the TrendWorX64 Viewer Help documentation.

11.2.1. Appearance Settings

The **Appearance** tab, shown previously in Figure 11.3, appears by default when you select the viewer object. This tab sets the appearance properties for the trend viewer's toolbar, side panel, title, and subtitle.

The "Show Toolbar" checkbox lets you prevent the toolbar from appearing with the trend, but if you choose to show it you use the "Start Position" option to choose the toolbar's initial position. You can dock the toolbar at the top, bottom, right, left, or let it float. The toolbar appears only in Runtime or Freeze mode. If the toolbar is hidden, runtime operators can double-click on the display to show the toolbar.

The "Show Side Panel" checkbox and "Position" option control the display of the viewer's side panel at runtime and specify the position of the side panel at the top, bottom, left, or right of the trend. The side panel is a powerful feature, which allows you to switch between the different types of charts predefined in TrendWorX64 Viewer. If you choose to show the side panel, make sure you configure it.

Although the Side Panel object appears just below the Viewer object in the configurator tree, we are going to side step it for the moment and focus on the Viewer's other objects. After that, we will return to the topic of the side panel.

11.2.2. Advanced Settings

The Advanced tab lets you customize the TrendWorX64 Viewer's appearance, behavior, header, measurements, text, etc. Properties on the Advanced tab come with helpful tips that appear for the selected property at the bottom of the tab.

11.3. Tabs

TrendWorX64 Viewer allows you to create multiple tabs inside the Viewer. These tabs are visible in Configuration mode as well as in Runtime mode. Figure 11.4 illustrates that a TrendWorX64 Viewer with multiple tabs and a side panel that provides a consolidated view of each tab. If you use these two features together in a Viewer, your runtime users will be able to switch easily between graphs and gain access to certain plots quickly.

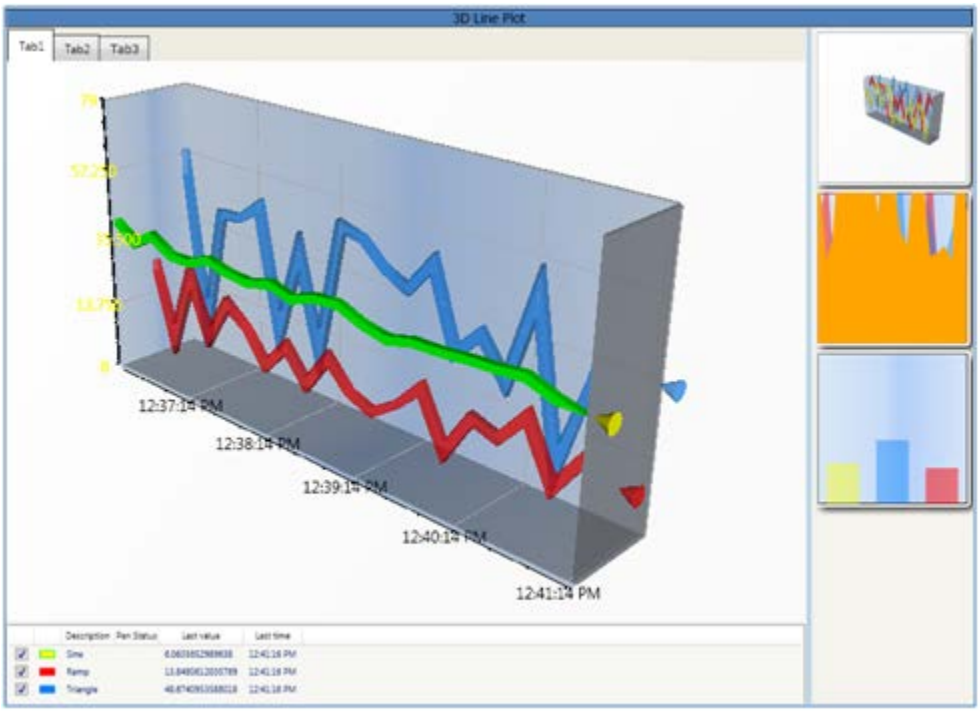


Figure 11.4 - TrendWorX64 Viewer with Side Panel and Multiple Tabs

You can add a new tab to the Viewer by selecting the Viewer and then clicking on the Add button at the bottom of the control's configuration dialog. Or you can right-click on the TrendWorX64Viewer in the tree control and select Add → Tab.

Selecting the tab in the tree control gives you access to its appearance tab where you give the tab a title, and can set a color scheme for the tab when it is selected and not selected. To create a uniform appearance among the tabs in the Viewer, you can also apply that scheme to all other tabs simply by clicking the "Apply To All Tabs" button.

At times, you may want to copy a fully-configured tab along with all of its charts. After copying it, you can edit the tab and its charts to create a new graph. To do this, you right-click the tab in the tree control and select the "Multiply" option. This lets you make one or more copies of the tab and all of its components.

11.4. Chart View

A chart is a container that holds one or more plots. Each tab in the Viewer can have any number of charts in it, but of course, you will limit the number of charts to keep the tab from becoming unusable.

Charts come with several options, as shown in Figure 11.5. You will also notice in the figure that charts can also be added to the side panel.

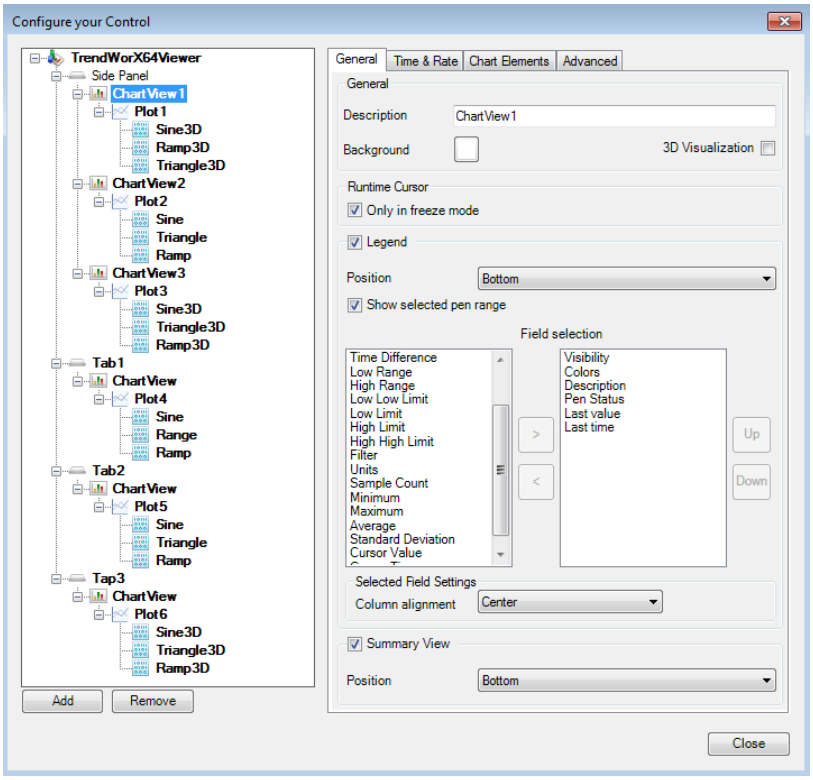


Figure 11.5 - Chart Options

> **Note:** You can add a plot to the chart by selecting the chart object, then clicking the Add button at the bottom of the screen.

You add a chart to a tab by right clicking the tab object in the tree and selecting Add → Chart. You configure a chart by selecting it in the tree view to bring up its options, which are spread over four tabs: the General tab, the Time & Rate tab, the Charts Elements tab, and the **Advanced** tab. We will look at the first three tabs in this course.

11.4.1. General Tab

On the chart's **General** tab shown in Figure 11.6, you can set the following:

- The general appearance
- Runtime cursor
- Legend
- Summary view

On the General tab, you can start by giving the chart a **Description** and choosing a **Background** color or image.

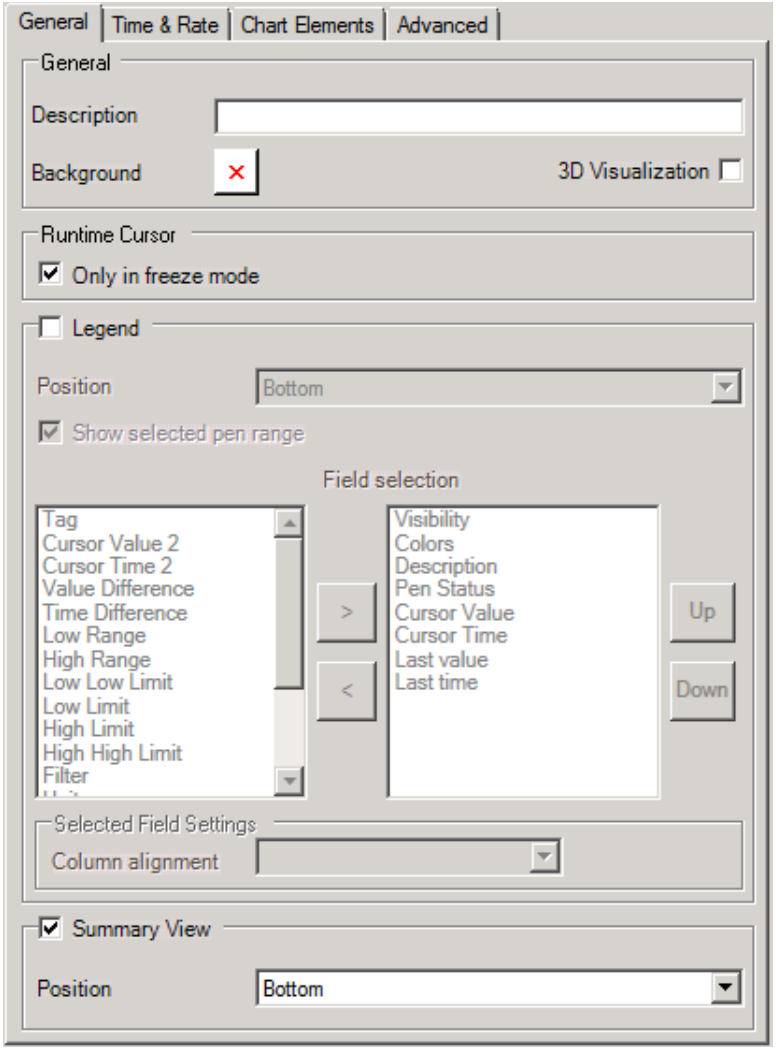


Figure 11.6 – The Chart's General Options

The “3D Visualization” checkbox gives the trend chart a third dimension, shown in the example in Figure 11.7.

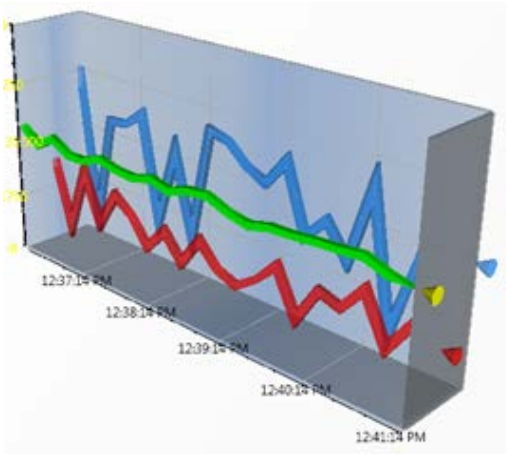


Figure 11.7 - 3D Visualization View

The cursor is always available to runtime users unless you put a checkmark in the “Only in Freeze Mode” checkbox. The “Legend” checkbox allows you to show or hide the legend in both runtime and configuration mode, and you can specify the content of the legend. Runtime users can manipulate pens during runtime if the chart has a legend that includes certain options. For example, if the legend includes the Visibility field, runtime users can show and hide individual pens in the chart. Selecting the “Summary View” checkbox displays a plot window to show the entire range of data that is collected; the Summary View shows only in Freeze mode.

> **Note:** More information about options on the **General tab** is available in the TrendWorX32 Viewer’s online Help. In the Workbench, click the Help icon in the upper right of the Workbench and then in the Contents tab navigate to the TrendWorX64 Viewer topics.

11.4.2. Time & Rate Options Tab

The chart's **Time & Rate** tab, shown in below, determines the data collection rate, data display rate, chart refresh rate, the Trend Period Tool Bar, and other factors that control what is stored in the TrendWorX64 Viewer data buffer and what is displayed. Alter these settings in configuration and runtime modes using the runtime toolbar.

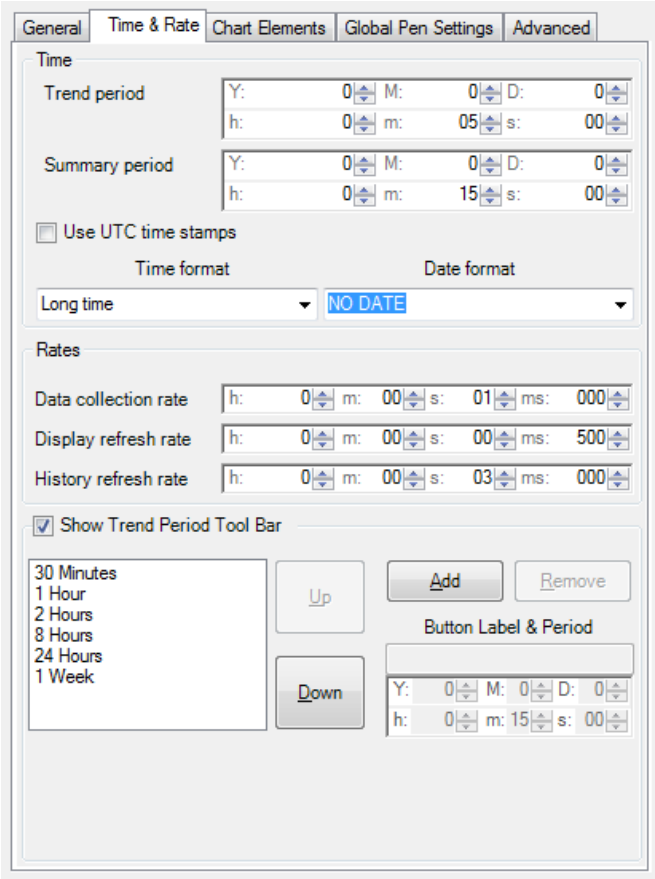


Figure 11.8 - Time and Rate Tab

The properties available that affect time are:

- **Trend Period**: Describes the duration of the interval shown in the Chart object display.
- **Summary Period**: Is the amount of data stored in the data buffer and that can be displayed in Freeze mode in the Summary window.
- **Use UTC time stamps**: If this option is checked, all time stamps stored in the database will be stored as UTC time stamps. This is to accommodate automatic daylight savings time switching in Windows when the TrendWorX64 Logger is logging data. All historical clients and reporting tools will always retrieve historical data in their local (non-UTC) time.

- You can select the desired Data Collection Rate, among other variables. Currently the fastest data-collection rate is 10 milliseconds (ms). The update rate is given by inserting the variables on the **Rates** tab. Therefore, if you change one of these variables, all other variables will be updated automatically.

Notice that the data collection rate is configured independently of the drawing action. The fastest display update rate is 50 ms, with the exception of bar plots, in which the display rate matches the data-collection period.

The **Display Refresh Rate** controls the speed at which the signal curves will be drawn. If, for example, the Data Collection Rate is set to 250 ms and the **Display Refresh Rate** is set to 1 sec, the samples will be collected at 250 ms, but the signal curve will be updated every second without loss of data. This is a great option to minimize system-resource use.

The **History Refresh Rate** controls the frequency at which the historical pens will be refreshed with new historical data from the TrendWorX64 historical database. This can be used as an optimization and load-balancing tool. For example, if the TrendWorX64 Logger is configured to log to the database every minute, then the **History Refresh Rate** should match this rate.

The **Trend Period Tool Bar** can be used to show buttons for dynamically switching the Trend Period by operators during Runtime. The number of buttons and order can be altered using the Up, Down, Add, and Remove buttons on the side. A name and trend period can be set with the time picker that activates when the Add button is clicked.

11.4.3. Chart Elements Tab

Chart Elements options (shown in Figure 11.9) include the color of lines and backgrounds, as well as how the different axes display. You can also alter the ranges that a multi-plot display uses. In runtime, when you click on the Show/Hide Axes button, this same tab displays as a dialog box so that the runtime user can change them. These settings apply to the configuration, runtime, and freeze mode.

You can set the following properties on the Chart Elements tab:

- Background and Line Color
- Show Grid
- X-Axis and Y-Axis
- Fill Style
- Global Range

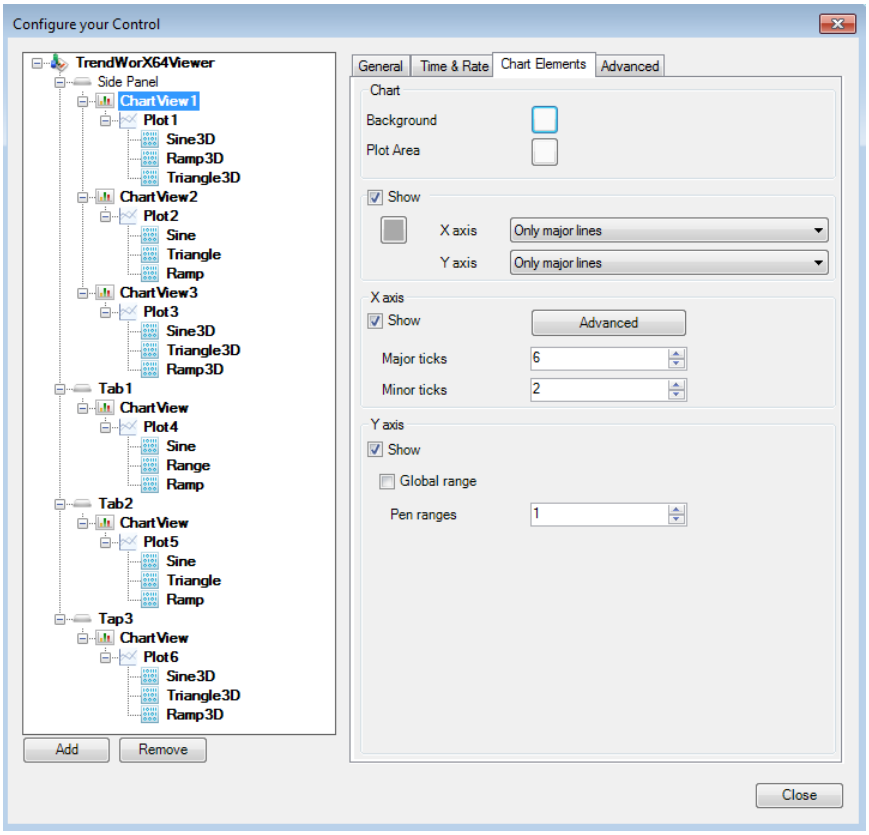


Figure 11.9 - Chart Elements Tab

11.5. Plots and Plot Types

Each chart is "drawn" by pens. There several ways a pen can draw a chart – each way is called a plot type. To choose the plot type a pen will use, you must first add a plot to the chart, and then choose its plot type. You can add any number of plots (i.e., plot types) to a chart. A *plot* is sometimes referred to as a *pen group*. It is a collection of pens that share a plot type. To understand this, you have to understand the plot types that are available.

You can see them on the Plot tab, shown in Figure 11.10. The supported plot types are:

- Line
- Area
- Bars
- Circular
- Pie

If you want to have five pens, three of which are lines (that is, a *line* plot type) and two of which are areas (that is, an *area* plot type), then you would need to create two plots: one for the three line pens and one for the two area pens. Then you would add their respective pens to the plots.

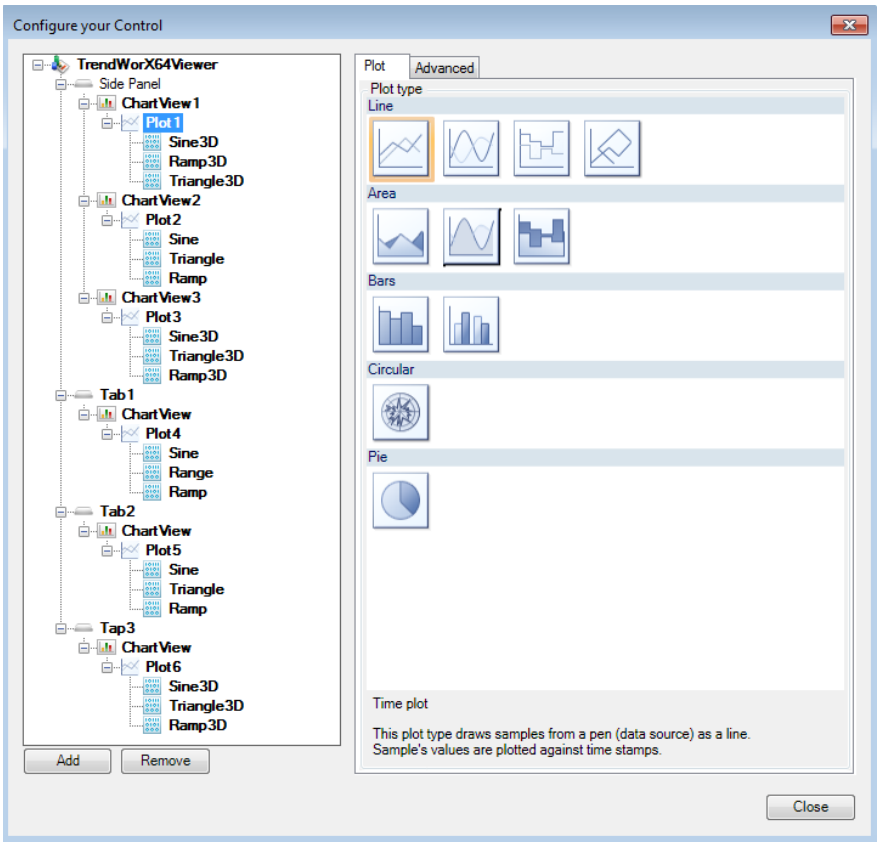


Figure 11.10 - Different Plot Types in TrendWorX64 Viewer

To add a plot (that is, a pen group) to a chart, right-click the chart object and select Add → Plot. Alternatively, you can select the chart object and click the Add button at the bottom of the dialog box. Then simply choose the plot type that you want the pens to use. After that, you can add pen to the plot object – pens are what we will cover next.

11.6. Pen Configuration

A pen is the point that puts values on a chart; it is the connection between the data source and your trend display. A pen writes the data point as well as the connection properties between data points. The following types of signals can be viewed in TrendWorX64 Viewer:

- OPC UA (Unified Architecture)
- OPC DA (Real-time data)
- OPC HDA (Historical data)

Runtime users can manipulate pens during runtime if the chart has a Legend that includes certain options. For example, if the legend includes the Visibility field, runtime users can show and hide individual pens in the chart.

You can have any number of pens of the same and differing styles on a chart. The pen takes on the style of the plot you add it to. To add a pen to a plot, right-click the plot and select Add → Pen, or select the plot object and click the "Add" button at the bottom of the dialog box. The **Pen Configuration** dialog box, shown below, has four tabs of options: the General tab, the Alarm tab, the Ideal Pen tab, and the Advanced tab.

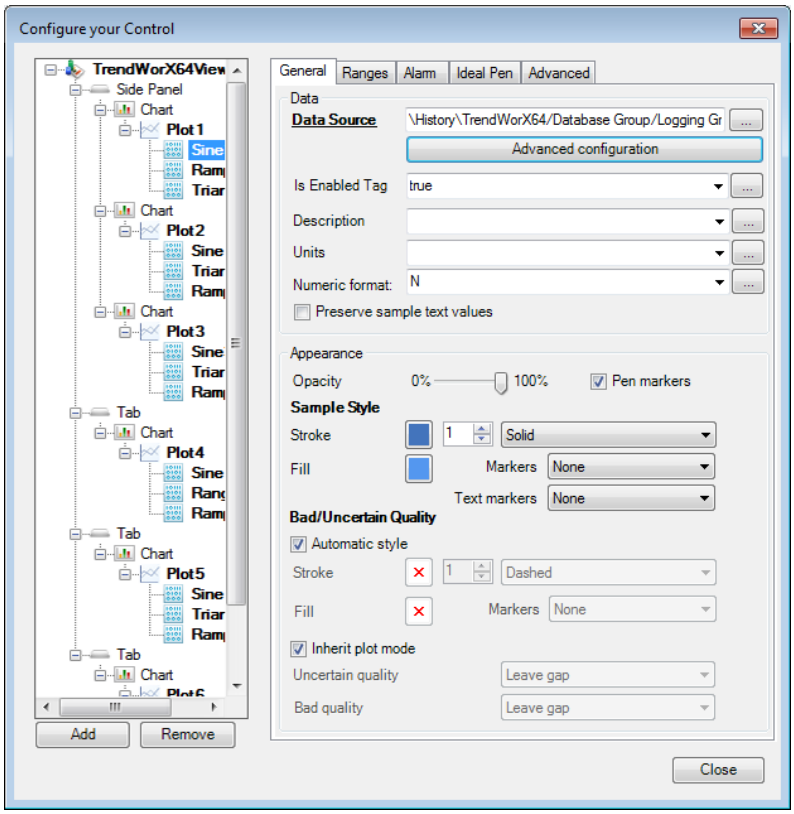


Figure 11.11 - Pen Configuration

11.6.1. General Tab

It is the pen configuration that handles the signal connection editing and configuration for the data displayed in the trend. When configuring a pen, based on what **Data Source** you provide, **Use DA Connection** and **Use HDA Connections** are automatically set; freeing you from worrying about which one to choose. However, you can use the Advanced Configuration button on the General tab to set filters, as shown in Figure 11.12. The **Aggregate Type** option in can be used to filter the samples logged into the logging database, as can a deadband filter for a DA connection.

Note: You can use aliases to construct the path and name of a pen's data source.

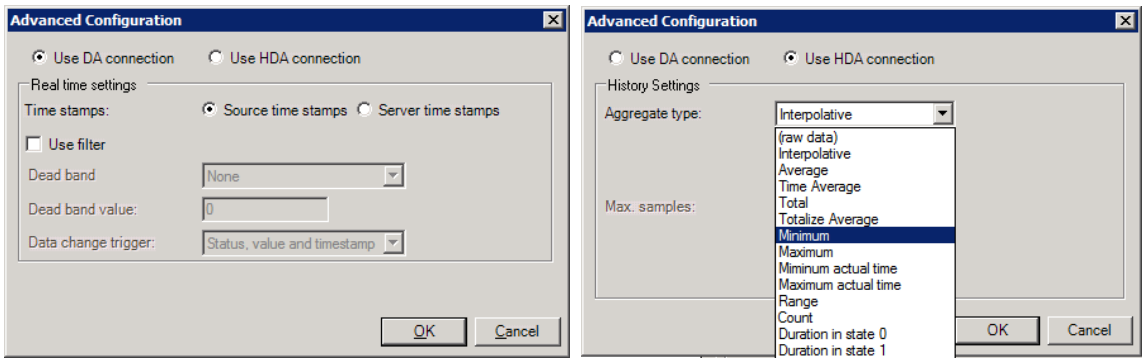


Figure 11.12 - Setting a Real-Time (left) or Historical (right) Data Source

Also on the General tab, a pen's appearance can be modified using "Stroke" and "Fill" color parameters. The "Opacity" setting allows the pen line or area to show the background through it. Setting the "Markers" option to None, Circle, Square, or Triangle specifies the symbol displayed at each data point in the display, which is helpful if you have multiple pens drawing lines. The pen's **Range** can be read directly from the server or automatically scaled. You can also set a fixed range for any pen. The "Configuration Axis" button opens an additional dialog where you can add labels, tick marks and other options to the chart for this particular pen.

11.6.2. Ranges Tab

On the Ranges tab the scale for the pen can be set to **Auto**, **AutoScale** or **Fixed**. Auto will automatically fit the trend to the viewer window. AutoScale will use the marginal percentage to scale the trend in the trend window. Fixed will allow the user to enter in their own values. The Configure Axis button opens up a new dialog for configuration of background color, title, tick marks, labels and base type (for certain plot types).

11.6.3. Alarm Tab

You can optionally set boundaries for the values that the pen writes. (You can choose to display the numerical values of these limits in the chart's legend by using the chart's General tab.) Note that you can click a field's ellipsis button to open the Data Browser where you can select an alias or tag that sets an alarm limit.

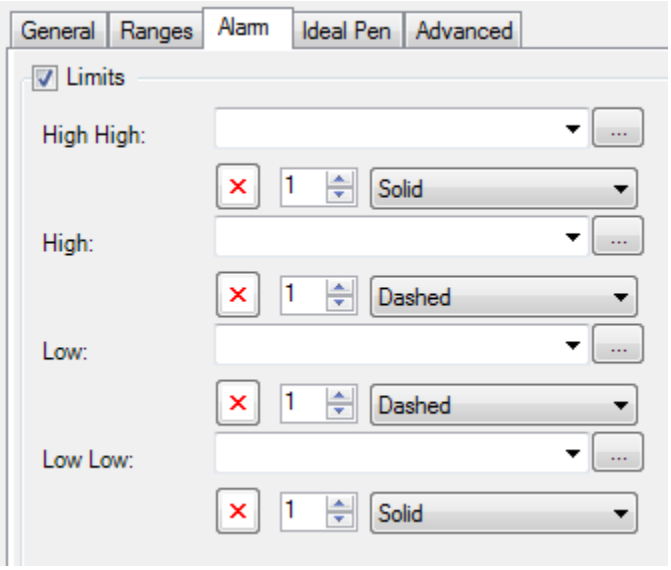


Figure 11.13 - The Pen's Alarm Tab

11.6.4. Ideal Pen Tab

You can configure any historical pen as an ideal pen. This feature allows for powerful comparisons of past historical data to current historical data for the same historical pen. There is no limit on the number of ideal pens in a TrendWorX64 Viewer.

As shown in Figure 11.14, you can use the Ideal Pen tab to make a pen an ideal pen and set its starting time and date.

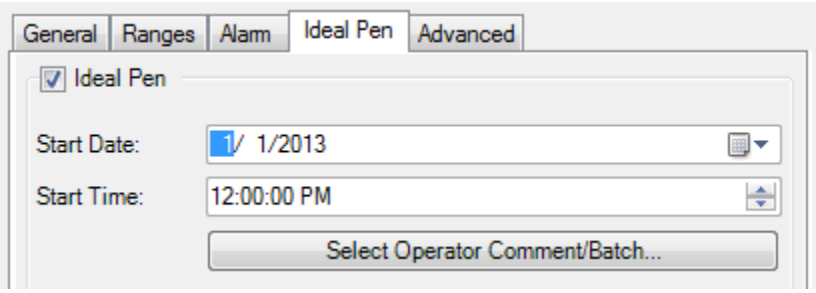


Figure 11.14 - The Ideal Pen Tab

Upon entering runtime, the TrendWorX64 Viewer populates the ideal pen with historical data starting at the selected time and date, while non-ideal historical pens update with current data from the historical database. In runtime, right clicking lets you know if a pen is an ideal pen. The legend Description field will also tell you if a pen is an ideal pen. You can set (or reset) any historical pen as an ideal pen at any time during runtime, and you can modify its starting time and date.

11.7. The Side Panel

One side panel object is created automatically for any Viewer that you create. You cannot remove the side panel or rename it. A side panel that displays beside the tabs you created in your display, as shown in Figure 11.15. Although the side panel has no properties of its own, you can add charts to it and can design those charts in the same way you design them for the viewer's tabs. The trends in the side panel are miniaturized charts.

By default, the side panel appears in runtime if you have selected the Show Side Panel check box in the viewer's Appearance tab, but a runtime user can choose to show the side panel at any time during runtime. If you have not configured a side panel, it will simply be blank.

> **Note:** Not all GENESIS64 features are supported in Microsoft Silverlight edition. Side panels are one of those features. If you are running Microsoft Silverlight edition, refer to the online Help for a list of features that are not supported.

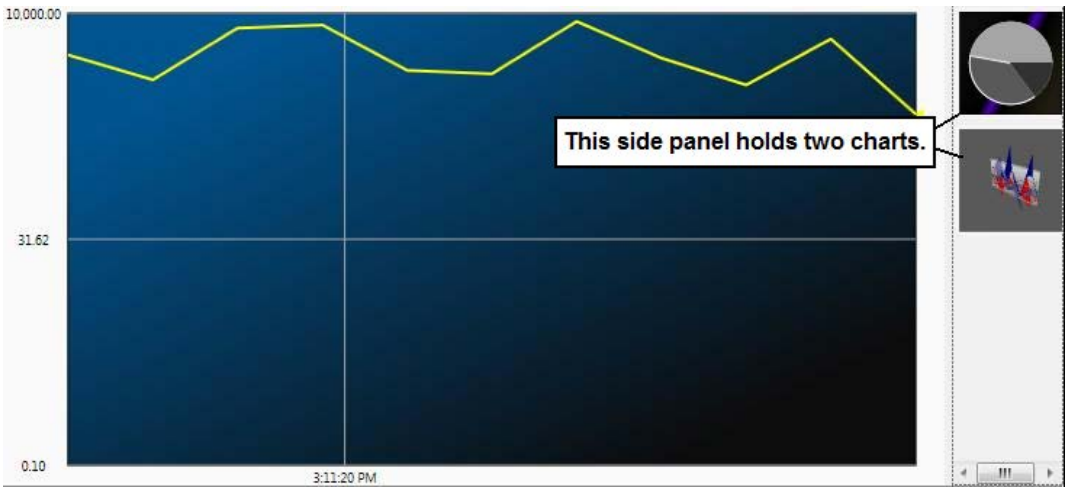


Figure 11.15 - Sample Side Panel

Adding charts to the side panel in the TrendWorX64 Viewer is similar to adding charts to a tab in the TrendWorX64 Viewer. Right-click Side Panel in the navigation tree and select Add, and then Chart. Configure the chart, and then add and configure the plot and the plot's pens.

11.8. Runtime Operations

The Trend Viewer **Runtime toolbar**, is the runtime user interface for the TrendWorX64 Viewer. The toolbar offers you access to various runtime functions and operations. To see the toolbar, you need to have the Enable Toolbar checkbox enabled in your TrendWorX64 Viewer's properties. Unless you set the Initial Position property to Hidden, the toolbar should appear at runtime in the selected position. To show or hide the toolbar, the runtime operator can double-click on the chart area. Notice that you cannot view the toolbar in configuration mode.

If the runtime operator freezes (or pauses) the trend display, the runtime toolbar expands to show additional options. Figure 11.17 shows the toolbar in normal mode while shows the runtime toolbar in freeze mode.

Figure 11.16 - Runtime Toolbar in Unfrozen Mode

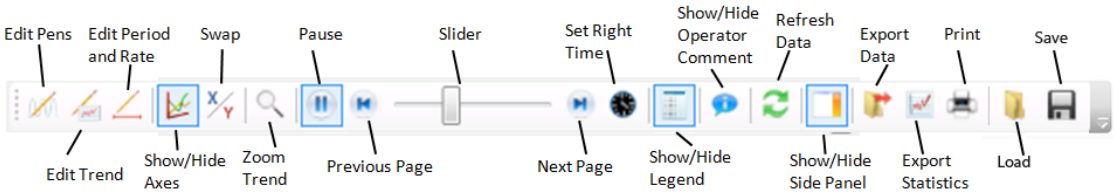


Figure 11.17 - Runtime Toolbar in Freeze or Pause Mode

Many of the buttons on the Runtime Toolbar provide access to some properties configurable in both Configure and Runtime modes, such as **Edit Pens**, **Edit Trend**, and **Edit Period**.

Some options, such as Slider and Previous/Next Page, Zoom Trend, Set Right Time, and Buffer Summary are only available when the viewer is in Freeze mode.

"Edit Pens" opens the chart's **Properties** dialog, allowing you to modify the chart, plot, and pen display. Modifications appear immediately in the runtime display, as soon as you close the Properties dialog.

The “Edit Trend” button opens the **Edit Trend** dialog box shown in Figure 11.18. This dialog gives the runtime user the same options that appear in configuration mode for the chart’s General tab, so that the general appearance, the runtime cursor, the legend, and the summary view can all be customized at runtime.

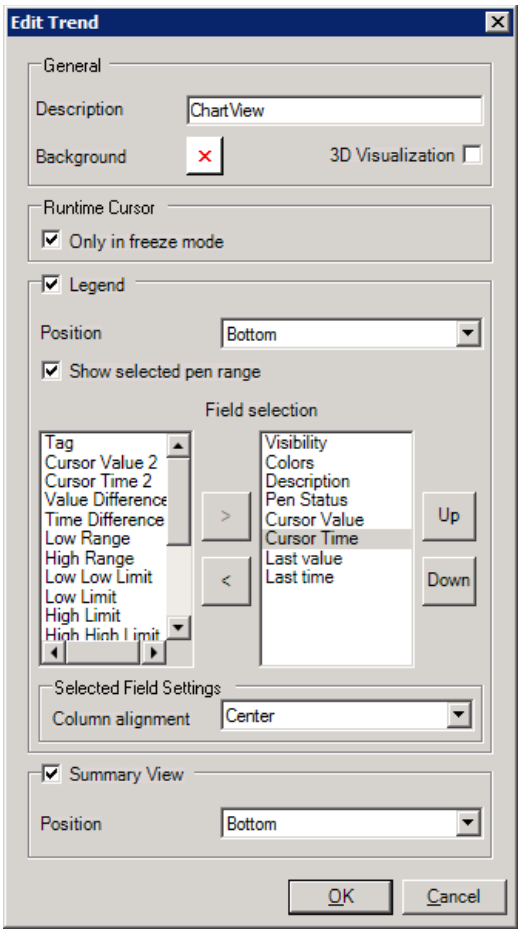


Figure 11.18 - Edit Trend

Clicking on the “Edit Trend Period and Rates” button opens **Edit Period and Rates** dialog box as shown in Figure 11.19.

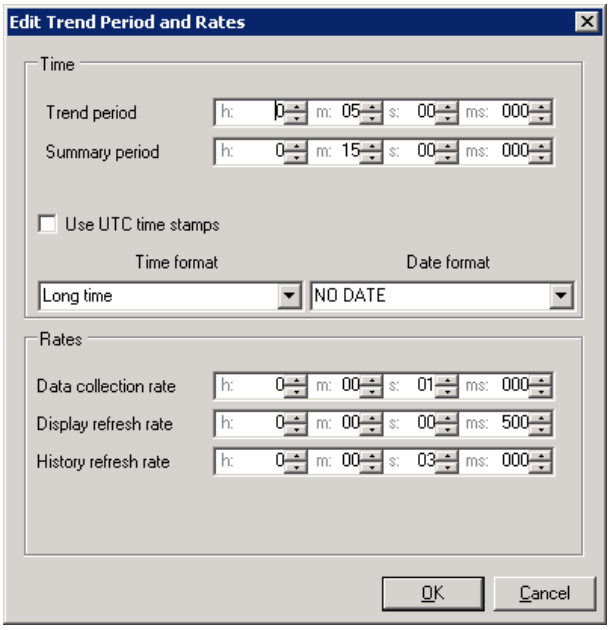


Figure 11.19 - Edit Trend Period and Rates

“Show/Hide Axes” button shows or hides the X- and Y-axes, giving your chart more room to display.

“Swap Y/X Axes” button lets the user switch the X-axis with the Y-axis, which can make visualization of the chart easier in some instances.

Clicking on the “Zoom” button and dragging a rectangle on the part of the chart lets the runtime user zoom in on a selected segment of the trend. The viewer resets the trend period to the boundaries set by the rectangle. This option is more effective when used in Freeze mode because incoming data does not cause the zoom frame to reset.

> **Note:** When used in “real-time mode” – the animated mode – the zoom along the time axis quickly resets (and disappears) as the animation frame is refreshed.

The “Freeze” button stops the trend from updating with incoming data. Freeze mode helps you look more closely at the data for a specific time from. You can use the **slider** at the right of the Freeze button to move forward and backward in time. Clicking the Freeze button a second time exits Freeze mode and returns you to real-time mode.

Clicking the "Set Right Time" button opens the **Set Right Time** dialog, shown in Figure 11.20. This dialog, allows you to enter the time at the end (on the right hand side) of the viewer and move to the data for that time. This option is very effective for reviewing historical data.

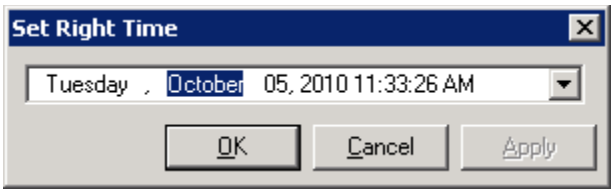


Figure 11.20 - Set Right Time

The **Legend** shows the assignment of pens, as shown in Figure 11.21. You can add and remove columns in the legend by clicking the Edit Trend button on the runtime toolbar.

Visibility	Colors	Description	Pen Status	Last value	Last time
☑		sim64:Float.Rand...	Good	99.67956	9:42:25 AM
☑		sim64:Float.Sine(...	Good	-50	9:42:25 AM
☑		Triangle	Good	14.42	9:42:25 AM

Figure 11.21 - Legend in TrendWorX64 Viewer

Additional options on the runtime toolbar and on the TrendWorX64 Runtime ribbon are described in detail in the TrendWorX64 Viewer's online Help.

The **Summary View** is a powerful feature located at the bottom of the TrendWorX64 Viewer; it is visible only in **Freeze mode** by clicking on the arrow pointing upwards. The Summary pane lets you view all data collected, but lets you choose the time span that displays above, giving you detailed access to collected data. Figure 11.22 shows how the summary view can be manipulated to show a specific timeframe of data.

Note: For more information about how to view trend data at runtime, please refer to the "Runtime Operations" topic in the TrendWorX64 Viewer online Help.

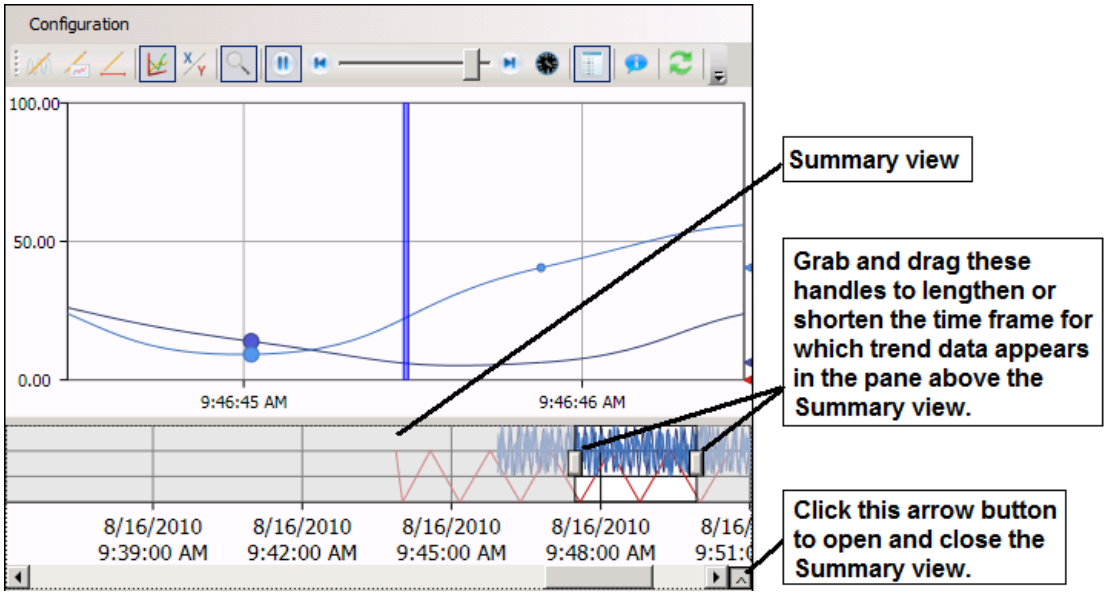


Figure 11.22 - Summary View

11.9. Workbench vs. GraphWorX64

The TrendWorX64 Viewer control can be dragged and dropped into GraphWorX64, where it has the same functionality as it does in Workbench. There are some additional settings found in the GraphWorX64 property sheet.

You can add the TrendWorX64 Viewer control into the GrapWorX64 display by clicking on the **Controls** tab of the GraphWorX64 ribbon and then clicking on the TrendWorX64 Viewer control button as shown in Figure 11.23. Alternatively, you can click on the **Toolbox** and select the TrendWorX64 Viewer control within the toolbox.

Figure 11.23 - TrendWorX64 Viewer Control in the Ribbon

Then the initial Trend Viewer Area can be drawn by clicking and dragging the crosshairs to the desired size that you want the trend to be. The TrendWorX64 Viewer control appears, as shown in Figure 11.24, with its selection handles visible.

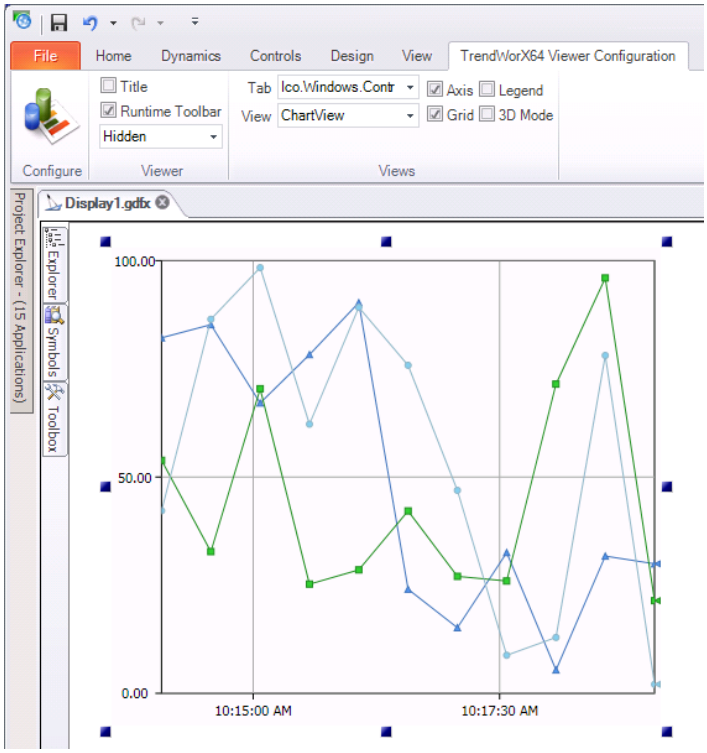


Figure 11.24 - TrendWorX64 Viewer

Note: The control can be resized by grabbing a handle and dragging the control to its new size. In configuration mode, the viewer is simply a graphic and does not display data from the data sources.

A few selected operations can be performed by using the TrendWorX64 Viewer Configuration ribbon shown in Figure 11.24. You can use the ribbon's options to open the TrendWorX64 Viewer configurator, change some of the viewer's settings, and modify options that display in the viewer during runtime.

Lab: Trend Viewer L11

11.1. Lab Overview

icTonics wants to view logged trend data that they deem important. They also want to view real time data in a graphical format. In this lab, you will customize a TrendWorX64 Viewer for icTonics, as well as explore some options in the control.

Estimated time to complete this lab: 20 minutes

11.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Add a real-time pen.
- Add a historical pen.
- Change the color of a pen.
- Add markers to a pen line.
- Create a chart view.
- Set up Time & Rate on a chart view.
- Multiply a plot.

11.1.2. Support Files

To complete this lab, you will need the following file(s):

- icTonicsTankMonitor.gdfx

11.2. TrendWorX64 Viewer Control

You can use the TrendWorX64 Viewer control to view real time or historical data in GraphWorX64. In this lab, we will create a GraphWorX64 display that will display both types of data.

11.2.1. TrendWorX64 Viewer Control Configuration

1. Open **GraphWorX** if you closed it after the previous lab.
2. Create a new GraphWorX64 display and save it as **"C:\Training\icTonicsTrends.gdfx**". You should save your work periodically as you progress through the lab.
3. We will continue by applying the **icTonics template** to this display. Click on the **Design** tab.
4. Here's a quick run-through of how to add a template to the gallery. If you added the template in the previous step, executing the bullets below is not necessary.
   - At the right end of the Templates section, click on the chevron (down arrow with a line above it) and select **Insert Templates to Gallery**.
   - In the **Edit File List** dialog, select **Add Files**.
   - From within the **C:\Training** folder, select **icTonicsTemplate.tdfx.**
   - Click **Open**. Click **OK**. **Save** the display.
5. Select the icTonics **template** you added previously.
6. Insert a **TrendWorX64 Viewer** onto the design surface by going to the **Controls** tab of the ribbon, selecting **TrendWorX64 Viewer**, and then clicking on the design surface and drawing a viewer.
7. As you did with the AlarmWorX64 viewer in the **icTonicsAlarms** display, size the control to fit the design surface.
8. Double-click on the control to bring up the "**Configure your Control**" dialog box.

   Note: You can also click on the Configure Viewer icon in the upper left to launch the "Configure your Control" dialog.

9. Click on the **Tab** entry in the tree on the left and change the **Title Text** to **icTonicsTrends**. You can also name the Tab entry in the tree icTonicsTrends if you like.

10. Click on "**Chart**" entry in the tree. From the **General** tab, change the **Description** to "**Real Time Trends**".

11. Right-click on **Chart** and add a **Plot.** Under this plot, add a **Pen**.

12. Click on the **Pen** and confirm the **General** tab is selected.

13. Click on the ellipsis button to the right of the **Data Source** textbox.

14. In the Data Browser dialog box, browse to the following tag: @ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.TankLevel.Value.

15. Click on "**OK**" to exit out of the Data Browser and return to your TrendWorX64 Viewer configuration dialog box.

16. Still on the pen's **General** tab, click the "**Advanced configuration**" button under the Data Source field. In the popup dialog box, make sure "**Use DA connection**" is selected.

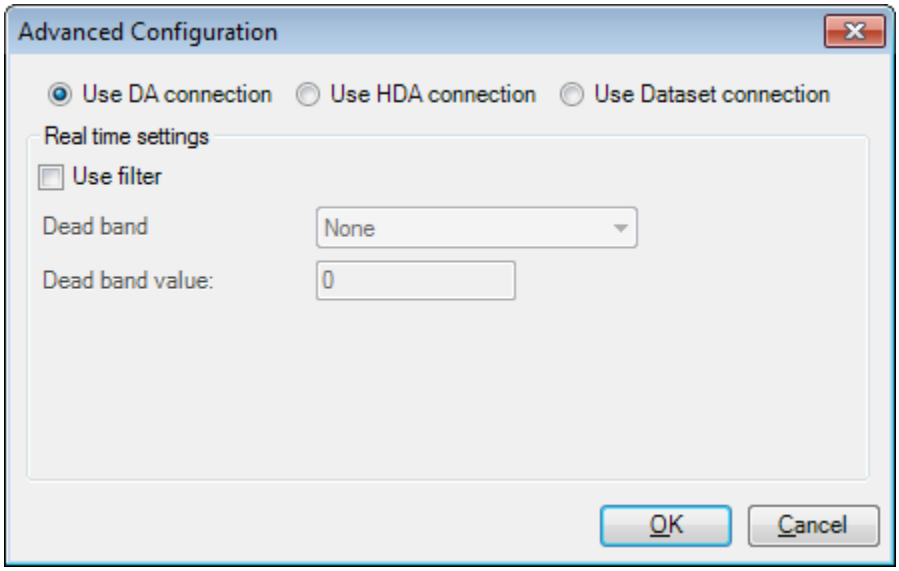


Figure L11.1 - Advanced Configuration

17. Remaining on the pen's **General** tab, change the description of the pen to "**Real Time Tank1 Level**".

18. In the Appearance section, change the **Stroke Thickness** to **3** and the color to Purple (R:112, G:48, B:160).

19. Your finished pen configuration should look similar to the figure below.

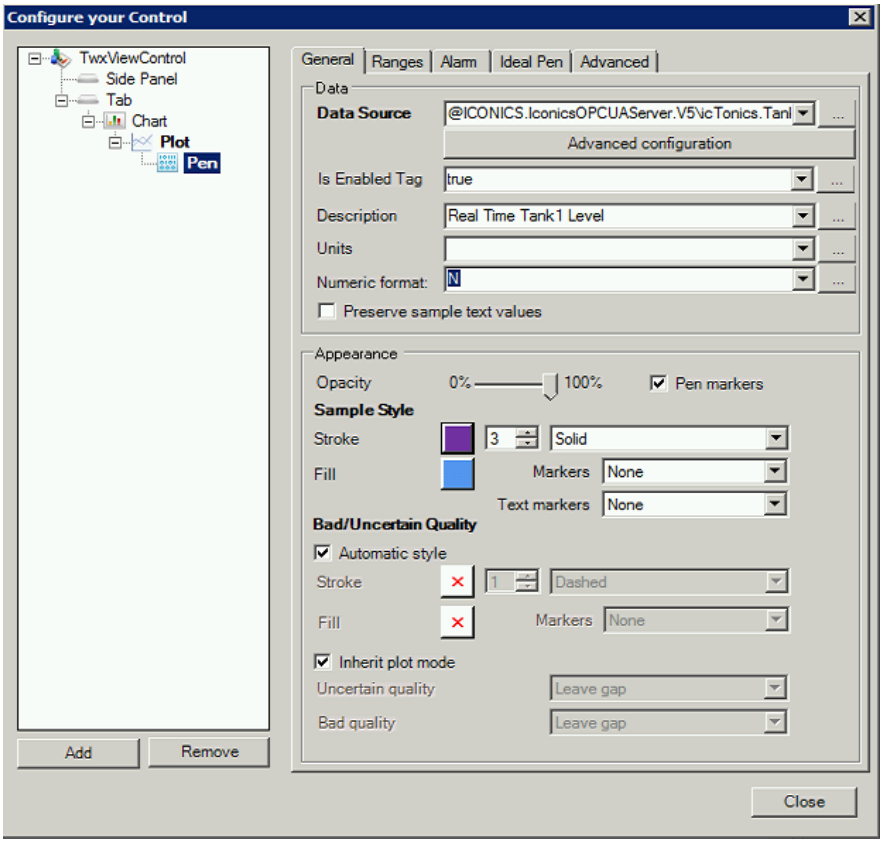


Figure L11.2 - Real-Time Pen Configuration

20. Right-click on **Plot** in the left-hand pane and select **Multiply**.

21. In the dialog box that comes up, leave the number of items as 1 and click on **Apply** (the green checkmark button).

22. Select the newly created plot (called Plot1) and select the first **Area** plot as its plot type.

23. Select Plot 1's pen. Notice that the data source for the pen is the same data source you chose for the first plot's pen.

24. Change the **Stroke** and **Fill** color to **yellow** (R:255, G:255: B:0). You are now done setting up this pen.

25. Right-click on Tab and select **Add → Chart**.

26. Select the new chart and define the description **Historical Trends**.

27. Select its **Time & Rate** tab.

28. In the **Rates** section, change the **Data collection rate** and **Display refresh rate** to **5** seconds. As you may recall, we set the Trend Logger Data collection rate to 5 seconds also.

29. Change the **History refresh rate** to **30** seconds. Your finished configuration should look similar to the figure below.

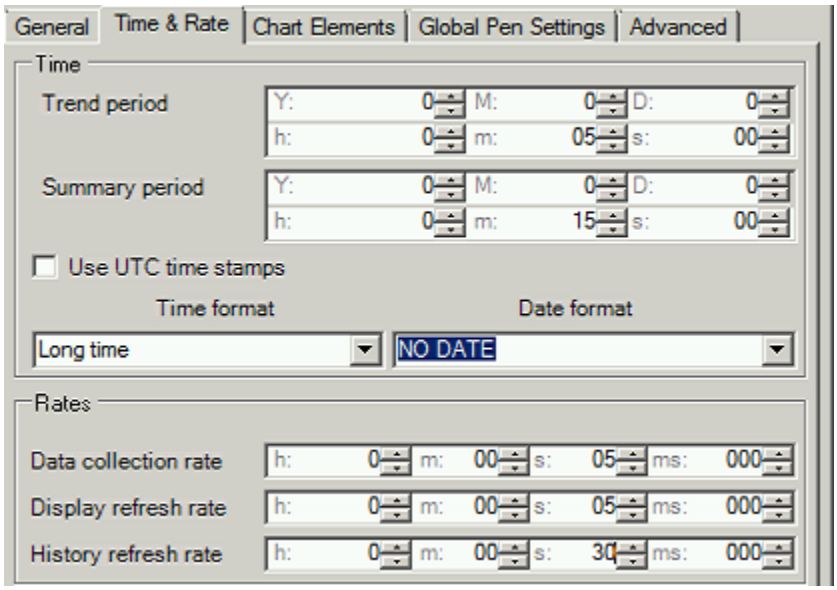


Figure L11.3 - Time & Rate Configuration

30. Now we are going to repeat the same steps that you executed previously to add a historical pen to the **Historical Trends** chart.

31. Add a **Plot** and a **Pen**.

32. Set the Data Source to **Home → Historical Data → TrendWorX64 → icTonicsTrends → Tank Levels → Tank1 Level.History**.

33. From within the **General** tab, give Pen2 the **Description** "**Historical Tank1 Level**".

34. Change the **Stroke** to **3** and set **Fill** and **Stroke** color to **Dark Blue** (R:0, G:112, B:192).

35. Select **Circle** as the **Markers** type. Your finished historical pen configuration should resemble the following image.

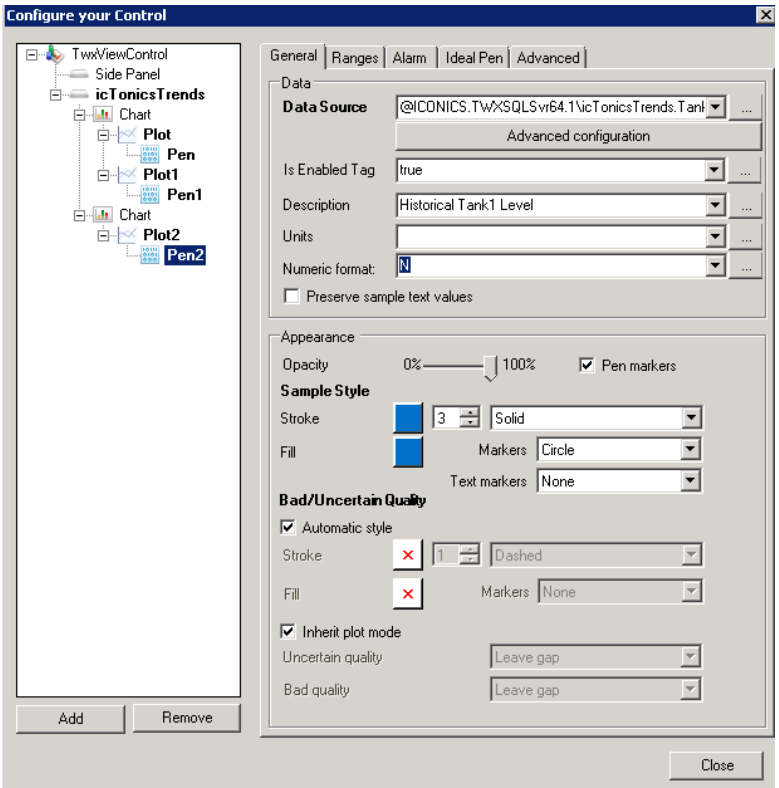


Figure L11.4 - Historical Pen Configuration

36. Click on **Close** to close the configuration dialog box.

37. Select the **TrendWorX64 Viewer** control.

38. Select the **TrendWorX64 Viewer Configuration** tab.

39. Click on **Save** icon in the ribbon.

40. Enter the name **icTonicsTrendViewer** and the **Save as type**: .twxx in the **C:\Training** folder.

41. Expose other **Save as** types: by clicking on the down arrow. Notice that there are two other file types: **Silverlight** (.twxxs) and **Mobile** (twxxp).

42. Save this (**icTonicsTrends.gdfx**) display and go into **Runtime**.

11.2.2. The TrendWorX64 Viewer Display

1. Launch a second instance of GraphWorX64 (you can right-click on the GraphWorX64 icon in the task bar and select GraphWorX64).

2. Load the **icTonicsTankMonitor** display into **Runtime**.

3. Change the **Tank1 Level Setpoint** tag a few times. See that your real time trend shows these changes immediately, but it takes about 30 seconds for the historical trends to refresh. If you leave the trend running long enough, your curve from the historical trend should look like your real-time trend.

4. Notice that your historical trend has circles indicating data collection points, as shown in the figure below.

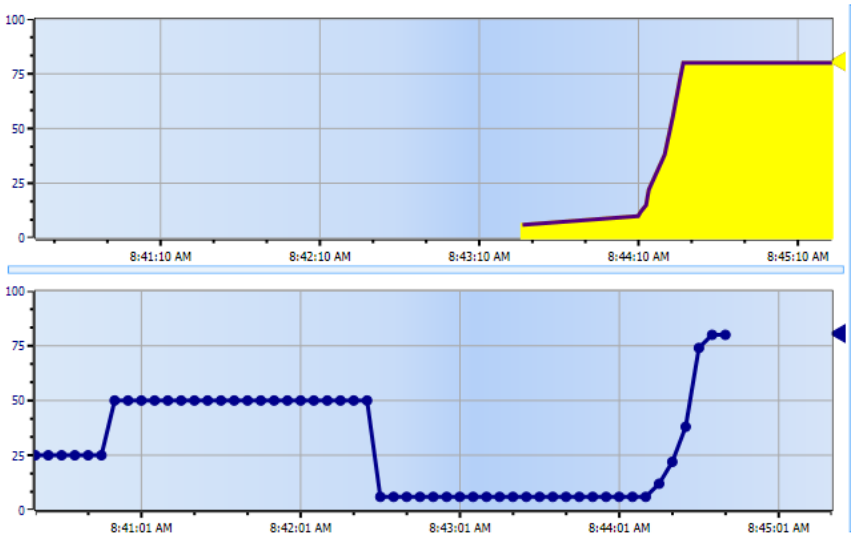


Figure L11.5 - TrendWorX64 Viewer

11.2.3. Trend Popup Display

We will now create a popup window using the trend display we created earlier.

1. In the **icTonicsTankMonitor.gdfx** display, add a dynamic **Pick Action** to the **BaseTank**. Hint: locate and select the BaseTank object in the Object Explorer. We are going to configure the pick action to open a popup window.

2. Select the **Dynamics** tab and click on the **Pick Action** dynamic.

3. Expand **CommandParameters** and set the **FileName** to "**icTonicsTrends.gdfx**".

4. Set the **TargetType** to "**Popup Window (Display Dependent - Modal)**".

5. Set the **OverrideWindowProperties** to **True** and expand **WindowsProperties** to expose the settings displayed in the following figure.

6. Set the **WindowsProperties** according to the figure below.

   Note: You can double-click in a field and toggle between values.

OverrideWindowProperties	**True**
⊟ WindowProperties	
SpecifyWindowLocation	True
SpecifyWindowSize	True
SpecifyWindowStyle	True
SpecifyCommandingOptions	True
StartPosition	**CenterOwner**
Left	Unspecified
Top	Unspecified
Width	**550**
Height	**550**
WindowState	Normal
TitleBarVisible	True
Text	
ControlBox	**False**
MinimizeBox	**False**
MaximizeBox	**False**
OuterBorder	True
Resizable	**False**
ToolWindow	False
InnerBorder	**False**
HorizontalScrollVisible	**Hidden**
VerticalScrollVisible	**Hidden**
SpecifyScrollBarColors	False
RibbonVisible	False
MenuVisible	**False**
NavigationBarVisible	**False**
StatusBarVisible	**False**
TopMost	False
CommandingEnabled	True
DragAndDropCommandingEnabled	True
CommandingDisplayName	
MaxCommandScope	Process
OverridePreviousDisplay	**True**

Figure L10.6 - Runtime Window Properties

7. Save the **icTonicsTankMonitor** display.

8. We will proceed by resizing the **icTonicsTrends** display.

9. Open the **icTonicsTrends**.gdfx display if you closed it.

10. Select **This Display: Canvas**. You can see when you have the display canvas selected by viewing the top of the properties explorer on the right.

11. Change the display size **Height** and **Width** to **550 x 550** and resize the template and the controls to fit within this screen.

12. To modify the template, deselect the **Lock** icon next to the **Template** entry in the object **Explorer**.

> ***Tip!*** You can group everything in the template together to make it easier to resize everything. Remember that you can hold down the "Shift" key to preserve aspect ratio as you resize an object.

13. Add a **Text Label** (Home tab → Shapes) to the display template
14. Double-click on the label and change the text to "**Tank 1**".
15. Add a button to the display. Change the button's Command to "**Close Window**", Double-click on the button and change the button label to "**Dismiss**".
16. Place the button at the bottom right corner of the display.
17. Your finished configuration should resemble the figure below.
18. Save the display.

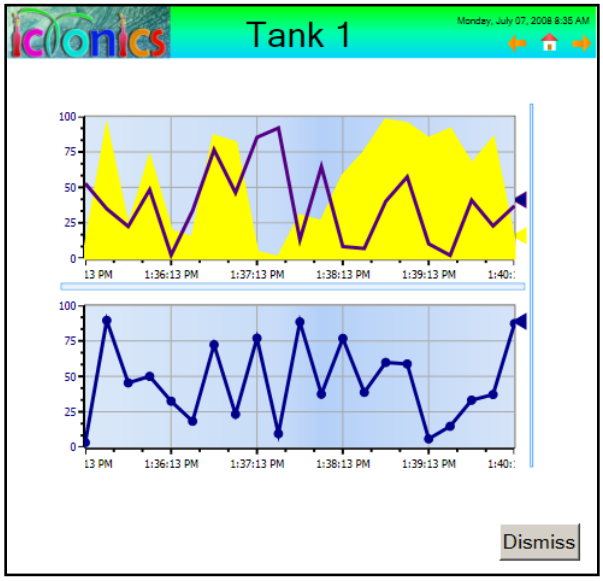


Figure L11.7 - Popup Trend Display

19. Go back to your **icTonicsTankMonitor** display in **Runtime**.
20. Click on the tank to see that your trend window pops up.

Note: You can click the Show/Hide button or right click in the header to turn runtime options on and off.

This concludes this lab.

Unified Data Manager 12

The Unified Data Manager (UDM) provides a centralized approach for managing and configuring commonly used items. You can configure expressions, value sets, tag groups, triggers, and registers by using the Unified Data Manager configuration interface, shown in Figure 12.1 below, in the Workbench. All of the items and their settings are stored in a dedicated SQL database. These items are exposed as OPC items and can be accessed from ICONICS applications via the Data Browser. By using the UDM, you can reduce development time and eliminate redundant work.

You can open the UDM within the Workbench by clicking the UDM icon in the Project Explorer or from the Start menu command in the GENESIS64 Tools folder.

The purpose of this chapter is to familiarize you with the capabilities of the Unified Data Manager. You will start by learning the operations that are common to all objects, such as creating items, folders, editing, etc. Then this lesson will proceed to each node in the UDM navigation tree. In turn, you will learn what expressions, groups, value sets, registers, and triggers are; what capabilities each has; and how you can use each in your work. After completing this chapter, you should know how to:

- Create items in the Unified Data Manager that you can use throughout GENESIS64
- Simplify application development using expressions, value sets, groups, registers, and triggers.

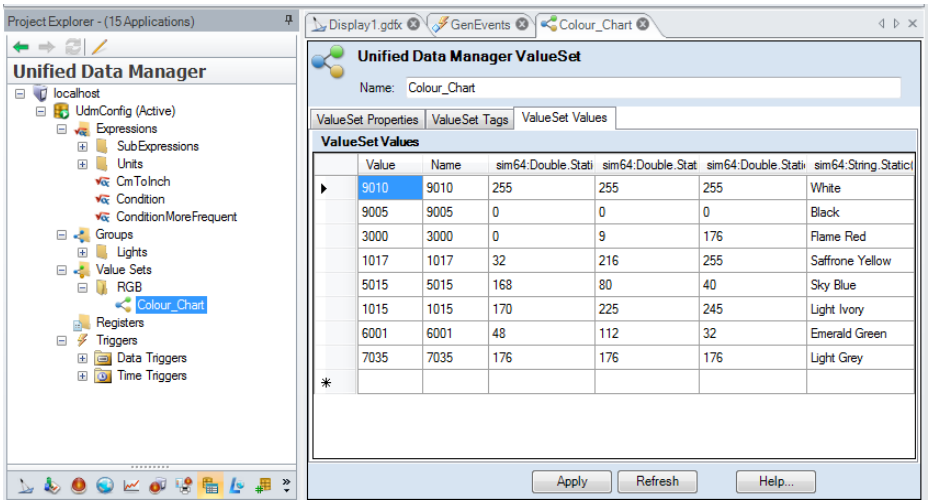


Figure 12.1 - Unified Data Manager Configuration

12.1 Working with Objects in the UDM

The layout of the Unified Data Manager configuration dialog consists of a tree control on the left and a property dialog that opens on the right when you edit an item from the tree. The hierarchy of the tree explorer starts at the level of your host machine, and then proceeds down from the database object to the nodes representing your item collections. Item collections can contain both folders and items.

As mentioned earlier, the configuration is stored in a SQL database. This configuration database can be created using the **SQL Create Database** dialog. You can also use the **SQL Attach Database** dialog to attach additional UDM SQL databases. Both of these dialog boxes can be launched using the "Database" button in the Edit section of the Home tab in the ribbon. Alternatively, you can launch them by right-clicking on the host machine item in the Project Explorer, and then selecting "New Database" or "Attach Database" from the popup context menu, as shown in Figure 12.2. Keep in mind that although you may see additional databases, only one database may be active at any time. Use the "Database" button on the Home ribbon or the popup menu to work with databases.

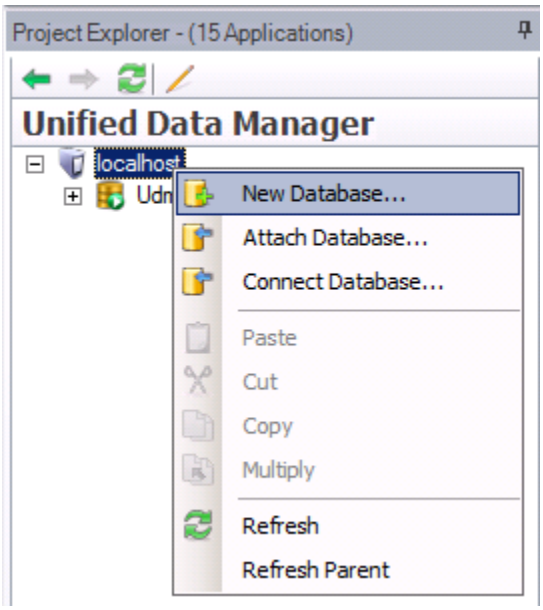


Figure 12.2 - Launching the Database Wizard

In the UDM navigation tree, the nodes **Expressions**, **Groups**, **Value Sets**, **Registers**, and **Triggers** are all at the same organizational level. You cannot add any new type of node at their level, but you can expand them and add sub-items to them. You can create as many folders as you wish, and give them names that are meaningful to you. Folders are listed alphabetically, followed by items that are contained within a folder. You can also create as many items as you wish, up to the limits of your database.

To create an item in the navigation tree hierarchy, right-click on the object you are adding the item from the menu:

- To **create a folder**, select the **Folder**
- To **create an item**, select **Expression**, **Register**, **Value Set**, **Register**, or **Trigger**. Your item choices vary depending on to which folder you are adding the item.
- To **edit or modify an item**, right-click on the item and select **Edit**, **Edit On New Tab**, **Rename**, or any other edit command.

Figure 12.3 shows the popup menu on a folder and on a specific item.

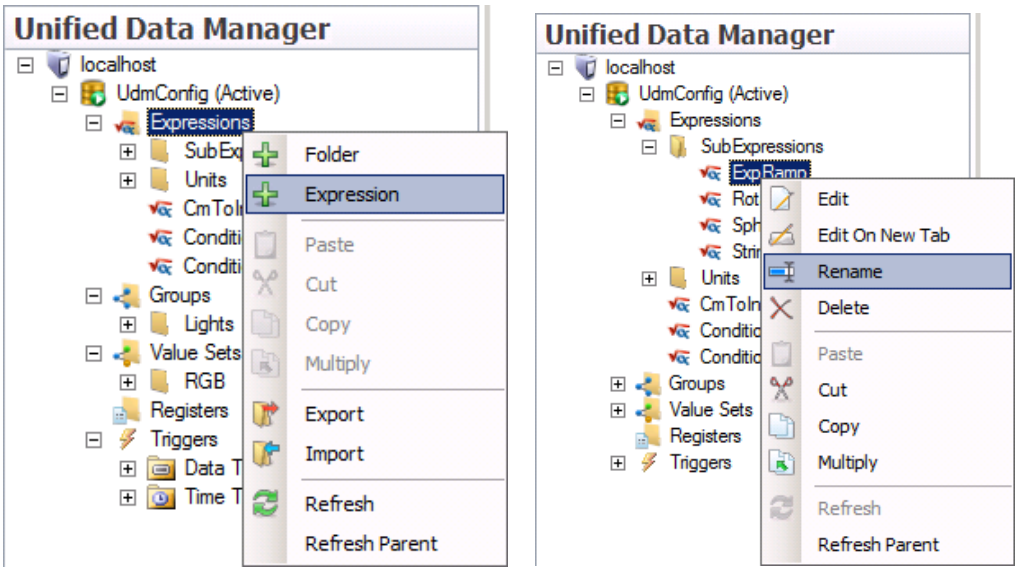


Figure 12.3 - Right-click Menus for Folders (Left) and Items (Right)

Nearly all of the work done in the UDM is found in configuration forms. The remainder of this chapter focuses on these different forms. Note that the configuration forms for folders have one and only one text field in which you can assign or edit the name.

12.2 Expressions

An expression is a function that takes input, performs a specified calculation, and returns an output. The calculation is executed periodically, at a user-configured rate. In expressions, you can use parameters and make the expressions writable. Such expressions can be accessed from a large variety of ICONICS products as single tags.

Thanks to their writable nature, expressions can be used for unit conversions. Consider the user-created function called *celsius_to_fahrenheit*, shown in Figure 12.4. The expression takes as its input a thermometer reading in degrees Celsius and converts the value to degrees Fahrenheit. This function will read every input and trigger tag every 100 milliseconds, and will return a Short data type. Because this function might be used with different thermometers, there is a parameter, named *Thermometer* defined, which stands for the currently selected thermometer.

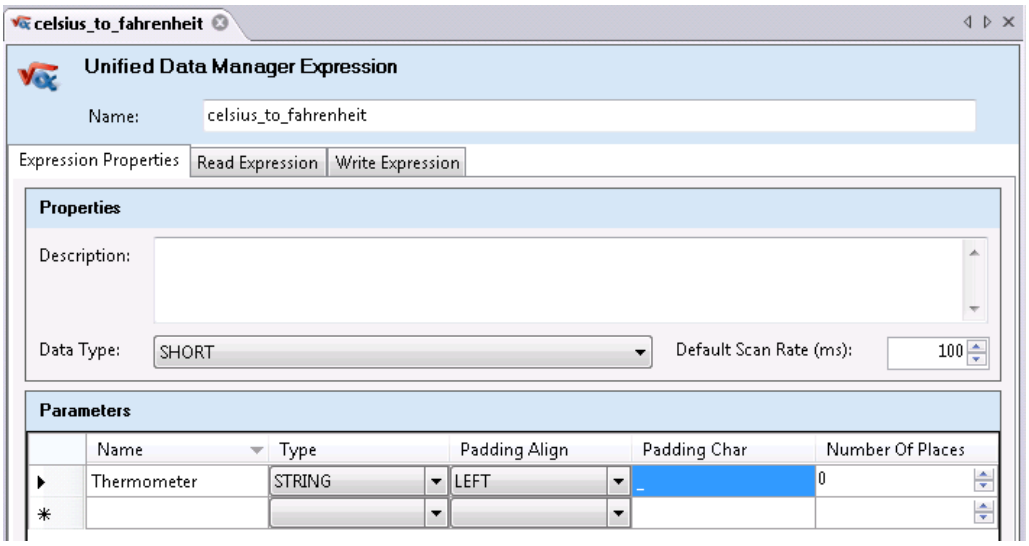


Figure 12.4 - Creating an Expression

Note: Parameters can be easily discerned in an expression formula because they are enclosed in double carats (for example, <<**Thermometer**>>), as you will see later.

The essential actions of an expression are contained on the **Read Expression** and **Write Expression** tabs. There are some minor but important differences between the options that you see on these tabs, both of which are shown in Figure 12.5. In this figure, note the different content of the Read and Write expressions.

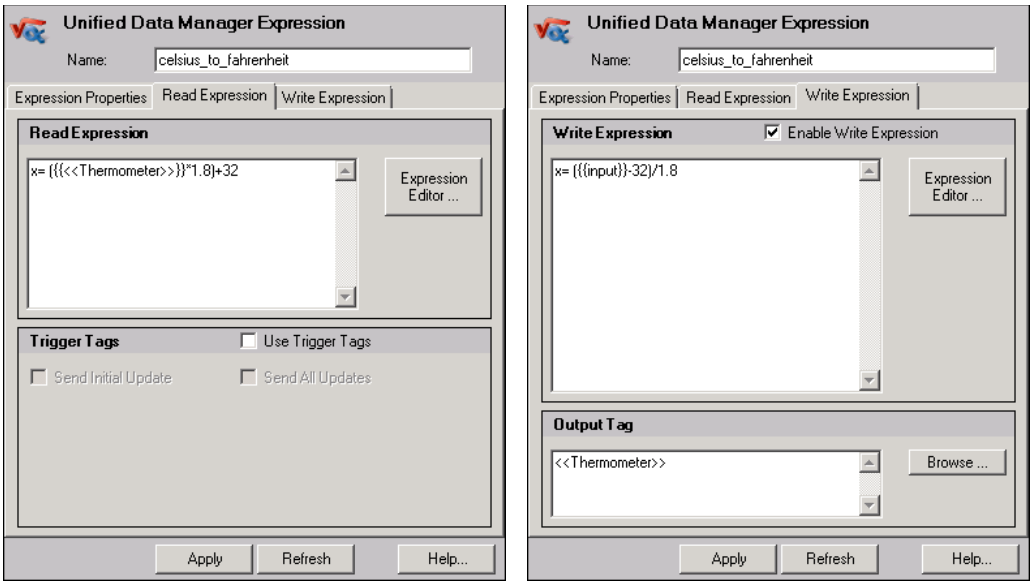


Figure 12.5 - The Read Expression (Left) and Write Expression (Right)

It is important to understand that you do not need to configure the **Write Expression** tab at all unless you intend to write values to the expression and perform a calculation with the written value. If you do need to perform such a calculation, you should remember that the input value, which an operator writes into the expression tag, is represented by a special string called **{{input}}**.

> **Note:** This tag is case sensitive. This means that if you type in a tag that says {{Input}} or {{inPut}} will not work.

In the Read Expression tab is the expression for calculating the conversion, which reads:

x= (<<Thermometer>>*1.8) + 32

Double triangular brackets “<<” and “>>” surround the Thermometer parameter. This parameter will be substituted with actual OPC tag (or other values) when a client application uses the expression. In this case, the substituted value would be a read/write OPC data point (this is because in the example we are also going to write into the point, as you will see later).

Notice that each tab contains a button called **Expression Editor**. The Expression Editor is a dialog that allows you to create expressions (and other functions), then checks for the validity of the expression.

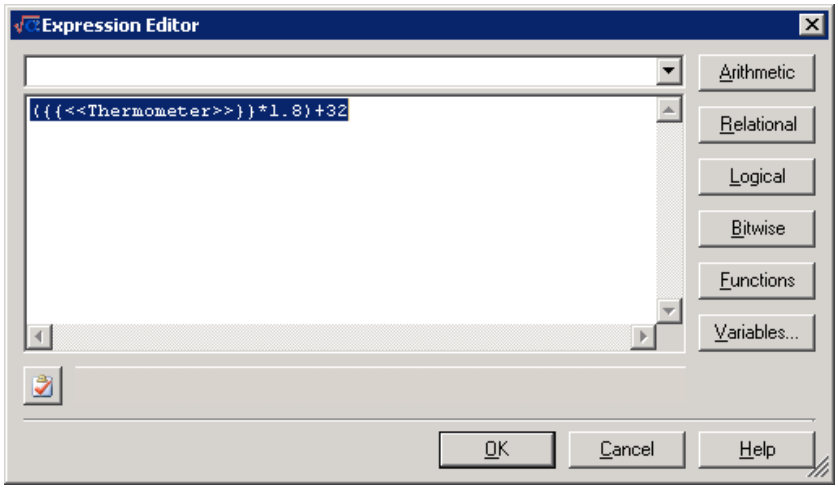


Figure 12.6 - Expression Editor

Each button in the Expression Editor displays a list of available functions. In cases such as the **Variables** button, the OPC tabs of the Unified Data Browser are opened to allow you to make an assignment based on tag values. The important thing to remember about the Expression Editor is that although it checks your expression syntax, it does not check whether the expression is correctly applied.

You do not have to use the Expression Editor at all. Instead, you can write your expression directly into the text box on the Read Expression tab. The expression will be evaluated whenever one of its inputs changes; or you can put a checkmark in the checkbox "Use Trigger tags" so that the expression will be calculated whenever one of the trigger tags becomes true, becomes false, or simply changes value as specified by the user.

Write expressions require that you check the "Enable Write Expression" checkbox to have the values calculated. They are configured similar to Read expressions with two exceptions. First, you should mark the place in your expression where you expect an operator's input. This place is represented by the special string **{{input}}**. For instance the write expression of the thermometer is:

x= ({{input}} - 32) / 1.8

Second, the **Write Expression** tab contains an "Output Tag" textbox where you should specify a data point where the result of the write expression will be stored. In the case of a conversion, it often makes sense to use the same tag as the one used in the read expression. In the case of our example, it will be our parameter.

It is relatively easy to create expressions, and the tools provided allow expressions to be as complex as you need. Using the expressions that you created is even easier.

As an example of using an expression, consider a process point on a GraphWorX64 display whose data source is set to the *celsius_to_fahrenheit* expression. Clicking on the ellipsis button in the DataSource property of a process point opens the Data Browser. The UDM's expressions can be found under the **Global Expressions** folder on the server that holds the Unified Data Manager configuration. In Figure 12.7, you can see the *celsius_to_fahrenheit* expression selected in Data Browser.

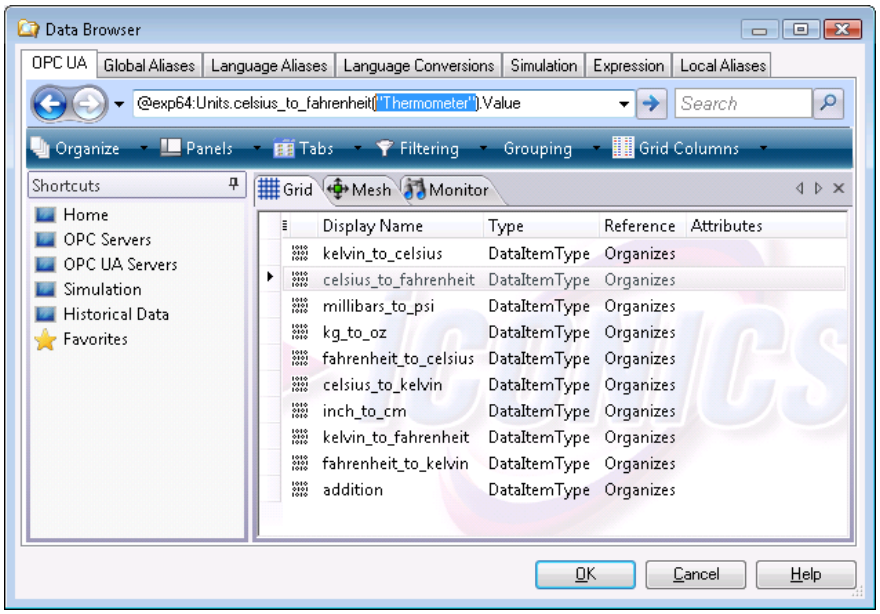


Figure 12.7 - Selecting Expression as a Data Source in the Data Browser

Note the string **"Thermometer"** enclosed by parenthesis is the data point name. You should replace the parameter with the name of the real thermometer OPC data point enclosed in quotes. You can do this by highlighting the parameter (Thermometer in this case) and browse to the OPC point to select it. The resulting tag path may look similar to this:

@exp64:Units.celsius_to_fahrenheit("@KEPware.KEPServerEx.V4\ Channel_1.Device_1.Tag_1.Value").Value

12.3 Groups

A group is a collection of data tags that are manipulated as a single item. It is represented by a single group tag. Each group tag is treated as a READ/WRITE data type. Any value written to a group tag is written to all the tags included in the group, so that all of the tags in the Group have the same value. For this reason, use Groups for tags you want to write a uniform value. For example, this feature can be deployed for controlling lights in a building. You can switch on or off all lights on a particular floor by changing only one single value. The figures in this section show a group tag that controls lights on floor one of a building.

Group data tags are organized in a tree structure of folders and group items. Since each group is represented as a data tag, a group data tag may also be included in other groups. Group items have two configuration forms.

On the **Group Properties** tab, you can change the data type of the tag, add its description, and create parameters that can be used in the same way as parameters in expressions or other UDM items.

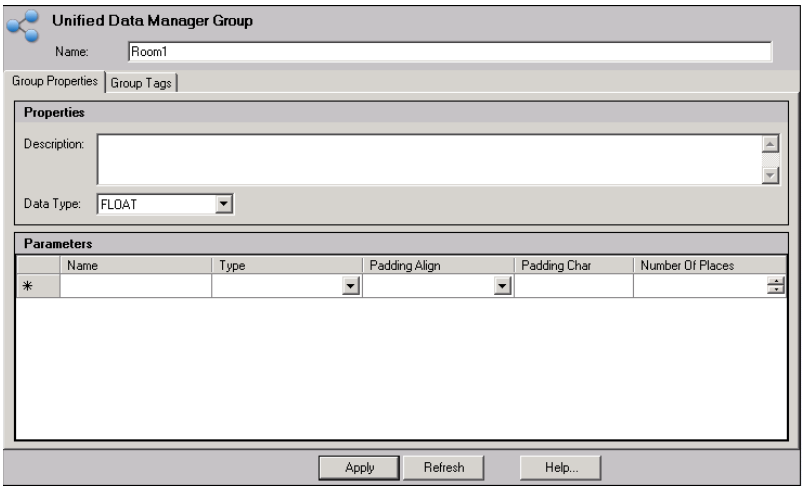


Figure 12.8 - Group Properties Dialog of Group Tag Item

On the **Group Tags** tab, you can add tags to the group tag. Whenever a value is written to the group tag, it is automatically written to all tags in this list.

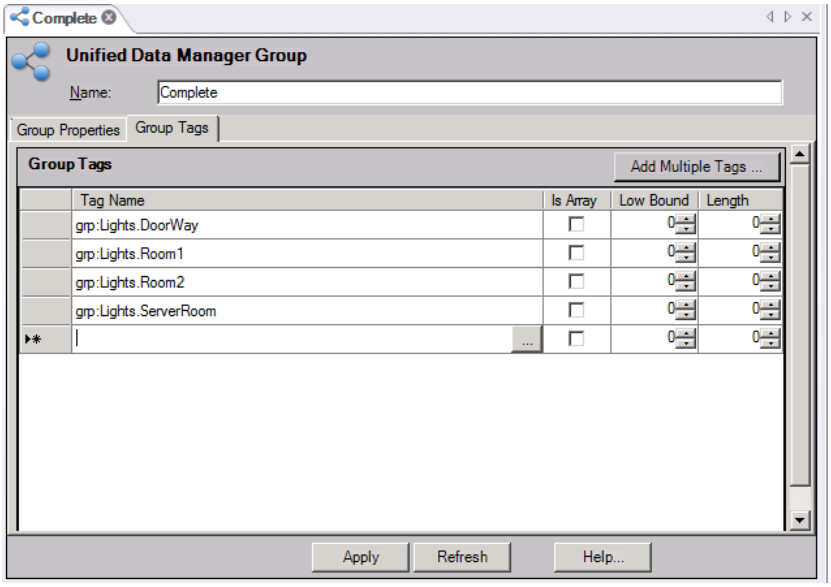


Figure 12.9 - Group Tags Dialog of Group Tag Item

A group can contain an unlimited number of data tags. Each data tag consists of the following attributes:

- **Tag Name:** A fully qualified data tag path (parameters or expressions can also be used) represented as a string. You can type in the tag path or select the source by using the Data Browser, which opens when you click on the ellipsis […] button next to the selected field. You can also use the "Add Multiple Tags" button to add in many tags at the same time.
- **Is Array:** If the tag is an array, put a checkmark in this column to indicate that the tag is an array.
- **Lower Bound:** specifies the lower limit of the tag if it is an array.
- **Length:** specifies the length of the array if the tag is an array.

GraphWorX64 provides an interface for writing values into a group tag. You just need to insert a Data Entry Point into a display and then browse for your group tag in Data Browser by clicking the ellipsis […] button to open the UDM and browsing in the **Groups** folder (highlighted in Figure 12.10) on the server that holds the Unified Data Manager configuration.

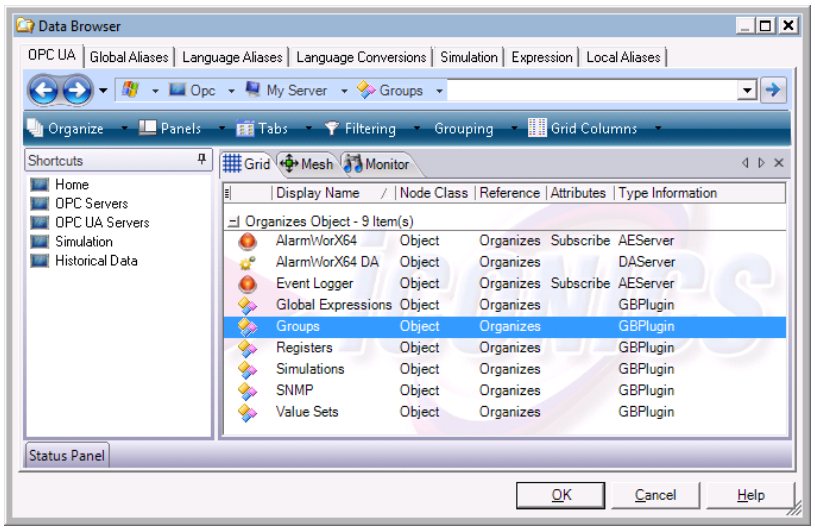


Figure 12.10 - Selecting Groups in Data Browser

12.4 Value Sets

A value set allows you to write pre-configured sets of values into a group of data tags. Each set of values has a reference value. Writing a reference value to a value set data tag will distribute pre-defined values to all data tags in the value set. A value set is different from a group in that each tag in a value set is updated with a preset value that can be different from tag to tag. Value set data tags are of *string* data type and are available as READ/WRITE data tags. You can also use parameters with value set data tags, just like you can use them with expressions and groups, which you have already seen.

Anything that requires multiple values to be written to set a meaningful collection of data is a candidate for a value set. One example is a GPS location, which requires two or three values: longitude, latitude, and altitude. Another use for a value set is for setting a color. Individual colors require three values to be written: one for red, one for green, and one for blue, in the RGB color space that computers use. Let us see how color value sets work.

Value sets are created and configured using a three-tabbed configuration form. On the **ValueSet Properties** tab, you can enter a description and add parameters.

Add members to the value set by using the **ValueSet Tags** tab. For any individual color, the color name or ID is written to one tag, then red is written to a second tag, green is written to a third tag, and blue is written to the fourth. You can see the configuration on the ValueSet Tags tab in the image below.

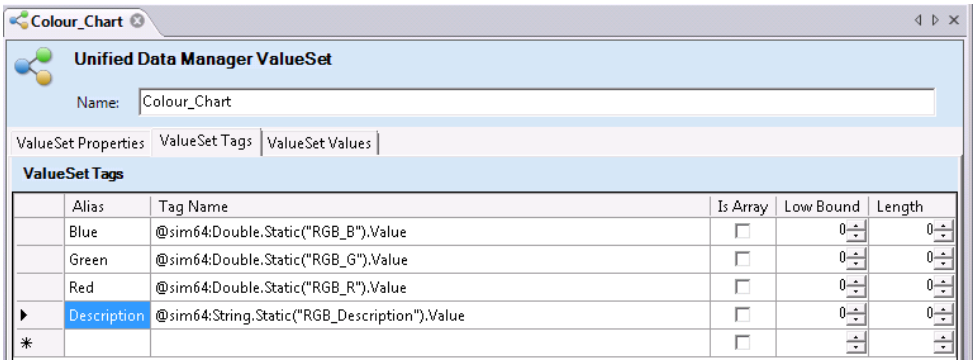


Figure 12.11 - Associate Tags with a Value Set

Once you associate tags with the value set, you need to add the colors that are part of the value set to the **ValueSet Values** tab as shown below.

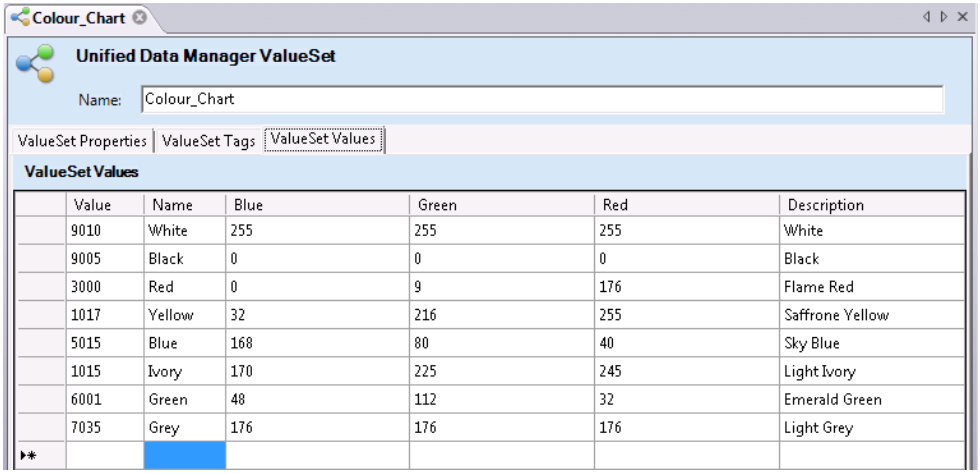


Figure 12.12 - Define Values for Tags

You can use, for instance, GraphWorX64 to write values to a value set tag. You just need to insert a Data Entry point into a display and browse for the value set tag in the Data Browser in the same way you browse for an expression or group, except that you select the **Value Sets** folder, which is highlighted in the next image. When you want to distribute the value set value for, for example, the color white, you would write to the tag “9010”, which is the value specified in the Value column of the ValueSet Values tab.

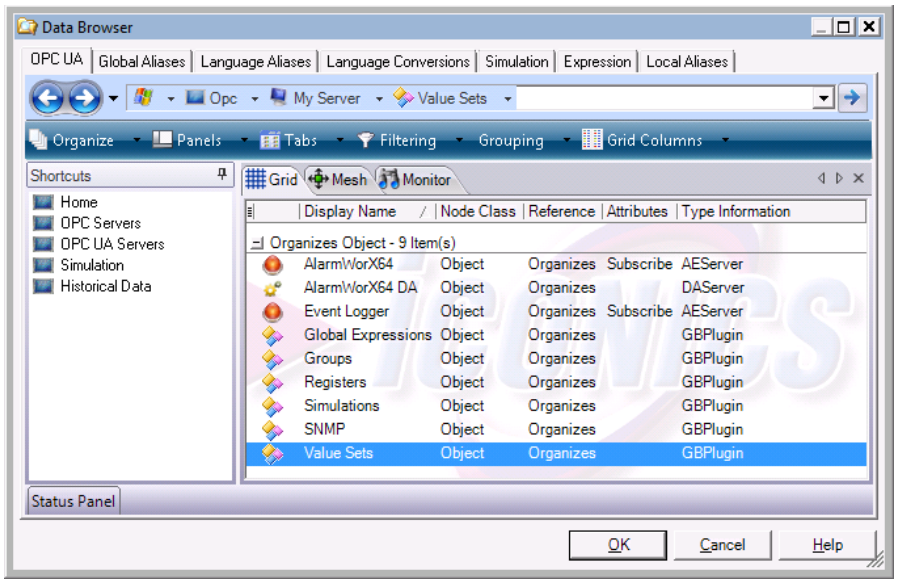


Figure 12.13 - Selecting the Value Sets Folder in the Data Browser

12.5 Registers

A register is a named address into which you can store values. In general, registers are named variables that all GENESIS64 clients can use. In the Unified Data Manager, a register consists of two configuration tabs.

In the **Register Properties** tab, shown below, you define the **Data Type** and a **Description**, and you decide whether the register is read only or writable. You can also enable or disable "Input Updates Propagation", which indicates whether values changed on input tag will be sent to an output tag.

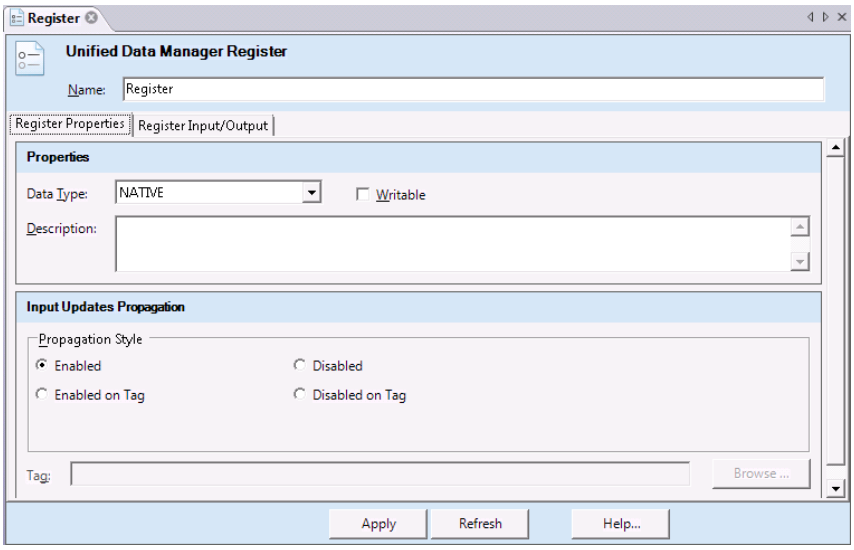


Figure 12.14 - Register Properties Configuration

How you configure the **Register Input/Output** tab depends on the type of the register you need. The options in the "Input Tag" section are designed for definition of an input signal for the register. You can choose to read an OPC Data Tag if you want to use this register to aggregate data to other OPC clients in GENESIS64. If you choose this option, you will need to specify the input tag path in the "Input OPC Data Tag" field. The default data type for this input tag is "Native" but you can choose an appropriate data type in the dropdown list. You can also specify the Scan Rate, or rate at which the register will poll the OPC tag.

Alternatively, if this is simulation variable, for example, you can choose “None” in the Input Tag section. You do not need to specify an input tag if you select this option, but you do have to provide the register with an Initial Value.

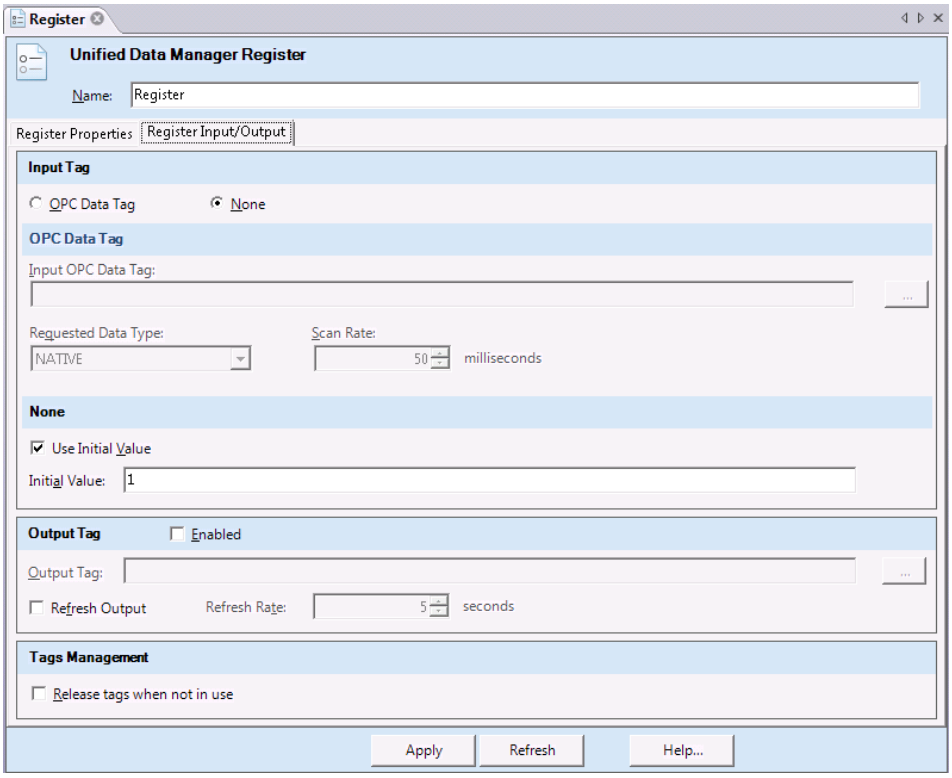


Figure 12.15 - Configuring Input/Output Properties of Register

If you need to bridge the data from the register to another OPC tag, check the “Enabled” checkbox in the **Output Tag** section. You can then specify the output tag path by typing it in or browsing for it. You can further indicate a refresh rate for the output tag by checking the “Refresh Output” option and giving a refresh rate.

The **Tags Management** section contains only the “Release tag when not in use” checkbox which, when checked, disconnects the input tag as well as the output tag when no client is connected to the register. This may save points counting toward your license. On the other hand, it will cost time when a client tries to request the point again. Having this option checked also disallow bridging.

As mentioned before, there are different types of registers. You can configure a register to achieve **data aggregation**, or provide a mechanism for data **bridging** where the value of one tag is written though the intermediate register to another tag. You can also use the register to **pre-fetch data** or to **hold** a value you enter into it. Let’s look at each of these four types of registers.

12.5.1 Bridging Registers

If you need a data point from one hardware device to be sent to a data point on another hardware device, use ***data bridging***. Data bridging maps the output of a device as the input to another device using the UDM Register as a bridge.

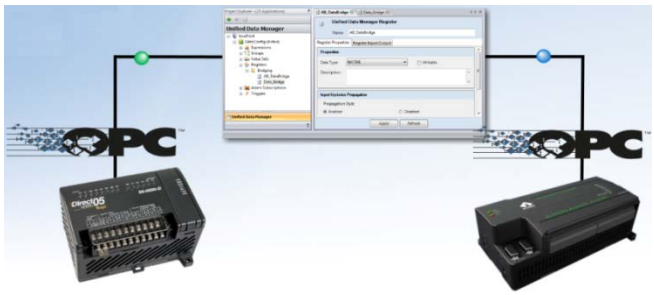


Figure 12.16 - Data Bridging

For bridging, you only need to specify an "Input OPC Point Tag" and an "Output Tag". To select a tag, click the field's ellipsis […] button to open the Data Browser.

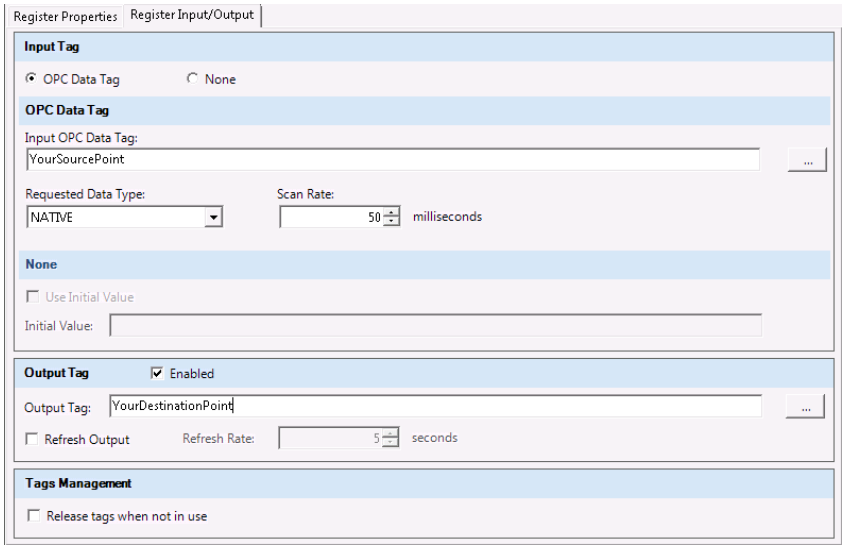


Figure 12.17 - Bridging configuration

Note: Do **not** check the "Release tags when not in use" checkbox, and do **not** change **Input Update Propagation** to "Disabled". If you do, bridging will not work.

12.5.2 Aggregation Registers

You create an aggregation register by specifying the same data source for the Input OPC Point Tag and the Output Tag. An aggregation register is usually used when you want all clients connected to only one server even when you have more OPC servers. By connecting them all to one server, you can aggregate data at that server.

You may find that you have hardware devices that cannot handle the volume of requests that are being sent to them. This happens if a device's tags are requested frequently or from several OPC clients, or if the device has a limited ability to cope with I/O requests. If the device cannot handle the requests, data becomes bottlenecked, and clients must wait for data to be returned.

One way you can overcome this problem is by using ***data aggregation***. Data aggregation collects multiple requests for a tag into one request, reducing network traffic.

In the example shown in Figure 12.18, there are three OPC clients that request the same temperature reading from a device. You can create a UDM register that handles those requests. The register acts as an intermediary that aggregates the three incoming client requests, sends one request to the device, gets one return from the device, which the register then forwards back to the three clients.

Figure 12.18 - Data Aggregation

Using the UDM register, you define one register for each tag whose requests you want to aggregate. Once you set up the register to aggregate tag requests, the register intercepts all client requests for the tag and pools them into one request that it sends to the device. In turn, the device returns one reply, which the register then broadcasts to the OPC clients that requested the tag.

In order to use this feature enter the OPC tag for the data point you are aggregating in both the "Input OPC Data Tag" field and the "Output Tag" field. Make sure you also **disable** input updates propagation on the **Register Properties** tab; otherwise, it may happen that your values could be running in circles.

> **Note**: You can also enable/disable the propagation based upon an OPC data point value.

12.5.3 Data Prefetch Registers

Another way to address problems related to I/O communication and volume is with ***data prefetch***. Data prefetch is a way of preloading data in anticipation of client requests.

Data prefetch loads data from a device onto the server even if no clients are requesting the data. Because the data is preloaded onto the server, the data is available when a client requests it; the client doesn't have to wait for the I/O from the device.

Data prefetch is useful with slower devices or communication networks where I/Os between clients and devices are typically delayed because, for example:

- Your older or slower devices do not have the capacity to fulfill their I/O requirements.
- Geographical distance separates clients from the server, or the server from the device.

For example, a client requests second-by-second polling data from a device that is located on the other side of the continent, and your limited hardware device cannot accommodate the requests in a timely way. In this case, data pre-fetch might provide the solution you are looking for.

Note: There is a downside to using data prefetch. The ongoing loading of data from the device to the server creates a continuous stream of traffic between the device and the server. For that reason, it is important that you use restraint when choosing the data points you use prefetch for; this is not a solution you want to overuse. You will have to determine whether the volume of traffic that prefetch creates works to your advantage. For example, even if a hardware device has 30 data points, there may be only one data point on that device where prefetch benefits you.

Also, keep in mind that any register that does data prefetch consumes a license point because the input/output tag is in constant use by the register.

The configuration of a Data Prefetch register is identical to that of an Aggregation register except make sure the "Release tags when not in use" checkbox remains *empty*.

12.5.4 Input Registers

If not combined with an output tag, registers usually serve as holding registers or read only registers connected to another OPC point. In order to get such a register, you must uncheck the "Enabled" checkbox in the Output section of the **Register Input/Output** tab.

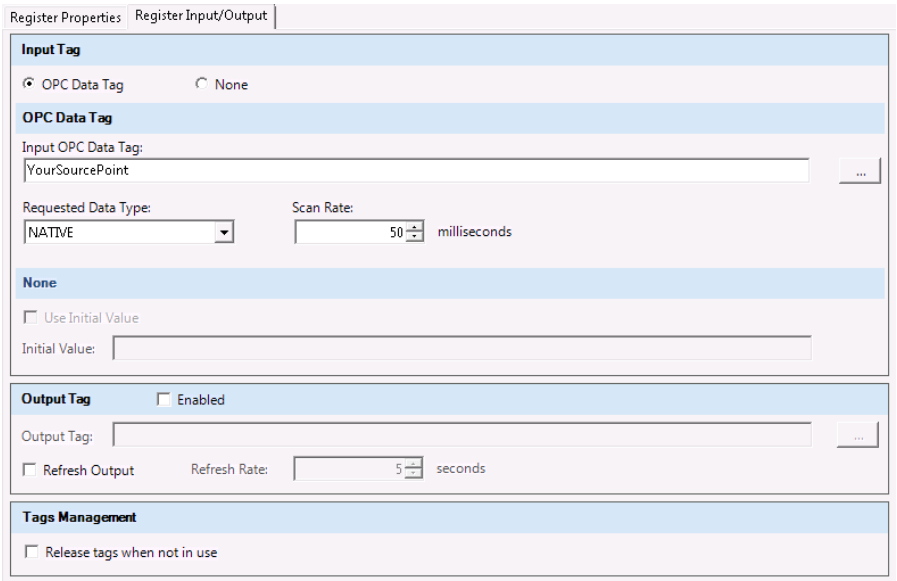


Figure 12.19 - Disabled Output Tag

Now that you have a register that you can use to read an OPC point defined as “Input OPC point” or you can create a holding register by selecting the “None” radio button. If you create a holding register, you can choose to define an “Initial value”. For the holding register, you should also go to the **Register Properties** tab and make the register Writeable.

> **Note**: It is not recommended that you make a register writeable if it has an input OPC Data Point but no output tag. If you enter a value in such a register, the value is stored in the register but the input OPC Data Point value does not change. The entered value is propagated to nowhere because there is no tag defined as the register’s output.

You can use the UDM registers in the same way as any other OPC points. You can select them using the Data Browser, as highlighted in Figure 12.20.

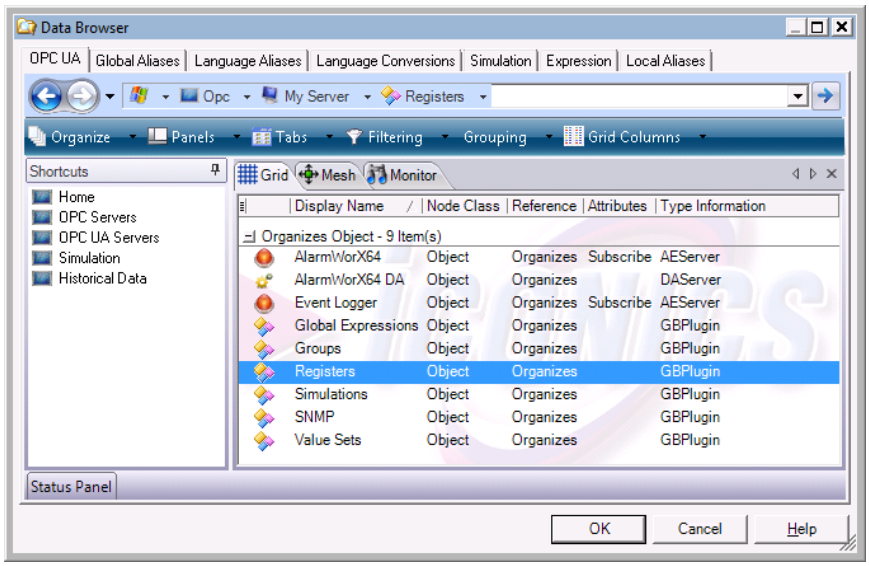


Figure 12.20 - Selecting Register in Data Browser

12.6 Triggers

A trigger is a rule that defines the conditions under which an event is to be executed. There are two types of triggers: data triggers and time triggers. *Data triggers* execute an event based on a specified condition that is defined in the trigger, while *time triggers* execute an event based on the time or sets of times that are part of the time trigger’s definition.

Furthermore, each trigger can be scheduled to trigger by using the trigger's **Advanced** tab, shown below.

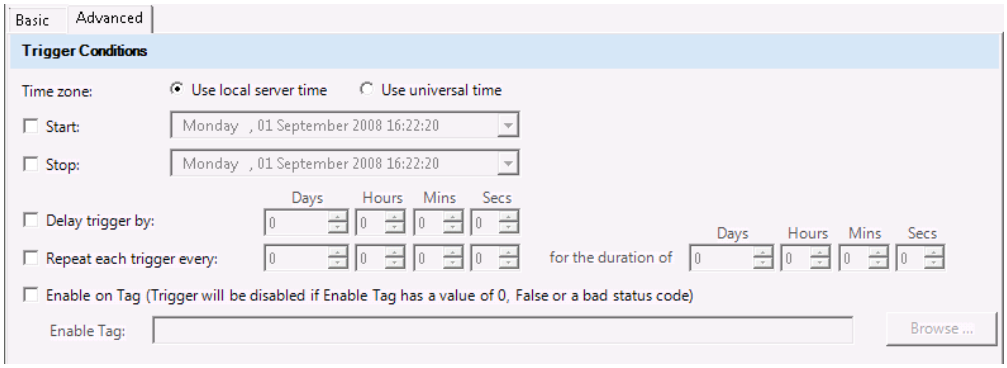


Figure 12.21 - Advanced Tab for a Trigger

To create a trigger, you expand the UDM's Triggers node, then either right-click "Data Triggers" and select the Data Trigger menu item (as shown below), or right-click "Time Triggers" and select the Time Trigger menu item.

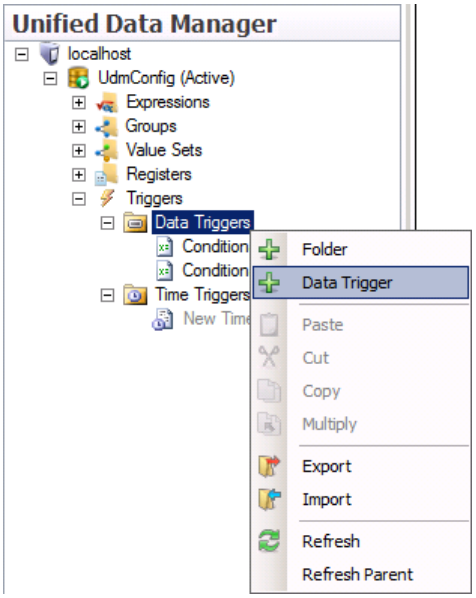


Figure 12.22 - Creating a New Trigger

Triggers are divided into condition triggers and event triggers. An *event trigger* is a one-shot trigger used for triggering an immediate action. However, if you need a continuous rather than single-shot action (for instance, for logging purposes), you would use a *condition trigger*. The type used is a function of what you want the trigger to do. Let us take a closer look at each type of trigger.

12.6.1 Data Triggers

A data trigger fires on any of the following conditions:

- When data changes (*event* trigger)
- When a data tag changes to TRUE (*event* trigger)
- When a data tag changes to FALSE (*event* trigger)
- When a data tag is TRUE (*condition* trigger)
- When a data tag is FALSE (*condition* trigger)

To select the data source that must meet the condition so that the trigger fires, click on the "Browse" button next to the "Data Tag" field.

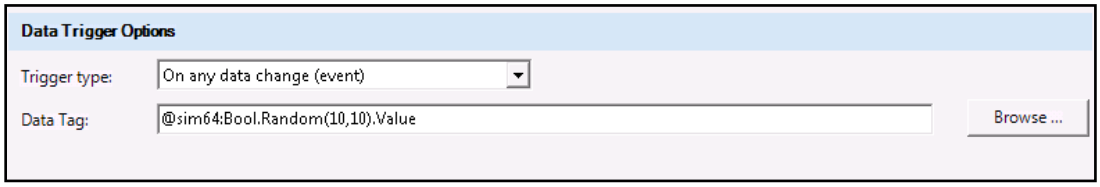


Figure 12.23 - Data Trigger Options with Selected Data Tag

12.6.2 Time Triggers

A time trigger executes an event or condition periodically, in accordance with a user-specified recurring timeframe. The recurring pattern can be a one-time event, can occur at different time intervals, or can be defined by specific dates and times. The Unified Data Manager's time trigger options change according to your selection and give you fine control over when the time trigger evaluates to **True**. Shown in Figure 12.24 is the trigger configuration dialog for a specific date and time trigger.

A time trigger event can be set to fire based on the following conditions:

- Once, at a set time
- After an interval of time has passed
- Recurring at specific dates and times

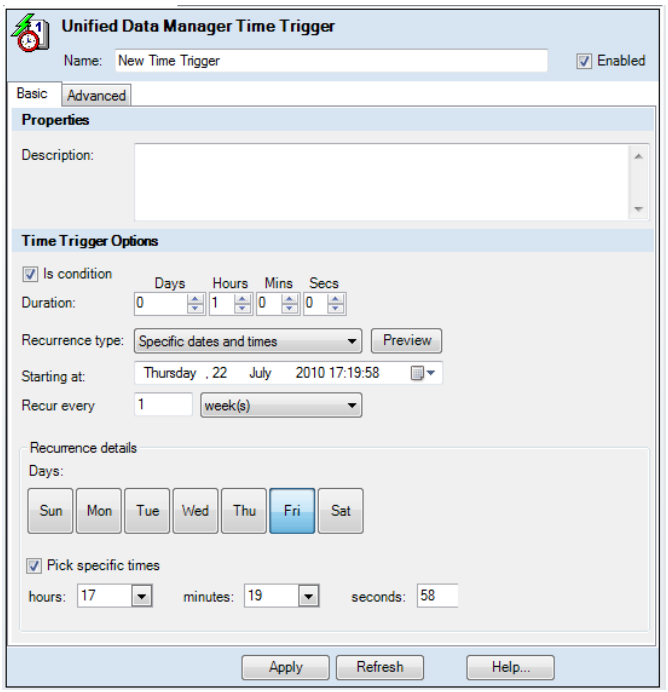


Figure 12.24 - Time Triggers Configuration

To set a time trigger *event*, you should leave the "Is Condition" checkbox unchecked; but if it is a time trigger *condition*, go ahead and put a checkmark in the "Is Condition" checkbox.

Select a "Recurrence type" of One time only, Time interval, or Specific date and time. Depending upon the time trigger recurrence type you select, the Options section changes to allow you to set appropriate parameters.

12.6.2.1 One Time Only Recurrence

To set a **onetime only** event, select the "One time only" Recurrence type, select the date and time that the trigger fires in the "Trigger at" box.

12.6.2.2 Time Interval Recurrence

To set a **time interval** at which an event fires, select the "Time interval" Recurrence type (as shown in Figure 12.25), then in the "Starting at" box enter the date and time that the time interval starts its counter, and then in the "Recur every" boxes specify the interval between time trigger events (the time span cannot be zero).

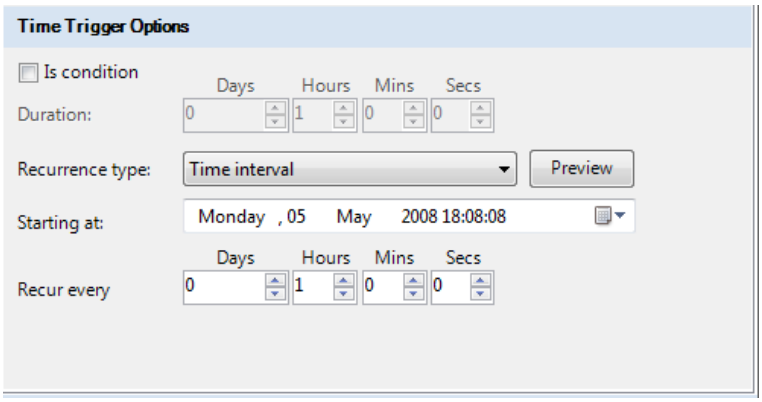


Figure 12.25 - Time Interval Selection

You can preview the times that the trigger will fire by clicking the "Preview" button. The figure below shows a sample of the type of preview you might see.

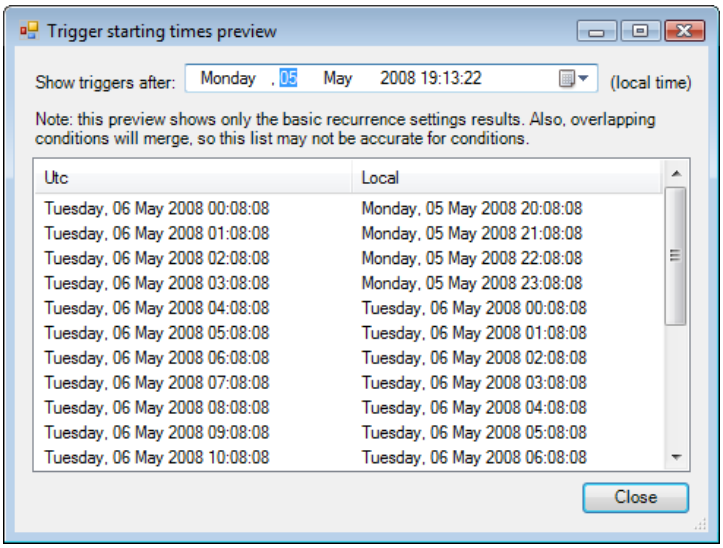


Figure 12.26 – Previewing a Trigger's Starting Times

12.6.2.3 Specific Date and Times Recurrence

To set **specific dates and times** when events fire, select the "Specific date and times" in the Recurrence type dropdown list. In the "Starting at" box, enter the time that the time interval starts its counter. In the "Recur every" boxes, specify the interval between time trigger events, and select the time period (seconds, minutes, hours, days, weeks, months, or years) from the dropdown list.

The Recurrence Details section changes depending on the selected interval. (Shown in below is the *Recur Every # Week(s)* selection.) Select the different days, months or times in the Recurrence details section.

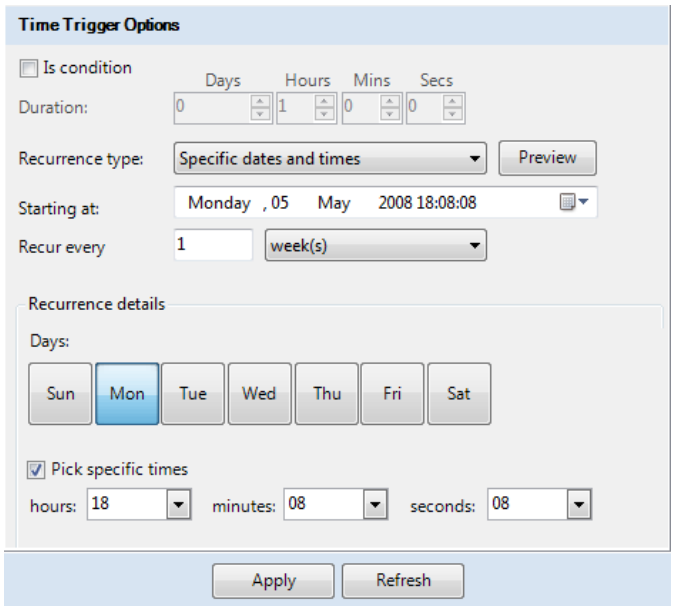


Figure 12.27 – Setting a Trigger's Specific Dates and Times

To select *specific times*, put a checkmark in the "Pick specific times" checkbox and set the time in the Hours, Minutes, and Seconds boxes. In the example shown above, the event will trigger at 4:08:08 PM every Monday. Remember you can see the schedule by clicking the "Preview" button.

12.6.2.4 Time Trigger Conditions

Some GENESIS64 applications can use a condition status to perform certain actions instead of relying on an event to be fired. For example, you can set a conditional time trigger in the Unified Data Manager so that the condition changes only once, changes in a repeating or recurring fashion, or changes at specific dates and times. All of the options we looked at in the section above apply to *conditional* time triggers, but now instead of an event, a Boolean value or flag is stored so that a program can READ the value and act *according to its own programming*. The condition time trigger appears in the Unified Data Browser so that it can be selected by an application. The time trigger condition is set so that it switches like this:

- From inactive to active once; the only recurring type.
- From active to inactive; and then inactive to active on a recurring basis.

The GENESIS64 online Help describes this type of trigger in more detail.

12.6.3 Using Triggers

Data triggers and time triggers are used in Hyper Historian. When you browse for triggers in Hyper Historian, the dialog box looks like below.

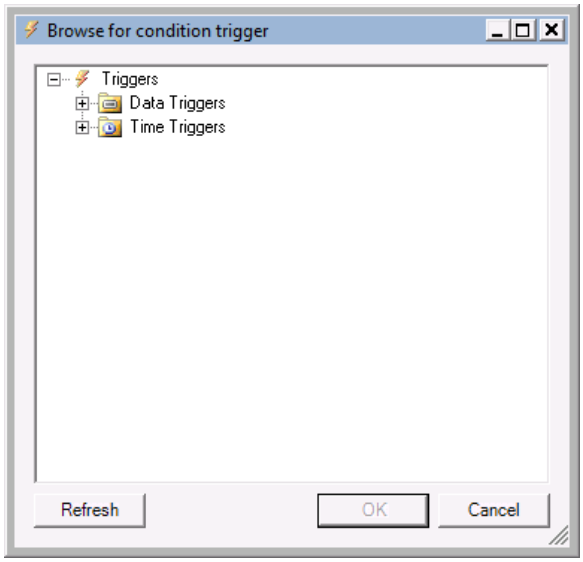


Figure 12.28 - Selecting a Trigger in Hyper Historian

Lab: Expressions and Registers L12

12.1. Lab Overview

This introduction to expressions and registers is intended to expose some of the available features and also demonstrate some rather simple expressions in an attempt to enhance your thoughts on how these very useful and simple to implement procedures can assist in performing some rather sophisticated mathematical exercises. There will also be some demonstration of how expressions can be interconnected with registers to produce some intended result.

Estimated time to complete this lab: 30 minutes

12.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Create folder for Registers and Expressions in the UDM.
- Create Holding Registers used for expression Inputs.
- Configure Expressions as a Counter and an Random Runtime Generator.

12.1.2. Support Files

To complete this lab, you will need the following file(s):

- CompressorTest.gdfx

12.2. Registers

Registers are named variables that all GENESIS64 clients can use. If you have used registers inside DataWorX32, then the features of Unified Data Manager registers are a subset of the features available for registers in DataWorX32. Unified Data Manager doesn't support the use of Unified Data Manager registers through OPC, as an alias or redundancy register, or allow automation through Visual Basic. The most significant difference between Unified Data Manager and DataWorX32 registers is that Unified Data Manager registers are not real OPC tags, and Unified Data Manager registers can be accessed only with GenClient and the appropriate plug-in. The Unified Data Manager is also missing special registers for data aliasing, switching and redundancy. Refer to the GENESIS64 online help system for details on the various register types..

1. Open **Workbench-SL** and select the **Unified Data Manager** provider.
2. Expand the icTonicsUDMConfig tree and add a folder called **Compressor** under **Registers → icTonics**..
3. We will continue by adding four registers configured as **Holding Registers**.
4. Right click on the Compressor folder and select **Add Register**.
5. Name the register **CompressorCounterInput**.
6. Click on the **Input / Output** tab.
7. **Uncheck** the **Input OPC Tag** and **Output OPC tag** checkboxes. This makes the register a **holding register**.
8. **Check** the **Use Initial Value** checkbox and enter a value of **0** (zero).
9. Click **Apply**.
10. Right-click on the **Compressor folder** and select **Export-Sub-Tree**.
11. Select the **Format**, **MS Excel®**. Click **OK**.
12. Click **Close**.
13. **Click** on the **Blue Text** of the location path. Notice that the cursor changes to a hand as you hover over the text.
14. Select **Save as**.
15. **Save** the file in the **C:\Training** folder. You can leave the default name or change it if you like.

16. Select Open Folder. Or use the Windows File Explorer to locate the .xlsx file you created.

17. **Double-click** on the **.xlsx** file. This launches Excel. If you see a Microsoft Wizard dialog, click Cancel.

18. Place the cursor in cell **A2**. Hold the **shift** key and use the **right arrow** on the keyboard to select all the populated cells in row 2.

19. **Ctrl-C** to copy the cells.

20. Place the cursor in cell **A3** and **Ctrl-V** to paste. Also place the cursor in cells **A4** and **A5** and paste. The end result should be four rows (**A2 – A5**) populated.

21. **Here is the key!** You need to be sure the light blue Table Outline includes all the cells you would like to import. Cells that are not outlined will not be imported.

22. If, for some reason now or in the future, you have to manually extend the table outline, select the triangular handle located at the lower right corner of the bottom right-hand cell.

23. The following figure should help locate the handle.

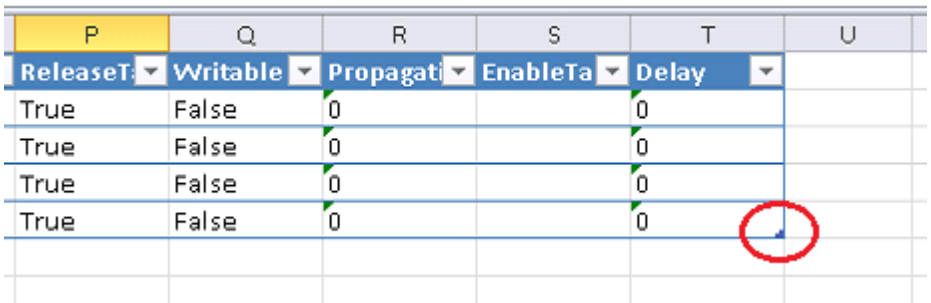


Figure L12.1 – Excel Table Outline

24. Rename the registers as follows:

Rename From	Cell	Rename To
CompressorCounterInput	B2	No Change
CompressorCounterInput1	B3	CompressorCounterOutput
CompressorCounterInput2	B4	CompressorRandomInput
CompressorCounterInput3	B5	CompressorRandomOutput

25. **Save** the file and close Excel.

26. Return to the **UDM** (Unified Data Manager).

27. Right-click on the **Compressor folder**.

28. Select **Import**, **Browse**, Drop down the file type and select **Excel (*.xlsx).**

29. Select the file you edited and click **Open**.

30. Leave the default settings and click **Upload**. Click **Close**.

31. Right-click on the icTonicsUDMConfig database and select **Refresh**.

32. This exercise was intended to introduce you to this feature. Obviously, being able to edit in Excel can be useful at a much larger scale.

33. Edit each of these registers CompressorRandomOutput, CompressorRandomInput, CompressorCounterOutput and CompressorCounterInput to enter a checkmark in each **Writeable** flag under the Properties tab.

34. **Apply** your changes.

12.3. Expressions

Expressions are combinations of data sources, numbers, operators and grouping symbols (such as brackets and parentheses) arranged in a meaningful way that can be evaluated. During Runtime mode, OPC servers resolve the data source for the expression and the expression is evaluated. There are two types of Expressions, local and global**.** Each of the two types are described in detail in the GENESIS64 online Help system.

We will begin by creating a one-second counter.

1. Open **Workbench-SL** and select the **Unified Data Manager** provider.

2. Expand the icTonicsUDMConfig tree and add a folder called **Compressor** under **Expressions → icTonics**.

3. Right-click on the Compressor folder and select **Add Expression**.

4. Name the Expression **CompressorOnTimeCounter**.

5. Set the **Default Scan Rate**: to **1000** (one second).

6. Click **Apply**.

7. Click in the **Read Expression** tab. We will be building the following expression syntax.

```
x=setvalue({{@rgs64:icTonics.Compressor.CompressorCounterOutput.Value}},{
{@rgs64:icTonics.Compressor.CompressorCounterOutput.Value}} +
tonumber({{@rgs64:icTonics.Compressor.CompressorCounterInput.Value}}))
```

8. There's many ways you can create an expression. For instance, you can manually type in the syntax or you can use the expressions editor.

9. The following steps will describe how to select and insert a function and browse for and insert a tag into the expression. Beyond that, you will be on your own to complete the expression. Learning the expression editor will take some practice.

10. On the right side, click on the **Expression Editor** button .

11. From within the **Expression Editor** dialog, select everything in the window. This will be replaced as we proceed.

12. Click the **Functions** button and select the **setvalue** function.

Note: Functions are case sensitive.

13. Select the word **variable**. This will be replaced when we select a tag.

Note: Be sure not to select any more characters than the ones you want to replace. For example, if you select the comma with the word 'variable', the comma would also be replaced and you would get a syntax error when you run the syntax checker.

14. Click the **Variables…** button and browse to select the tag Home → OPC Classic Servers →My Server → Registers → icTonics → Compressor → CompressorCounterOutput and click **OK**.

15. Proceed by selecting the word **value**.

16. When your expression is complete (the syntax should match step 7), click on the syntax checker button.

17. Click **OK**. Be sure to **Apply** your changes.

18. Create a second expression and leave all the settings in the expression at the default values.

19. Name the expression **CompressorOnTimeRandom**.

20. Click in the **Read Expression** tab.

21. The float tag used in the expression below is located at Home → OPC Classic Servers → My Server → Simulations → Float → Random (random tag from the bottom of the split window).

Note: The random tag will look like this: @sim64:Float.Random(Period[sec],Min,Max,Phase[deg]).Value. You need to set the parameters manually.

x=IF {{@sim64:Float.Random(1,0.0,10.0,1).Value}} > {{@rgs64:icTonics.CompressorRandomInput.Value}}THEN setvalue({{@rgs64:icTonics.CompressorRandomOutput.Value}},{{@rgs64:icTonics.CompressorRandomOutput.Value}}+1)

22. The ELSE statement is not needed and can be removed.

12.4. Adding the 'KeepAlive' Register

Expressions won't execute if they are not actively being used by the system (in displays or alarms). This exercise will demonstrate this scenario since you may run into while developing expressions.

1. Open the **CompressorTest.gdfx** display in the GraphWorX64 editor.
2. Select the top process point under the Expression Output label.
3. Delete it using a **Shift-Delete**.
4. Enter **Runtime**. You should notice that the Random Output no longer increments. This is because nothing in the system is requesting updates from the expression. The following steps will correct this issue.
5. From within the Workbench-SL, under the **Registers → icTonics → Compressor** tree node, add another register named **KeepAlive**.
6. **Enable** the Input OPC Tag.
7. **Set** the OPC Tag to:
@exp64:icTonics.Compressor.CompressorOnTimeRandom.Value
8. **Disable** the Output OPC Tag.
9. **Uncheck** the **Release tags when not in use** checkbox.
10. Click **Apply** and restart the **UDM** service.
11. Check the **CompressorTest** display in **Runtime** and the updates should occur normally.

This concludes this lab.

Global Aliases 13

The Global Aliasing System (GAS) is a powerful referencing feature that can be used in any GENESIS64 applications to quickly switch between multiple data sources using a single reference by changing the value of the reference.

When you design a display, any process point can contain one or more global aliases. The Global Aliasing Server is able to resolve global alias references and provide the correct value for the tag at runtime. That tag is then used to display the current data being observed or controlled. In practice, you might define a button that opens a popup menu where you can select one out of ten different data sources. Each selection will change the value of the global alias reference in the displays. This in turn changes the data source for a process point in the GraphWorX64 display, so that in runtime, the data changes on your display. With this system in place, a single process point and a button can do the work of ten process points on a single display or alternatively the work of ten displays with a single process point. This is the power of global aliasing.

The Global Aliasing System follows a certain structure of values that groups common objects into categories. Consider Table 13.1, which demonstrates the global aliasing hierarchy in the left column on an example of building control in the right column.

Table 13.1 - Global Aliasing Mapping

Global Aliasing	Building Example
Theme	Buildings
Theme value	Building A, Building B
Alias	Lights, Heating
Alias Value	OPC points specific for Building A and B controlling Lights, Heating

After completing this chapter, you should be familiar with:

- General uses for global aliases
- How to create and use themes
- How to create and use global aliases

13.1 Architecture

Global aliases are stored and maintained in a SQL Server database and those aliases can be accessed over the network through the GAS Server. When you install GENESIS64, the installer creates a GAS server database with a default configuration. However, you may want to or need to create and configure your own GAS databases before you create global aliases configuration.

Figure 13.1 below shows the GAS architecture. Note the role of the FrameWorX server. If global aliases do not resolve or connections to the data sources are missing, make sure the FrameWorX server is functioning correctly and the service is running.

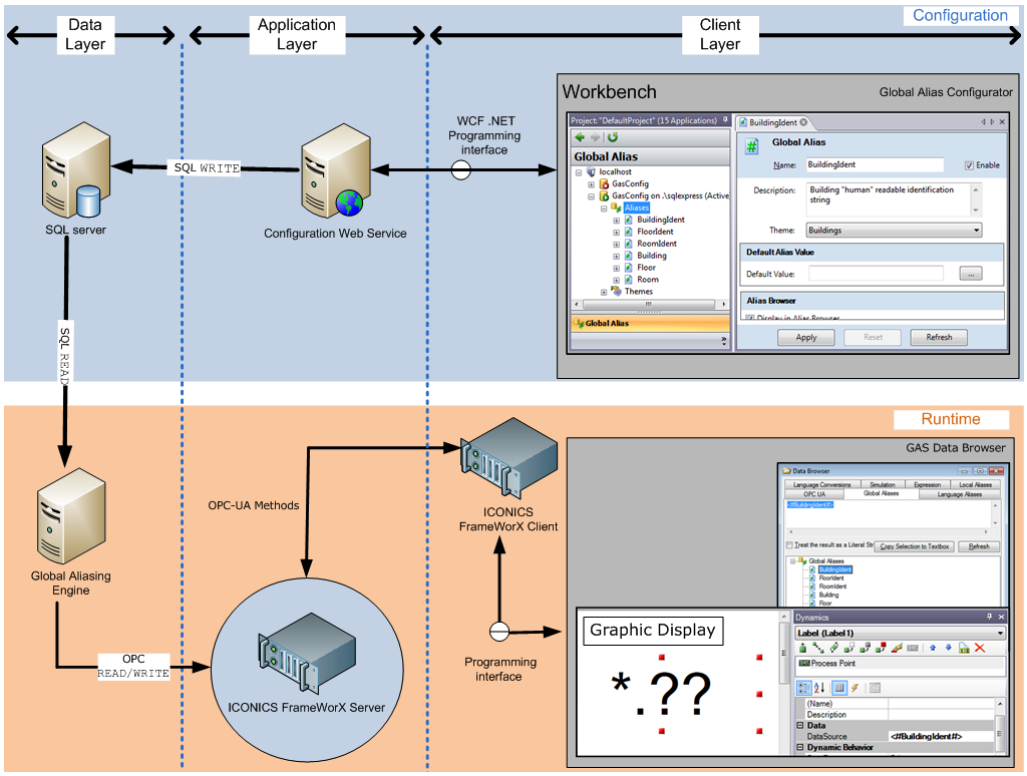


Figure 13.1 - Global Aliasing System (GAS) Architecture: Configuration (Top) and Runtime (Bottom)

You create global aliases and themes inside a configuration database. The GAS can have one *active* configuration database at a time. All aliases and themes used in your displays must be defined to that configuration. Any time you make a different configuration active, you must restart the GAS service so that it can recognize the change.

13.2 Definition of Global Alias

A global alias is a data string encapsulated between the delimiters <# and #> that enables you to create an object (such as a trend pen in TrendWorX64 or a process point in GraphWorX64) that can easily switch among multiple data sources using one unique name. Instead of creating multiple versions of an object (one for each tag), you can create one version and let global aliasing find the value for the object to be displayed. By using global aliases, you can reduce the overall number of objects in your display files as well as the number of tags that you have to manage.

The Global Aliasing system provides global storage for aliases and resolves aliases at runtime. The aliases can be used in OPC tags, menu values, file names, and almost any other place where you can insert text values into a display, map, trend, or alarm. Figure 13.2 shows how a global alias is used to switch between multiple OPC tags in a GraphWorX64 display. The values that a global alias resolves to are defined in the GAS as *alias values*. All global aliases and alias values are created and configured in the Global Aliasing interface in the Workbench.

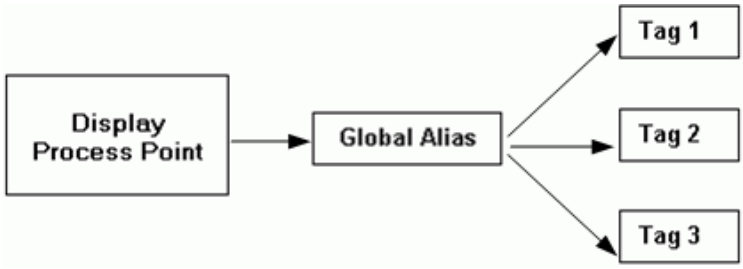


Figure 13.2 - A Single Global Alias for Multiple Data Sources

A collection of aliases with similar properties is called a theme. Aliases can be nested, eventually resolving to the value or property you wish.

13.2.1 A Time Saver

Consider lights in a building that you monitor, with each individual light reporting its current condition. Each light is assigned an alias, and that alias is globally available to GENESIS64 applications. In the scheme shown in the building example, buildings are divided into individual buildings, floors, rooms, and then the data sources you want to monitor. The address to a particular data source might be the following:

```
@Buildings.Administration.Floor_4.Room_403.Light_08
```

In this scheme, buildings are divided into individual buildings (`Administration`), floors (`Floor_4`), rooms (`Room_403`), and then the data sources you want to monitor (`Light_08`). Using this scheme, for 3 buildings, each with 6 floors, 34 rooms, and 20 lights you would have to identify 12,240 individual tags in a display to fully define the namespace.

With global aliases, this can be greatly simplified with the following: define a Building_ID alias for the building, substitution of which into your path would yield:

```
@Buildings.<#Building_ID#>.Floor_4.Room_403.Light_08
```

This single substitution reduces the number of unique tags by a factor of three, to 4,080 tags that you would have to identify in the display. Defining additional aliases could reduce the path to the following:

```
@Buildings.<#Building_ID#>.<#Floor_ID#>.<#Room_ID#>.<#Light_ID#>
```

This leaves you with *one* unique path to 12,240 individual tags that you can use anywhere! To accommodate the actual alias values, you would define values for: the three different buildings, floors 1 through 6, rooms 01 through 34, and lights 01 through 20.

That sums to 63 global alias values you need to define along with four global aliases. In your display, the process point would use only *four* global aliases. As you can reuse global aliases, this becomes a valuable, time-saving solution!

13.2.2 A Design Aid

Global aliases can also aid in display design. For the sake of this example, all three displays are of the same design. We will look at what you do as the user, and what happens behind the scenes.

First, at runtime, when you click on the Administration building (which assigns the value Administration to the Building_ID global alias), the display changes to show the label “Administration” in the title bar identifying the building you are looking at.

Then, on the same display, you select the fourth floor (which assigns the value Floor_4 to the Floor_ID alias and is used for selecting a floor diagram). The display then shows a diagram of the fourth floor with the rooms it contains. You only need to have one floor diagram for all of your buildings.

Finally, you click on room number 403 (which assigns the value Room_403 to the Room_ID alias and is used for selecting a room diagram) and another diagram appears, showing the lights in that room. Again, you only need to have one room diagram (as long as all the rooms are similar). The room diagram shows a status indicator showing each light's condition.

This solves your design problem. The complete path to each data source is built using the aliases you supplied. This automated construction of a path to the data source is a process that is referred to as *alias resolution*.

> **Note:** For examples of how Global Aliasing is used in GraphWorX64 displays, see the example files in GenDemo: FLOOR_CONTROL_GAS.GDFX and FLOOR_OVERVIEW_GAS.GDFX.

13.3 Alias Resolution

Alias resolution is the process of assigning a specific value to an alias.

Each global alias can be associated with a theme. A theme links a global alias to one or more data values (e.g. tags). The Global Aliasing engine allows you to assign different values to aliases based on the currently selected theme value. Theme values can be selected dynamically; either programmatically through an automation API or by a Pick action.

Figure 13.3 shows how a generic single alias can be used, for example, to link multiple tags to a single process point in GENESIS64. The Global Aliasing Server resolves the alias based on the selected theme value, which associates the alias to the data values (tags).

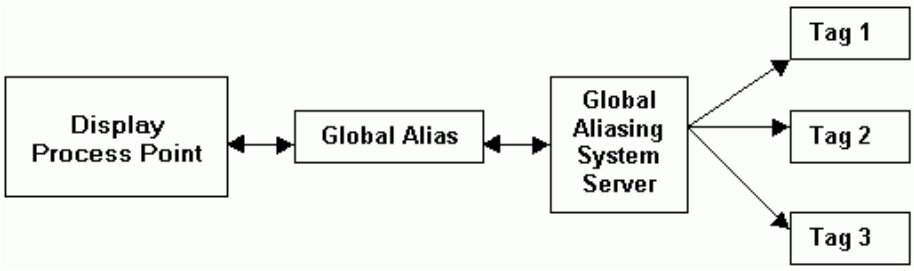


Figure 13.3 - Alias Resolution

Each theme can have one or more theme values associated with it, and each alias value is then associated with a theme value. A theme value allows you to switch between the data values that are linked to the theme, as shown in Figure 13.4. For example, if you have one theme with three theme values, and each theme value is associated with a tag, you can toggle between the theme values and therefore the tags.

Thus, you have a single process point associated with three different values, as shown in Figure 13.4. All themes and theme values are created and configured in the Global Aliasing configuration interface in the Workbench.

In addition, a single alias can be read by many different applications (for example, GraphWorX64, TrendWorX64, and AlarmWorX64), as shown in Figure 13.4. You can also associate multiple aliases with a single theme.

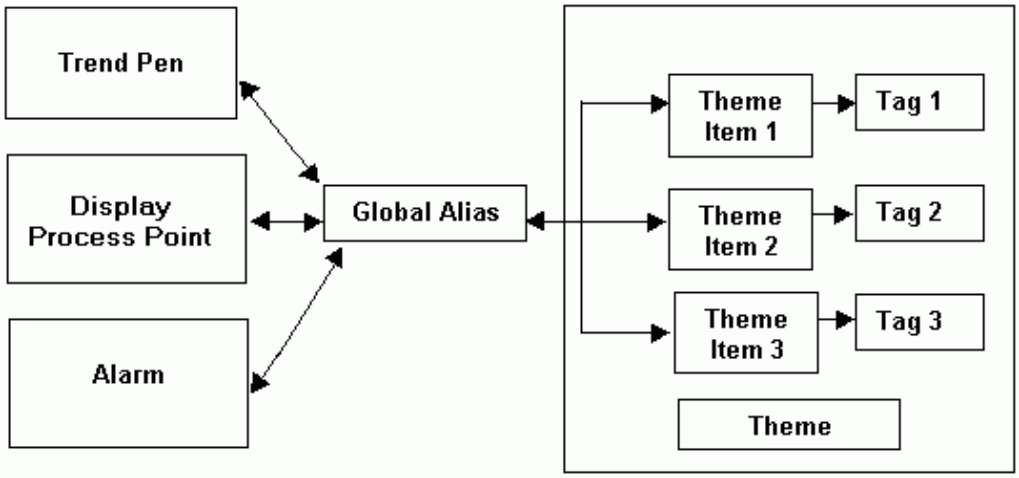


Figure 13.4 - Using Theme Values to Switch between Data Values

13.4 Using Themes and Theme Values

A theme can represent any general category, such as equipment, signals, files, regions, quality controls, departments, and much, much more. The sole purpose of a theme is to act as a category for the global aliases that use it. You assign alias values to each theme value when you associate a global alias with a theme.

The power of a theme is in the number of aliases that you associate with it. For example, the Buildings theme might also be associated with a second global alias called Floor_ID, a third called Room_ID, and a fourth called Light_ID. Plan the themes that you create so that by applying a theme at runtime you essentially enable an effective, efficient system for obtaining global aliases and their values. Note that one global alias can only be associated with one theme only.

The resolution of aliases is controlled by the theme scope (that is, on what level a theme is applied to your application). The Global Aliasing system supports three different levels of aliases:

- **Machine-level** applies to the entire computer.
- **Process-level** applies to the current process (such as, GraphWorX64, TrendWorX64, AlarmWorX64, or EarthWorX64.)
- **Document-level** applies only to the current document/display and its embedded controls (for example, a GraphWorX64 pop-up window).

Note: Document level aliasing is available only in GraphWorX64. It does not apply to the TrendWorX64 Viewer and AlarmWorX64 Viewer.

In GraphWorX64 you can have multiple levels of documents or pop-up windows, as shown in Figure 13.5.

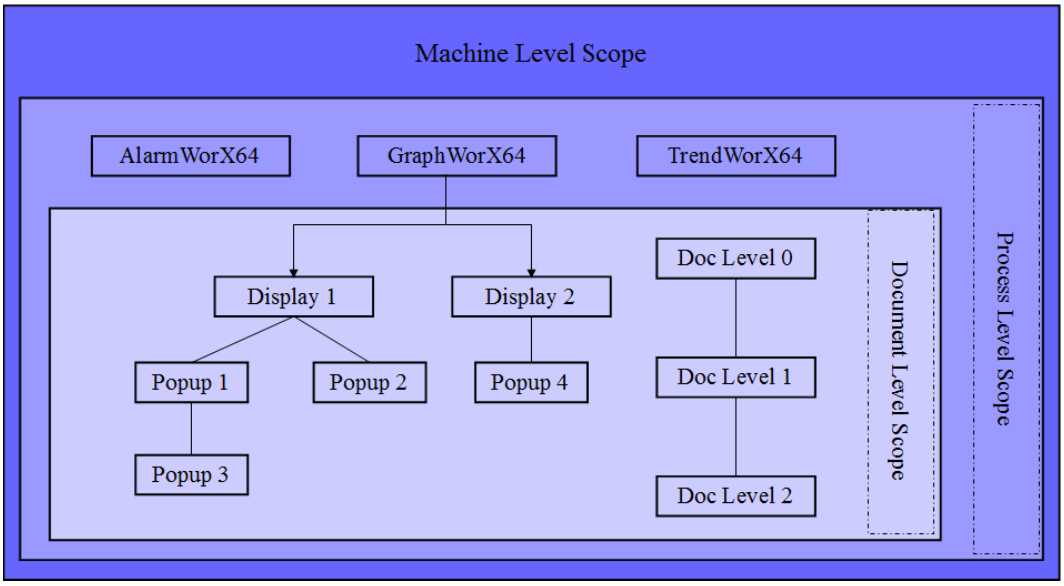


Figure 13.5 - Theme Scope

13.5 Configuring Themes and Global Aliases

To define themes and global aliases, open the Global Aliasing configuration interface in the Workbench by clicking the "Global Aliasing" icon in the Project Explorer, or go to **Start → All Programs → ICONICS → Tools → Global Aliasing**. After installation of GENESIS64, you will find a sample Global Aliasing configuration database, which demonstrates an example of themes and global aliases.

13.5.1 Configuration Database for Global Aliasing

When configuring global aliasing, first select the database in which you want themes and global aliases to be stored. Make sure you expand the database node in the Project Explorer to view existing global aliases and themes already created in the database.

If you modify your configuration database, you should reload it so that all connected clients are notified of the change and can use the latest values. In order to reload the database, right-click on the configuration database and select "Reload Configuration".

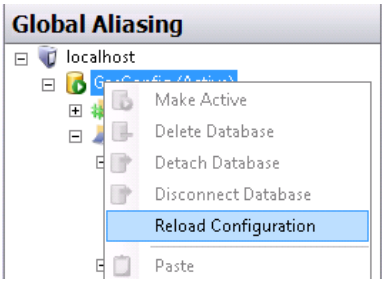


Figure 13.6 - Reload Configuration when Modified

13.5.2 Configuring Themes and Theme Values

In the Global Aliasing Configurator, expand the configuration database in the tree view so you can see the tree nodes called **Aliases** and **Themes**. Right-click **Themes** then select **Theme** from the popup menu. A form for defining a new theme opens, as shown in Figure 13.7.

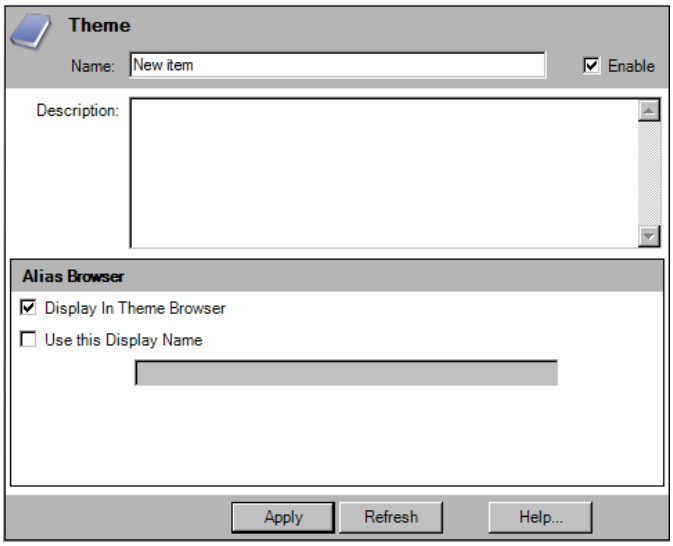


Figure 13.7 - Adding a New Theme

Once you have created the theme, you can define theme values for it. From the tree in the navigation pane, right-click the theme, then select **Theme Value** from the popup menu.

In Figure 13.8, a theme value of *Building C* is being added to the theme called *Buildings*. Note the **Default Theme Value** checkbox. A checkmark here indicates that the alias value that gets assigned to that particular theme value will be the default value for its global alias. For most themes, you will want to identify one theme value as the default so that, during runtime, when no value is selected, the global alias resolves to a value in all instances. Tips for easily identifying the default include:

- Always choosing the *first* theme value as the default, or
- Including the word DEFAULT in the theme value's name, or
- Using some other way to make it easy to identify the default value.

In Figure 13.8, the theme value is enabled and will be listed under the Theme tab that appears in the Data Browser.

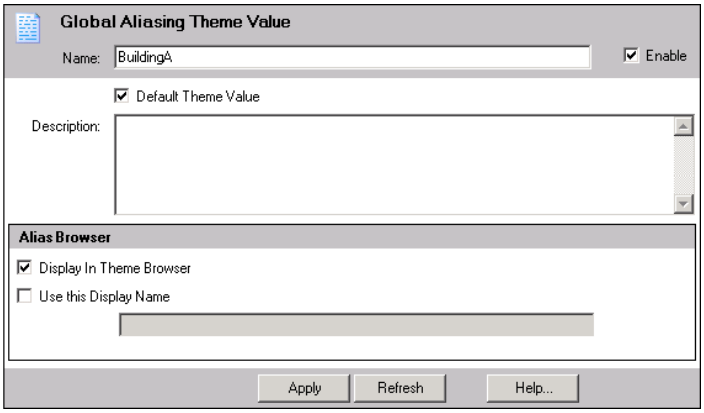


Figure 13.8 - Theme Values for the Theme Called Buildings

13.5.3 Configuring Global Aliases and Alias Values

Once you have defined a theme, you can define the global aliases that will associated with that theme, along with the alias values that get used with that theme. A theme, however, is not required for defining a global alias.

You can use folders to organize your global aliases. To create a folder, right-click **Aliases** in the navigation tree then select **Folder** from the popup menu, and define the folder. This adds the folder to the **Alias** node of the tree. Folders can also have subfolders.

Once you have a folder structure, you can add aliases to these folders. To create a global alias, right-click **Aliases** (or the alias folder you want to add it to) in the navigation tree then select **Alias**. The form for adding aliases, shown in Figure 13.9, appears.

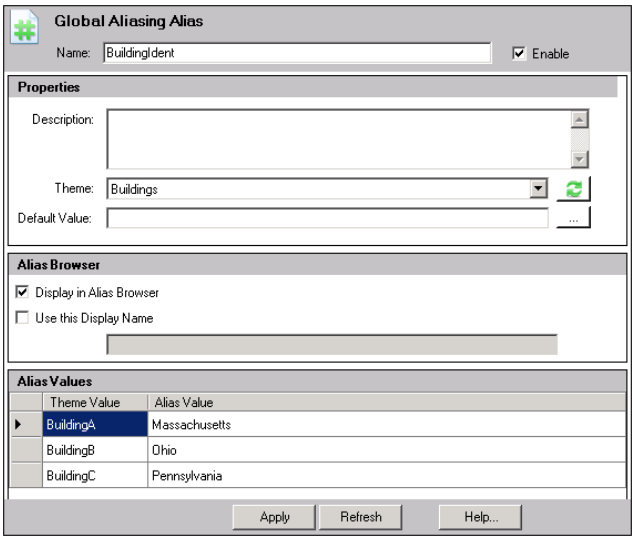


Figure 13.9 - Adding a Global Alias Definition

If you assign a theme, the theme's values appear in the **Alias Values** pane at the bottom of the form. In the **Alias Value** column, you provide the values that will be assigned to the global alias when the theme is in use. There are a few things you should keep in mind when entering alias values:

- You can type an alias value in the field, or choose a value such as a language alias from the Data Browser.
- One of the theme values may be the default value.
- You can nest a global alias in an alias value, as demonstrated in Figure 13.10. When adding a global alias to the alias value, use the following syntax: `<#GlobalAlias#>`.

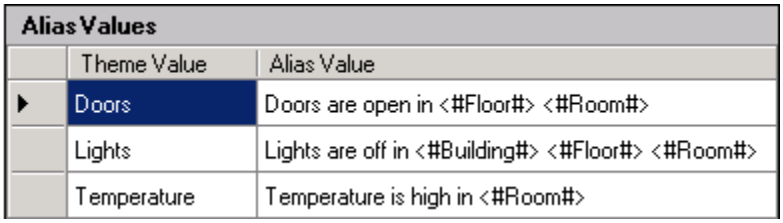


Figure 13.10 - Global Aliases Used in Alias Values

Once you have defined your themes, theme values, and global aliases, you can use them, for example, in GraphWorX64, AlarmWorX64, TrendWorX64, and EarthWorX64.

13.6 Using Global Aliases

Before you can use a global alias in a display, make sure the configuration database where it is defined is active. From the navigation tree in the Global Alias Configurator, right-click the configuration database then select Make Active from the popup menu.

13.6.1 Using a Global Alias in a GraphWorX64 Display

One way to show or use a Global Alias in a display is to insert a process point for a tag that uses a global alias in its path; when you browse for and select the tag, edit its path to replace the part that should be resolved dynamically with the global alias. For example, this data source:

```
@Buildings.Administration.Floor_4.Room_403.Light_08
```

Could become:

```
@Buildings.<#Building#>.Floor_4.Room_403.Light_08
```

When you go into runtime, you will see the default value of the Global Alias. However, GAS enables you to dynamically resolve an alias during runtime and to simultaneously apply one alias on different scopes.

You have two main options on how to set Global Aliasing themes or Aliases in GraphWorX64. First, you can automatically set them as your display enters runtime. Second, you can make use of Pick actions to give the operator control over current resolution of your Aliases.

13.6.2 Runtime Parameters of GraphWorX64 Display

You can set Global Alias Theme or Alias to be set automatically when your display enters runtime. Click in the blank area of the display to show the **This Display** property, shown in Figure 13.11.

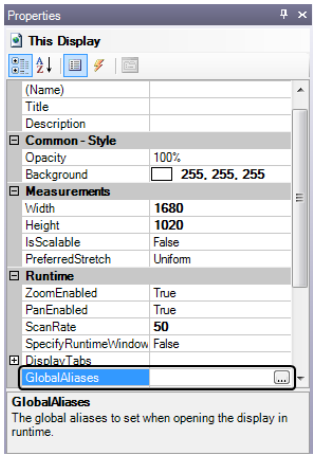


Figure 13.11 - Global Aliases Property for This Display

Put the cursor in the **Global Aliases** property, and then click the ellipsis button. The **Set Global Themes and Aliases** dialog box appears, as shown in Figure 13.12.

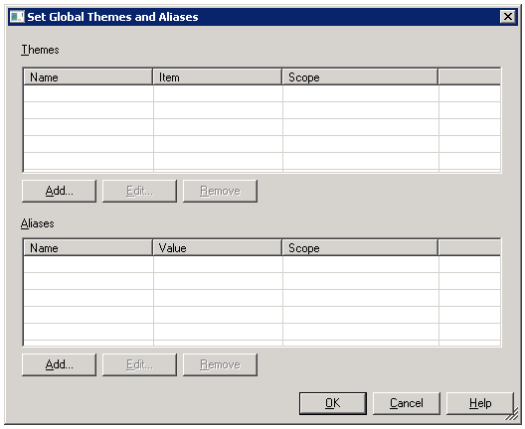


Figure 13.12 - Set Global Theme and Aliases Dialog

Use the Set Global Themes and Aliases dialog box to establish the initial setting of Global Themes and Aliases for the display when going into runtime.

To set the scope for a theme or theme value, click the “Add” button in the top **Themes** section of the dialog box. This displays the **Edit Global Themes** dialog box as shown in Figure 13.13 where you select a theme and its scope for the display.

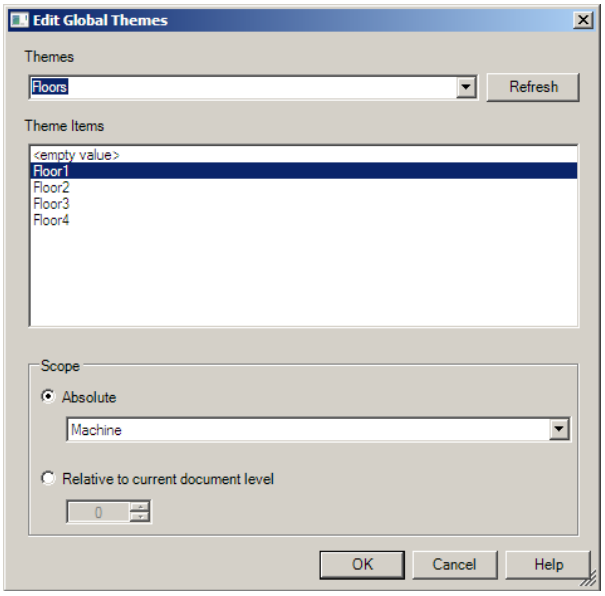


Figure 13.13 - Selecting the Display’s Themes

You can apply the Alias theme to the machine, the process, a specified document level, or relative to the document level that is current during runtime.

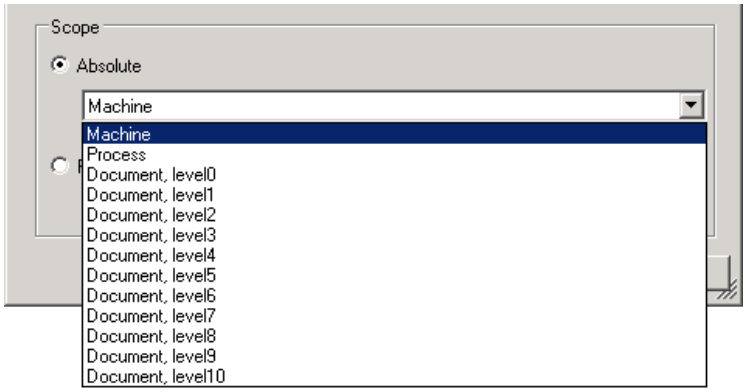


Figure 13.14 - Absolute Scope Options

Alternatively, you can dynamically define a global aliases and its value. That is, defining a global alias that is not in the GAS configuration database. To set the global alias or value, click the “Add” button in the bottom **Aliases** section of the dialog box.

This displays the **Edit Global Aliases** dialog box as shown in Figure 13.15 where you select a global alias, optionally a value, and the scope.

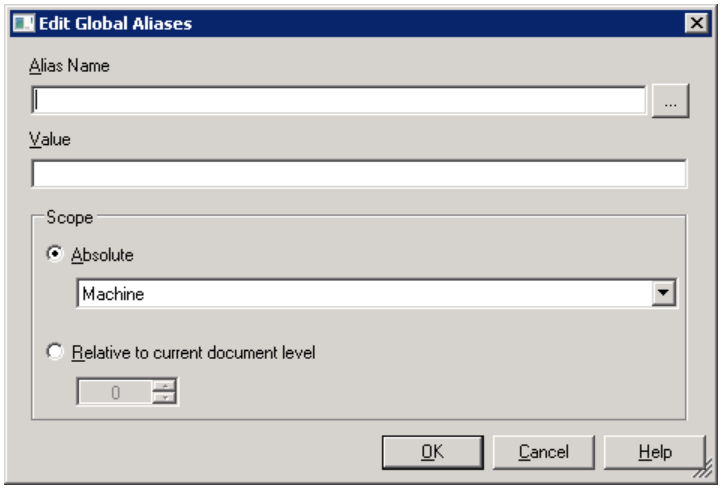


Figure 13.15 - Edit a Display's Global Aliases

13.6.3 Pick Actions in GraphWorX64

You can use global aliases in a Pick action dynamic to set a state, change a value, load a different display, or perform any action where variable substitution allows you to generalize the action at runtime. As a result, a runtime operator can set a global alias to a specific value with a click of a button.

Keep in mind that Pick actions can be added to nearly any object you include in a display. Furthermore, buttons and the Function Key dynamic have Pick actions already embedded in them.

Commands with which global aliases can be associated include:

- **Pick action-Load display:** Sets the global aliases in the newly loaded display.
- **Pick action-Set global aliases:** Sets the specified global alias theme value in the currently open display; can apply to the whole display or a specified object or symbol.
- **Display tabs:** Each tab can include a set of global aliases.

13.6.4 Global Aliasing with TrendWorX64

You can also use global aliases in OPC tags in TrendWorX64 Viewer when you create a new pen, using global aliases in the data source path just as you would in GraphWorX64.

13.6.5 Global Aliasing with AlarmWorX64

You can use global aliases in OPC alarms in AlarmWorX64 Viewer in the same way you might use them with displays in GraphWorX64. You can use a global alias to identify all or part of an OPC tag for an alarm.

An AlarmWorX64 configuration can be set to a particular theme as a runtime setting. In the AlarmWorX64 Server Configurator, use the database configuration, as shown in Figure 13.16 to specify the theme using the "GAS Theme" field. Clicking on the ellipsis button opens the **Set Global Themes and Aliases** dialog box, as shown in Figure 13.12, where you set Global alias themes and aliases the same way you did for GraphWorX64.

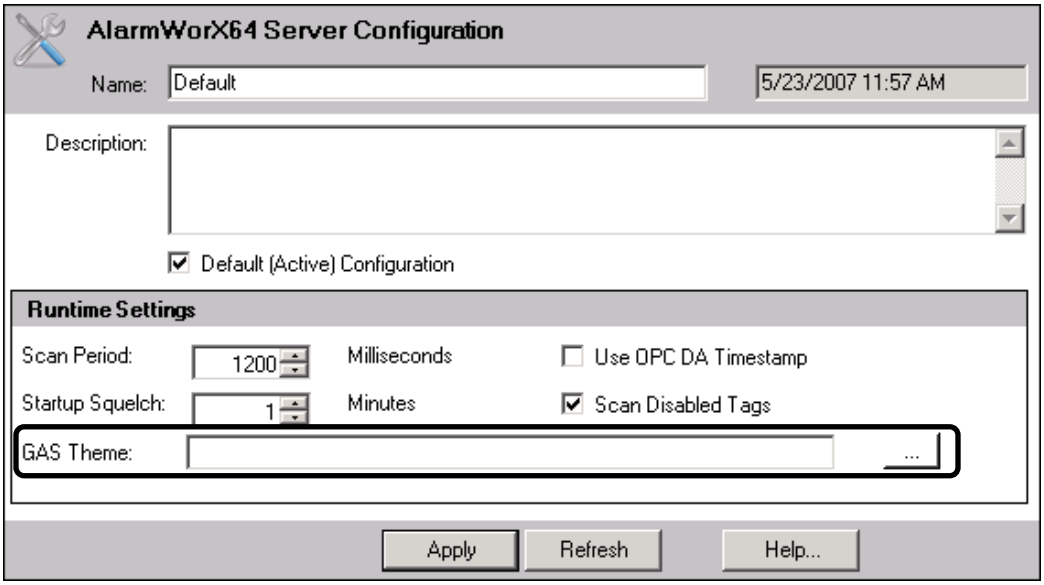


Figure 13.16 - AlarmWorX64 Server Configurator Sets the Theme

13.7 Global Color Palettes

13.7.1 About Global Color Palettes

GENESIS64 provides the ability to create Global Color Palettes that provide the following benefits:

Swappable Palettes of Colors

One possible use for Global Color Palettes is for applications that require separate distinct Day/Night modes, such as for navigation purposes, marine use, etc.

For example, one defined color could be named “Background” and could be set to be white for “Day Mode” and to black for “Night Mode”. Then, the color setting of “Background” could be configured as (assigned to) the Background property for a Display or Control. Switching the active palette from 'Day' to 'Night 'mode would cause the background of the Display/Control to switch from White to Black.

Named Colors

Another possible use for Global Color Palettes is 'color standardization' within a project. For example, a defined color named “HighAlarm” could be set to red.

Later on, that color could be redefined as yellow, but the change would only need to be made in one place (the Global Color Palette). All references to that color in HMI displays will automatically use the updated color.

Dynamic Colors

This use for Global Color Palettes is useful for colors that get their values from tags. For example, one single tag could provide one 32-bit color value. Three tags could provide Red, Green, and Blue (RGB) values. Four tags could provide Alpha (for transparency/opacity), Red, Green, and Blue values.

13.7.2 Configuring Global Color Palettes

The configuration of Global Color Palettes is done through the Global Aliasing provider in the Workbench, as show below.

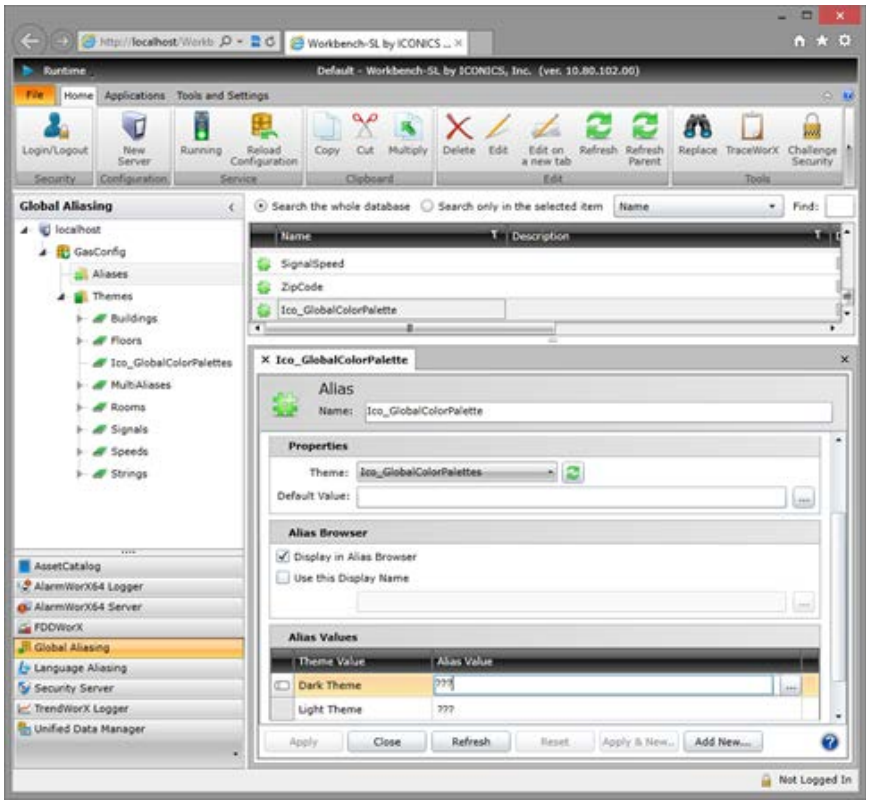


Figure 13.17 - Configuring a Global Color Palette in the Global Aliasing Provider in Workbench-SL

13.7.3 Create a Color Palette Theme

Expand the Themes node within the Global Aliasing provider and click on the **Color Palette** theme. You'll see the Color Palette properties in right-side window within the Workbench, as shown below.

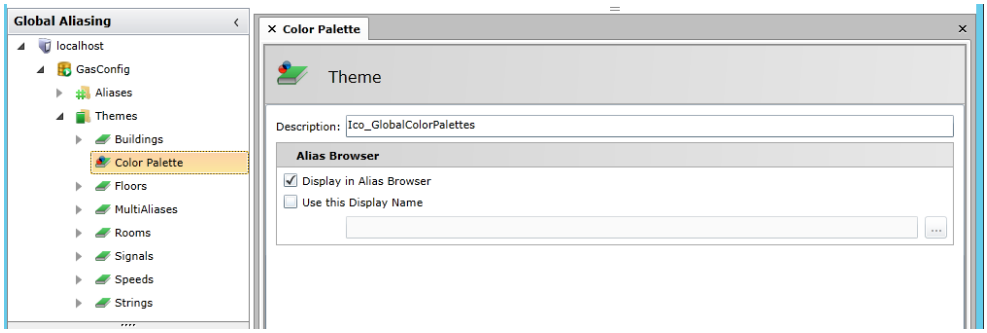


Figure 13.18 - Color Palette Theme in the Global Aliasing Provider in Workbench-SL

You can change the description, decide if this theme should be displayed in the Alias Browser and if you wish to use a separate Display Name for this theme within the Alias Browser (if you click this checkbox, you can enter a different Display Name in the text entry field or click on the ellipsis [...] to select one through the Data Browser). Click 'Apply & Close' to proceed.

13.7.4 Add Theme Values

Right-click on the Color Palette theme and select 'Add Theme Value'. This opens the Theme Value properties in the right-side window of the Workbench, as shown below.

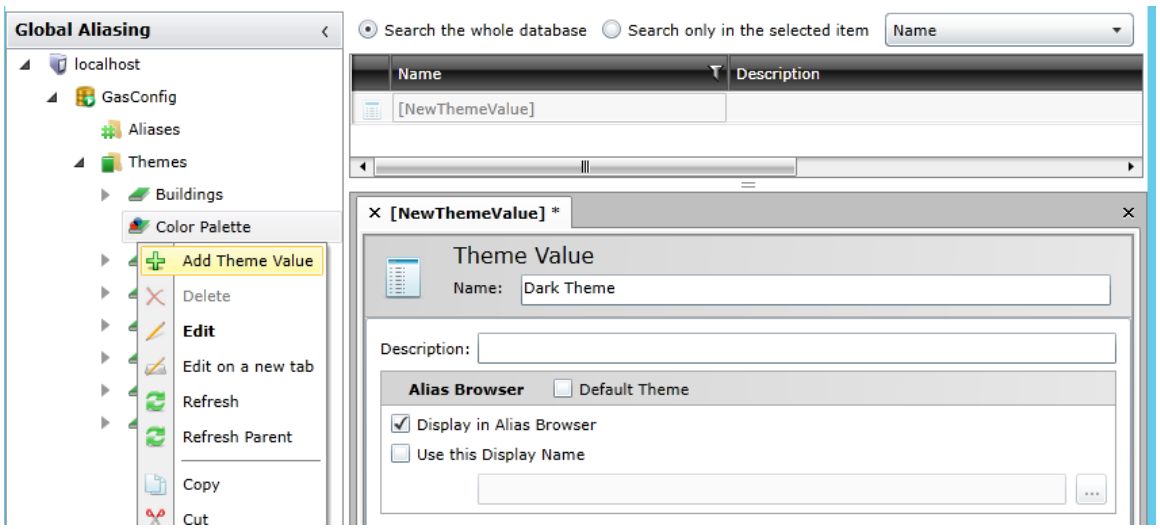


Figure 13.19 - 'Dark Theme' Theme Value Properties

You can give your Theme Value a Name. In this example, we'll be setting up a 'Dark Theme'.

You can also change the description, decide if the connected theme should be the Default Theme, decide if this theme value should be displayed in the Alias Browser and if you wish to use a separate Display Name for this theme value within the Alias Browser (if you click this checkbox, you can enter a different Display Name in the text entry field or click on the ellipsis [...] to select one through the Data Browser). Click 'Apply & Close' to proceed.

In this example, we'll also create a second Theme Value following the same steps and call that one 'Light Theme'.

13.7.5 Edit a Color Palette Alias

Click on the **Aliases** branch and you'll see the Color Palette theme in the right-side window, as shown below.

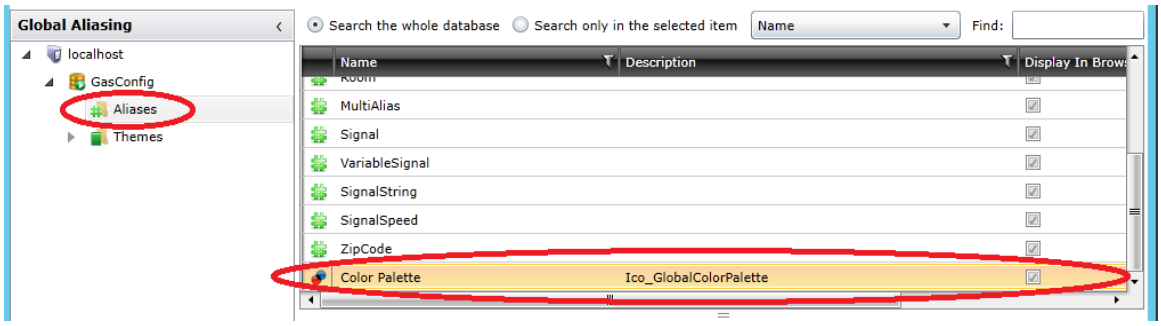


Figure 13.20 - Color Palette Theme in Global Aliasing Provider

Double-click on the Color Palette alias. This opens the Color Palette alias properties in the right-side window of the Workbench, as shown below.

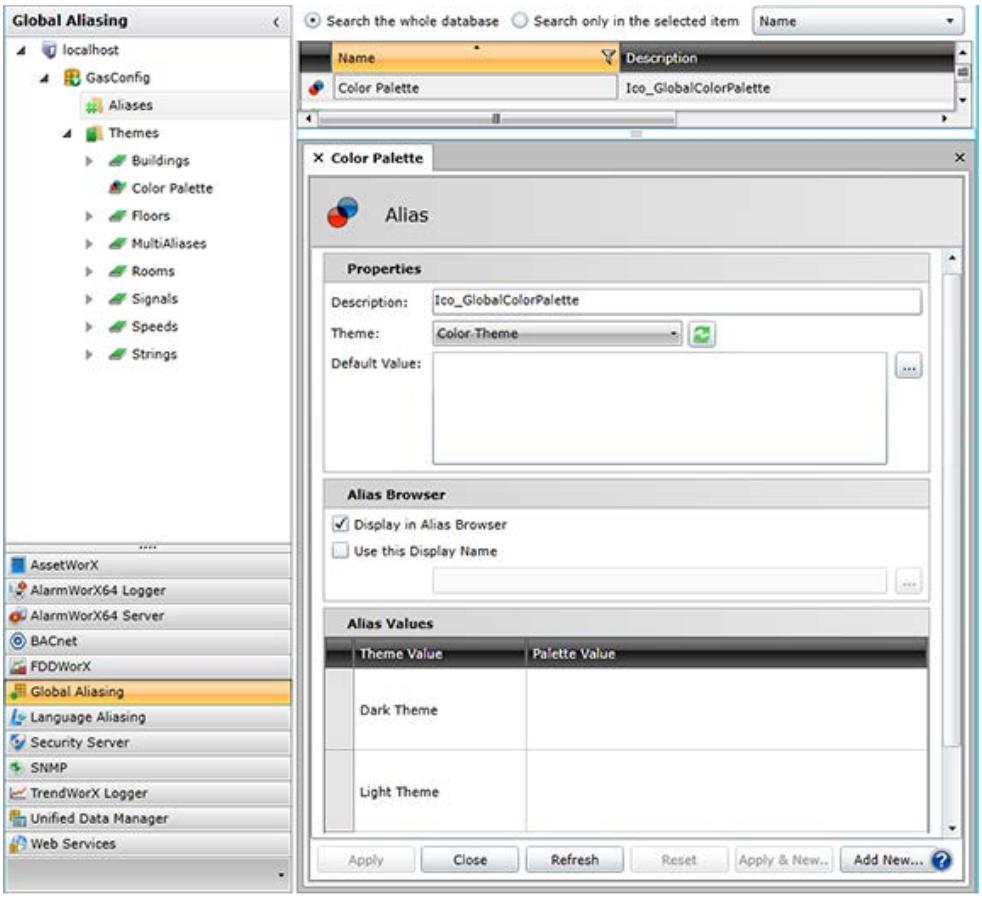


Figure 13.21 - Color Palette Alias

Within the Color Palette Alias properties, you can provide a Description, select the associated Theme (from the pulldown menu) and provide a Default Value (by entering one within the text entry field or by clicking on the ellipsis button [...] and selecting one via the Data Browser.

You can also decide if this alias should be displayed in the Alias Browser and if you wish to use a separate Display Name for this alias within the Alias Browser (if you click this checkbox, you can enter a different Display Name in the text entry field or click on the ellipsis [...] to select one through the Data Browser).

Notice that our 'Dark Theme' and 'Light Theme' Theme Values are listed in the Alias Values section of the Alias properties. In the next step, you'll be able to add Palette Values to these themes.

13.7.6 Adding Palette Values

Within the **Alias Values** section of the Color Palette alias properties, you can click within the **Palette Value** column's cell for your selected Theme Value. This enables an ellipsis button [...] to the right side of the column's cell. Click on this ellipsis to open the **Color Palette Configuration** window, as shown below.

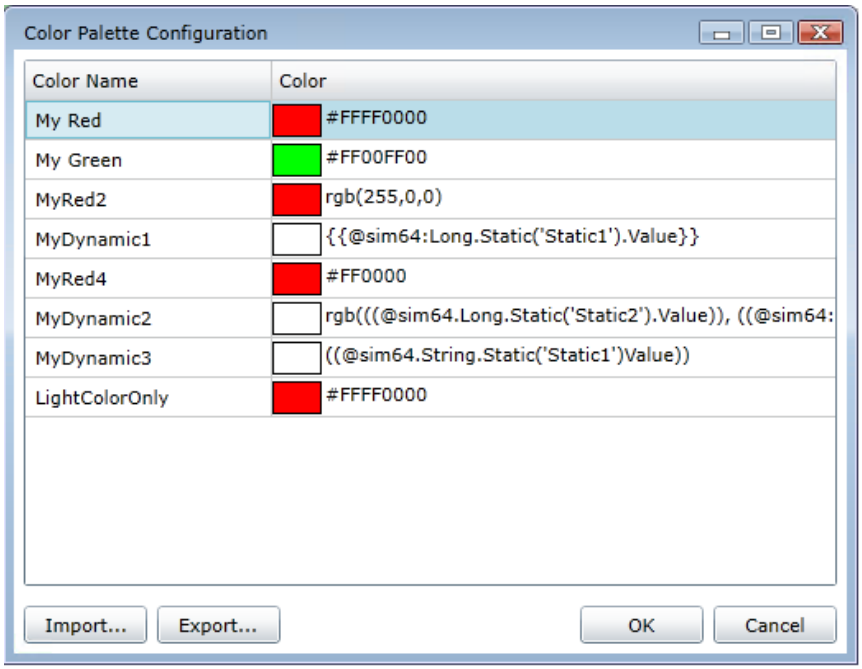


Figure 13.22 - Color Palette Configuration Window

In the **Color Palette Configuration** window, you can add a **Color Name** and then select the **Color** through multiple ways. One way is to enter characters into the text entry field that correspond with the following encodings:

- **Eight digit hexadecimal** [e.g. #FF00800]
- **Six digit hexadecimal** [e.g. #008000] - where alpha is assumed to be opaque
- **RGB** [e.g. rgb(0,128,0)
- **ARGB** [e.g. argb(255, 0, 128, 0)]
- **{{tagname}}** [expected to be a 32-bit integer]
- **rgb({{tagnameRed}}, {{tagnameGreen}}, {{tagnameBlue}})**
- **argb({{tagnameAlpha}}, {{tagnameRed}}, {{tagnameGreen}}, {{tagnameBlue}})**
- **Gradient Encoded as XAML**

Another way to select a **Color** is to click within the Color column cell for a specific Color Name. This activates the Color Picker dropdown menu, as shown below.

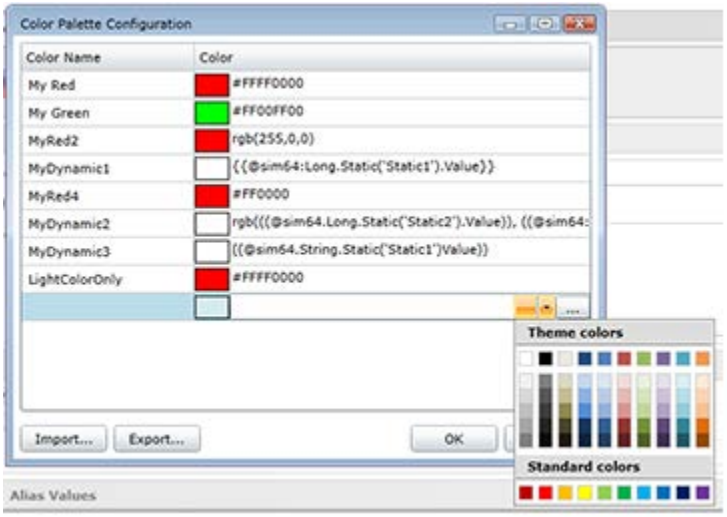


Figure 13.23 - Color Picker Dropdown Activated in Color Palette Configuration Window

Once you have selected a color by entering text or via the Color Picker, you can add another color by hitting **Enter**. You can remove any color by highlighting the row within the window and hitting **Delete**.

Click 'OK' to save the current Color Palette Configuration for your selected Theme Value. The Palette Value column cell for your selected Theme Value will now show your provided values, as shown in the following image.

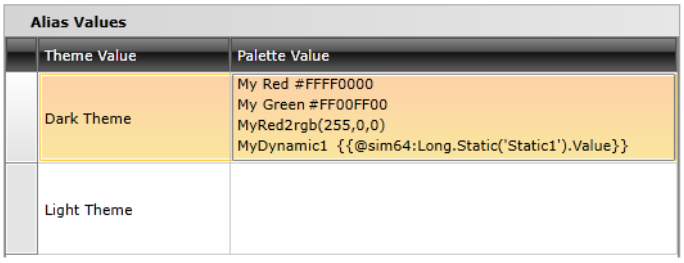


Figure 13.24 - Filled Palette Value for Selected Theme Value

Click 'Apply & Close' to enable your settings for your selected Color Palette Alias.

13.7.7 Import/Export

You can also choose to Import or Export these colors. In the Color Palette Configuration window, clicking the **Export** button allows you to save the current configuration within the Color Palette Configuration as a text (.txt) file. Clicking the **Import** button allows you to retrieve any previously saved exported Color Palette Configuration text (.txt) file.

13.7.8 Using a Global Color Palette in GENESIS64 Applications

Once you have configured a Global Color Palette within the Global Aliasing provider in the Workbench, you'll be able to make use of the configured Global Colors and Themes within integrated GENESIS64 applications, such as GraphWorX64.

The example below shows the new Global Color tag added to the Fill dialog, an option within GraphWorX64 while creating/editing a new display. Selecting colors from the Global Color tab is performed in the same way as selecting from the existing Solid Color or Gradient tabs.

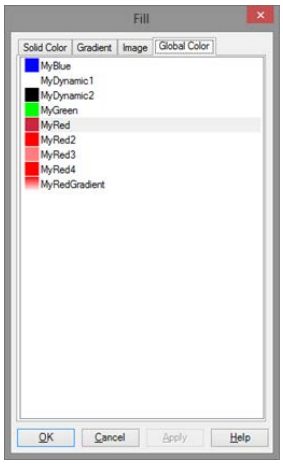


Figure 13.25 - Global Color Tab in the Fill Dialog in GraphWorX64

As previously mentioned in 'About Global Color Palettes', one of the benefits of Global Color Palettes is fast-switchable or 'swappable' palettes of colors. The following example shows how to make a quick color theme change (from Dark Theme to Light Theme) while in GraphWorX64's Configuration Mode.

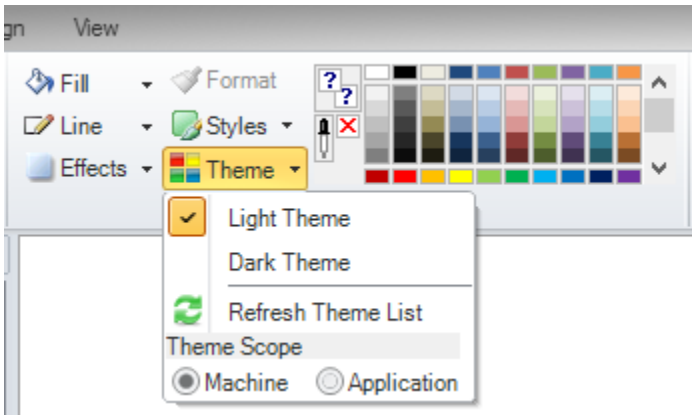


Figure 13.26 - Quick Switch of Color Theme in Configuration Mode

And, of course, the same fast color theme switching can be done in Runtime Mode, as well, as shown below.

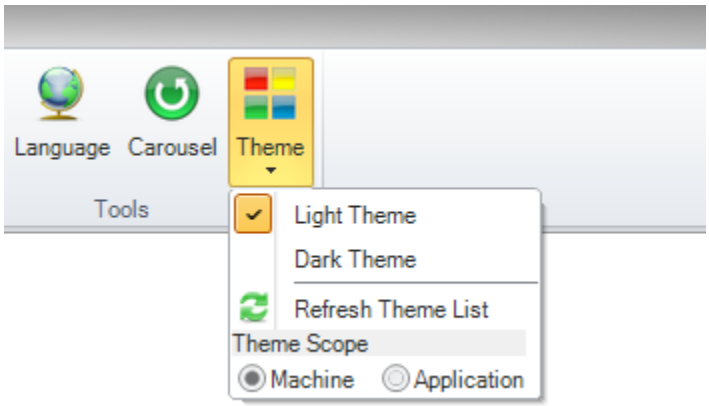


Figure 13.27 - Quick Switch of Color Theme in Runtime Mode

Lab: Global Aliasing L13

13.1. Lab Overview

On the production floor, there are many tanks running at the same time producing different types of drinks. However, we do not need to look at each of the mixer tanks at the same time, and therefore, we do not need to create different displays for each of the tanks. Instead, we will use Global Aliasing to create a single dynamic display that can view each of the tanks.

Estimated time to complete this lab: 20 minutes

13.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Create a global alias configuration database.
- Create an alias theme.
- Create theme items.
- Create a global alias.
- Assign values to different themes of the alias.
- Activate the global aliasing configuration.

13.1.2. Support Files

To complete this lab, you will need the following file(s):

- icTonicsHome.gdfx
- icTonicsTankMonitor.gdfx
- icTonicsTrends.gdfx

13.2. Global Alias Configuration

We will need to define the global alias and the corresponding value that the alias will resolve to during Runtime. All this is done through a configuration file. In this section, we will configure the alias, the alias value, and a theme that we can switch to during Runtime.

13.2.1. Theme Configuration

1. Open **Workbench-SL** if you closed it after finishing the previous lab.
2. Select the **Global Aliasing** icon in the Project Explorer.
3. Right-click on localhost and select **New Database** to create a new configuration database.
4. From within the **Create a new Database** dialog, the **Select the SQL Server:** field should be defined as **(local)\SQLEXPRESS**.
5. Enter **icTonicGASConfig** as the **Database name**:.
6. **Uncheck** the **Include Sample Data** checkbox and click on the **OK** button.
7. Expand the icTonicGASConfig configuration Provider Explorer on the left.
8. Right-click on **Themes** and select **+ Add Theme** to create a new theme.
9. In the **New Theme** tab, give name the theme **TanksTheme** and then click on **Apply & Close**.
10. In the Provider Explorer, right-click on **TanksTheme** and select **+ Add Theme Value**.
11. Name this theme value **Tank1Theme**
12. **Check** the box **Default Theme**, then click **Apply & Close**.
13. Right-click on **Tank1Theme** and select **Multiply**.
14. In the **Multiply Options** dialog box, with the **Name** field checked, change Tank1Theme to **Tank{0}Theme**.
15. Change the **Number of copies** to **2**.
16. Change the **First Number** to **2** and the **Numeric Places** to **1**.

17. Your configuration should mimic the following figure.

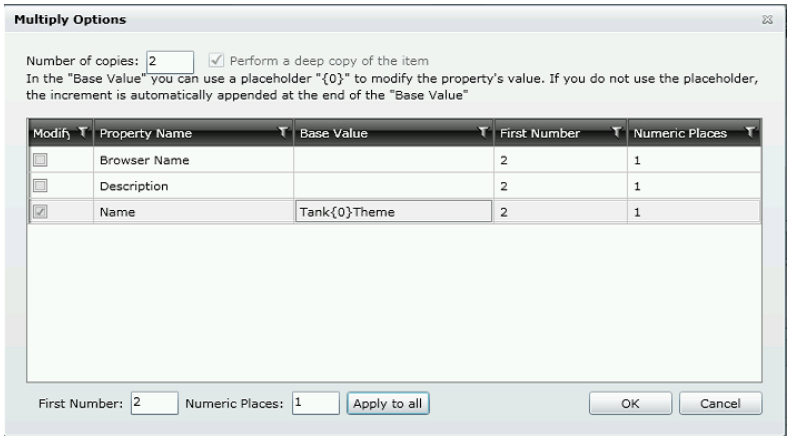


Figure L13.1 – Multiplying a Theme Value

18. Be sure to click the **Apply to all** button.

19. Click **OK** to start the multiplication.The theme values named Tank1Theme, Tank2Theme, and Tank3Theme will now exist.

13.2.2. Alias Configuration

1. Right-click on **Aliases** and select + **Add Alias** to create a new global alias.

   Note: Beware of typos or extra spaces in the alias definition, as any wrong character will prohibit your alias from working.

2. Name this Alias **TanksAlias** and choose **TanksTheme** from the Theme: dropdown list.

3. Notice that once you choose the **Theme Value** column below, the **Alias Values** section expands to display the TankAlias theme values.

4. Set the values in the Alias Value column as shown in the table below.

   Note: Each of the entries in the table below are single words and do not contain spaces.

Table L13.1 - Alias Values for Tanks

Theme Value	Alias Value
Tank1Theme	Tank1
Tank2Theme	Tank2
Tank3Theme	Tank3

5. Click **Apply & Close** to save the configurations.

6. Repeat the steps you've learned to create another alias called **AlarmFilter** with values as indicated in the table below.

Table L12.1 - Alias Values for AlarmFilter

Theme Value	Alias Value
Tank1Theme	Tank1 Level
Tank2Theme	Tank2 Level
Tank3Theme	Tank3 Level

7. Once you are done, make the icTonicsGASConfig database **Active**.

8. You will now have to reload the Global Aliasing configuration by clicking the **Reload Configuration** button in the Global Alias ribbon. You should see a notification that the configuration was updated correctly.

9. Click **Ok** to close the Configuration Reloaded dialog.

10. Using the icon in the ribbon, **Start** the Global Aliasing Service.

13.3. GraphWorX64 Implementation

Now that we have a Global Alias configuration in place, we will need to configure our displays to use these aliases.

1. Open the **icTonicsTrends** display and select the **Tank1** label. As done previously, you may need to unlock the template.

2. Add a process point dynamic to this label by selecting the **Dynamics** tab on the lower right corner and clicking on the **Process Point** icon on the top of the explorer window.

3. When the **Data Browser** comes up, select the **Global Aliases** tab.

4. Expand **Global Aliases** tree in the bottom pane and double-click on **TanksAlias**.

5. Select the **Copy Selection to Textbox** button.

6. Check the **Treat the result as a Literal String** checkbox.

7. The Data Browser should resemble the following figure. Click on "**OK**".

Figure L13.2 - Browsing for Global Alias

8. Double-click on the Trend Viewer control in the icTonicsTrends display to bring up the "**Configure your Control**" dialog box.

9. Click on your real-time pen under Plot. Find "**Tank1**" in the data source, and replace **Tank1** with **<#TanksAlias#>**. <#" and "#> are the delimiters for Global Aliases.

10. Your resulting syntax should be:
    @ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.<#TanksAlias#>.TankLevel.Valu

11. Change the description to read **"Real Time <#TanksAlias#> Level"** (include the double quotes).

12. Do the same thing for the other **real time** and **historical tags** configured in the control.

13. Click on "**Close**" to close the control. Then save the display.

14. Open the **icTonicsTankMonitor** display in a second instance of GraphWorX64.

Note: You should always make a backup of your work (displays) before using the Replace feature.

15. In the **Home** tab of the ribbon, locate the **Text** section and click on the chevron next to the "Find" action and select "**Replace**".

16. When the **Replace** dialog box comes up, in the **Find Type** section, check the "**Dynamic Data Source**" checkbox.

17. Select the "**Current Display**" radio button.

18. In the "**Find what:**" field, type in **Tank1** without quotes and in the **Replace With** field type in **<#TanksAlias#>.** Your Replace dialog box should resemble the following figure.

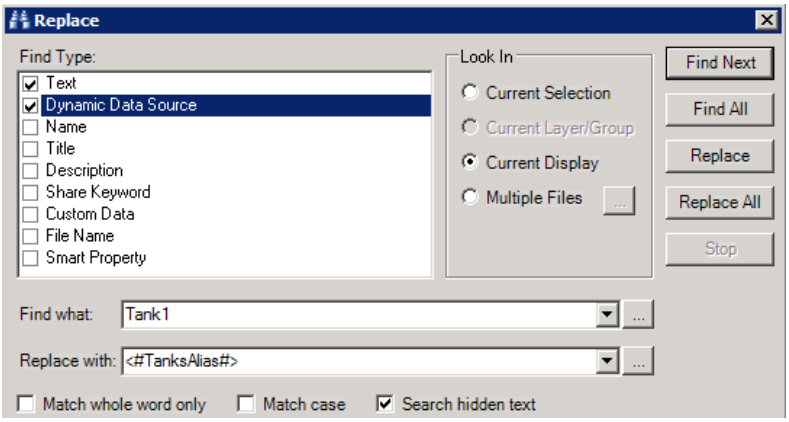


Figure L13.3 - Search and Replace

19. Click on the "**Replace All**" button to start the replacement. Once it is done, you should get a list of the objects that have been replaced in the results section.

20. **Close** the dialog box and **Save** the display.

21. Create a button called "**Mixer Tank 1**".

Note: You can label a button by double-clicking on it.

22. Place a **Button** into the left hand side of the display.

23. In the Dynamic properties of the button, change the Command to **Set Global Aliases** (from the ===== Local Commands ===== section).

24. Under the **Command Parameters** section, expand the **GlobalAliases** drop down list and select **Global Aliases**.

Note: Make sure GraphWorX64 is in Advanced Mode or you won't be able to see all your options.

25. In the **Select Global Themes and Aliases** dialog box, click on the **Themes** "**Add**" button.

26. In the **Themes** dropdown list, select **TanksTheme**.

27. Select **Tank1Theme** in the **Theme Item**s window.

28. In the **Edit Global Themes** dialog box, under **Scope**, select the **Absolute** radio button and in the dropdown list select **Machine.**

29. Click on **OK** all the way back to the display.

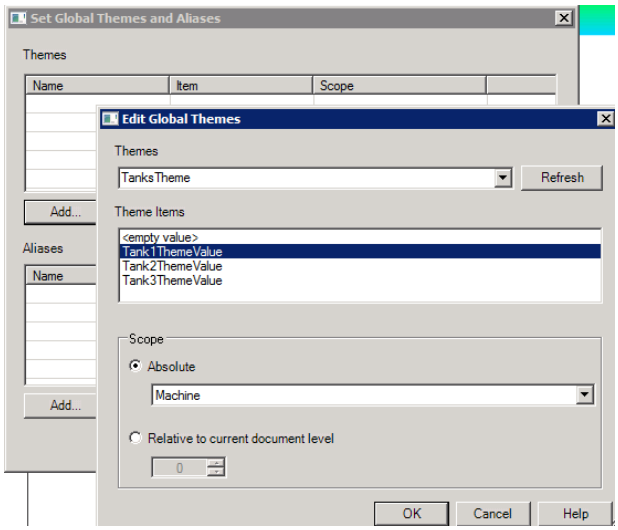


Figure L13.4 - Edit Global Themes Dialog Box

30. Now duplicate the **Mixer Tank 1** button twice.

31. Create two more buttons and set the global alias theme value to **Tank2** on the second button and **Tank3** on the third button. Change each button's text accordingly..

Note: Beware of typos or extra spaces in the alias definition, as any wrong character will prohibit your alias from working.

32. Your finished display should resemble the figure below.

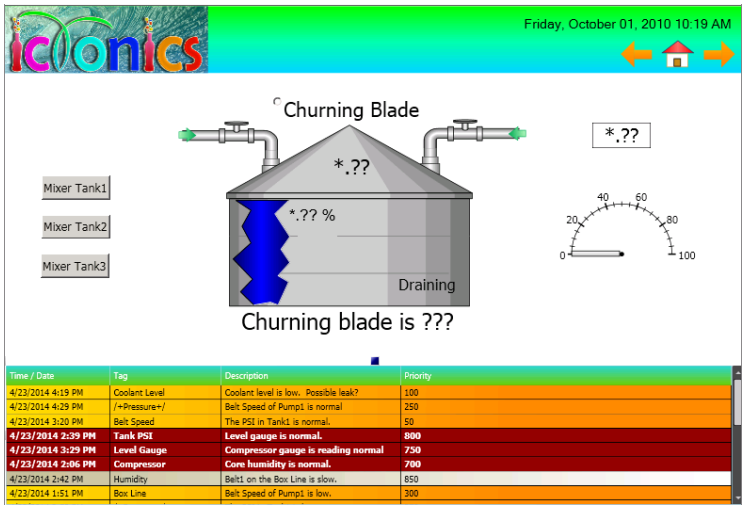


Figure L13.5 – Finished icTonicsTankMonitor Display

33. Go to **Runtime** and load the **icTonicsTankMonitor** display.

34. Observe how the **Tank1** process point label changes as you click on each button.

35. When you click on the tank to open the **icTonicsTrends** pop up display, you should see that the label in the pop up reflects the same tank number as the button you had selected. This is because you configured the global aliases with a machine level scope.

This concludes this lab.

PortalWorX-SL 14

ICONICS PortalWorX-SL provides a Web browser-based Runtime environment utilizing Microsoft Silverlight technology for several ICONICS HMI/SCADA, manufacturing intelligence and analytical applications. It is complementary to the Workbench-SL configuration tool, also accessed through a standard Web browser.

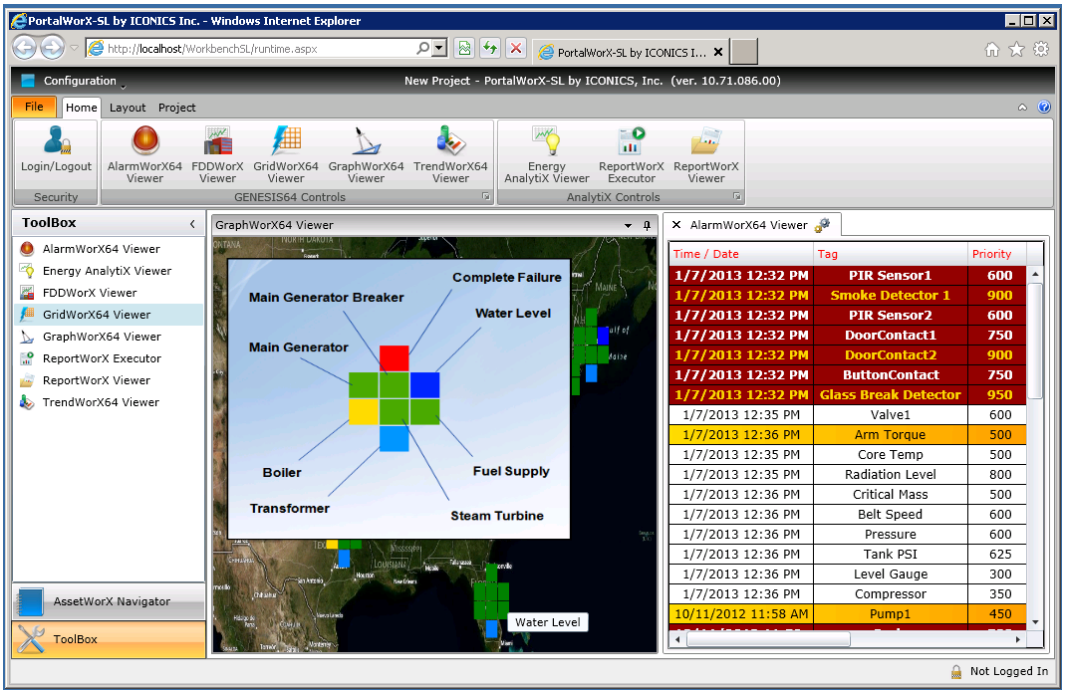


Figure 14.1 - PortalWorX-SL Running in Internet Explorer

14.1. Objectives

After completing this chapter, you should know:

- How to Use PortalWorX-SL Web-based Runtime Tool
- How to Access Tools and Providers
- How to Utilize the AssetWorX Navigator

14.2. Introduction to PortalWorX-SL

14.2.1. Opening PortalWorX-SL

To open PortalWorX-SL, from the Windows **Start** button, select **All Programs** → **ICONICS** → **PortalWorX-SL**.

When you open PortalWorX-SL for the first time, you will see the Asset Navigator in the Project Explorer on the left side of the browser window. In the top middle of the screen, you will see the controls/providers (viewers and executors) that you can open within PortalWorX-SL.

PortalWorX-SL features multiple components that can be further customized by the user, including:

- **Asset Navigator** - This appears within the Project Explorer panel on the left side of the browser window, allowing users to utilize a tree structure view of an organization's assets (and connected data therein).
- **Ribbon Bar** - This contains the 'Show' checkboxes which allows users to view or hide specific PortalWorX-SL components [Asset Navigator, Ribbon Bar, Toolbox, Headers, Ribbon Title] as well as the groups of both GENESIS64 and AnalytiX Controls (when loaded).
- **Controls** - Depending on which Controls/Providers are loaded from specific installation media (a GENESIS64 installation disc or an AnalytiX installation disc, for example), this part of the Ribbon shows which controls can be accessed from PortalWorX-SL. These can include:
  - AlarmWorX64 Viewer
  - GraphWorX64 Viewer
  - GridWorX64 Viewer
  - TrendWorX64 Viewer
  - FDDWorX Viewer
  - ReportWorX Executor
  - ReportWorX Viewer
  - Energy AnalytiX Viewer

- **Viewer/Executor Window** - The 'main' section of PortalWorX-SL where any loaded viewer can be specifically configured for runtime visualization. Note: The majority of configuration for any viewer is done in a separate configuration provider (such as through the classic Workbench or Workbench-SL). PortalWorX-SL provides additional options for strictly visualizing configured data, as explained in the Help topics for each attached control/provider.
- **Toolbox** - The Toolbox is an additional listing of all loaded controls/providers - useful if you have hidden the top Ribbon bar or wish to move the list of controls/providers around within the PortalWorX-SL window.

14.3. Switching Between PortalWorX-SL and Workbench-SL

PortalWorX-SL contains multiple viewers and runtime options within the GENESIS64 HMI/SCADA suite, while Workbench-SL contains several configuration providers. There may be instances where users may wish to switch between both tools within the same browser.

14.3.1. From PortalWorX-SL to Workbench-SL

When you have PortalWorX-SL open in your browser, you'll notice certain product identifiers to let you know which of the two Silverlight-based tools you currently have open, as shown in the following image. For instance, with PortalWorX-SL (running in Internet Explorer 9 in the following example), you'll notice PortalWorX-SL in the top window description, in the browser tab name and in the Default project name .

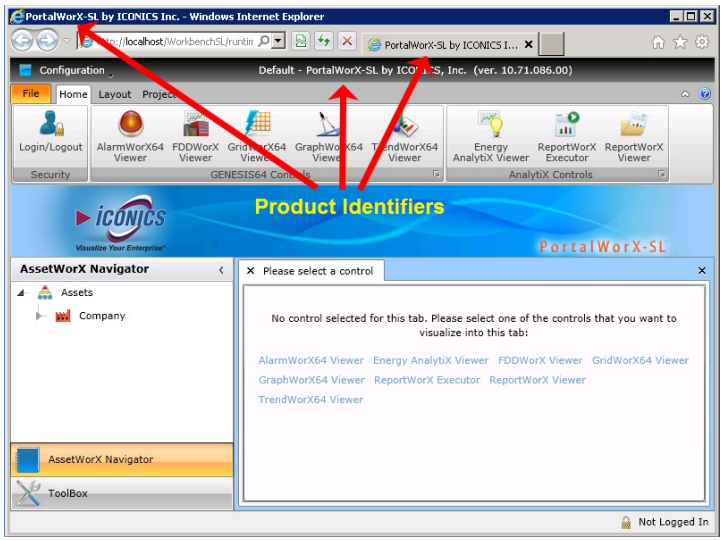


Figure 14.2 - Product Identifiers within PortalWorX-SL (Running in Internet Explorer 9)

PortalWorX-SL is the **Runtime** tool that you are presently using. If you wish to switch to Workbench-SL, you wish to use the **Configuration** tool so you will need to click on the **Configuration** button (Configuration) in the top left of the screen. This will open (continuing to use Internet Explorer 9 as the browser in our example) an additional tab containing the Workbench-SL Runtime tool.

14.3.2. From Workbench-SL to PortalWorX-SL

When you have Workbench-SL open in your browser, you'll notice certain product identifiers to let you know which of the two Silverlight-based tools you currently have open, as shown in the following image. For instance, with Workbench-SL (running in Internet Explorer 9 in the following example), you'll notice Workbench-SL in the top window description, in the browser tab name and in the Default project name.

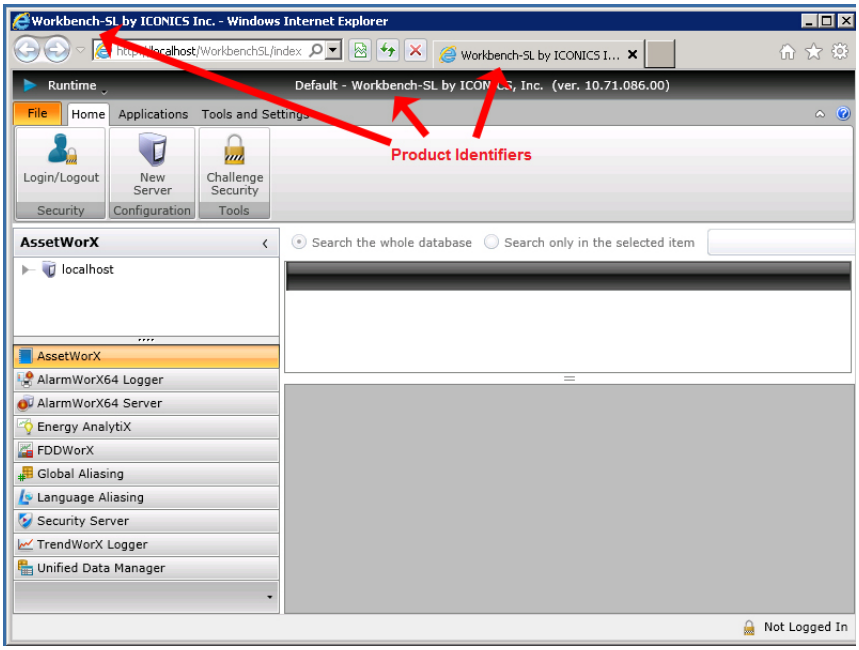


Figure 14.3 - Product Identifiers within Workbench-SL (Running in Internet Explorer 9)

Workbench-SL is the **Configuration** tool that you are presently using. If you wish to switch to PortalWorX-SL, you wish to use the **Runtime** tool so you will need to click on the **Runtime** button (Runtime) in the top left of the screen. This will open (continuing to use Internet Explorer 9 as the browser in our example) an additional tab containing the PortalWorX-SL Runtime tool.

14.4. Ribbons

PortalWorX-SL contains four ribbons at the top of the browser screen:

- File
- Home
- Layout
- Project

... as shown below.

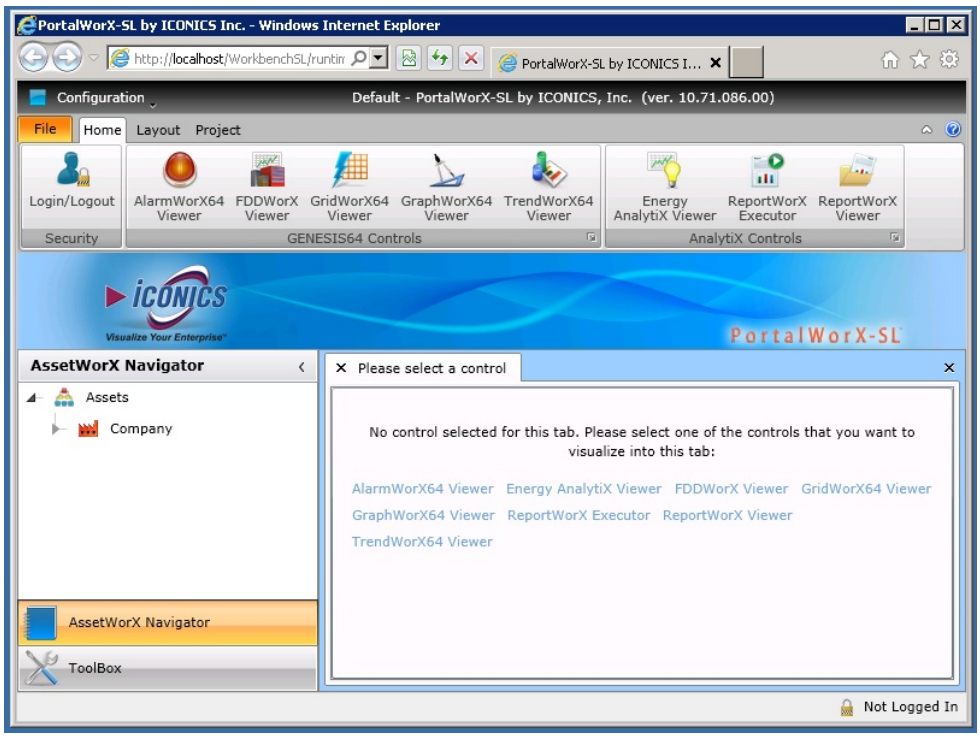


Figure 14.4 - PortalWorX-SL As it Appears When First Opened

14.4.1. File Ribbon

The File Ribbon contains the following options:

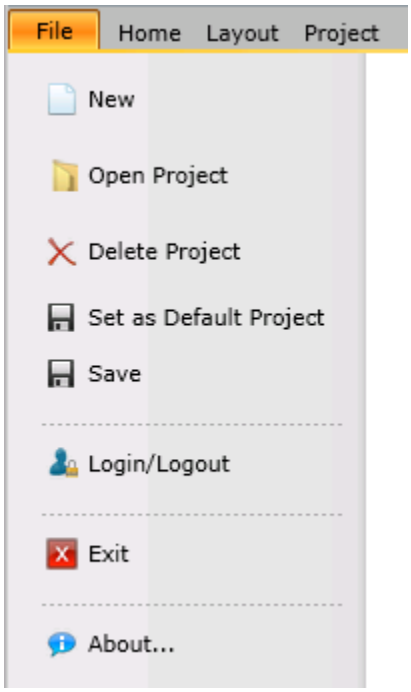


Figure 14.5 - File Ribbon

New - Clicking on 'New' brings up three 'new project' options. 'Empty Project' allows you to create a new empty project. 'Default Project' allows you to create a default project containing default applications. 'Clone Project' allows you to create a clone of the project in use.

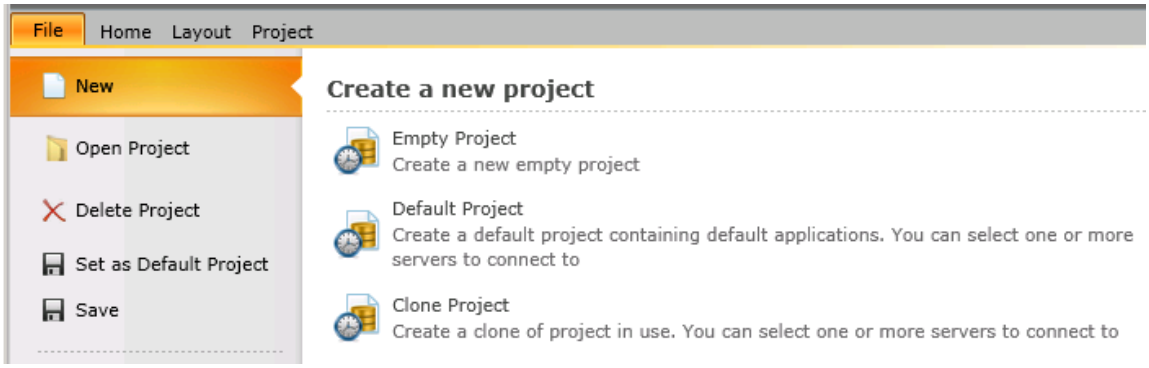


Figure 14.6 - New Project Options

Open Project -Clicking on 'Open Project' allows you to select from previously saved projects, including whichever one has been set as 'Default'.

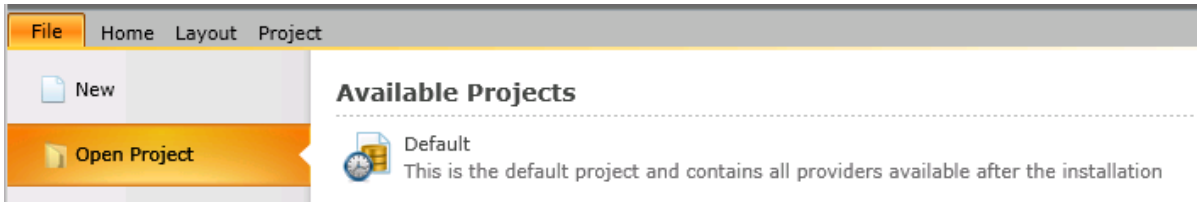


Figure 14.7 - Open Project Options

Delete Project - Clicking on 'Delete Project' allows you to delete previously saved projects. You cannot delete the 'Default' project.

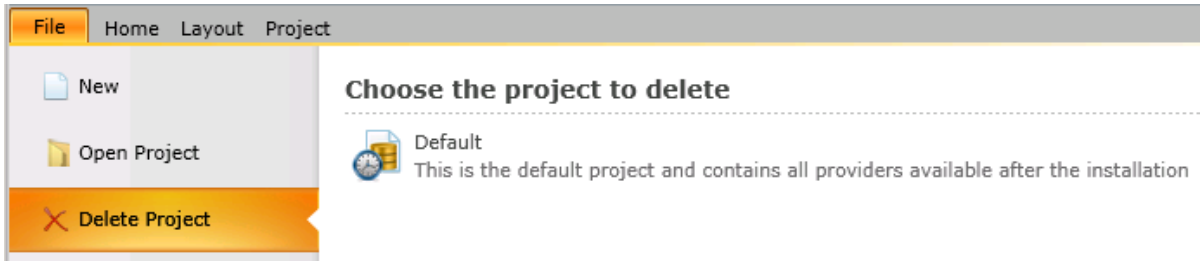


Figure 14.8 - Delete Project Options

Set As Default - Clicking on 'Set As Default' sets the project as the default one. When you reload PortalWorX-SL on the same machine, the project you set as Default will be loaded automatically.

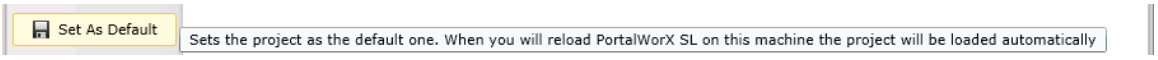


Figure 14.9 - Set As Default

Save - Clicking on 'Save' saves recently made changes to the existing project.

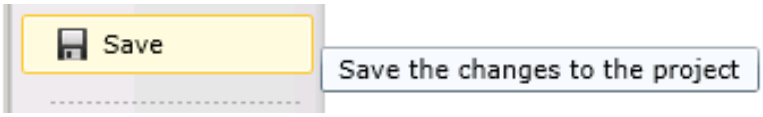


Figure 14.10 - Save Option

Login/Logout - Clicking the 'Login/Logout' button opens the Security Login Window, which allows you to enter your User Name and Password to Login, Log Out or Change Password.

Figure 14.11 - Login/Logout Button

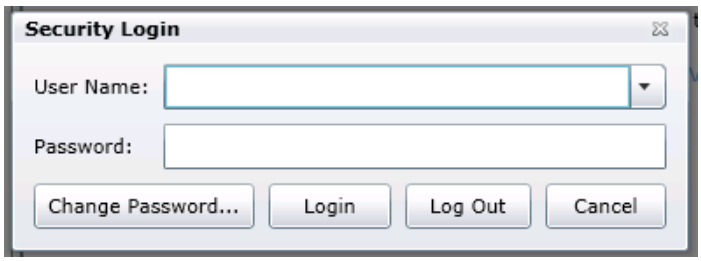


Figure 14.12 - Security Login Window

Figure 14.13 - Change Password Window

Exit - Clicking 'Exit' brings up a confirmation message asking if you would like to close the browser window (and thereby end that particular PortalWorX-SL session).

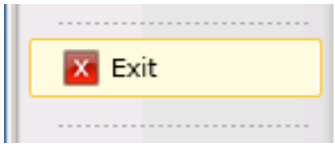


Figure 14.14 - Exit Button

Click 'Yes' to proceed to close the application.

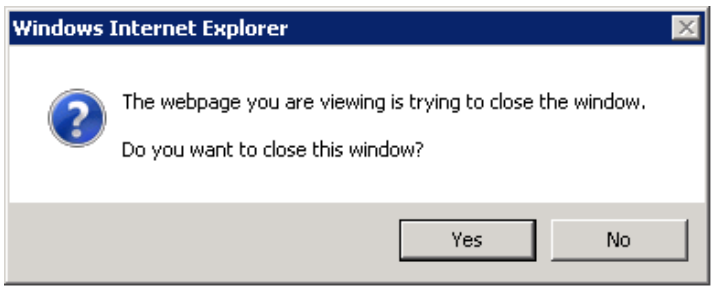


Figure 14.15 - Close Browser Window Confirmation

About - Clicking 'About' brings up the About box for PortalWorX-SL. Click 'OK' in the About box to close it and return to the application.

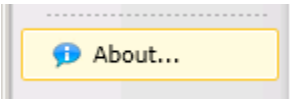


Figure 14.16 - About Button

Figure 14.17 - PortalWorX-SL About Box

14.4.2. Home Ribbon

The Home Ribbon in PortalWorX-SL contains two sections.

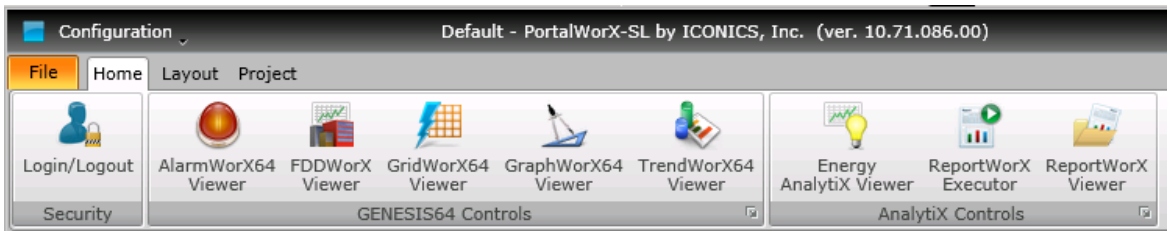


Figure 14.18 - PortalWorX-SL Home Ribbon

14.4.2.1. Security

The first section, **Security**, contains the following item:

Login/Logout - Clicking the 'Login/Logout' button opens the Security Login Window, which allows you to enter your User Name and Password to Login, Log Out or Change Password.

Figure 14.19 - Login/Logout Button

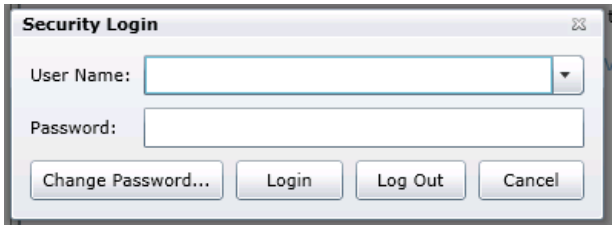


Figure 14.20 - Security Login Window

Figure 14.21 - Change Password Window

14.4.2.2. Controls

Controls - The second section (or sections) are set by which Controls are added based on which ICONICS products you have installed on your PC. PortalWorX-SL may show controls from a GENESIS64 installation or from an AnalytiX installation.

For instance, in the example below, the following controls have been added via a GENESIS64 product installation.

Figure 14.22 - GENESIS64 Controls

Clicking on the small square in the bottom right of the Controls section ( ) brings up the following window, which allows you to rename Providers (Controls) and add any missing provider (control) that may not have initially been loaded with the application (for instance, from a subsequent ICONICS product installation).

You can rename a provider/control as you add it by entering a new name in the text entry field, selecting the desired provider/control from the pull-down menu, then clicking on the 'Add' button. Click 'OK' to save your changes and return to the main PortalWorX-SL screen.

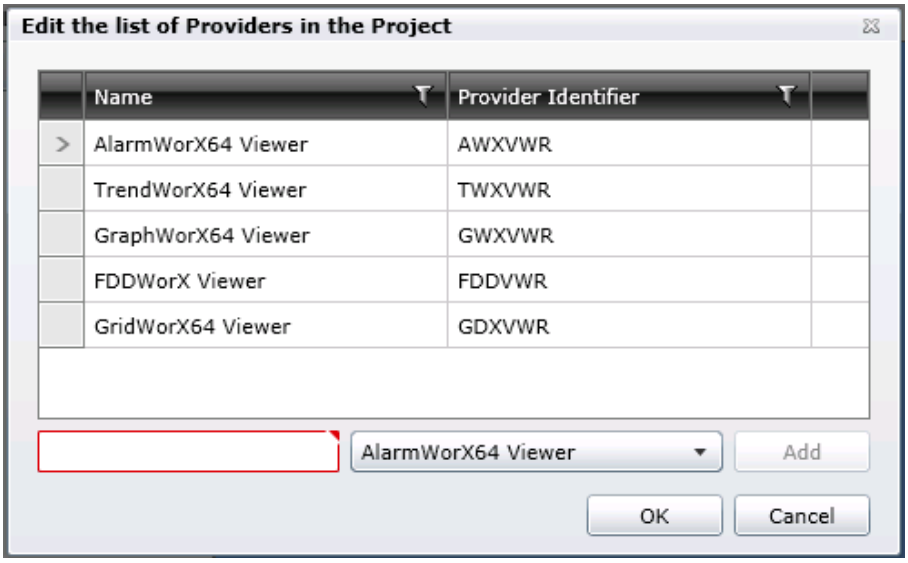


Figure 14.23 - Provider Editor

14.4.3. Layout Ribbon

The Layout Ribbon in PortalWorX-SL contains four sections.

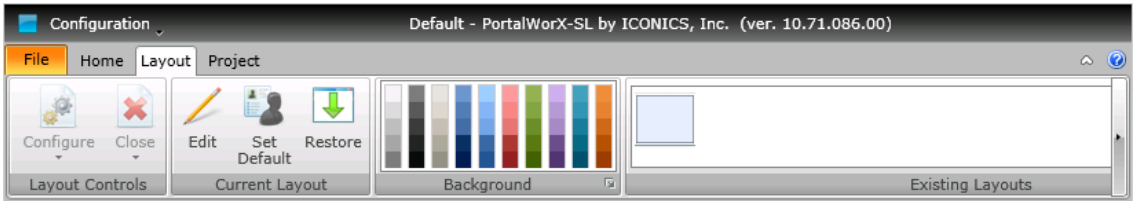


Figure 14.24 - Layout Ribbon in PortalWorX-SL

14.4.3.1. Layout Controls

The first section, **Layout Controls**, is activated (no longer grayed out) when you have selected at least one control for your present project. It contains the following:

Configure - Clicking the 'Configure' button allows you to, first, select which control you would like to configure and then input the required information for that control, as shown in the following image. This is the same action taken when you click on the Configure logo ( ) within a control tab.

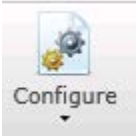


Figure 14.25 - Configure Button

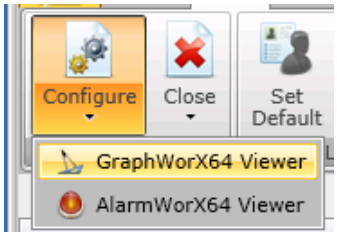


Figure 14.26 - Selecting the GraphWorX Viewer to Configure

The **Configure Web Part Window** allows you to provide a title, name and URL.

Figure 14.27 - Configure Web Part Window

Close - Clicking the 'Close' button closes the selected layout.

Figure 14.28 - Close Button

14.4.3.2. Current Layout

The **Current Layout** section contains the following:

Edit - The Edit button brings up the following '**Specify layout properties**' window.

Figure 14.29 - Edit Button

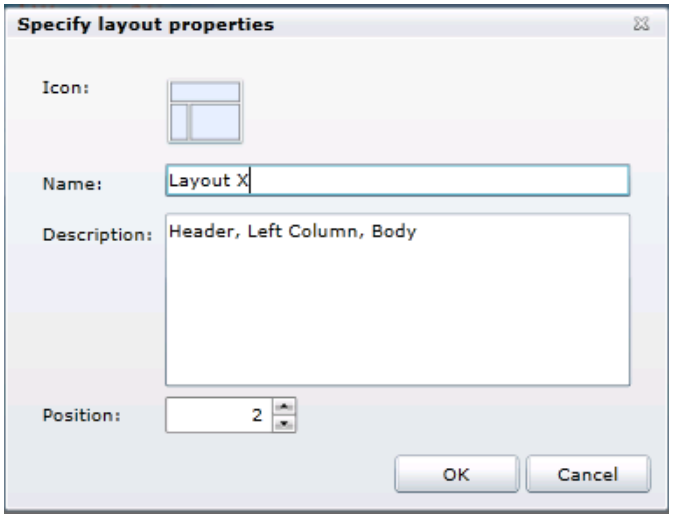


Figure 14.30 - Specify Layout Properties Window

If you click on the image next to 'Icon:', this will open a file browser so that you can select a new representational image (.jpg or .png) for your selected layout. For instance, the Icon in the image above signifies that the layout has a wide top section (the "Header" noted in the 'Description' box), with a shorter width left box (the "Left Column") and longer width right box (the "Body") below it. However, you can use any image (at 48x48 pixels) with whatever significance you choose.

Ultimately, what you select will be shown in the Existing Layouts section (described below) for easy layout selection. Once you have an Icon set, enter a Name and Description, then click on 'OK' to proceed. The Position field allows you to change the position of the layout in the Layout Gallery and in the Layout menu

About User and Public Profiles

In PortalWorX, every user can customize his own portal. The administrator can create a default portal that gets stored in the “PUBLIC PROFILE”. When the user logs in for the first time, he will see this “public profile" portal. At that point, he can change it and then proceed to save any changes. These changes will be seen by that specific user only and the settings will be stored in his own “USER PROFILE”. The profiles can be compared to similar settings within Microsoft SharePoint, where each user (if he is allowed) can change and configure the portal as he likes, but the changes are then seen by that specific user only.

The administrator can, at any moment:

- change the default portal for the new user, and/or
- change the default portal for new and existing users.

The user can, at any moment:

- discard the changes he did in his own portal and restore the default portal created by the administrator.

Set Default - Clicking the 'Set 'Default' button sets the default layout for the user profile.

Figure 14.31 - Set Default Button

Restore - Clicking on the 'Restore' button restores the current layout using the public profile.

Figure 14.32 - Restore Button

14.4.3.3. Background

The **Background** section of the Layout Ribbon allows you to set a color behind the controls in the main window within PortalWorX-SL. Hovering over a color box within the color palette shows the colors hexadecimal color code. Click on the color and it will automatically appear in the background of your selected layout.

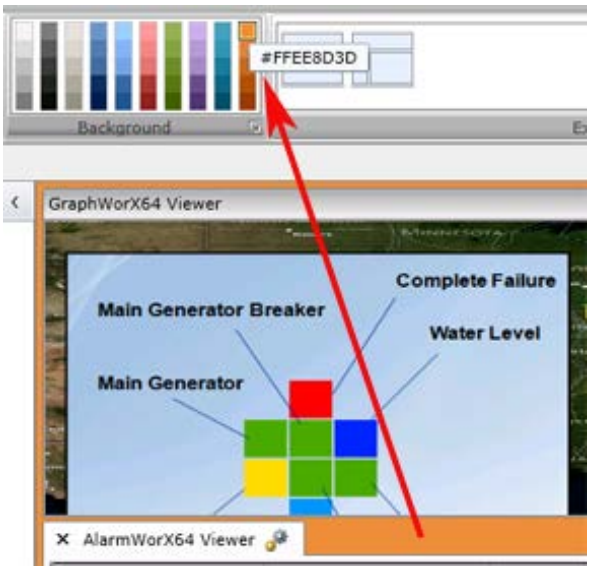


Figure 14.33 - Selecting a Background Color from the Color Palette

Clicking on the small square in the bottom right of the Background section ( ) brings up the following '**Pick a color**' window. You can fine-tune the color selection by selecting a color profile from the pull-down menu.

Choices include CMYK, HLS, HSV or RGB. Depending on your color profile selection, you'll then be able to either use the color picker tools/sliders to the left and right of the text entry fields or enter numbers directly into the fields (including the hexadecimal color code [next to the '#'] if HLS, HSV or RGB were selected). Once you have selected your preferred background color, click OK to return to the main PortalWorX-SL window.

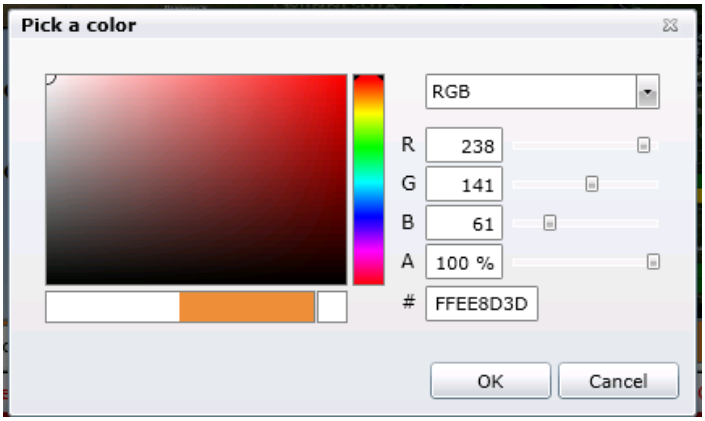


Figure 14.34 - Pick a color Window

14.4.3.4. Existing Layouts

The Existing Layouts section of the Layout Ribbon shows existing selections (as icons that can be set via the Current Layout section of the Layout Ribbon) to replace the currently selected layout. Hover over any of the shown layouts to see its name (as shown below). Click on the icon to enable it. When there are multiple existing layouts, you can use the Up, Down and Expand Window buttons to the right to view them all.

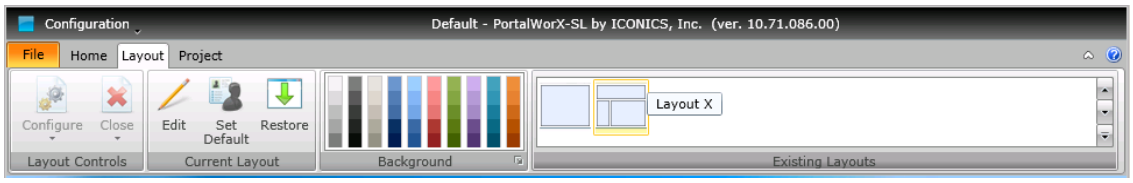


Figure 14.35 - Layout Selection Options

14.4.4. Project Ribbon

The Project Ribbon in PortalWorX-SL contains five sections.

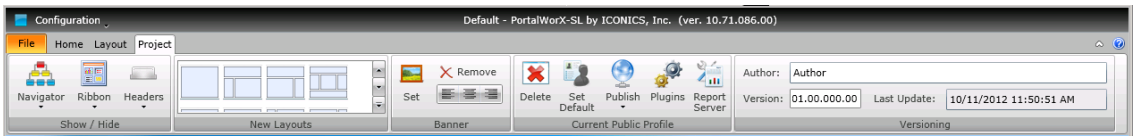


Figure 14.36 - Project Ribbon in PortalWorX-SL

14.4.4.1. Show/Hide

The **Show/Hide** section contains buttons to either show or hide different elements within PortalWorX-SL. These include:

- **Navigator** - The Navigator button specifies which elements are visible in the navigator.

Figure 14.37 - Navigator Button

Clicking on the 'Navigator' button brings up a list of the elements that you can Show or Hide, including Assets, Reports and the Toolbox.

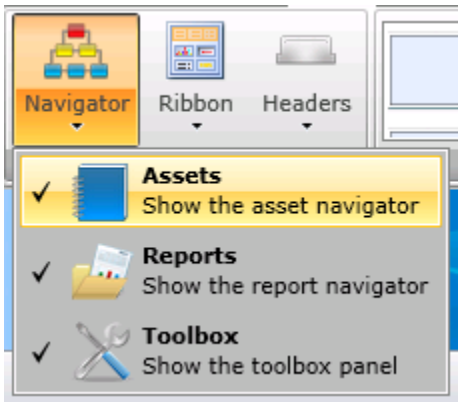


Figure 14.38 - Show/Hide Navigator Button Options

- **Assets** - Shows or hides the Asset Navigator tool in the Project Explorer.
- **Reports** - Shows or hides ReportWorX in the Project Explorer. This ReportWorX selection will not be functional unless a Report Server has also been installed.
- **Toolbox** - Shows or hides the Toolbox, which provides a listing of the available controls/viewers.
- **Ribbon** - The Ribbon button specifies the visibility of the ribbon, the title and the menu.

Figure 14.39 - Ribbon Button

Clicking on the 'Ribbon' button brings up the following list of options:

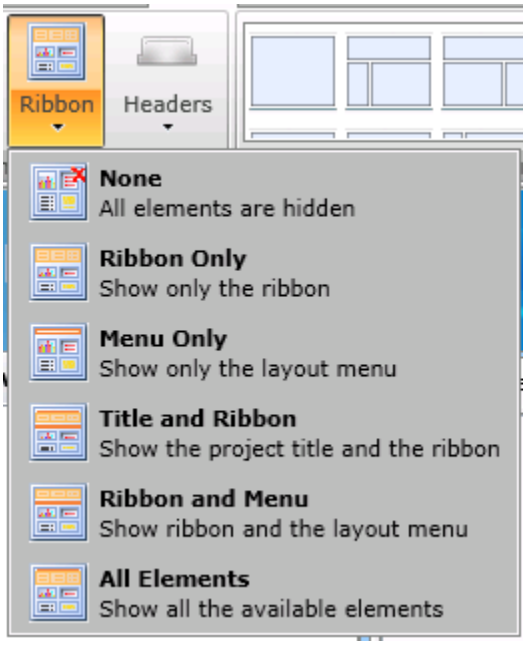


Figure 14.40 - Show/Hide Ribbon Options

If you select 'None' or 'Menu Only', since Ribbons are needed for configuration of PortalWorX-SL's runtime environment, you will first see an Error message notifying you that administrators will be able to retrieve the Ribbon again but normal users will not. Once you click OK, the Ribbons will disappear.

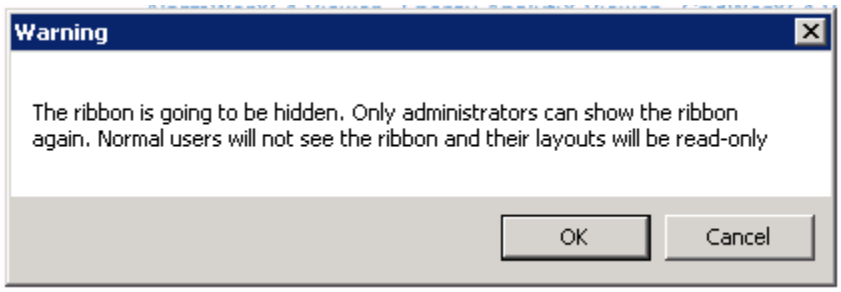


Figure 14.41 - Hiding Ribbon Notification

For administrators, the following message will appear at the top of the screen for a few seconds to let you know you know how to retrieve the hidden Ribbons (CTL+F1):

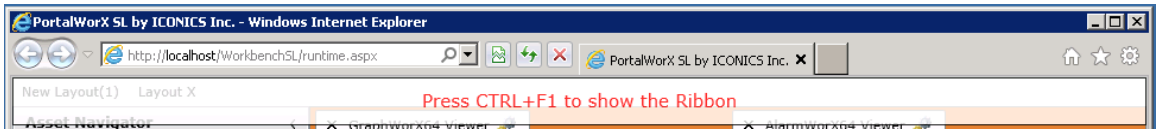


Figure 14.42 - Ribbon Retrieval Reminder

- **Headers -** The Headers button specifies the visibility for all the headers in the current layout.

Figure 14.43 - Headers Button

Clicking on the 'Headers' button brings up the following options:

Figure 14.44 - Show/Hide Headers Options

14.4.4.2. New Layouts

The **New Layouts** section contains pre-loaded layout templates in multiple viewer window configurations that users can select to replace the currently loaded layout. You can use the Up, Down and Expand Window buttons to the right to view them all. Hovering over a selected layout template, as shown below, shows the layout's description.

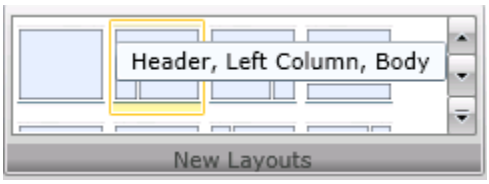


Figure 14.45 - Hovering Over a Selected Layout Template

Clicking on a selection opens the 'Specify layout properties' window, as shown in the following image.

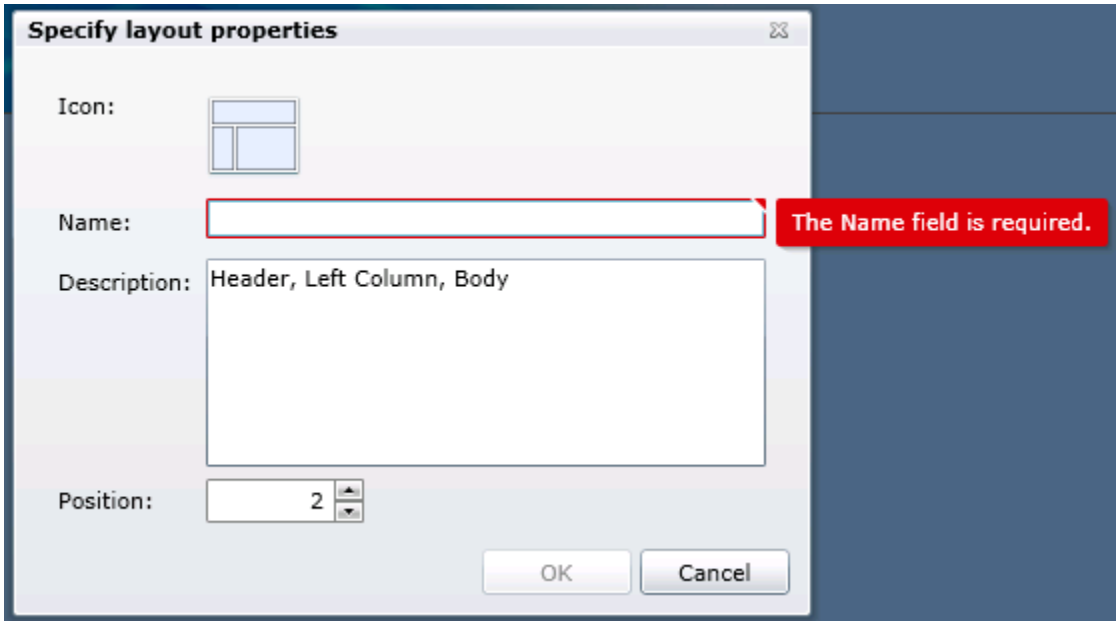


Figure 14.46 - Specify Layout Properties Window

If you click on the image next to 'Icon:', this will open a file browser so that you can select a new representational image for your selected layout. You may wish for the Icon to be accurately representative of the layout or you can use a different image with your own assigned meaning. You can use any image (at 48x48 pixels) with whatever significance you choose. Ultimately, what you select (and save) will be updated in the Existing Layouts section of the Layout Ribbon for easy selection. Once you have an Icon set, enter a Name and Description, then click on 'OK' to proceed.

14.4.4.3. Banner

The **Banner** section of the Project Ribbon allows you to set an image to appear at the top of the PortalWorX-SL screen; for instance, as an identifier for your company/organization or specific department, division or project.

Set - The Set button opens a file explorer window to select your desired image. Keep in mind that you will want to select an image that is sized appropriately to allow you to see your configured viewer windows beneath it.

Figure 14.47 - Set Button

Once you have selected a banner image via the file explorer, it will appear immediately underneath PortalWorX-SL's Ribbons, as shown in the following image.

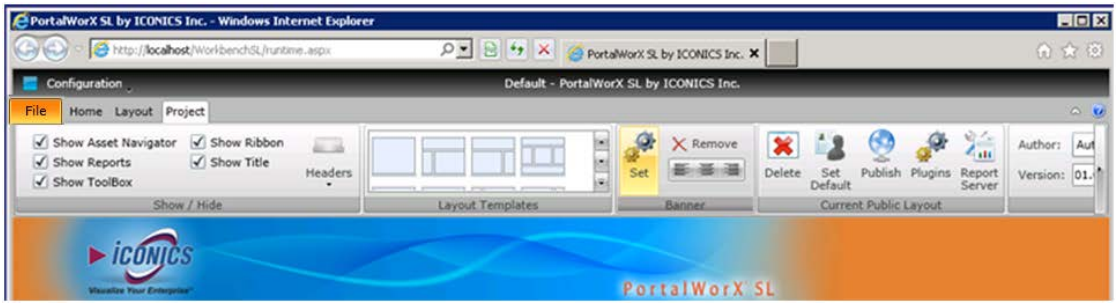


Figure 14.48 - A Sample ICONICS Banner in PortalWorX-SL

Remove - Clicking the 'Remove' button deletes the loaded banner from the PortalWorX-SL main window.

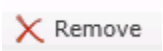


Figure 14.49 - Remove Button

Alignment Buttons - Once you have added your Banner to PortalWorX-SL, you can use the Alignment Buttons to align it to the left, center or right of the top of the screen.

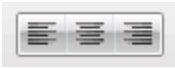


Figure 14.50 - Alignment Buttons

14.4.4.4. Current Public Layout

Each portal can have multiple layouts. The users can switch the layouts using the ribbon gallery or the title menu (right below the ribbon, hidden by default). The current layout is the layout currently visible. The Current Public Layout is the default version of the layout created by the administrator associated with the currently visible layout.

The **Current Public Layout** section of the Project Ribbon contains the following:

Delete - Clicking the 'Delete' button removes the current layout from the public profile as well as from all of the user's profiles. Once you click on the 'Delete' button, you'll see a warning message, shown below, to ensure you wish to remove the current layout.

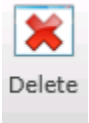


Figure 14.51 - Delete Button

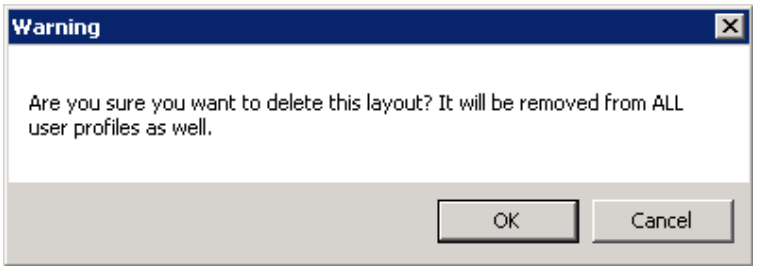


Figure 14.52 - Layout Deletion Warning

Set Default - Clicking the 'Set Default' button sets the default layout for the public profile.

Figure 14.53 - Set Default Button

Publish - Clicking the 'Publish' button publishes the layout to the public profile.

Figure 14.54 - Publish Button

Plugins - Clicking the 'plugins' button configures the plugins used by the project.

Figure 14.55 - Plugins Button

The following window appears. Use the pull-down menu to select which controls should be included in the present project. You can customize the control names by renaming them within the text entry field to the left of the pull-down menu. If you are okay with the selection, click on the 'Add' button and the control will appear in the list. If you are okay with the entire plugin list, click 'OK' to close the window and return to the main PortalWorX-SL screen.

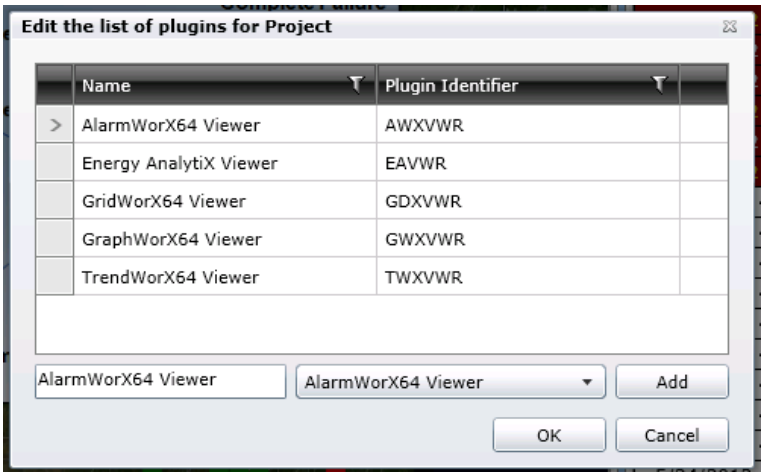


Figure 14.56 - Plugins List Editing Window

If you wish to remove a plugin/control from the list, click on it to highlight it then click on the Delete key. You'll see the following warning. Click 'OK' to proceed with the deletion. If you are okay with the entire plugin list, click 'OK' to close the window and return to the main PortalWorX-SL screen.

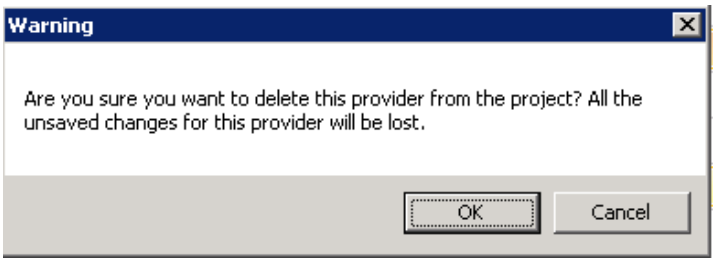


Figure 14.57 - Provider Deletion Warning

Report Server - Clicking the 'Report Server' button configures the server used for reports within the ReportWorX controls that tie into PortalWorX-SL.

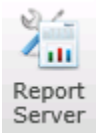


Figure 14.58 - Report Server Button

Once you click on the Report Server button, the following window will open:

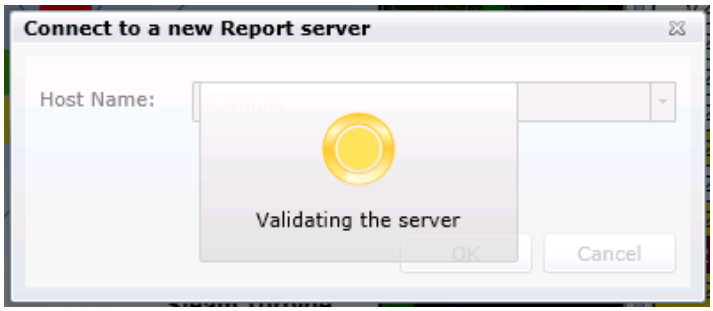


Figure 14.59 - Report Server Connection - Validation

Once the server is validated, you'll be able to select a Host Name via pull-down menu, as shown below:

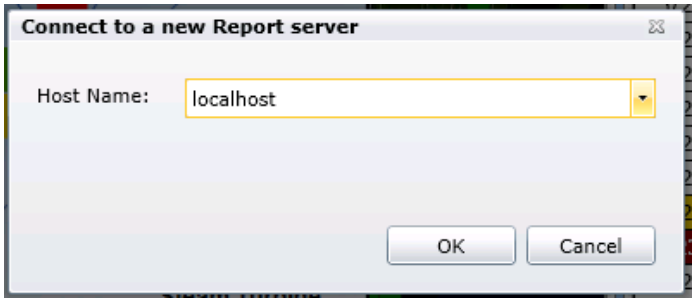


Figure 14.60 - Selecting a Host Name

14.4.4.5. Versioning

The **Versioning** section of the Project Ribbon contains the following text fields to differentiate the current project when it is saved:

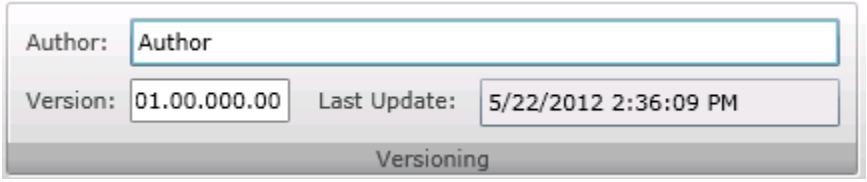


Figure 14.61 - Versioning Text Fields

Author - Enter the author of the project

Version - The Version field will let you keep track of project origination and subsequent changes.

Last Update - The Last Update field will automatically keep track of the last time the project was saved with changes.

14.5. AssetWorX Navigator

14.5.1. What is AssetWorX Navigator?

AssetWorX Navigator (located within PortalWorX-SL and also as a control within GraphWorX64) is the corresponding Runtime tool to ICONICS' AssetWorX provider (located within Workbench-SL).

AssetWorX is used to configure a tree-like structure that provides a functional hierarchy for navigation and for data roll-ups, while AssetWorX Navigator uses that same asset tree set-up in Runtime to perform pre-set functions (commands) through PortalWorX-SL's viewers/controls or as an added control within a GraphWorX64 display.

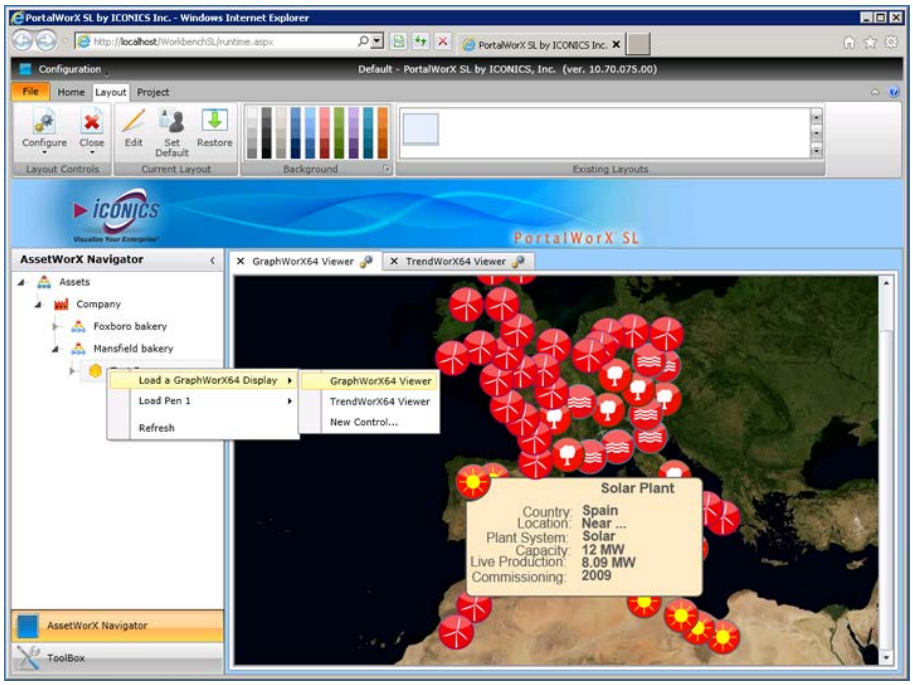


Figure 14.62 - Running a Command Through an Asset in AssetWorX Navigator

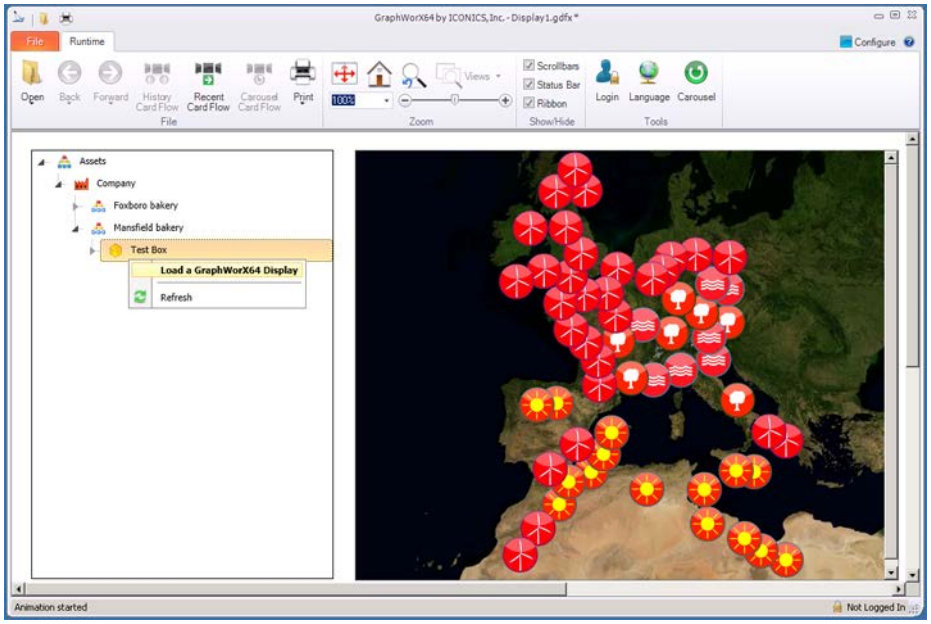


Figure 14.63 - Running a Command Through an Asset in an AssetWorX Navigator Control to a GraphWorX64 Viewer Control in a GraphWorX64 Display in Runtime

The AssetWorX Navigator provider within PortalWorX-SL will show an up-to-date view of whatever assets have been configured using the AssetWorX provider in Workbench-SL.

Note: When you first install GENESIS64, the default database in the AssetWorX provider in Workbench-SL will have sample assets, similar to what is shown below, to explore to better understand the asset tree structure and how it can be fully utilized. The AssetWorX Navigator in PortalWorX-SL will reflect any saved changes to this database.

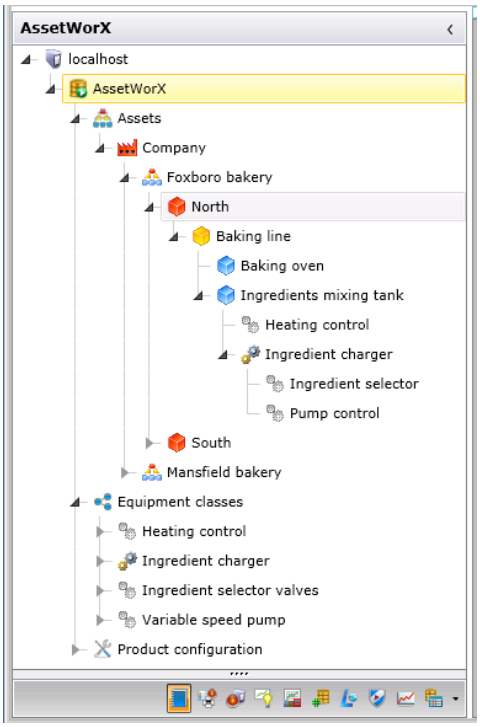


Figure 14.64 - AssetWorX (in Workbench-SL) with Sample Asset Data

14.5.2. AssetWorX Navigator in PortalWorX-SL

PortalWorX-SL initially loads with the AssetWorX Navigator visible in the left section of the browser window. The asset tree that is initially loaded here is based on what database is activated through the AssetWorX provider in Workbench-SL.

Note: When you first install GENESIS64, the default database in the AssetWorX provider in Workbench-SL will have sample assets to explore to better understand the asset tree structure and how it can be fully utilized. The AssetWorX Navigator in PortalWorX-SL will reflect any saved changes to this database, as shown in the following figure.

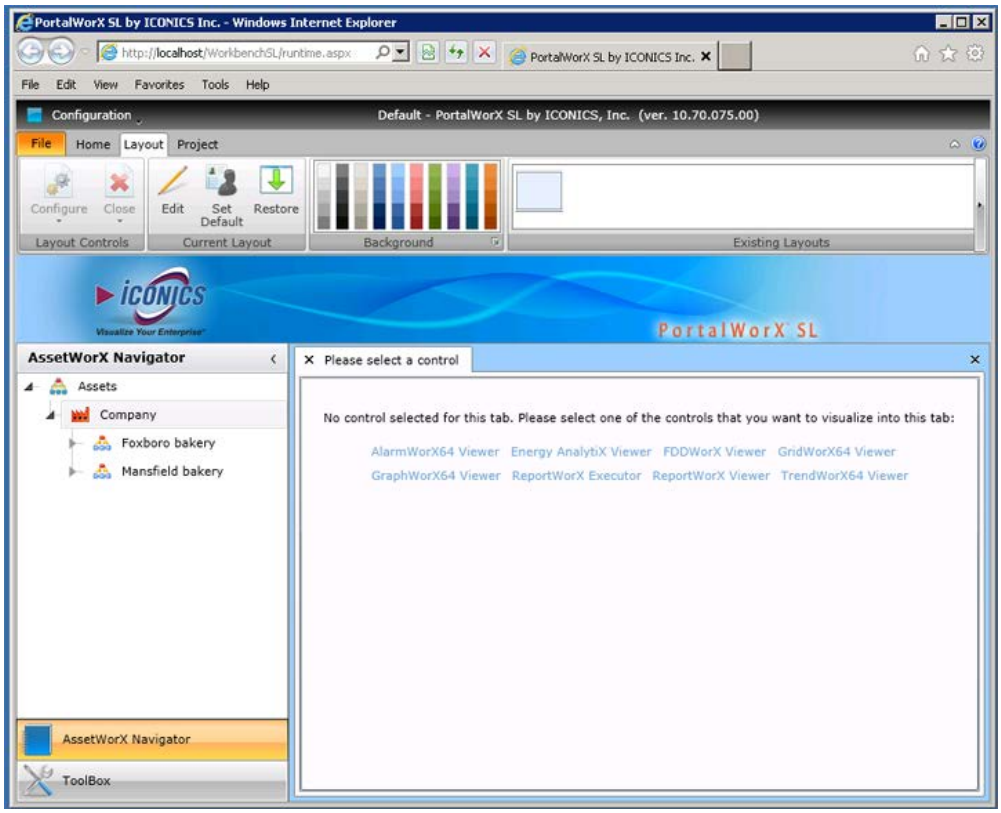


Figure 14.65 - AssetWorX Navigator in PortalWorX-SL

14.5.3. Using Commands Through AssetWorX Navigator

In addition to showing an up-to-the-minute representation of your organization's assets in tree form (that have been configured using the AssetWorX provider in Workbench-SL), the AssetWorX Navigator also allows you to run commands through the various PortalWorX-SL controls.

The following example takes you through the steps to configure a command through an asset in AssetWorX that can then be triggered through AssetWorX Navigator to a PortalWorX-SL control.

1. First, we will set a command within an Equipment asset in the 'AssetWorX' default database in the AssetWorX provider in Workbench-SL. Launch Workbench-SL from the **Start menu → All Programs → ICONICS → Workbench-SL**.

After you enter your User Name and Password, you'll see Workbench-SL open in your preferred Web browser as shown below. In the default 'AssetWorX' database, expand the tree so that you can see the 'Mansfield bakery' node.

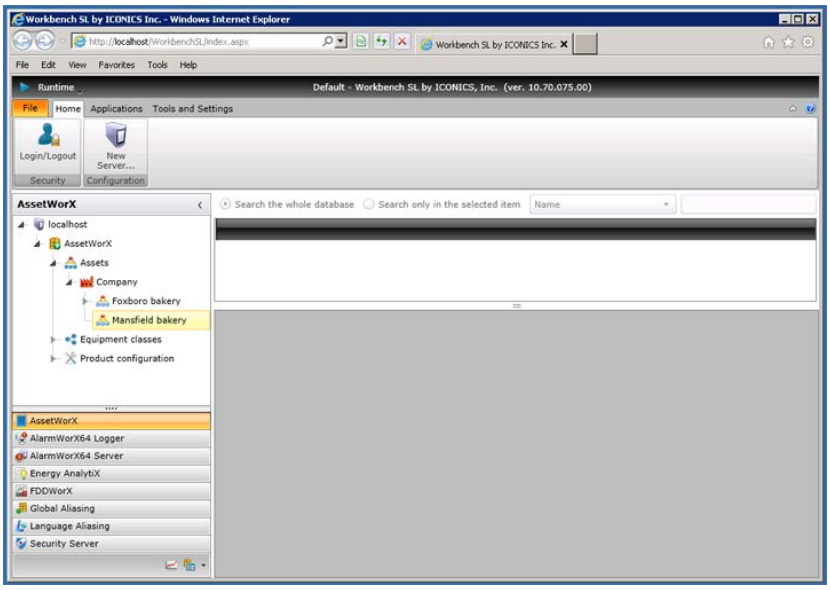


Figure 14.66 - Workbench-SL with Tree Expanded

2. Right-click on 'Mansfield bakery' in the AssetWorX provider and click on 'Add Equipment'. The Equipment properties window will open in the right side of the screen. Give your Equipment asset a Name (in our example, we have named it "Test Box"), then click on the Commands tab, as shown below.

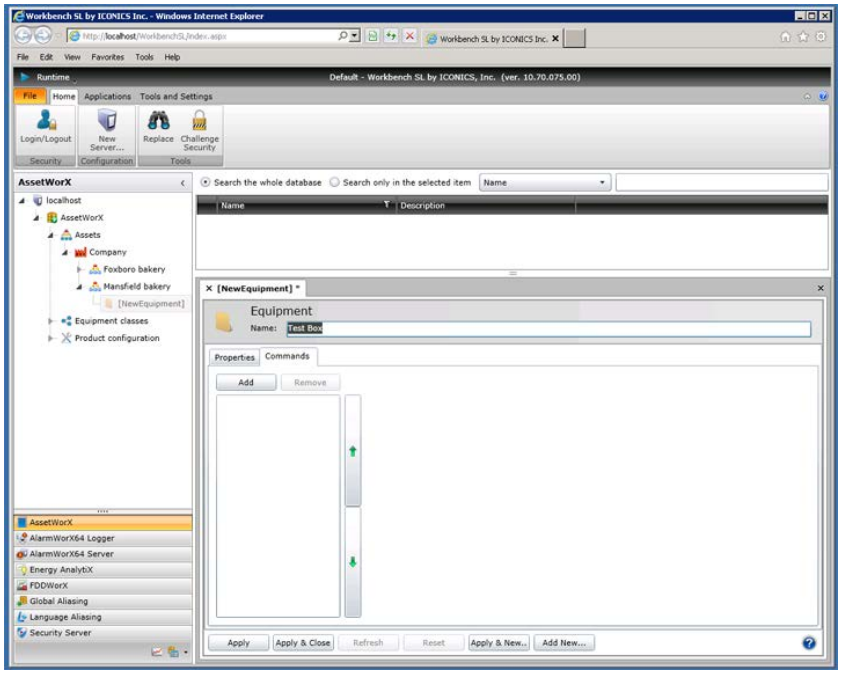


Figure 14.67 - Creating New Equipment in AssetWorX

3. In the Commands tab, click on the 'Add' button to add a command. You'll see that 'New Command' appears in the top of the box to the left and additional properties appear to the right. In our example, we want to use "Load Graphics Display", so select that from the 'Command:' pull-down bar at the top, as shown below.

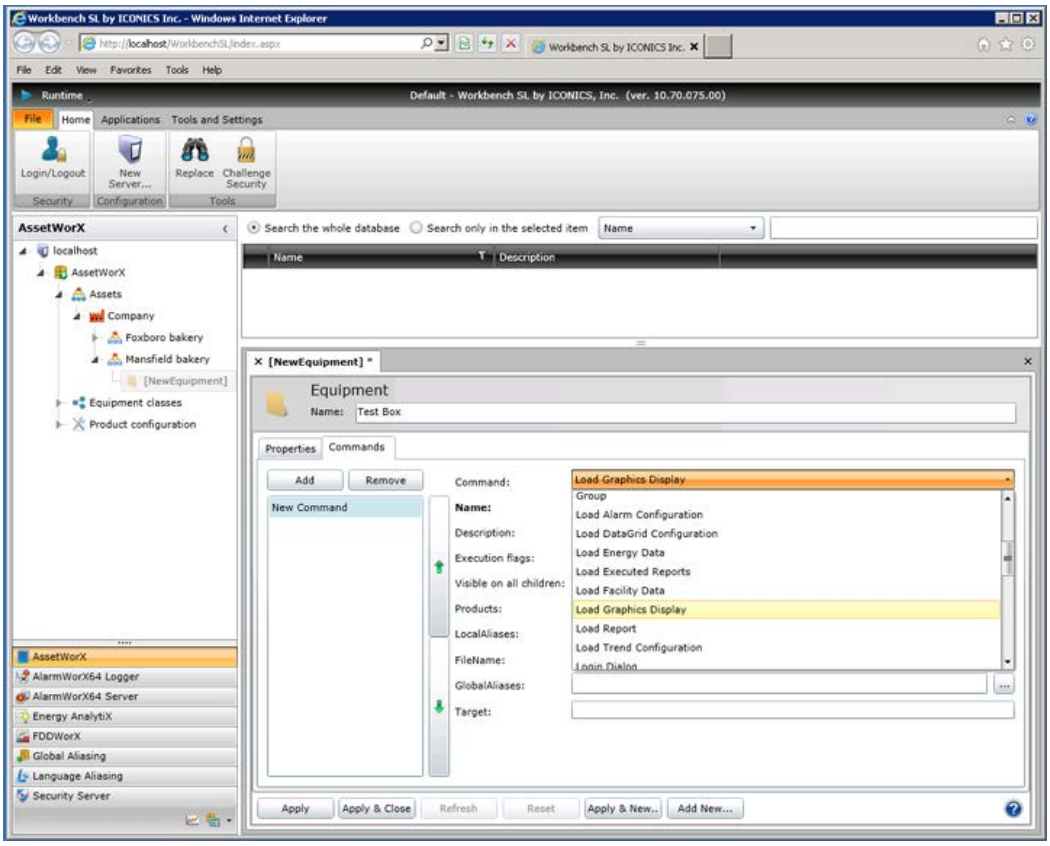


Figure 14.68 - Adding a Command to the Asset

Proceed to fill out the remainder of the Command properties. Since we are using the 'Load Graphics Display' command, we want to make sure we provide the location of our desired GraphWorX64 Silverlight display (.gdfxs) file. In our example, we're using a file called RenewableEnergy.gdfxs that we've place in the following location: http://localhost/pubdisplay/RenewableEnergy.gdfxs.

Click on the 'Apply & Close' button to save your settings.

4. Now you can open PortalWorX-SL to view the asset (with attached command) that you just created. [See "Switching Between Workbench-SL and PortalWorX-SL"]. In the image below, you'll notice that our 'Test Box' asset now appears in the asset tree in AssetWorX Navigator.

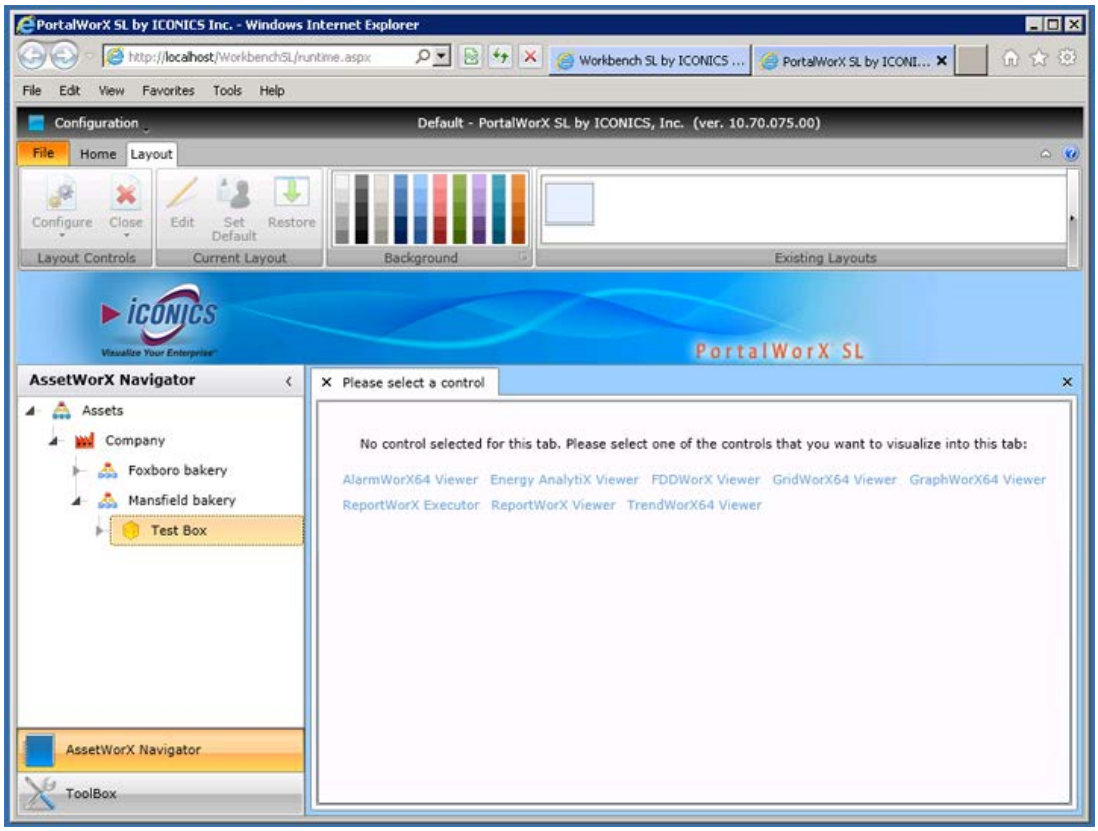


Figure 14.69 - A Configured Asset in AssetWorX Navigator

5. Right-click on the newly created asset (in our example, 'Test Box') and you'll be able to activate the attached command(s). Since we created a 'Load Graphics Display' for our 'Test Box' asset in AssetWorX, and named it 'Load GraphWorX64 Display', that is what will appear to activate the command. You'll also notice that you can activate the command into a 'New Control' as a Target name had not been previously set for the Equipment asset in AssetWorX.

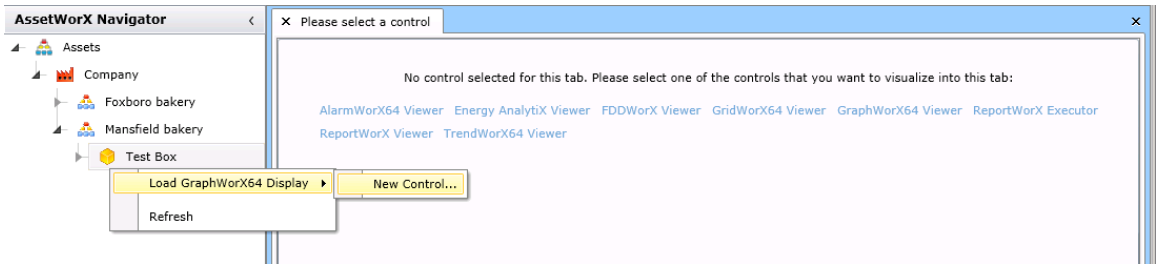


Figure 14.70 - Activating an Asset's Command in a New Control in PortalWorX-SL

If you had *named a specific Target in the Equipment properties in AssetWorX*, then the command can be activated in that specifically named Target in PortalWorX-SL, as shown below. Notice there is no carat [ ] after 'Load GraphWorX Display' in the image below, as you would have already set up the target control (named 'Target Control' in the image below) in AssetWorX. This is especially useful if you have multiple controls in your layout and want to initially set up commands in for specific controls in ahead of time.

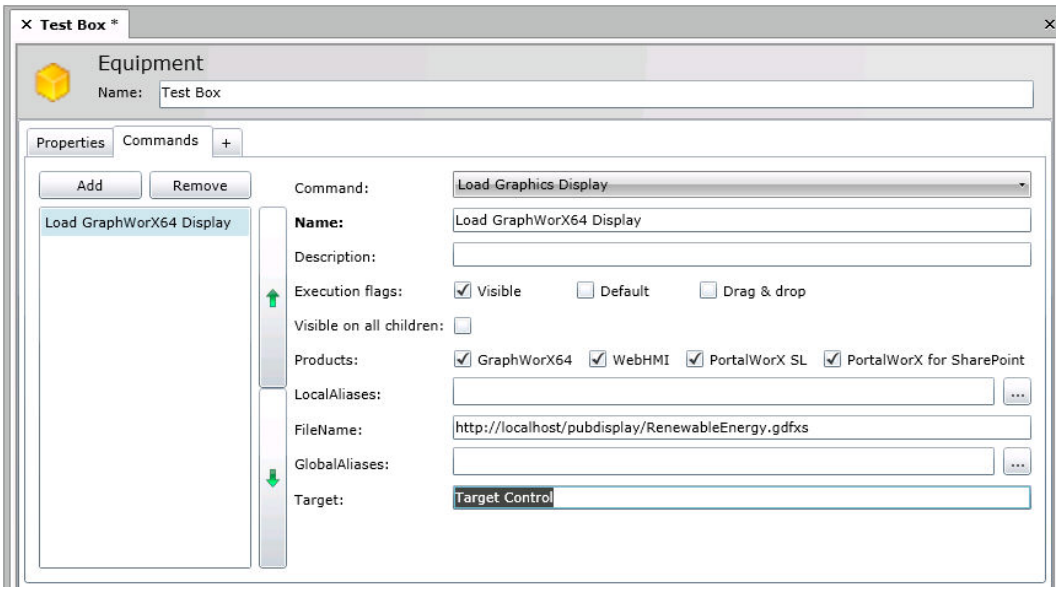


Figure 14.71 - Naming a Target Control in AssetWorX for An Asset's Command in PortalWorX-SL

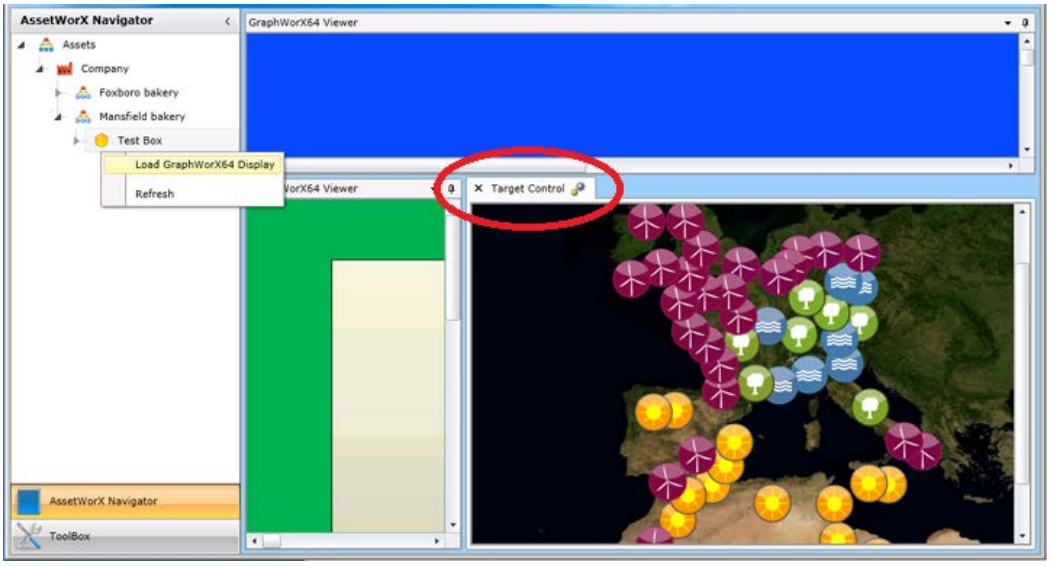


Figure 14.72 - The Same Command Sent to a Named Control in PortalWorX-SL

The name needs to be entered in the Target text field in the Command tab of either Equipment or Equipment Class properties in the AssetWorX provider in Workbench-SL.

14.5.4. Saving Files for Display in PortalWorX-SL

The example used in the previous section, Using Commands Through AssetWorX Navigator, showed how a GraphWorX64 display file can be saved specifically for use within PortalWorX-SL using Silverlight-based technology.

For the GraphWorX64 display, the target URL for the viewer/Web part is the location of the intended .gdfxs file.

For AlarmWorX64 Viewer, the target URL should be the location of a .awxxs file.

For GridWorX64 Viewer, the target URL should be the location of a .gdxxs file.

For TrendWorX64 Viewer, the target URL should be the location of a .twxxs file.

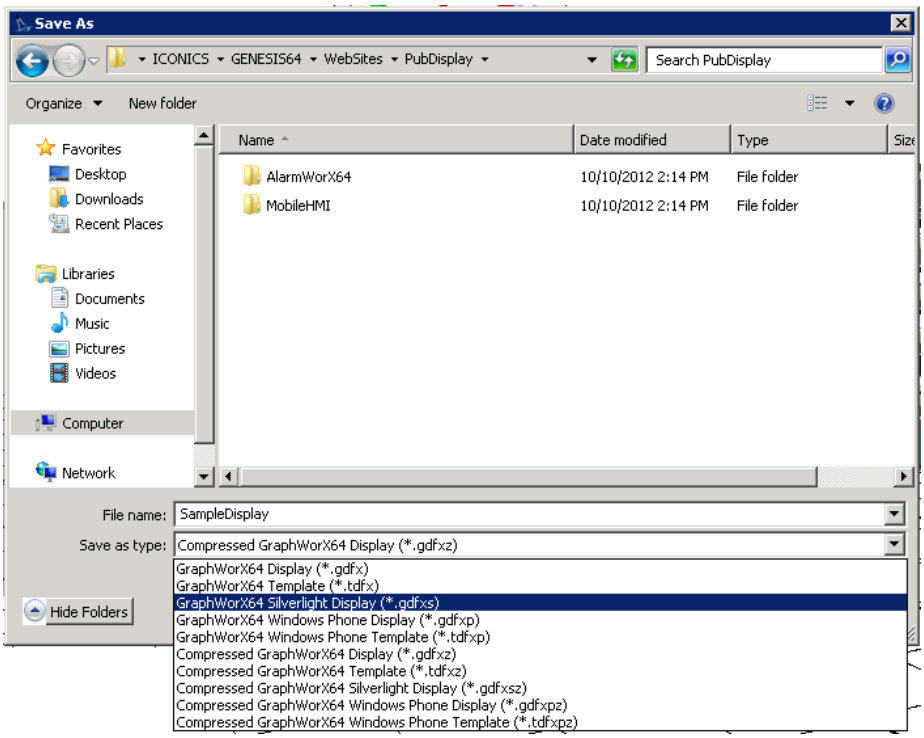


Figure 14.73 - Saving a GraphWorX64 Silverlight Display (*.gdfxs) File

14.6. Viewers

The Viewers within PortalWorX-SL are the Runtime Web Parts connected to data configured in other ICONICS components including AlarmWorX64, Energy AnalytiX, FDDWorX, GridWorX64, GraphWorX64, ReportWorX and TrendWorX. Viewers can be added into a selected layout within PortalWorX-SL and each has its own related properties for connection to existing data and runtime options (including Commands, where applicable). The viewers can also interact with the AssetWorX Navigator provider.

14.6.1. AlarmWorX64 Viewer

14.6.1.1. Adding an AlarmWorX64 Viewer in PortalWorX-SL

To Add an AlarmWorX64 Viewer in PortalWorX-SL

1. First, launch PortalWorX-SL via the **Start Menu → All Programs → ICONICS → PortalWorX-SL**. You will first see the Windows Security login in order to connect to PortalWorX SL, as shown below. Enter your User Name and Password, then click on 'OK' to proceed.

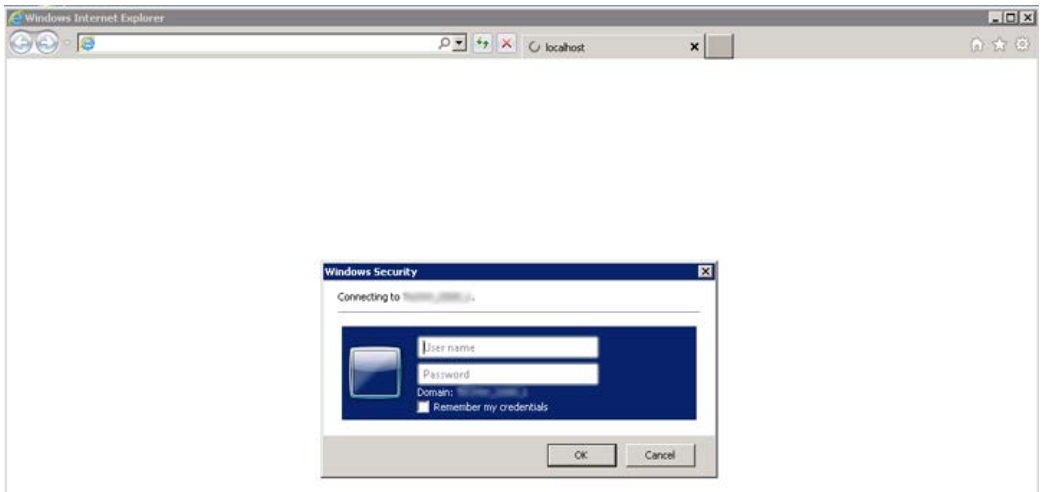


Figure 14.74 - Windows Security Login

2. PortalWorX-SL will now open in your selected Web browser, as shown below. You can launch an AlarmWorX64 Viewer in multiple ways. You can select it within the GENESIS64 Controls in the Home Ribbon OR you can select it within the main window in the lower right of the PortalWorX SL browser window OR you can select it from the list within the Toolbox in the left navigation box.

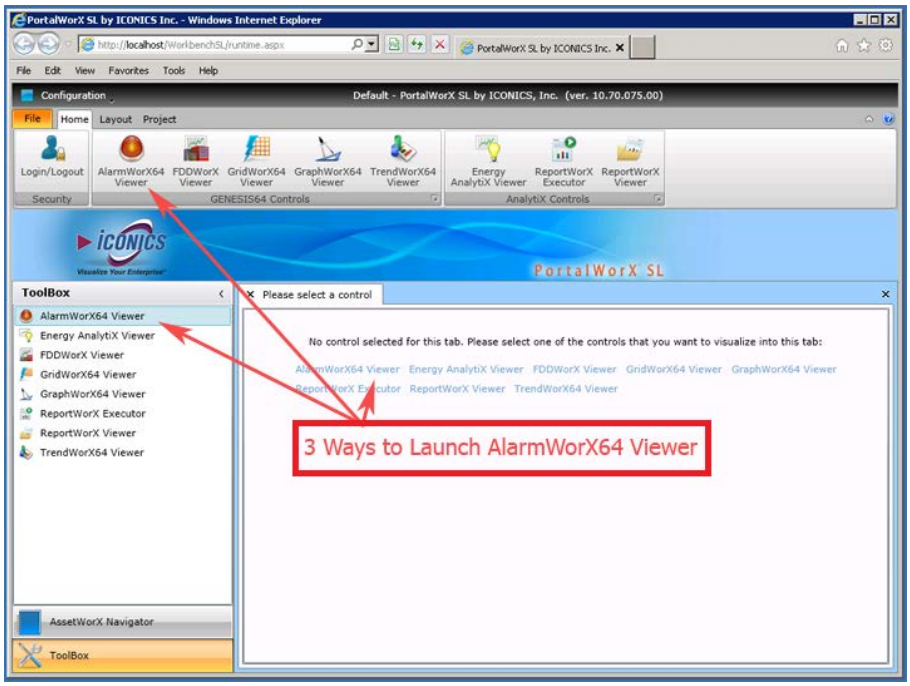


Figure 14.75 - Options for Launching AlarmWorX64 Viewer in PortalWorX SL

Once you have selected an AlarmWorX64 Viewer, it will initially connect to its configuration database (which can be set up via the AssetWorX provider in Workbench SL).

3. The following "Configure Web Part" window will then appear. You can fill out the settings or leave them as they are.

Figure 14.76 - Configure Web Part Window

- **Title** - This is the name for the Viewer itself.
- **Name** - This can be a specific name for the data that will shown within the viewer. When first launched, the AlarmWorX64 Viewer will include default characters here.
- **URL** - Enter a file name for an AlarmWorX64 Silverlight (.awxxs) file to display in the viewer.
- **Show the Header** - Click on this checkbox to include the Viewer's Header.
- **The control can be dragged** - Click on this checkbox to enable dragging for this viewer.

Once you have completed updating these settings, click on the 'OK' button to proceed.

4. You can now proceed with **Configuration**.

14.6.1.2. AlarmWorX64 Viewer Configuration (PortalWorX-SL)

ICONICS' AlarmWorX64 Viewer, shown below, allows you to monitor alarms remotely from a portal. Add this viewer to PortalWorX-SL and automatically receive real-time alerts in a scrollable view.

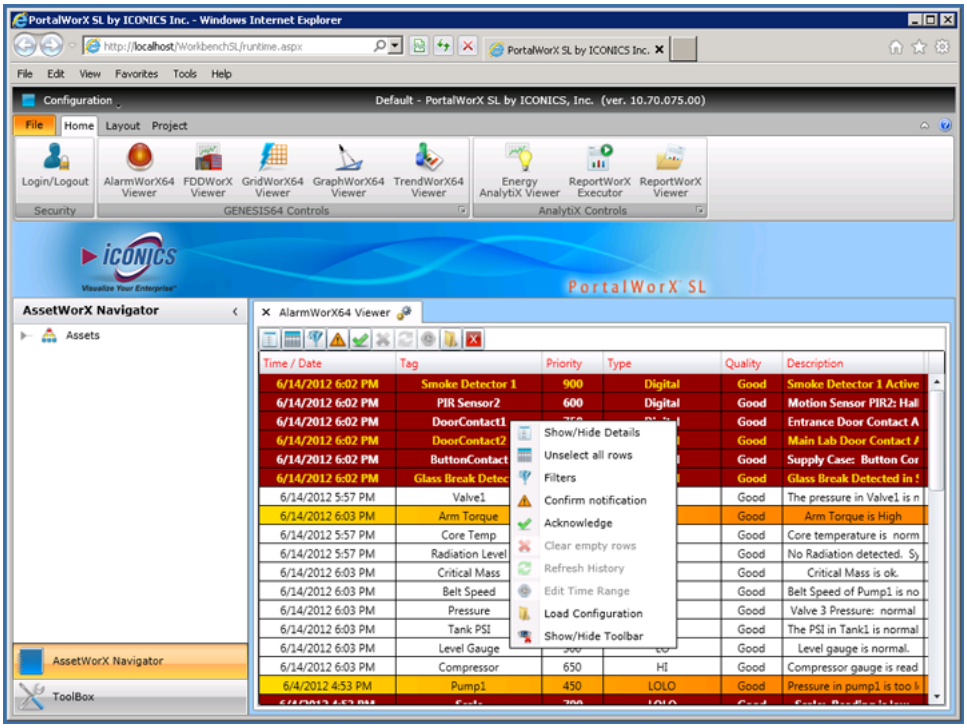


Figure 14.77 - AlarmWorX64 Viewer in PortalWorX-SL

When you right-click inside the AlarmWorX64 Viewer, you are able to select from several options, including the following:

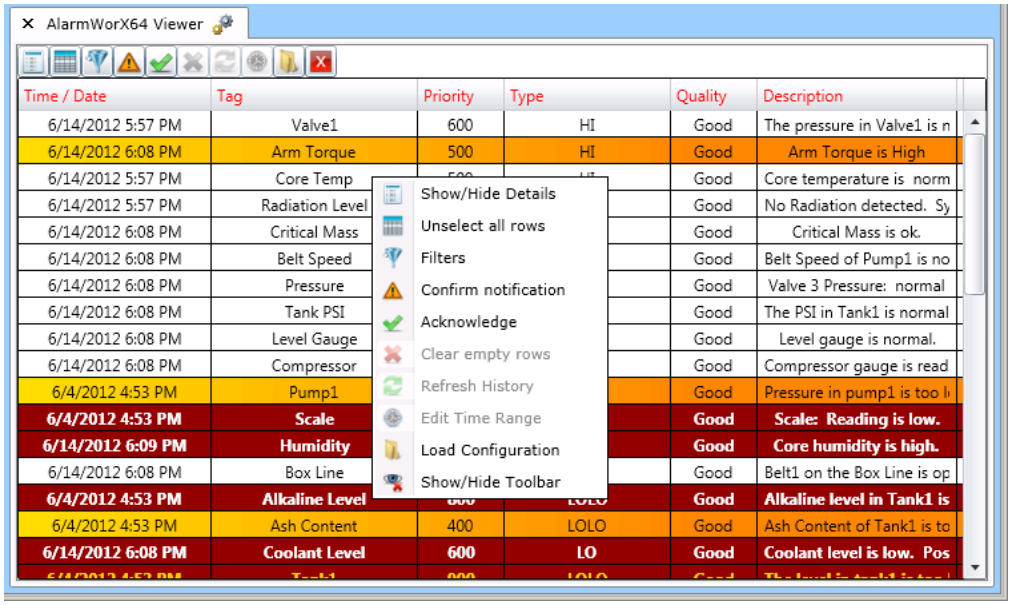


Figure 14.78 - Right-Click Options in AlarmWorX64 Viewer

- **Show/Hide Details** - Click this selection to hide (if shown) or show (if hidden) the loaded data within the Viewer. **Note**: In some instances, you may need to re-enter the Source File URL in the AlarmWorX64 Viewer Properties window and click on "Apply" to show the loaded data after hiding it.
- **Unselect all rows** - If you have previously selected any rows within the viewer, selecting this option will deselect them.
- **Edit filters** - Clicking this option opens the "Select a filter from the list" window, shown below.

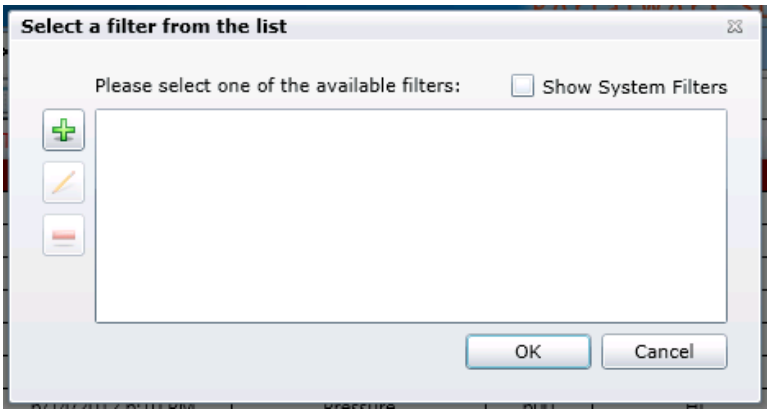


Figure 14.79 - Select a Filter from the List Window

Click on the button and the "Configure Alarm Filter" window, shown below, appears.

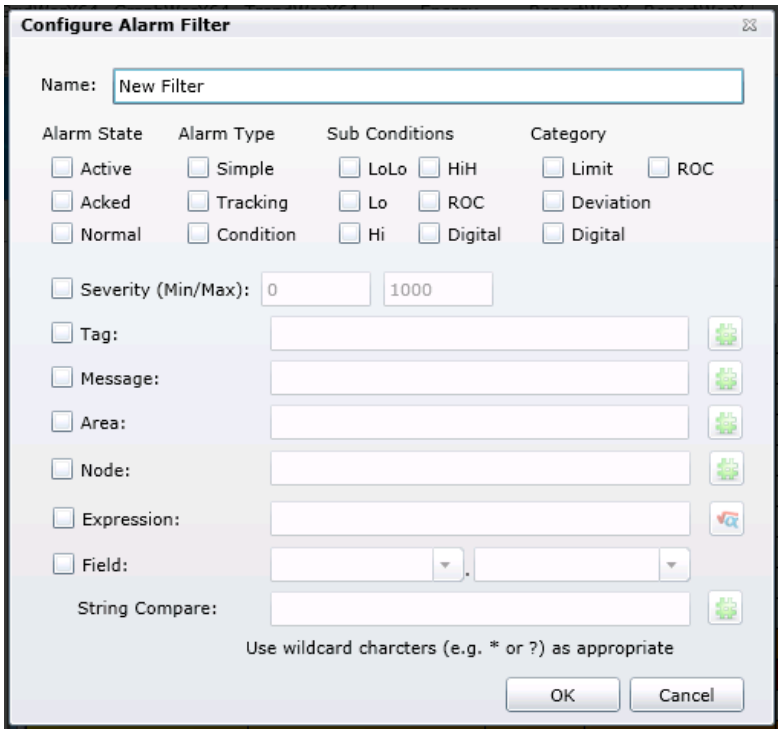


Figure 14.80 - Configure Alarm Filter Window

From this window you can set your alarm filter properties, just as you would within ICONICS' AlarmWorX64 application. Make your settings, then click "OK" to return to the Select Client Side Filter window. You'll notice that your newly added filter appears, as shown below, and the Edit ( ) and Remove ( ) buttons are now active.

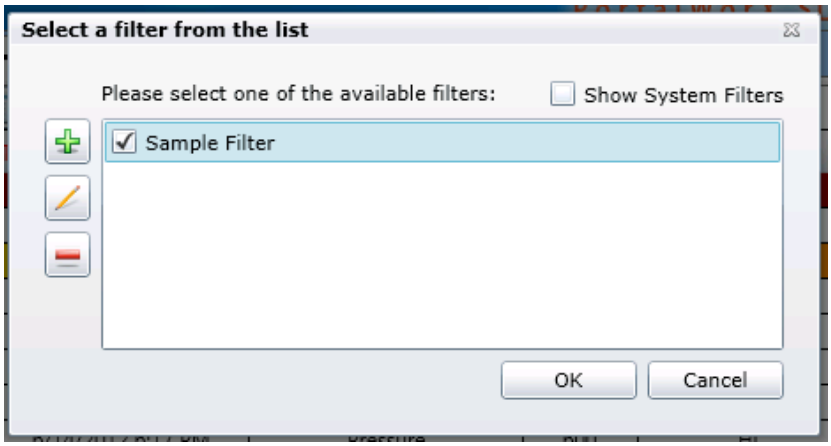


Figure 14.81 - Filter Added

Clicking on the "Show System Filters" checkbox populates the Select Client Side Filter window with pre-set filters accompanying the alarm file.

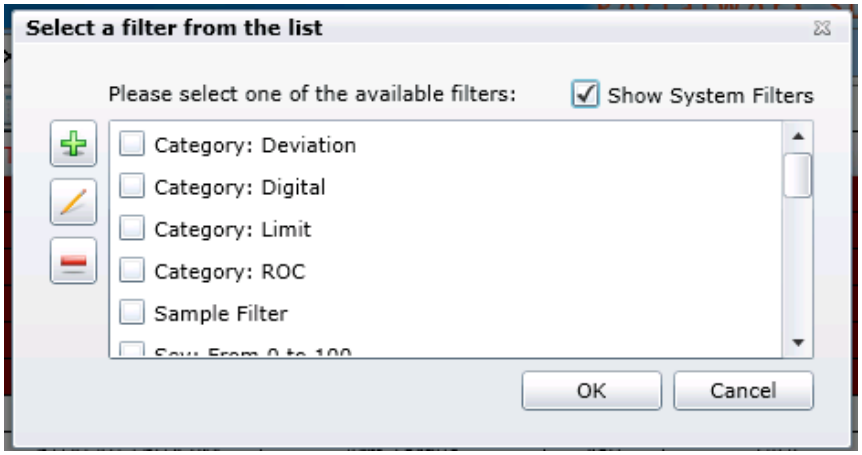


Figure 14.82 - 'Show System Filters' Enabled

Select your client side or System filter(s), then click OK to return to the viewer.

- **Confirm notification** - Click on this option within the viewer to confirm that you were notified of the displayed alarm.
- **Acknowledge** - Clicking on this option opens the "Acknowledge Alarms and Events Window", shown below.

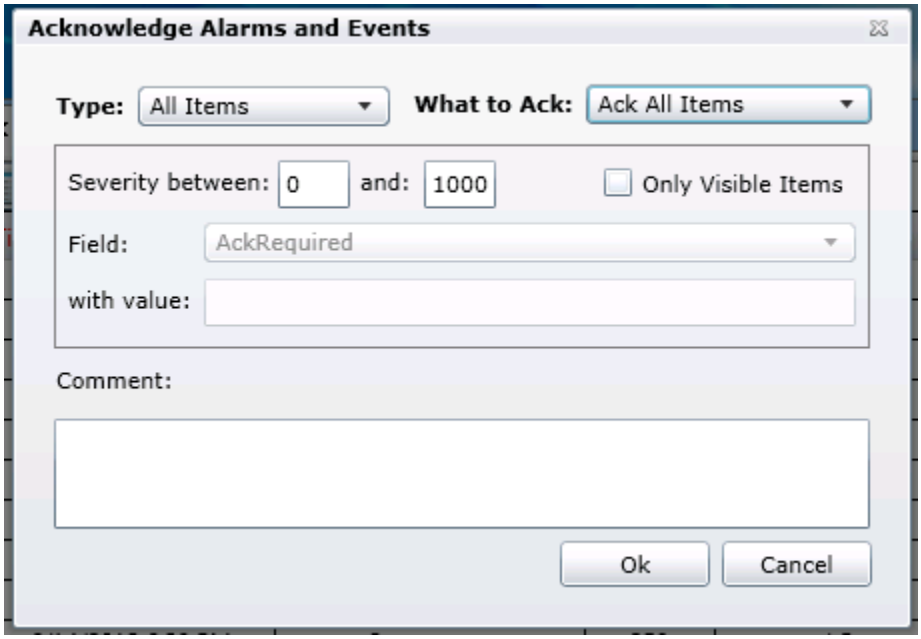


Figure 14.83 - Acknowledge Alarms and Events Window

Click on the "Type:" pull-down to select whether to acknowledge Alarms Only, Events Only, Tracking Only or All Items. Click on the "What to Ack" pull-down to select whether to Ack All Items, Ack by Comparison, Ack Filtered Items, Ack Selected Items or Ack Not Active Items.

If you selected to "Ack by Comparison", this will allow you to set a parameter for "Field:" via the pull-down menu (Ack Required, Active Time, AREA, Category, ConditionName, EventClass, EventId, EventType, Message, NewState, OriginalSource, Severity, SourceName, StatusCode or SubConditionName) and enter a value for that parameter in the text entry field.

You can also enter a Comment to help describe how you have set your acknowledgements.

Click "OK" to return to the Web Part.

- **Clear empty rows** - If enabled, this option allows you to remove blank rows from the alarm viewer within the viewer.
- **Refresh History** - If enabled, this option allows you to update the alarm viewer within the viewer so as to view more recent items.
- **Edit Time Range** - If enabled, this option allows you to set the time range for alarms to be viewed within the viewer.
- **Load Configuration** - Similar to how you first loaded the existing AlarmWorX64 Silverlight (.awxxs) file, you can enter a new file for the viewer to display.
- **Show/Hide Toolbar** - Clicking on this option opens a toolbar at the top left of the viewer containing these same viewer options. Click on the button to close the toolbar.

Figure 14.84 - AlarmWorX64 Viewer Options Toolbar

14.6.2. Energy AnalytiX Viewer

14.6.2.1. Adding an Energy AnalytiX Viewer in PortalWorX-SL

1. First, launch PortalWorX-SL via the **Start Menu → All Programs → ICONICS → PortalWorX-SL**. You will first see the Windows Security login in order to connect to PortalWorX SL, as shown below. Enter your User Name and Password, then click on 'OK' to proceed.

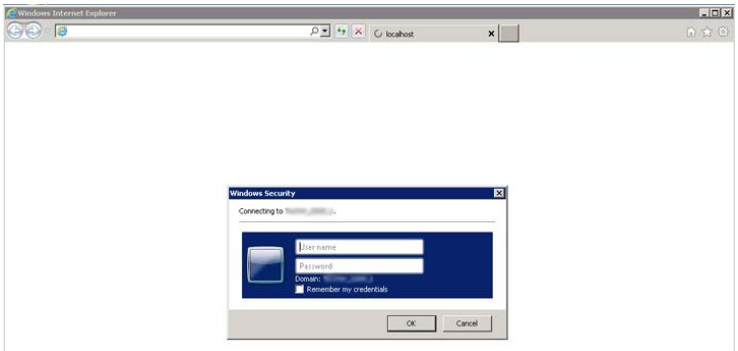


Figure 14.85 - Windows Security Login

2. PortalWorX-SL will now open in your selected Web browser, as shown below. You can launch an Energy AnalytiX Viewer in multiple ways. You can select it within the GENESIS64 Controls in the Home Ribbon OR you can select it within the main window in the lower right of the PortalWorX-SL browser window OR you can select it from the list within the Toolbox in the left navigation box.

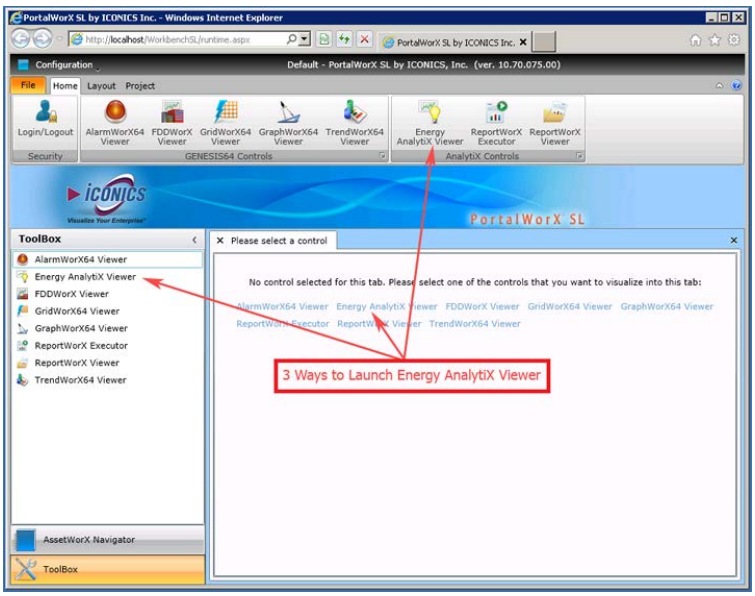


Figure 14.86 - Options for Launching Energy AnalytiX Viewer in PortalWorX-SL

Once you have selected an Energy AnalytiX Viewer, it will initially connect to its configuration database (which can be set up via the AssetWorX provider in Workbench SL), as shown below.

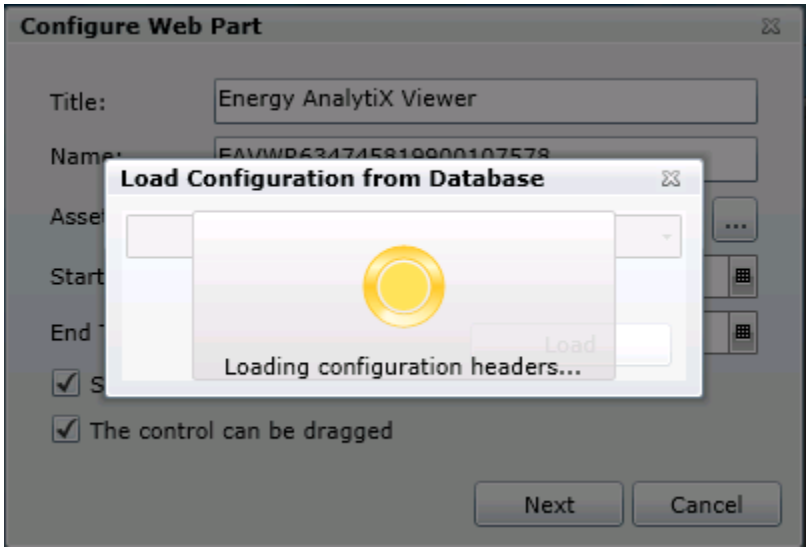


Figure 14.87 - Load Configuration from Database Window

3. The following "Configure Web Part" window will then appear. You can fill out the settings or leave them as they are.

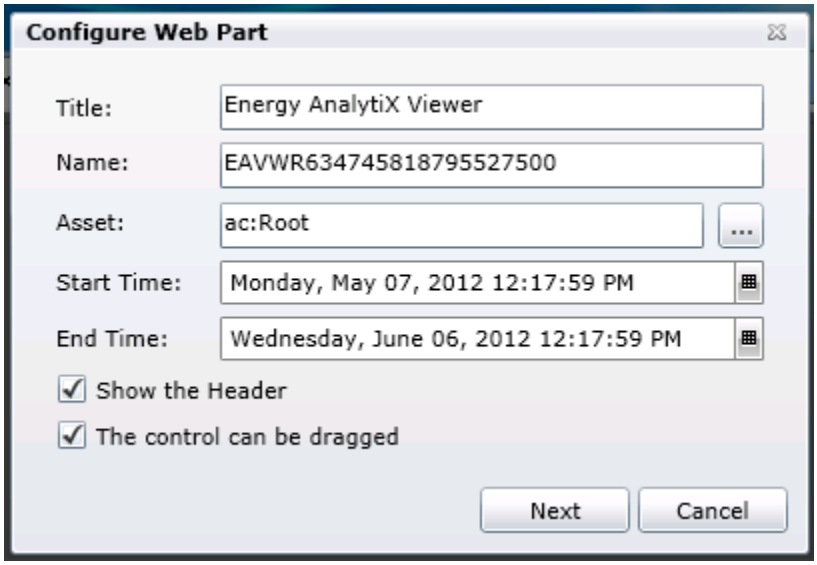


Figure 14.88 - Configure Web Part Window

- **Title -** This is the name for the Viewer itself.
- **Name -** This can be a specific name for the data that will shown within the viewer. When first launched, the Energy AnalytiX Viewer will include default characters here.

- **Asset** - This will be filled with "ac:Root" by default, but you can either enter a new asset in the text field or click on the ellipsis [...] button to open the data browser to navigate to your AssetWorX configuration database.
- **Start Time** - This is the starting point for the Energy AnalytiX data to be used within the viewer. You can enter the required information in the text entry field (in Day/Date/Time format) or click on the calendar button [ ] to set the required start time.
- **End Time** - This is the ending point for the Energy AnalytiX data to be used within the viewer. You can enter the required information in the text entry field (in Day/Date/Time format) or click on the calendar button [ ] to set the required start time.
- **Show the Header** - Click on this checkbox to include the Viewer's Header.
- **The control can be dragged** - Click on this checkbox to enable dragging for this viewer.

Once you have completed updating these settings, click on the 'Next' button to proceed.

4. You can now proceed with Configuration.

14.6.2.2. Configuring the Energy AnalytiX Viewer

The Energy AnalytiX Viewer is a Silverlight control that is used to visualize the data collected by the Energy AnalytiX server. There is a FDDWorX Viewer that can be used within PortalWorX-SL and a similar Web Part that can be used in PortalWorX SP (utilizing SharePoint).

In this Quick Start, we will configure a Energy AnalytiX viewer to display a grid with meter data. We will add a Row Detail to the grid so that when we expand the meter data, we can display more information, a chart showing the current week's distribution of meter data, and asset details.

Creating a Grid to Display Meter Data

1. In your Energy AnalytiX Viewer, right-click **Viewer** and select **Add Grid**, as shown below. A grid (called "Grid") is added to the Viewer tree.

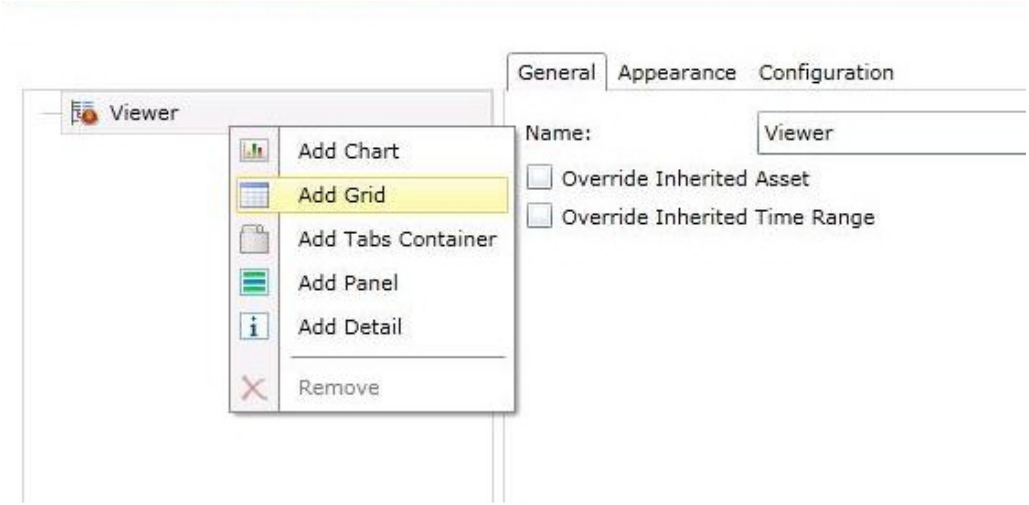


Figure 14.89 - Adding a Grid

2. Select the **Grid** in the Viewer tree, and select its **Data** tab, which is shown below. Notice your choices for selecting a **Data Query**: you can choose **Consumption** calculations, **Cost** data, **Carbon** calculations, **Meter** data, and **Weather** data. In this example, we will choose **Meter Data**. You will notice that the Data tab displays options for retrieving meter data.

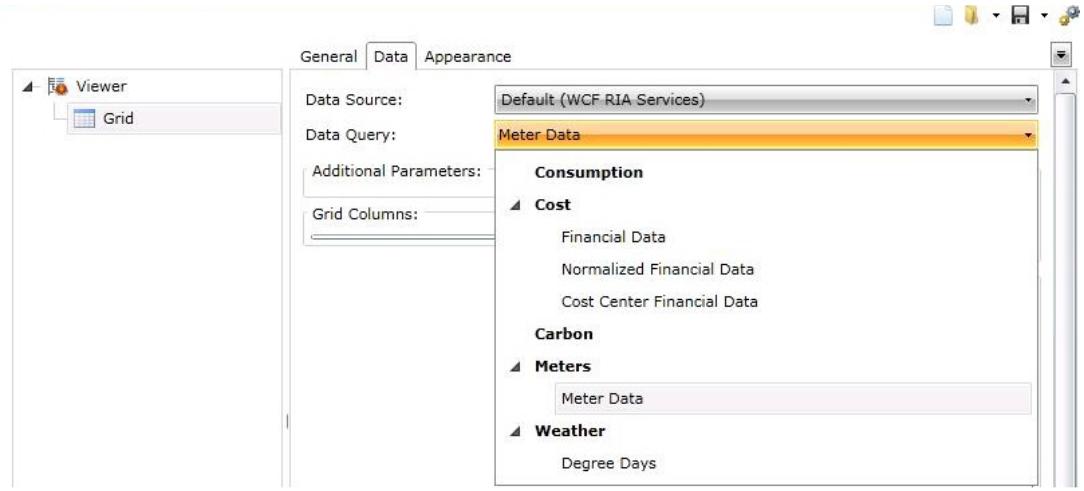


Figure 14.90 - Data Tab for the Grid

Creating a Row Detail and Panel

1. Right-click the **Grid** in the Viewer tree and select **Add Row Detail**. This adds a "Row Detail" to the grid and will allow you to expand a row in your grid to retrieve more information.

2. Right-click the new **Row Detail** and select **Add Panel**. This adds a panel to the Row Detail.

3. Click the new **Panel** in the tree and make sure that the Layout Orientation specified on the **Appearance** tab is **Horizontal**. This will ensure that if you add multiple features to this panel, they will be displayed side-by-side. If you prefer that features added to the panel be displayed top-to-bottom, you can select **Vertical** orientation.

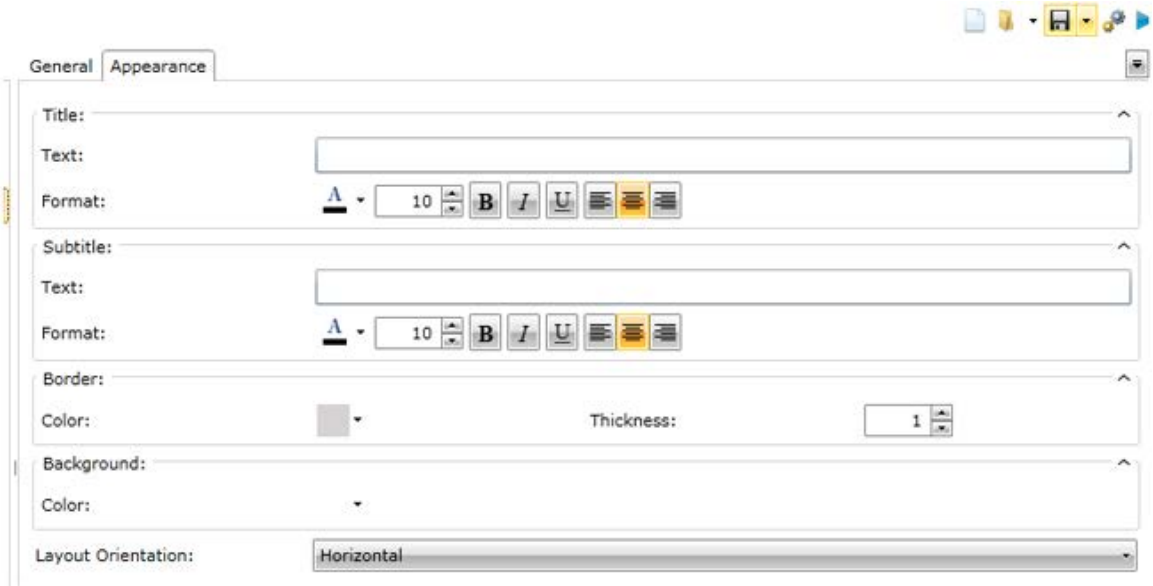


Figure 14.91 - Panel's Appearance Tab

Creating a Tabs Container and Tabs

1. Right-click on the new **Panel** and select **Add Tabs Container**. This adds a Tab Container to the panel.

2. Right-click on the new **Tab Container** and select **Add Tab**. This adds a new tab to the Tab Container.

3. Select the new **Tab** in the Viewer tree. On its **Appearance** tab, enter a title for the tab's Title text.

Creating a Chart and Series

1. Right-click the **Tab** and select **Add Chart**. Then select the new chart to display its **General** tab; here you can select a Column chart for its **Chart Type**.

2. Right-click the **Chart** in the Viewer tree and select **Add Series**. This adds a series to the chart.

3. Click on the new **Series** in the tree to display its options. For this series, we will only want to look at the meter readings that have occurred this week, so first, check the **Override Inherited Time Range** check box to display the time range override options.

4. In the **Start** section, change the start to **Preset** and **First Day Current Week**.

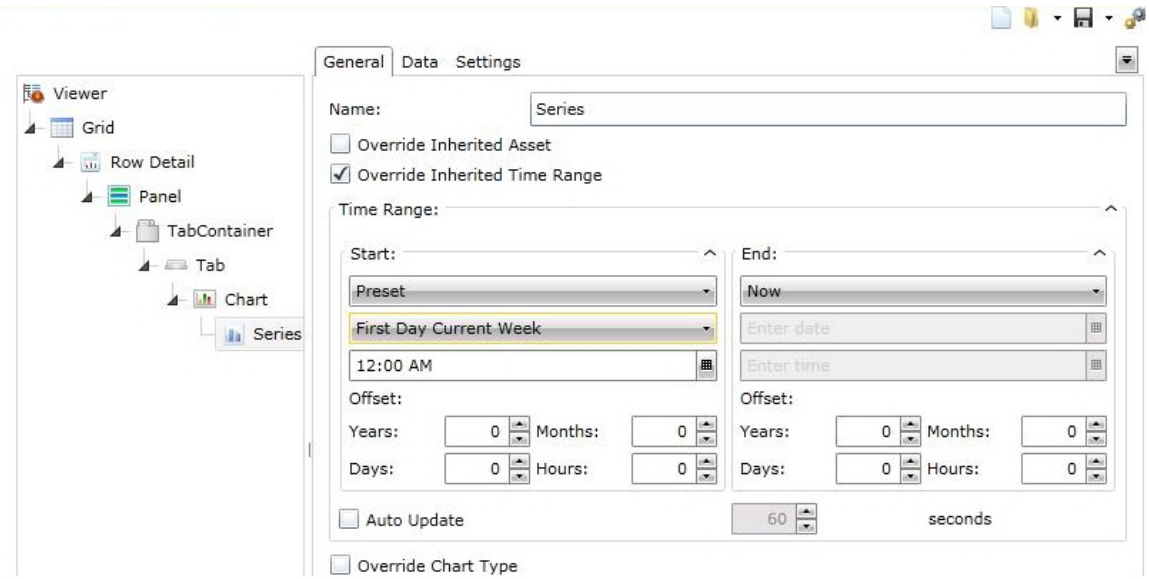


Figure 14.92 - Overriding the Time Range

5. On the Data tab, select **Meter Data** as the **Data Query**.

6. Check the **Format** check box and change the Format to D.

7. Next, create another **Tab** in the **Tab Container**. Configure this tab to display last week's meter readings.

Creating an Asset Detail

1. Next, add an Asset Detail to the panel to be shown next to the Tabs Container. Right-click on **Panel** and select **Add Detail**.

2. Select the **Asset Detail** in the tree and on its **Data** tab, choose the **Weather** > **Degree Days** query. When you are finished, your tree should look similar to the one in the figure below

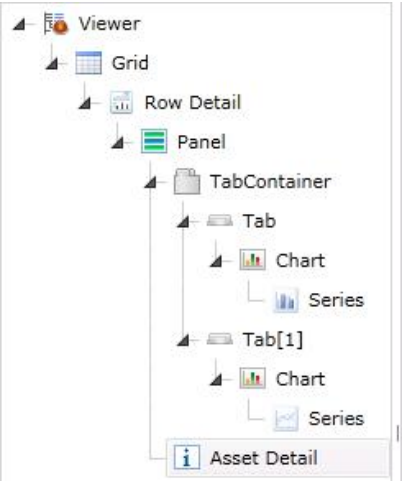


Figure 14.93 - Final Configuration

3. Click the **Save** icon at the top of the viewer to save this configuration as an .eav file.

Testing the Configuration File

1. Go to Workbench SL, select an asset (that is, an equipment node in the asset tree) and create a **Load Energy AnalytiX Data** command for the configuration file you just saved.

2. Return to the Viewer/Web part. Clicking the blue play button at the top right of the viewer will switch the viewer to Runtime mode. You won't see any results there now because the viewer is configured to use an Inherited Asset.

3. To verify that your configuration is working correctly, you can click the **Viewer** in the tree and, on its **General** tab, check the **Override Inherited Asset** check box and select **Specific Asset** and from the drop-down list select the asset whose meter data you want to see. If you switch to runtime, you will see a grid of meter readings. If you click the plus sign [+] at the beginning of any row, you will see the panel that we defined.

14.6.3. FDDWorX Viewer

14.6.3.1. Adding an FDDWorX Viewer in PortalWorX-SL

To Add an FDDWorX Viewer in PortalWorX-SL

1. First, launch PortalWorX-SL via the **Start Menu → All Programs → ICONICS → PortalWorX-SL**. You will first see the Windows Security login in order to connect to PortalWorX SL, as shown below. Enter your User Name and Password, then click on 'OK' to proceed.

Figure 14.94 - Windows Security Login

2. PortalWorX-SL will now open in your selected Web browser, as shown below. You can launch an FDDWorX Viewer in multiple ways. You can select it within the GENESIS64 Controls in the Home Ribbon OR you can select it within the main window in the lower right of the PortalWorX SL browser window OR you can select it from the list within the Toolbox in the left navigation box.

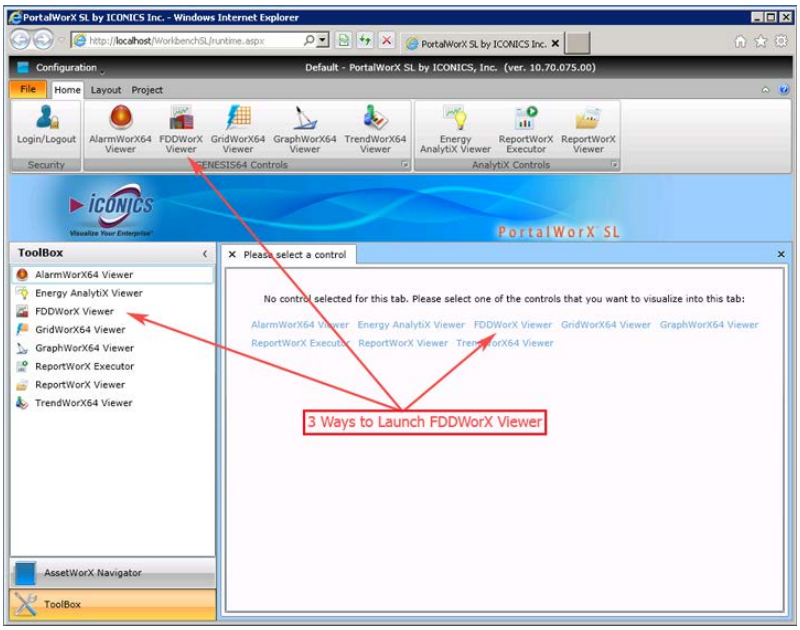


Figure 14.95 - Options for Launching FDDWorX Viewer in PortalWorX SL

Once you have selected an FDDWorX Viewer, it will initially connect to its configuration database (which can be set up via the AssetWorX provider in Workbench SL), as shown below.

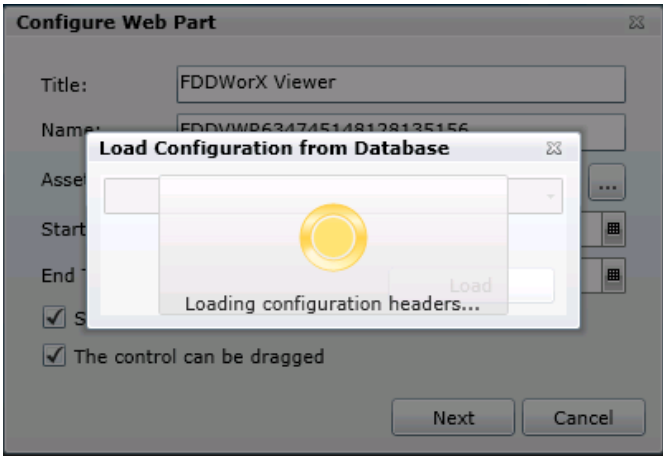


Figure 14.96 - Load Configuration from Database Window

3. The following "Configure Web Part" window will then appear. You can fill out the settings or leave them as they are.

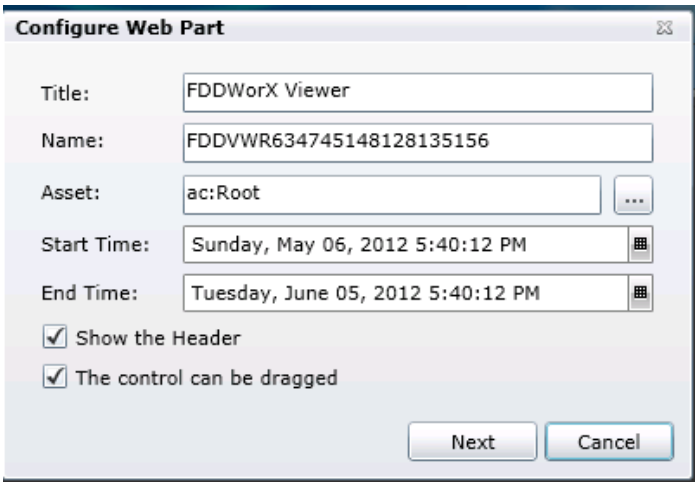


Figure 14.97 - Configure Web Part Window

- **Title** - This is the name for the Viewer itself.
- **Name** - This can be a specific name for the data that will shown within the viewer. When first launched, the FDDWorX Viewer will include default characters here.
- **Asset** - This will be filled with "ac:Root" by default, but you can either enter a new asset in the text field or click on the ellipsis [...] button to open the data browser to navigate to your AssetWorX configuration database.

- **Start Time** - This is the starting point for the FDDWorX data to be used within the viewer. You can enter the required information in the text entry field (in Day/Date/Time format) or click on the calendar button [ ] to set the required start time.
- **End Time** - This is the ending point for the FDDWorX data to be used within the viewer. You can enter the required information in the text entry field (in Day/Date/Time format) or click on the calendar button [ ] to set the required start time.
- **Show the Header** - Click on this checkbox to include the Viewer's Header.
- **The control can be dragged** - Click on this checkbox to enable dragging for this viewer.

Once you have completed updating these settings, click on the 'Next' button to proceed.

4. You can now proceed with **Configuration**.

14.6.3.2. Configuring the FDDWorX Viewer - Quick Start

The FDDWorX Viewer is a Silverlight control that is used to visualize the data collected by the FDDWorX server, including Faults, Fault Summaries, Asset Summaries and Diagnostic causes. There is a FDDWorX Viewer that can be used within PortalWorX-SL and a similar Web Part that can be used in PortalWorX SP (utilizing SharePoint).

In this Quick Start, we will configure a FDDWorX viewer to display a grid with faults. We will add a Row Detail to the grid so that when we expand the fault, we can display more information including a list of causes, a chart showing the current week’s distribution of faults, and asset details.

Creating a Grid to Display Faults

1. In your FDDWorX Viewer, right-click on "Viewer" and select "Add Grid", as shown below.

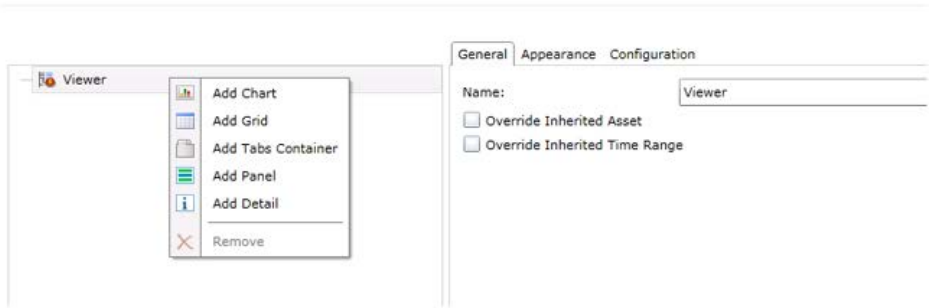


Figure 14.98 – Adding a Grid

2. Click your Grid in the tree and select the Data tab. Select "Faults" from the Data Query drop down menu

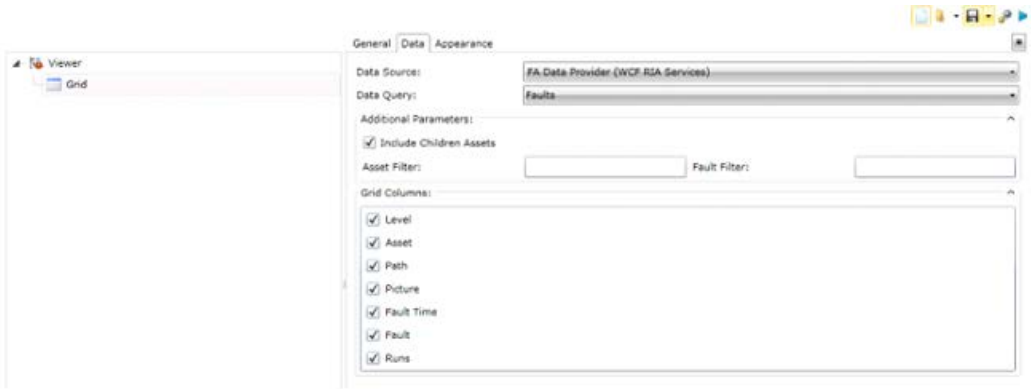


Figure 14.99 – Data Tab for Grid

Creating a Row Detail and Panel

1. Right-click the Grid in the tree and select "Add Row Detail". This will allow you to expand a row in your grid to retrieve more information.

2. Next, right-click the new Row Detail and select "Add Panel".

3. Click the Panel in the tree and make sure that the Layout Orientation specified on the Appearance tab is "Horizontal". This will ensure that if you add multiple features to this panel, they will be displayed side-by-side. If you prefer that features added to the panel be displayed top-to-bottom, you can select "Vertical" orientation.

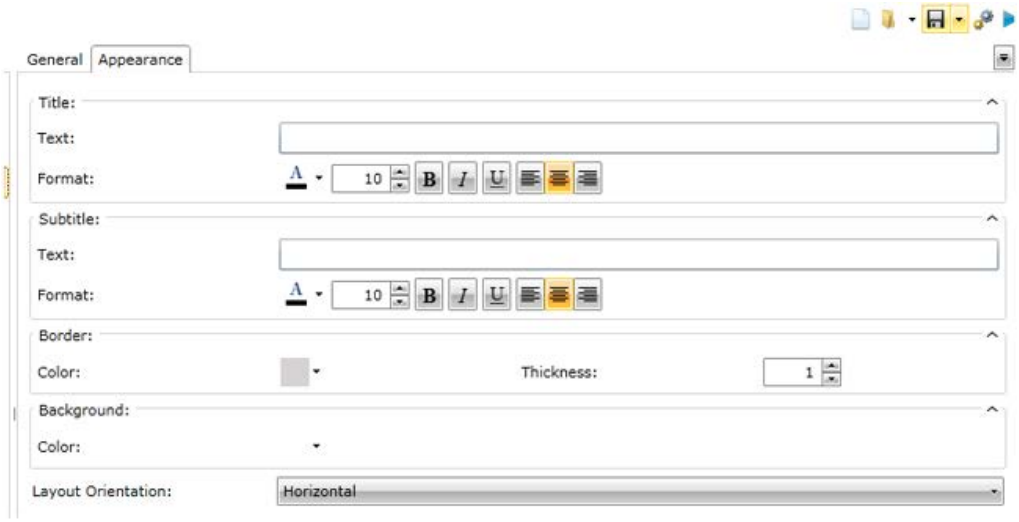


Figure 14.100 – Panel Appearance Tab

Creating a Tabs Container and Tabs

1. Right-click on the new Panel and select "Add Tabs Container".

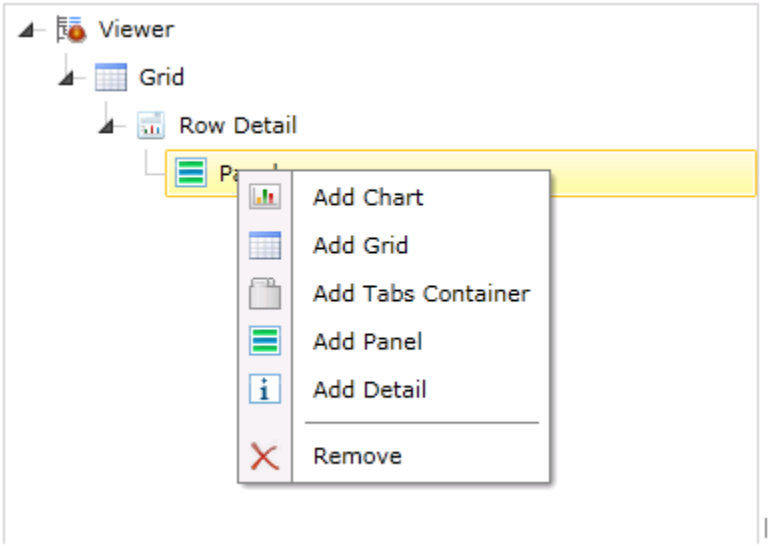


Figure 14.101 – Adding a Tabs Container

2. Right-click on the new Tabs Container and select "Add Tab".

3. Select the tab in the tree. On the Appearance Tab, enter “Distribution” for the Title text.

Creating a Chart and Series

1. Right-click the Tab and select "Add Chart". Select a Bar chart for Chart Type.

2. Next, right-click the chart and select "Add Series".

3. Click on the series in the tree. For this series, we will only want to look at the faults that have occurred this week, so first, check the Override Inherited Time Range check box. In the Start section, change the start to "Preset" and "First Day of Current Week".

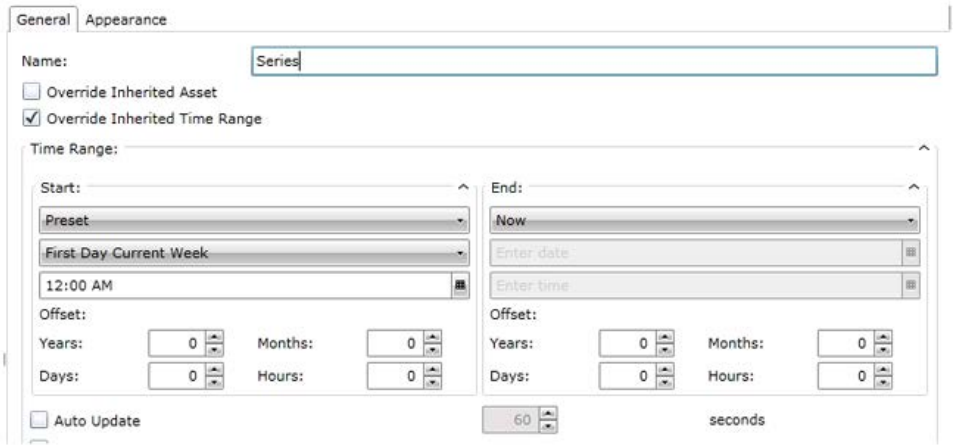


Figure 14.102 – Overriding the Time Range

4. On the Data tab, select "Distribution by asset" for the Data Query. Select "Day" as the Interval Type in the Additional Parameters section.

5. Check the "Format" check box and change the Format to MMM-dd.

6. Next, try creating another Tab for inclusion in the Tab Container. Name it “Causes” and add a Grid to it that uses the latest Causes data query.

Creating an Asset Detail

1. Next, we will add an Asset Detail to our panel to be shown next to our Tabs Container. Right-click on "Panel" and select "Add Asset Detail".

2. Select the Asset Detail in the tree and on the Data tab, choose the "Summary by asset Data" Query.

   When you are finished, your tree should look similar to the following figure.

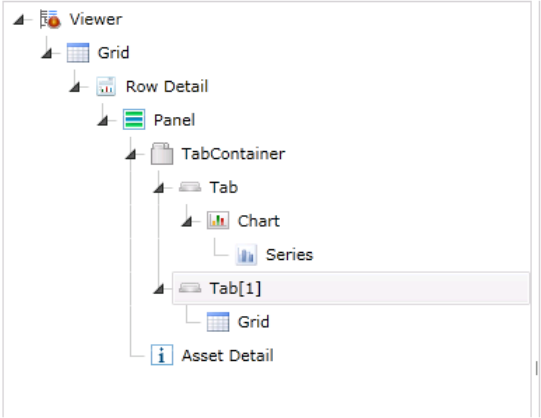


Figure 14.103 – Final Configuration

Make sure to click the "Save" button at the top of the viewer to save this configuration. Clicking the blue play button at the top right of the viewer will switch the viewer to Runtime mode. You won't see any results there now because the viewer is configured to use an Inherited Asset. This means the asset that is passed to the queries in the viewer is determined when you select an asset in the tree that has a **Load FDDWorX Data** command that was defined for it in the Workbench SL.

To verify that your configuration is working correctly, you can click the Viewer in the tree and check the "Override Inherited Asset" check box and select some specific asset for which faults have occurred. If you switch to Runtime, you will see a grid of these faults. If you click the plus sign [+] at the beginning of any row, you will see the panel that we defined.

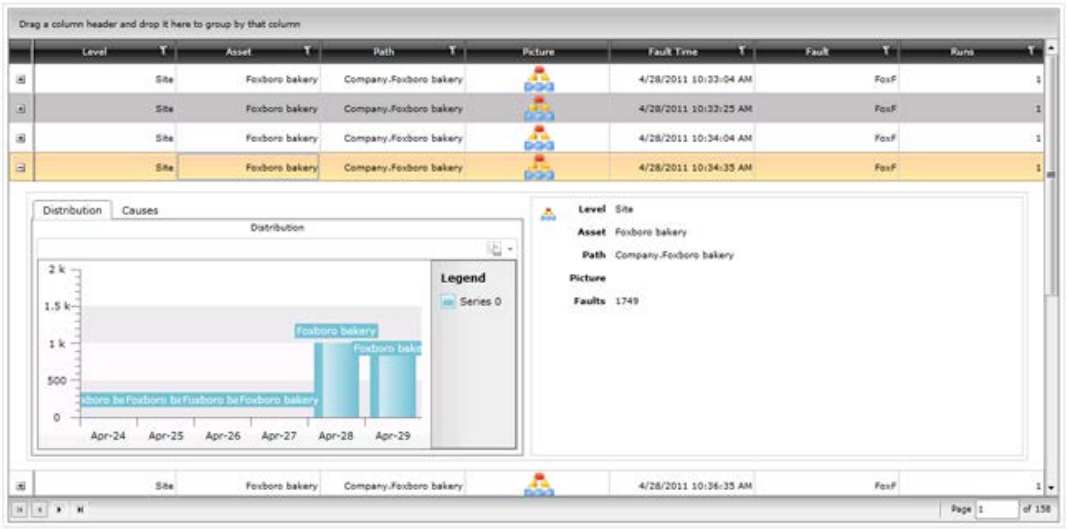


Figure 14.104 – FDDWorX in Runtime Mode

14.6.4. GridWorX64 Viewer

14.6.4.1. Adding a GridWorX64 Viewer in PortalWorX-SL

To Add a GridWorX64 Viewer in PortalWorX-SL

1. First, launch PortalWorX-SL via the **Start Menu → All Programs → ICONICS → PortalWorX-SL**. You will first see the Windows Security login in order to connect to PortalWorX SL, as shown below. Enter your User Name and Password, then click on 'OK' to proceed.

Figure 14.105 - Windows Security Login

2. PortalWorX-SL will now open in your selected Web browser, as shown in the following figure. You can launch a GridWorX64 Viewer in multiple ways. You can select it within the GENESIS64 Controls in the Home Ribbon OR you can select it within the main window in the lower right of the PortalWorX SL browser window OR you can select it from the list within the Toolbox in the left navigation box.

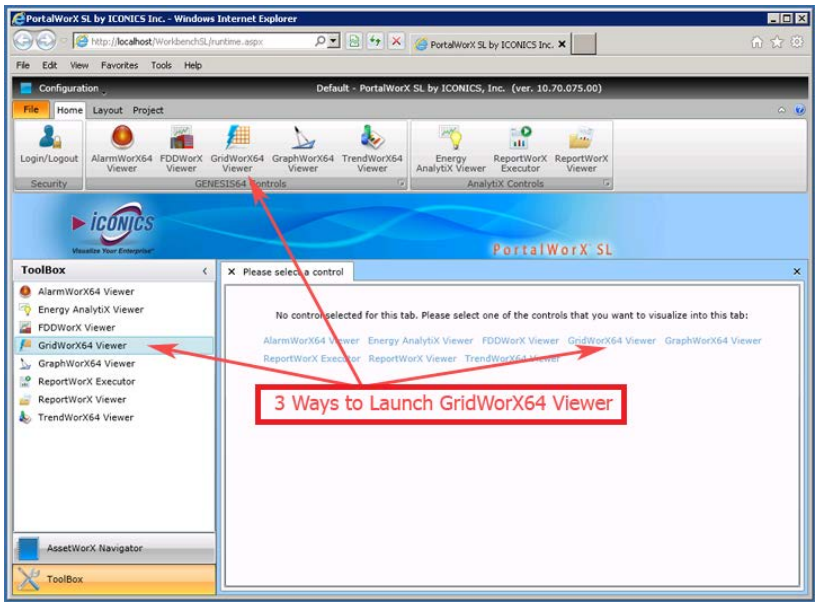


Figure 14.106 - Options for Launching GridWorX64 Viewer in PortalWorX SL

Once you have selected a GridWorX64 Viewer, it will initially connect to its configuration database (which can be set up via the AssetWorX provider in Workbench SL).

3. The following "Configure Web Part" window will then appear. You can fill out the settings or leave them as they are.

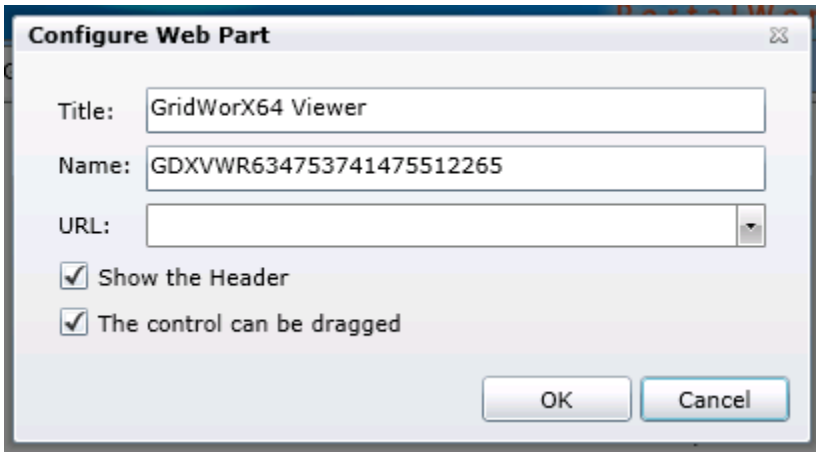


Figure 14.107 - Configure Web Part Window

- **Title** - This is the name for the Viewer itself.
- **Name** - This can be a specific name for the data that will shown within the viewer. When first launched, the GridWorX64 Viewer will include default characters here.
- **URL** - Enter a file name for GridWorX64 Silverlight (.gdxxs) file to display in the viewer.

- **Show the Header** - Click on this checkbox to include the Viewer's Header.
- **The control can be dragged** - Click on this checkbox to enable dragging for this viewer.

Once you have completed updating these settings, click on the 'OK' button to proceed.

4. You can now proceed with **Configuration**.

14.6.4.2. GridWorX64 Viewer Configuration (PortalWorX-SL)

ICONICS' GridWorX64 Viewer, shown below, allows you to visualize database data in the form of OPC-DA or through DataGrid Control. You can perform basic read and write actions along with stored procedures for connected databases. This application works similar to Data Mining OPC Server in GENESIS32.

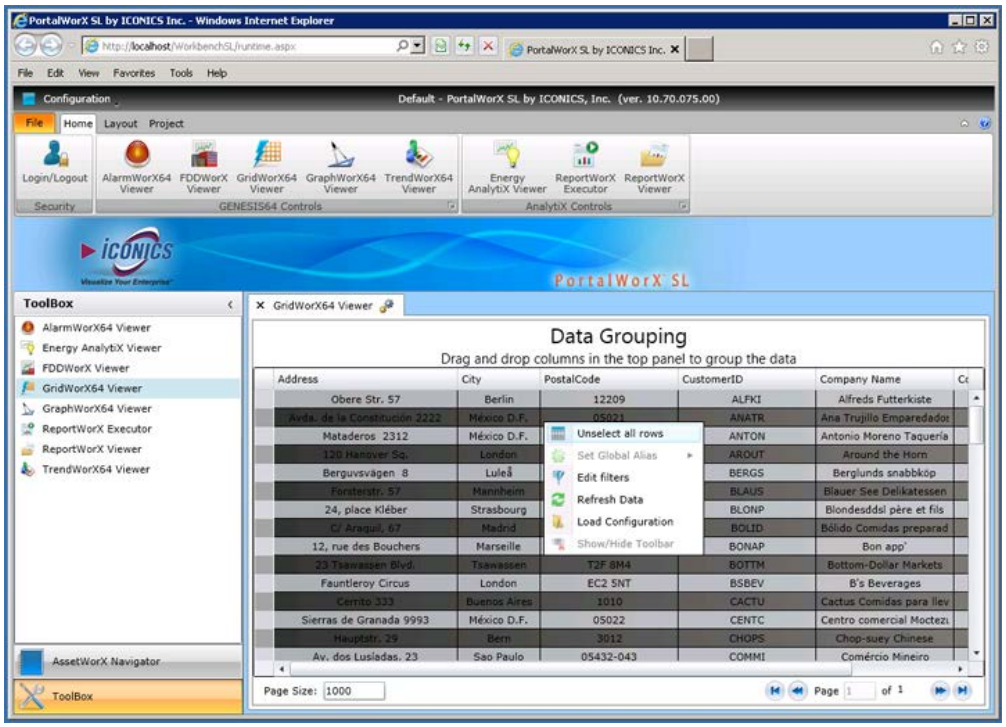


Figure 14.108 - GridWorX64 Viewer in PortalWorX-SL

When you right-click inside the GridWorX64 Viewer, you are able to select from several options, including the following:

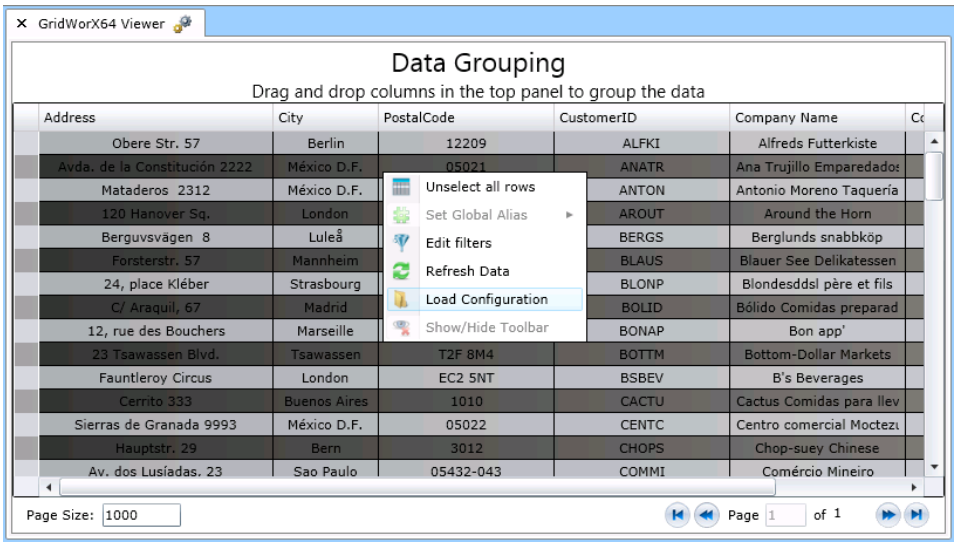


Figure 14.109 - Right-Click Options in GridWorX64 Viewer

- **Unselect all rows** - If you have previously selected any rows within the viewer, selecting this option will deselect them.
- **Set Global Alias** -
- **Edit filters** - Clicking this option opens the "Select a filter from the list" window, shown below.

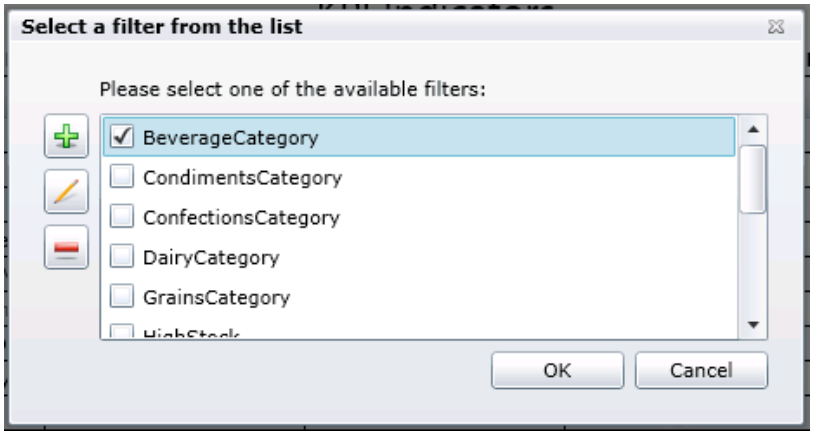


Figure 14.110 - Select a filter from the List Window

- **Refresh Data** - If enabled, this option allows you to update the alarm viewer within the viewer so as to view more recent items.
- **Load Configuration** - Similar to how you first loaded the existing GridWorX64 Silverlight file (.awxxs), you can enter a new file for the viewer to display.

- **Show/Hide Toolbar** - Clicking on this option opens a toolbar at the top left of the viewer containing these same viewer options. Click on the button to close the toolbar.

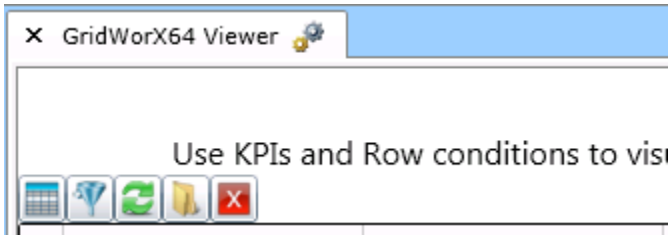


Figure 14.111 - GridWorX64 Viewer Options Toolbar

14.6.5. GraphWorX64 Viewer

14.6.5.1. Adding a GraphWorX64 Viewer in PortalWorX-SL

To Add a GraphWorX64 Viewer in PortalWorX-SL

1. First, launch PortalWorX-SL via the **Start Menu → All Programs → ICONICS → PortalWorX-SL**. You will first see the Windows Security login in order to connect to PortalWorX SL, as shown below. Enter your User Name and Password, then click on 'OK' to proceed.

Figure 14.112 - Windows Security Login

2. PortalWorX-SL will now open in your selected Web browser, as shown below. You can launch a GraphWorX64 Viewer in multiple ways. You can select it within the GENESIS64 Controls in the Home Ribbon OR you can select it within the main window in the lower right of the PortalWorX SL browser window OR you can select it from the list within the Toolbox in the left navigation box.

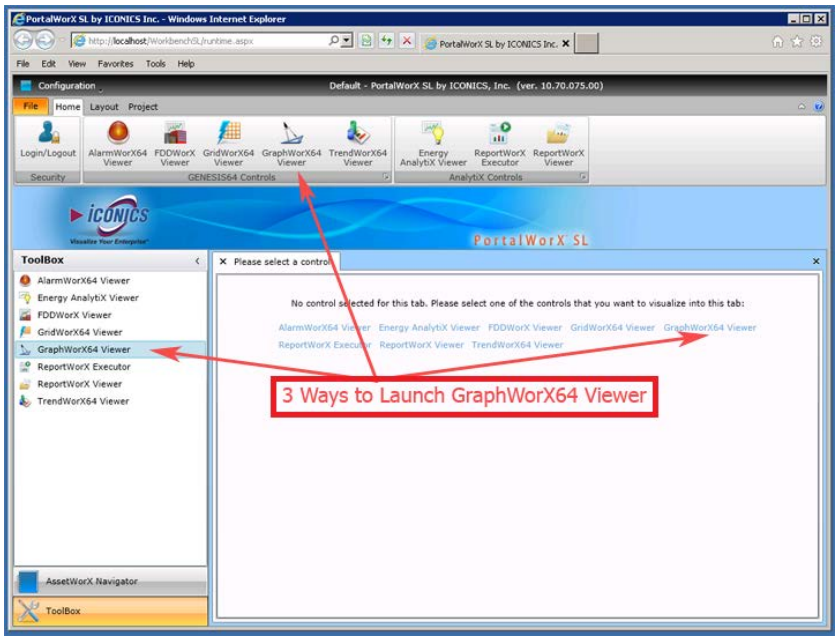


Figure 14.113 - Options for Launching GraphWorX64 Viewer in PortalWorX SL

Once you have selected a GraphWorX64 Viewer, it will initially connect to its configuration database (which can be set up via the AssetWorX provider in Workbench SL).

3. The following "Configure Web Part" window will then appear. You can fill out the settings or leave them as they are.

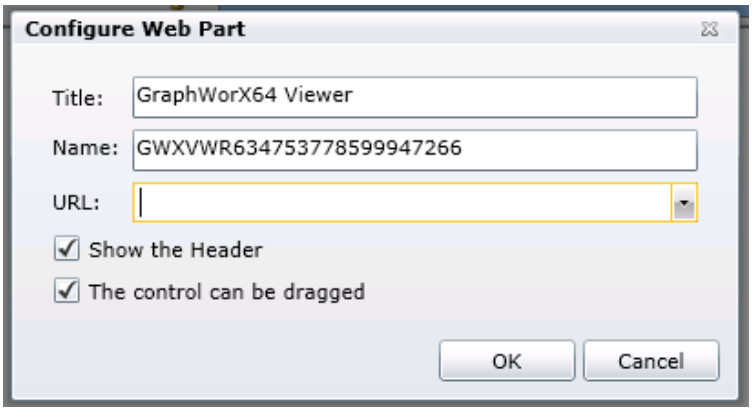


Figure 14.114 - Configure Web Part Window

- **Title** - This is the name for the Viewer itself.

- **Name** - This can be a specific name for the data that will shown within the viewer. When first launched, the GraphWorX64 Viewer will include default characters here.
- **URL** - Enter a file name for a GraphWorX64 Silverlight (.gdfxs) file to display in the viewer.
- **Show the Header** - Click on this checkbox to include the Viewer's Header.
- **The control can be dragged** - Click on this checkbox to enable dragging for this viewer.

Once you have completed updating these settings, click on the 'OK' button to proceed.

4. You can now proceed with **Configuration**.

14.6.5.2. GraphWorX64 Viewer Configuration (PortalWorX-SL)

ICONICS' GraphWorX64 Viewer, shown below, allows you to visualize important operations data in an interactive, real-time display via a portal.

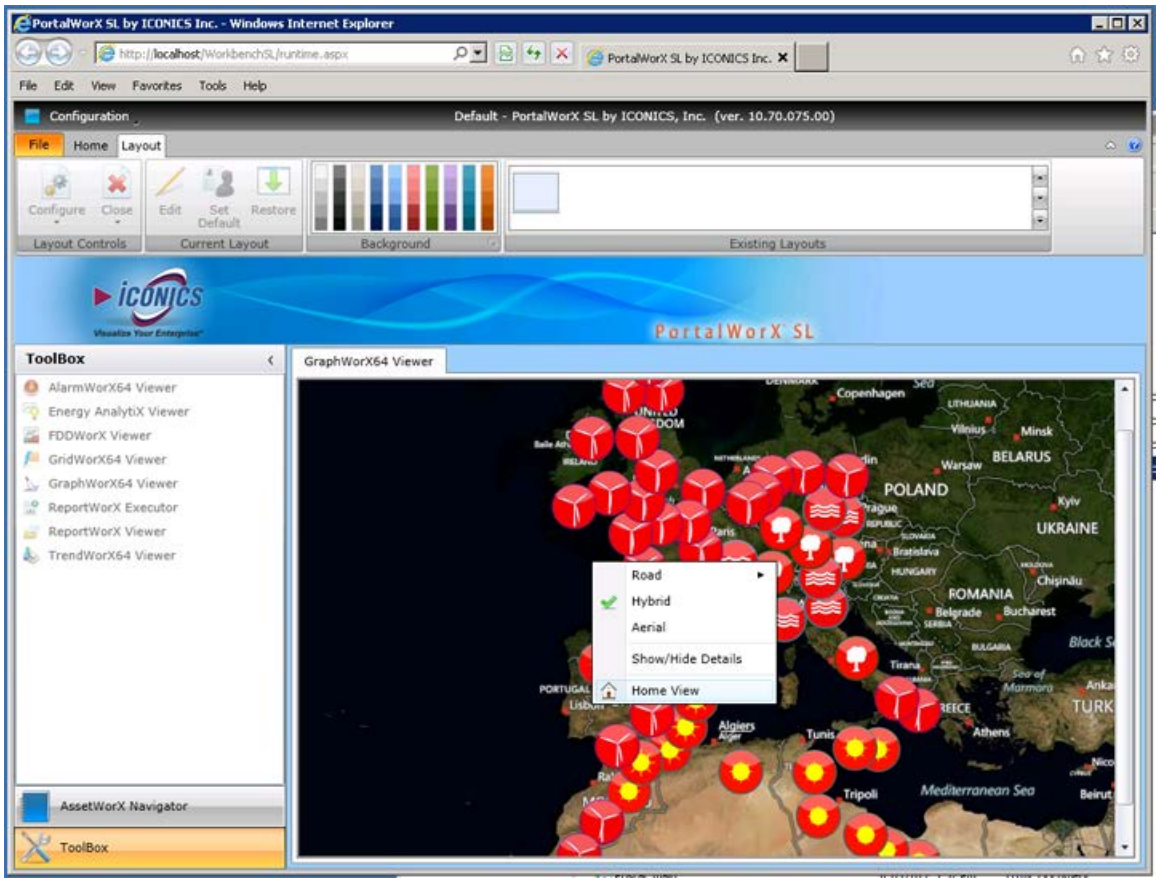


Figure 14.115 - GraphWorX64 Viewer in PortalWorX-SL

When you right-click inside the GraphWorX64 Viewer, you are able to select from the options that were originally set in GraphWorX64 and then saved as part of that specific GraphWorX64 Silverlight display. These may be different from display to display. For instance, in our example below, the display uses a map as part of the data visualization. Right-clicking within the window allows users to configure options specific to a map display such as Road, Hybrid, Aerial, Show/Hide Details, etc.

Figure 14.116 - Right-Click Options in GraphWorX64 Viewer - Example 1

In a different GraphWorX64 Silverlight display file, one in which the data is more chart-oriented, right-clicking the window brings up an entirely different set of options, as shown below.

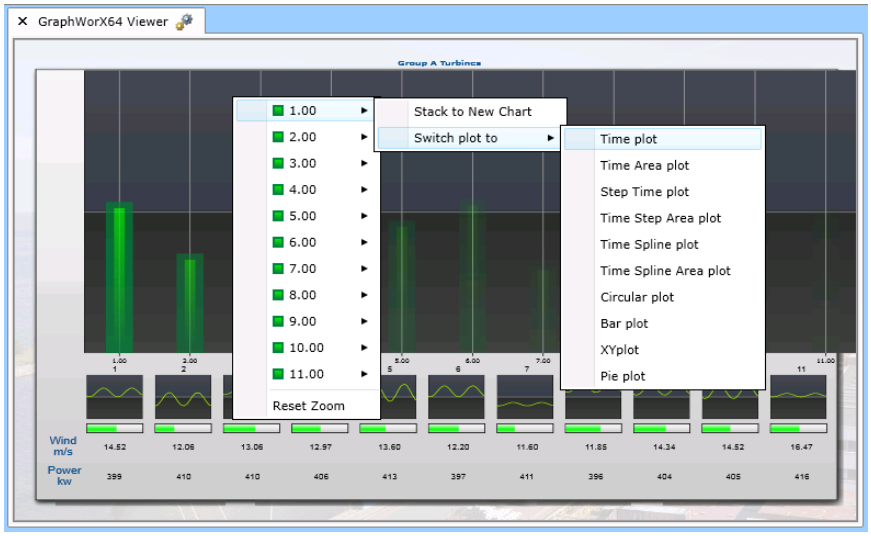


Figure 14.117 - Right-Click Options in GraphWorX64 Viewer - Example 2

Of course, in most cases, **left**-clicking within any GraphWorX64 display in Runtime is meant to allow the user to directly interact with the visual elements within that display.

14.6.6. Report Executor

14.6.6.1. Adding a ReportWorX Executor in PortalWorX-SL

To Add a ReportWorX Executor in PortalWorX-SL

1. First, launch PortalWorX-SL via the **Start Menu → All Programs → ICONICS → PortalWorX-SL**. You will first see the Windows Security login in order to connect to PortalWorX SL, as shown below. Enter your User Name and Password, then click on 'OK' to proceed.

Figure 14.118 - Windows Security Login

2. PortalWorX-SL will now open in your selected Web browser, as shown below. You can launch a ReportWorX Executor in multiple ways. You can select it within the GENESIS64 Controls in the Home Ribbon OR you can select it within the main window in the lower right of the PortalWorX SL browser window OR you can select it from the list within the Toolbox in the left navigation box.

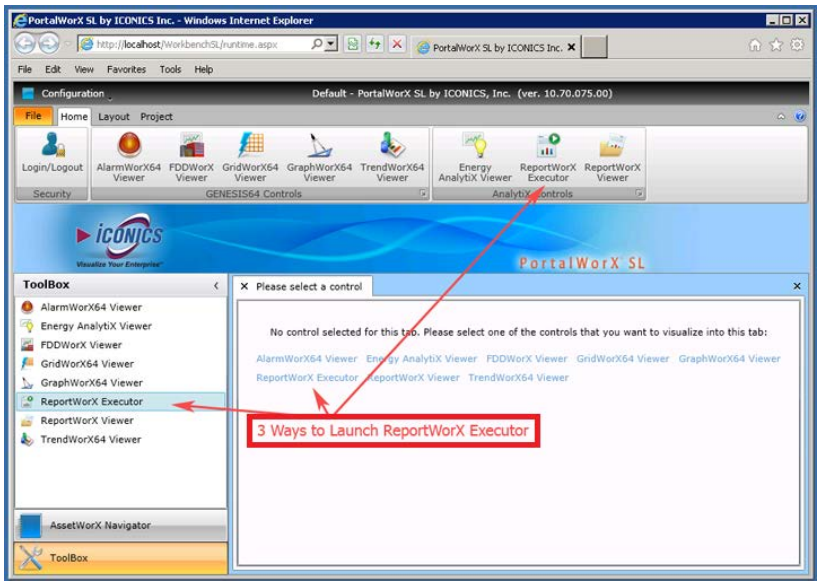


Figure 14.119 - Options for Launching ReportWorX Executor in PortalWorX SL

Once you have selected a ReportWorX Executor, it will initially connect to its configuration database (which can be set up via the ReportWorX Configurator, a component loaded from an ICONICS BizViz installation).

3. The following "Configure Web Part" window will then appear. You can fill out the settings or leave them as they are.

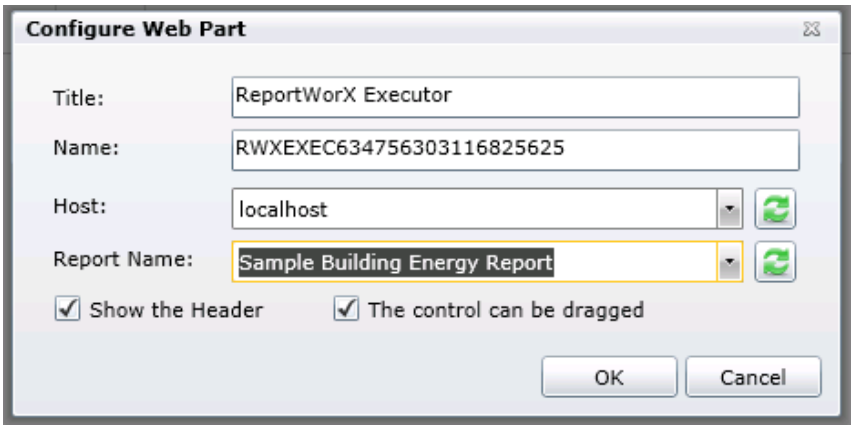


Figure 14.120 - Configure Web Part Window

- **Title** - This is the name for the Viewer itself.
- **Name** - This can be a specific name for the data that will shown within the viewer. When first launched, the AlarmWorX64 Viewer will include default characters here.
- **Host** - The machine name where the reports are located. This field may be pre-filled by the current machine name, but you can use the pull-down menu to select an alternative host.
- **Report Name** - This should be pre-filled by the reports associated to the selected Host. Use the pull-down menu to select your desired report.
- **Show the Header** - Click on this checkbox to include the Viewer's Header.
- **The control can be dragged** - Click on this checkbox to enable dragging for this viewer.

Once you have completed updating these settings, click on the 'OK' button to proceed.

4. You can now proceed with **Configuration.**

14.6.6.2. ReportWorX Executor Configuration (PortalWorX-SL)

ICONICS' ReportWorX Executor, shown below, allows you to execute reports directly within your browser. Its standalone mode allows you to specify a default report for execution.

The advantage of connecting the Report Executor to the Report Navigator is that it allows users to dynamically switch between report folders, either by right-clicking on a folder or report within the Report Navigator or clicking on the configuration icon (the gears) to the right of the viewer name.

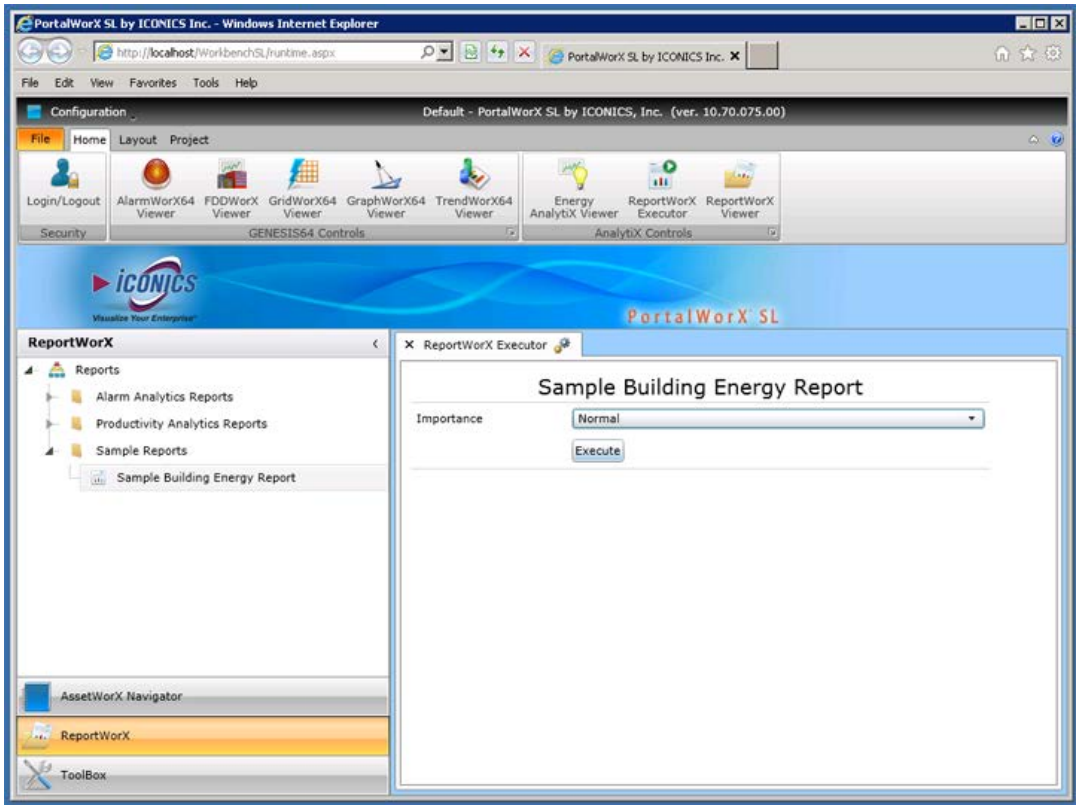


Figure 14.121 - ReportWorX Executor in PortalWorX-SL

To activate the Report Navigator, click on 'Project' to open the Project Ribbon. Next, click on 'Navigator' in the Show/Hide section of the ribbon, then click on 'Reports'. If you have previously connected to a server containing a ReportWorX database (with the reporting service currently running) via the Report Server button (via the same Project ribbon), you'll see the ReportWorX tree explorer appear with 'Reports' listed as the top item, as shown in the following image.

You can use the Report Navigator to load reports directly into an existing or new viewer window within PortalWorX-SL. Just right-click on an element in the Reports tree navigator and choose from the options that appear. In the example below, we are loading the 'Sample Building Energy Report' within the existing ReportWorX Executor window.

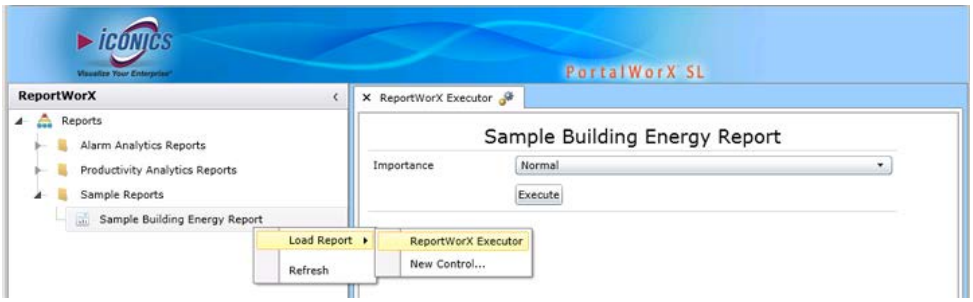


Figure 14.122 - Loading a Report through the Report Navigator into the ReportWorX Executor in PortalWorX-SL

Once the report has been loaded, you'll be able to set additional properties according to how each report was set up in the ReportWorX Configurator. The following example shows a report that includes an interval, which allows the user to set specific start and end times as well as the "value of 'n' for multiplied interval".

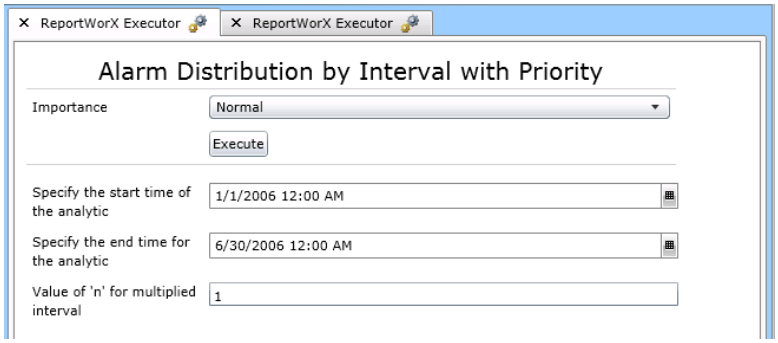


Figure 14.123 - A ReportWorX Executor Example

In contrast, the following report requires the user to only set the 'Importance'.

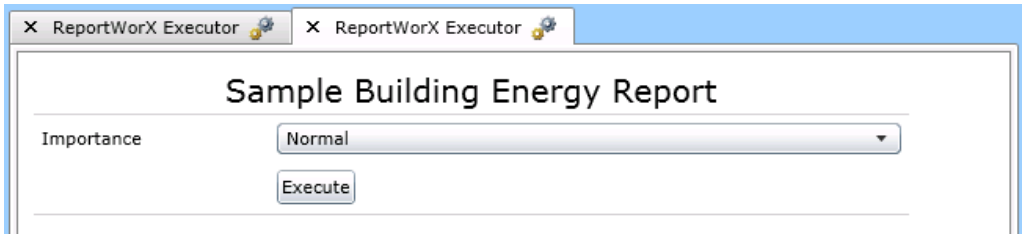


Figure 14.124 - An Additional ReportWorX Executor Example

Click on the "Execute" button to start the process within PortalWorX-SL.

14.6.7. ReportWorX Viewer

14.6.7.1. Adding a ReportWorX Viewer in PortalWorX-SL

To Add a ReportWorX Viewer in PortalWorX-SL

1. First, launch PortalWorX-SL via the **Start Menu → All Programs → ICONICS → PortalWorX-SL**. You will first see the Windows Security login in order to connect to PortalWorX SL, as shown below. Enter your User Name and Password, then click on 'OK' to proceed.

Figure 14.125 - Windows Security Login

2. PortalWorX-SL will now open in your selected Web browser, as shown below. You can launch a ReportWorX Viewer in multiple ways. You can select it within the GENESIS64 Controls in the Home Ribbon OR you can select it within the main window in the lower right of the PortalWorX SL browser window OR you can select it from the list within the Toolbox in the left navigation box.

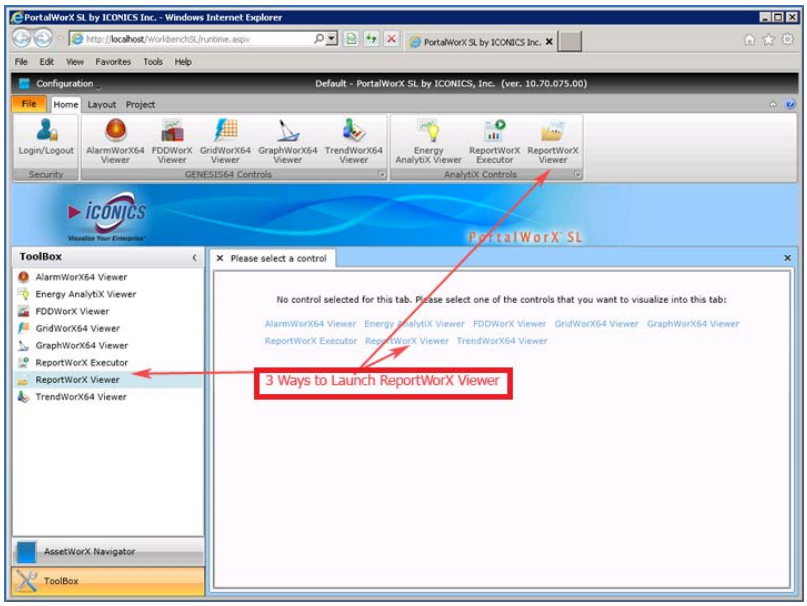


Figure 14.126 - Options for Launching ReportWorX Viewer in PortalWorX SL

Once you have selected a ReportWorX Viewer, it will initially connect to its configuration database (which can be set up via the ReportWorX Configurator, a component loaded from an ICONICS BizViz installation).

3. The following "Configure Web Part" window will then appear. You can fill out the settings or leave them as they are.

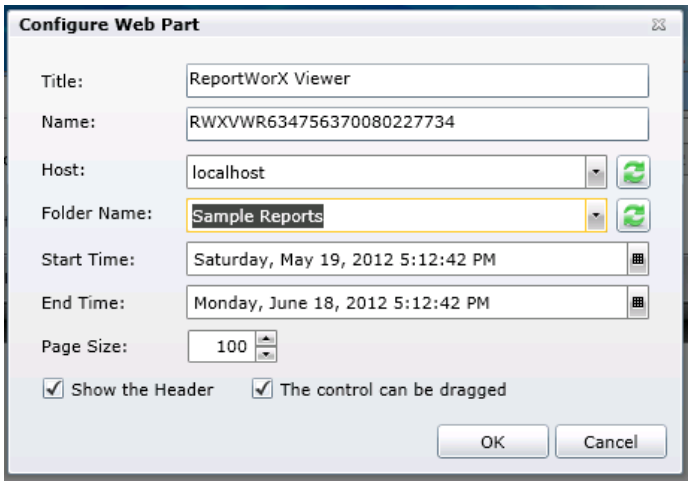


Figure 14.127 - Configure Web Part Window

- **Title** - This is the name for the Viewer itself.
- **Name** - This can be a specific name for the data that will shown within the viewer. When first launched, the AlarmWorX64 Viewer will include default characters here.
- **Host** - The machine name where the reports are located. This field may be pre-filled by the current machine name, but you can use the pull-down menu to select an alternative host.
- **Folder Name** - This should be pre-filled by the report folders associated to the selected Host. Use the pull-down menu to select your desired folder.
- **Start Time** - Select a start time for a range of data to be reported. Click on the calendar button [ ] to open the calendar tool to select a day, date and time, as needed.
- **End Time** - Select an end time for a range of data to be reported. Click on the calendar button [ ] to open the calendar tool to select a day, date and time, as needed.
- **Page Size** - Use the text field (and/or the up and down arrows) to enter the number of executed reports to display on the same page.
- **Show the Header** - Click on this checkbox to include the Viewer's Header.
- **The control can be dragged** - Click on this checkbox to enable dragging for this viewer.

Once you have completed updating these settings, click on the 'OK' button to proceed.

4. You can now proceed with **Configuration**.

14.6.7.2. ReportWorX Viewer Configuration (PortalWorX-SL)

ICONICS' ReportWorX Viewer, shown below, allows you to quickly access recently executed ReportWorX reports. It allows you to visualize reports in Excel, PDF or HTML format, based on availability.

The advantage of connecting the Report Viewer to the Report Navigator is that it allows users to dynamically switch between report folders, either by right-clicking on a folder or report within the Report Navigator or clicking on the configuration icon (the gears) to the right of the viewer name.

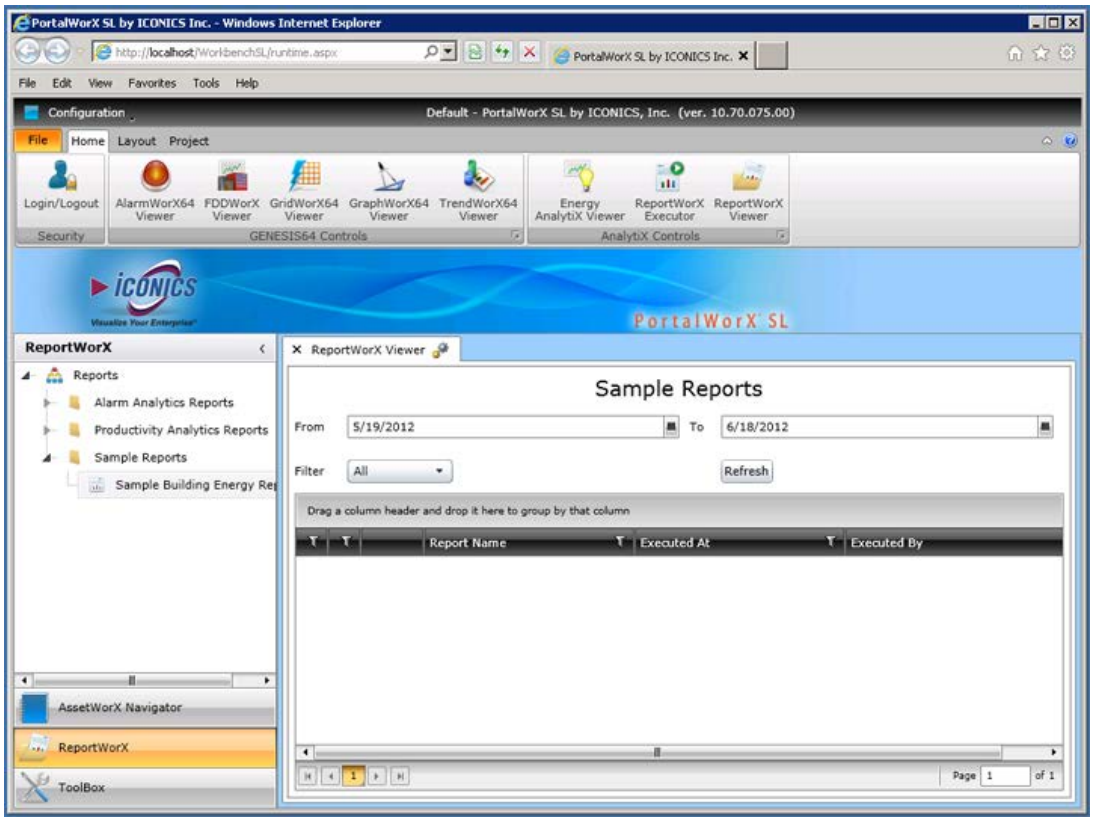


Figure 14.128 - ReportWorX Viewer in PortalWorX-SL

To activate the Report Navigator, click on 'Project' to open the Project Ribbon. Next, click on 'Navigator' in the Show/Hide section of the ribbon, then click on 'Reports'. If you have previously connected to a server containing a ReportWorX database (with the reporting service currently running) via the Report Server button (via the same Project ribbon), you'll see the ReportWorX tree explorer appear with 'Reports' listed as the top item, as shown below.

You can use the Report Navigator to load reports directly into an existing or new viewer window within PortalWorX-SL. Just right-click on an element in the Reports tree navigator and choose from the options that appear. In the example below, we are loading the 'Sample Building Energy Report' within the existing ReportWorX Viewer window.

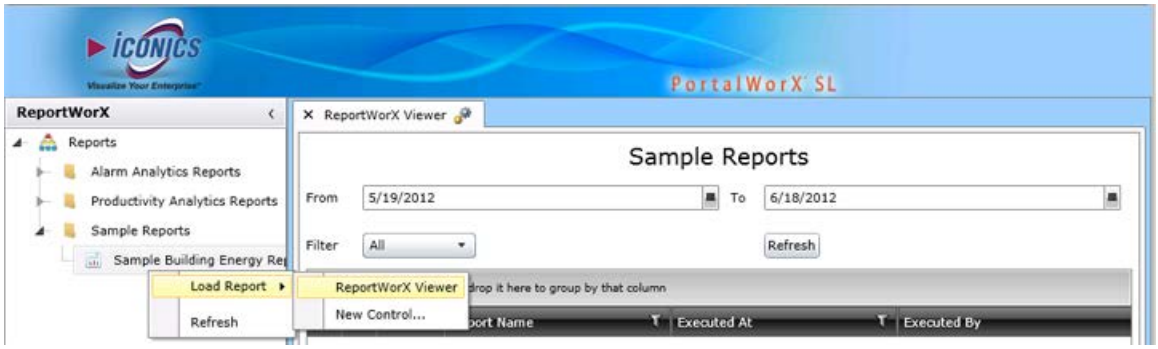


Figure 14.129 - Loading a Report through the Report Navigator into the ReportWorX Viewer in PortalWorX-SL

- **From/To** - Enter dates or click on the calendar button [ ] to select a new start ("From") or end ("To") date to find reports within your desired range.
- **Filter** - Use the pull-down to select from All, Succeeded, With Errors, Failed or Cancelled.
- **Refresh** - Click on the Refresh button to load the resulting reports from your settings.

14.6.8. TrendWorX64 Viewer

14.6.8.1. Adding a TrendWorX64 Viewer in PortalWorX-SL

Open the PortalWorX-SL application by navigating to **Start** → **All Programs** → **ICONICS** → **PortalWorX-SL**. Enter your credentials if a login dialog box appears.

Once in PortalWorX-SL, you can add a TrendWorX64 Viewer by clicking **TrendWorX64 Viewer** in the ***Please select a control tab*** within the viewer/executor window or by clicking the **TrendWorX64 Viewer** button in the GENESIS64 Controls group on the **Home** ribbon.

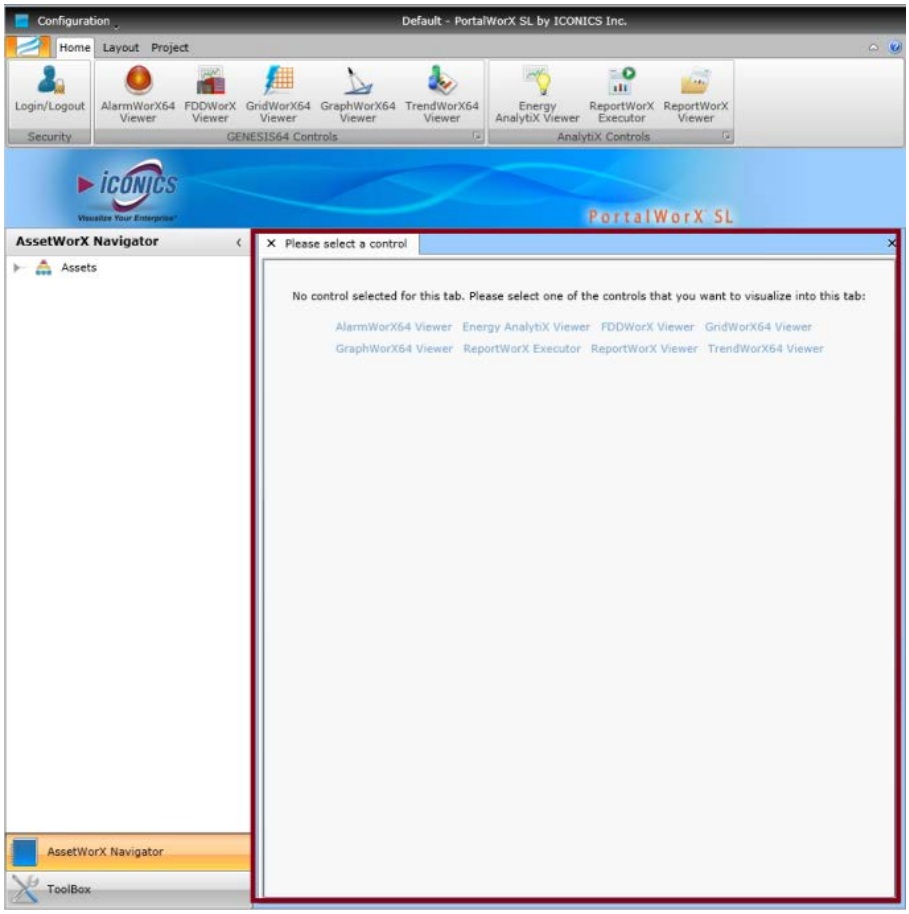


Figure 14.130 - Selecting a Viewer in PortalWorX-SL

When first added to the page, the TrendWorX64 Silverlight Web Part prompts you to select a TrendWorX64 Silverlight (.twxxs) file in the **Configure Web Part** dialog box, as shown below.

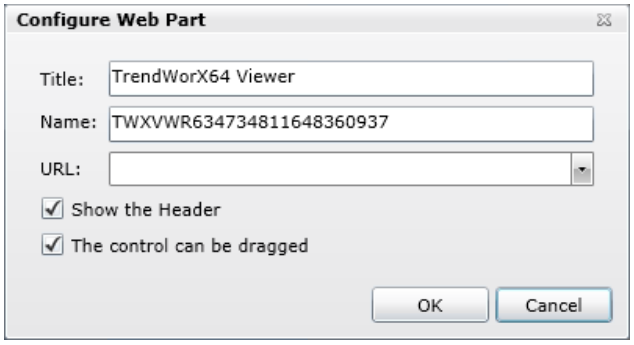


Figure 14.131 - "Configure Web Part" Selection

Enter the URL path corresponding to the location where you have placed a TrendWorX64 Silverlight display file in the **URL** box and click **OK**.

Info

Note: By default, the PortalWorX "localhost" represents the location where you have placed the GENESIS64 installation on your machine. For example, if you have saved the file "ArmRotation.twxxs" in the following folder:

C:\Program Files\ICONICS\GENESIS64\WebSites\PubDisplay

...you can enter the following URL in the **Configure Web Part** dialog box:

http://localhost/GENESIS64/WebSites/PubDisplay/ArmRotation.twxxs

It may take a few moments for the trend file to load. In this case, a status window such as the one below will appear.

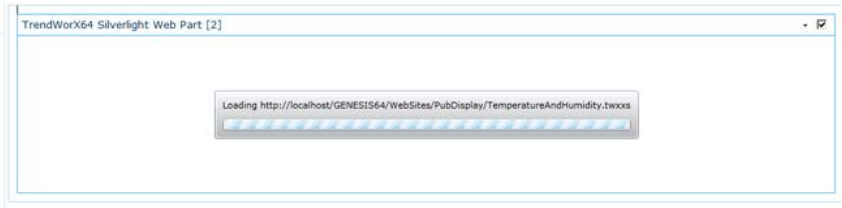


Figure 14.132 - Loading the TrendWorX64 Silverlight Display File

Once the file has completed loading, you will then see your selected trend file displayed in the TrendWorX64 Silverlight Web Part, as shown in the following figure.

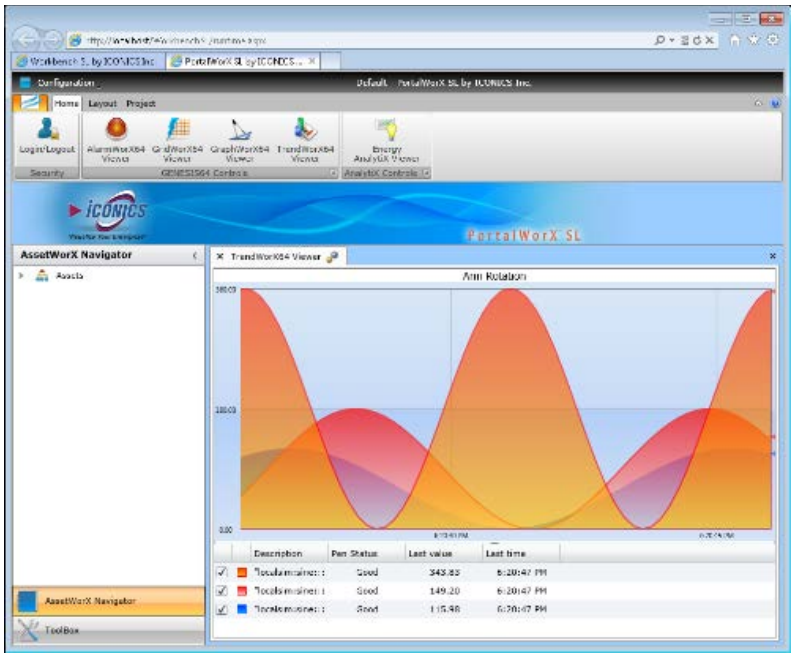


Figure 14.133 - TrendWorX64 Silverlight Web Part with Loaded TWXXS File

14.6.8.2. TrendWorX Viewer Configuration (PortalWorX-SL)

To edit the properties of the TrendWorX Silverlight Web Part, click on the Configure button to the right of the title on the control tab. You can also select the **Configure** command in the Layout Controls group on the **Layout** ribbon and choose the control that you wish to edit.

The **Configure Web Part** dialog box appears:

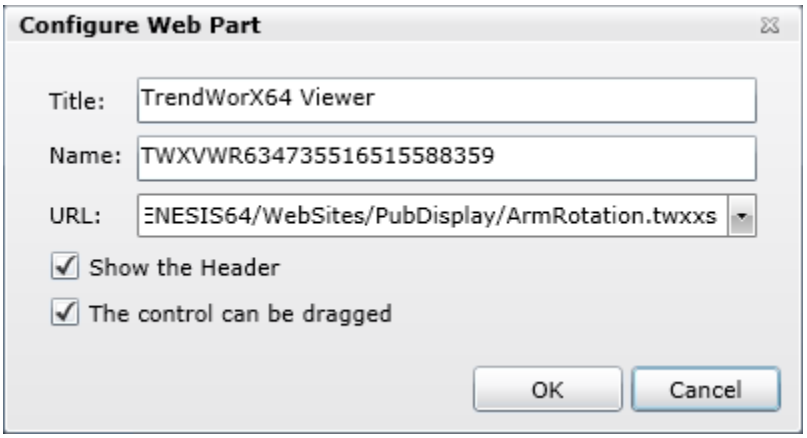


Figure 14.134 - Editing Control Properties with "Configure Web Part" Dialog Box

This dialog box allows you to edit the following properties of the TrendWorX64 Viewer control:

- **Title:** Enter the title of the control that will appear on the tab within the viewer/executor window in PortalWorX.
- **Name:** Enter the name that serves as the identifier for the control. Each control must have a unique name.
- **URL:** Enter the URL path corresponding to the location where you have placed a TrendWorX64 Silverlight display file in the **URL** box and click **OK**.

Info

Note: By default, the PortalWorX "localhost" represents the location where you have placed the GENESIS64 installation on your machine. For example, if you have saved the file "ArmRotation.twxxs" in the following folder:

C:\Program Files\ICONICS\GENESIS64\WebSites\PubDisplay

...you can enter the following URL in the **Configure Web Part** dialog box:

http://localhost/GENESIS64/WebSites/PubDisplay/ArmRotation.twxxs

- **Show the Header:** Enable this check box to display a tab above the chart display, which shows the name of the control.
- **The control can be dragged:** Enable this check box to allow moving of this control within the viewer/executor window.

Additional Options in the TrendWorX64 Silverlight Viewer

Once you have successfully loaded your TrendWorX Silverlight (.twxxs) file, you will be able to interact with the Web Part in several ways. For instance, you can show or hide a selected trend color pen by clicking on the check box in the **Visibility** column on the far left of the legend grid beneath the main trend display.

When you double-click inside the TrendWorX64 Silverlight Web Part, the runtime toolbar appears. In addition, when you right-click inside the TrendWorX64 Silverlight Web Part, you are able to select from several other options:

- If you have zoomed into the trend display, you can return to the original view setting by clicking on **Reset Zoom**.

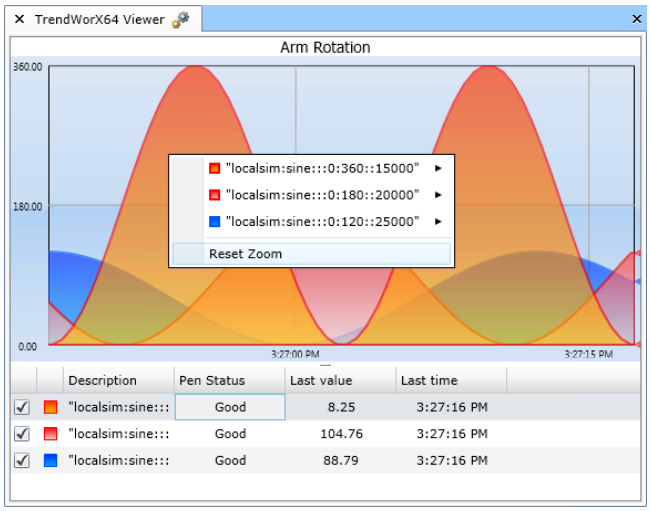


Figure 14.135 - Returning to Original Zoom Level

- You can also click on a pen color (which also lists the data source description) and then on **Stack to New Chart** to move that particular pen onto its own separate display within the control, as shown below. Once additional charts are created, you can move pens to a new chart or one of the other existing charts.

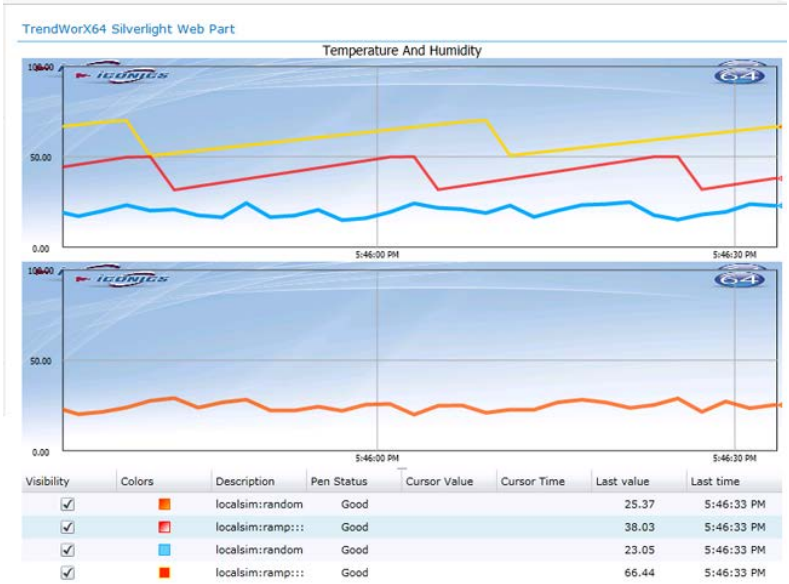


Figure 14.136 - Selected Pen Color Stacked to a New Chart

- Finally, you can select **Switch plot to** in order to use a different plot from the one originally loaded (where applicable), including: Time plot, Time Area plot, Step Time plot, Time Step Area plot, Time Spline plot, Time Spline Area plot, Circular plot, Bar plot, Histogram plot, XY plot, and Pie plot.

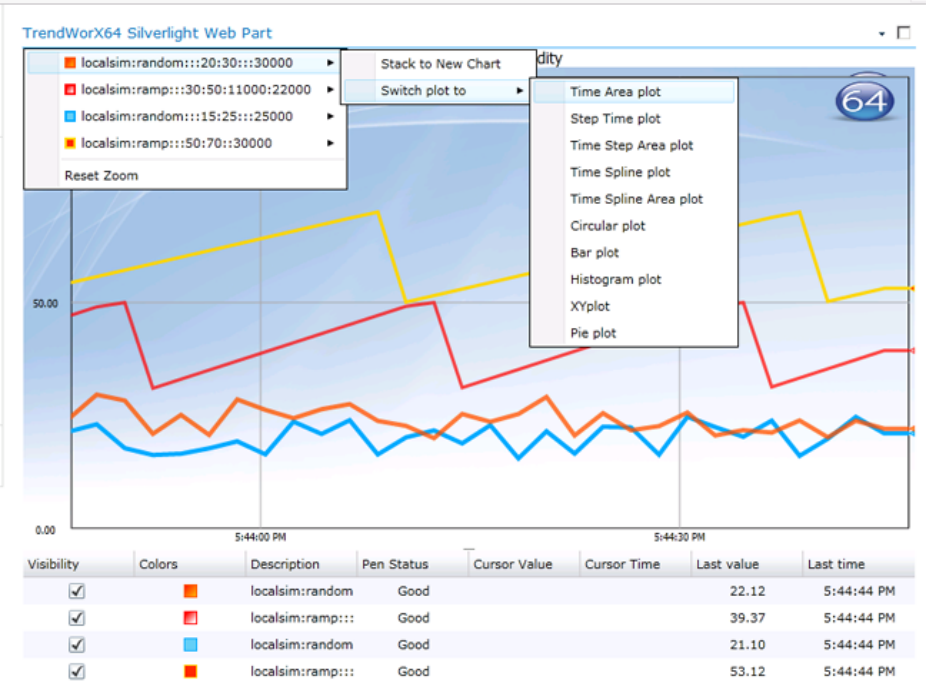


Figure 14.137 - Switching to a New Type of Plot

Lab: PortalWorX-SL L14

14.1. Lab Overview

We've created the asset tree, configured and applied equipment classes and added a command to an asset. PortalWorX-SL is where all the pieces come together. Using the delivered Web Parts, we will create a Runtime dashboard to utilize all the aforementioned elements that we have developed. Let's move on.

Estimated time to complete this lab: 45 minutes

14.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Saving and Publishing the GraphWorX64 displays.
- Publish a TrendWorX64 Viewer.
- Publish an AlarmWorX64 Viewer.
- Create an Internet portal.

14.1.2. Support Files

You will need the following file(s) to complete this lab. These files should already reside in your **C:\Training** folder.

- icTonicsTankMonitor.gdfx
- icTonicsTrends.gdfx
- icTonicsTrendViewer.twxx
- icTonicsAlarmViewer.awxx

14.2. Preparing Existing Files for Use in PortalWorX-SL

Additional features added to GENESIS64 greatly improve the experience of migrating existing GraphWorX64 displays, TrendWorX64 viewers and AlarmWorX64 viewers into a portal that is viewable in a Web browser. Let's see how this works.

14.2.1. Preparing Files for Use in PortalWorX-SL

GraphWorX64 displays and AlarmWorX64/TrendWorX64 viewers need to be saved as Silverlight versions and stored in the IIS virtual path, PubDisplay, in order to be used in PortalWorX-SL. The intent of this lab is to demonstrate how this is done. Let's get started.

14.2.2. Saving a Display as a Silverlight Version

We will save both the **icTonicsTankMonitor** and **icTonicsTrends** displays as Silverlight display files.

1. Load the **C:\Training\icTonicsTankMonitor.gdfx** display in **GraphWorX64**.
2. From within the **icTonicsTankMonitor.gdfx** display, select the **AlarmWorX64 Viewer control.**
3. Click on the **Save** icon in the ribbon.
4. **Important**: Save the **AlarmWorX64** viewer file in the folder **C:\Program Files\ICONICS\GENESIS64\WebSites\PubDisplay** with the **Save as type**: **AlarmWorX64 Silverlight files (*.awxxs)**.

   Note: Why is saving to the PubDisplay folder important? Silverlight files are designed to be viewed in a Web browser. The PubDisplay folder is a Virtual Path on the local IIS (Internet Information Server). The URL for viewing our files is http://hostname/pubdisplay/filename. This will make more sense as we proceed.
5. Name the file **icTonicsAlarmViewer.awxxs**.
6. Click **Save**.
7. **Delete** the **AlarmWorX64 Viewer control** from the **icTonicsTankMonitor** display.

Note: Later in this lab, you'll see why we don't need the AlarmWorX64 viewer embedded in the published display.

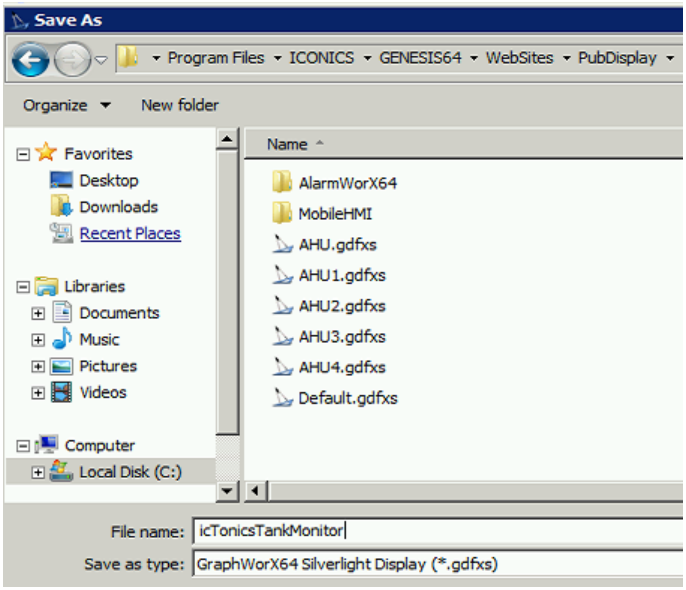


Figure L14.1 – Saving a Display as a Silverlight Version

8. From the **Display : Canvas**, select the explorer **Properties** tab.
9. In the **Measurements** section, change the **Height** from **768** to **500**.
10. **Name** the file, as seen in the figure above, **icTonicsTankMonitor.gdfxs.**
11. Be sure to specify the **Save as type:** as **GraphWorX64 Silverlight Display (gsfxs)**.
12. **Important**: Save the display file in the **C:\Program Files\ICONICS\GENESIS64\WebSites\PubDisplay** folder.
13. Click **Save**.
14. Save a **Silverlight** version of the **icTonicsTrends.gdfxs** display to the **PubDisplay** folder also.
15. Leave the **icTonicsTrends** display **Open** in GraphWorX64.

14.2.3. Saving a TrendWorX Viewer as a Silverlight Version

1. We will proceed by saving the **TrendWorX64 Viewer** control as a **Silverlight** version.
2. From within GraphWorX64, with the **icTonicsTrends** display open, select the **TrendWorX64 Viewer** control.
3. Click on the **Save** icon in the ribbon.
4. **Important**: Save the TrendWorX64 viewer file in the folder **C:\Program Files\ICONICS\GENESIS64\WebSites\PubDisplay**.
5. **Save as type**: **TrendWorX64 Silverlight (*.twxxs)**.
6. Name the file **icTonicsTrendViewer.twxxs**.
7. Click **Save**.

14.2.4. Defining Web Part Zones in PortalWorX

Creating ICONICS Web Part zones in PortalWorX-SL is easier than in Microsoft SharePoint. This is partly due to the fact that the Web Parts are native to ICONICS, where in SharePoint, the ICONICS Web Parts would have to be registered with SharePoint in order for SharePoint to know they exist. Although we won't be using SharePoint in this lab, it is a supported platform.

Our goal in this lab is to create a PortalWorX-SL view that contains three zones and three Web parts (GraphWorX64, TrendWorX64 and AlarmWorX64). Our completed view, as it is displayed in Internet Explorer, should resemble the following image.

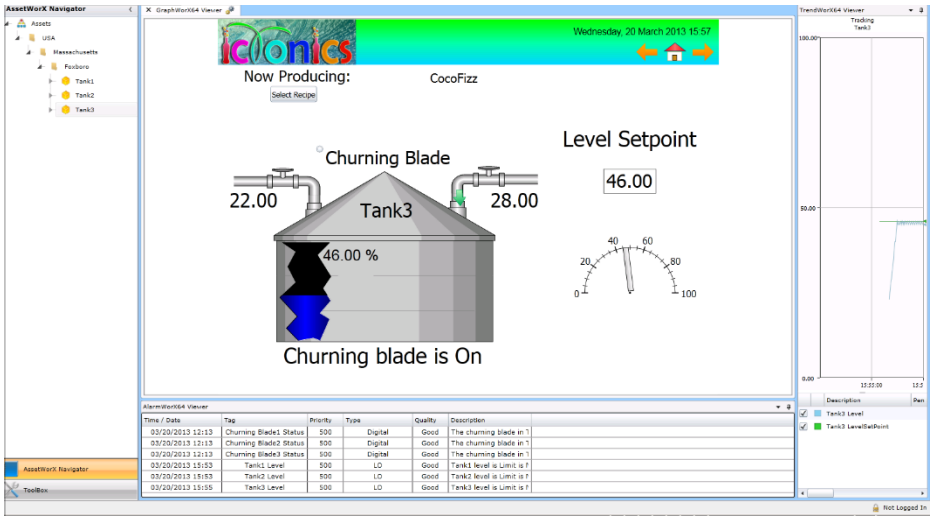


Figure L14.2 – PortalWorX-SL View with 3 Zones and 3 Web Parts

1. In the previous section, we saved Silverlight versions of the display, alarm viewer and trend viewer files. We'll use these files in a PortalWorX dashboard. Let's proceed to create a layout.

2. From within **PortalWorX-SL** select the **Project** tab.

   Note: To launch PortalWorX from within Workbench-SL, you can click on the Runtime link in the upper left. This will in a separate browser session.

   If the Runtime selection is not visible in Workbench-SL, click on the **Tools and Settings** tab and check **Show the Ribbon Title**.

3. In the "**New Layouts**" section of the ribbon, double-click the layout, as circled in the figure below.

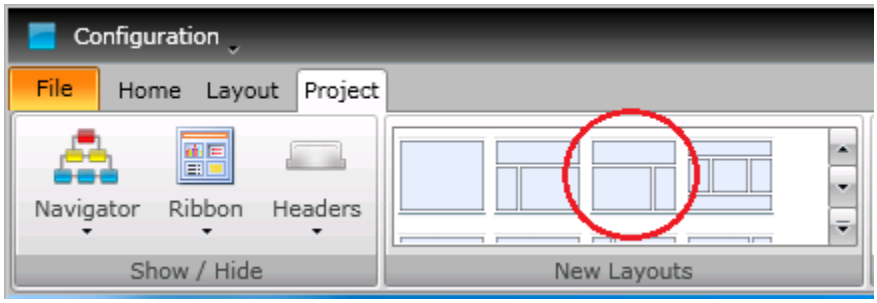


Figure L14.3 – PortalWorX-SL Layout Selection

4. From within the "**Specify layout properties**" dialog, enter the **Name: icTonics Layout.**

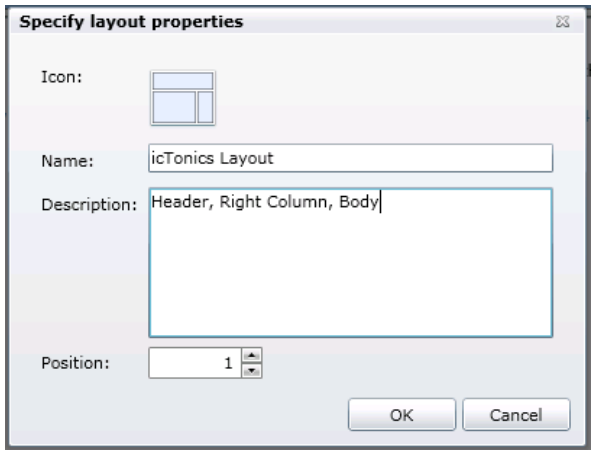


Figure L14.4 – PortalWorX-SL

5. Click **OK**.

6. We will reconfigure the layout by 'grabbing' a zone by the tab and relocating the zone.

7. Click the **tab** of the **Lower Left Zone** and hold the left mouse key down.

8. **Drag** the mouse to the **lower middle anchor**.

9. As shown in the following figure, when your cursor is on the locator where you want to anchor the zone, the anchor will change color (yellow for instance). Observe the circle in the figure below.

   Note: Notice the various **anchor points** as indicated by the **shaded gray squares**.

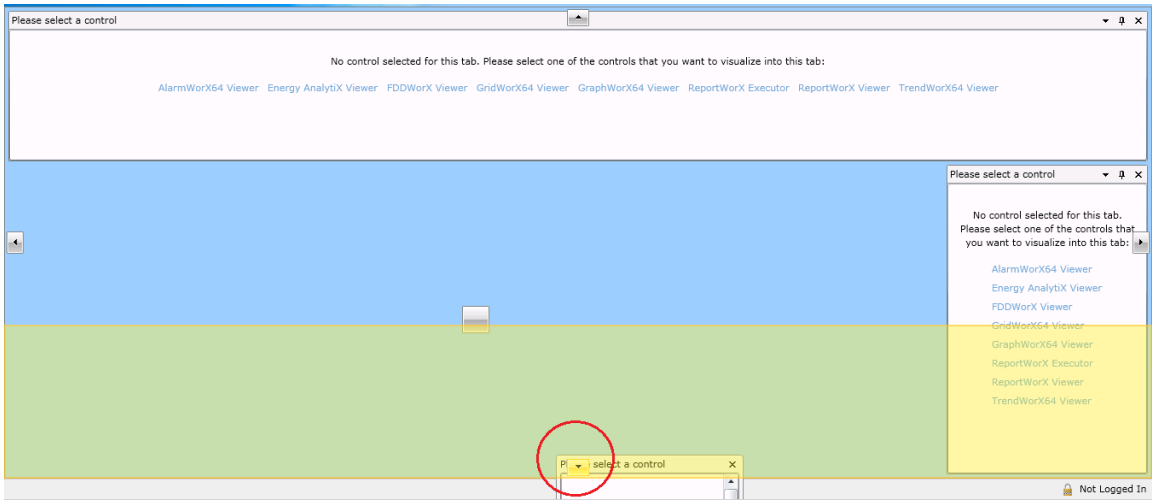


Figure L14.5 - Relocating the Lower Left Zone

10. Using the same technique, 'grab' the **Middle Zone** (on the right) and anchor it to the anchor in the **Middle Right** of the layout.

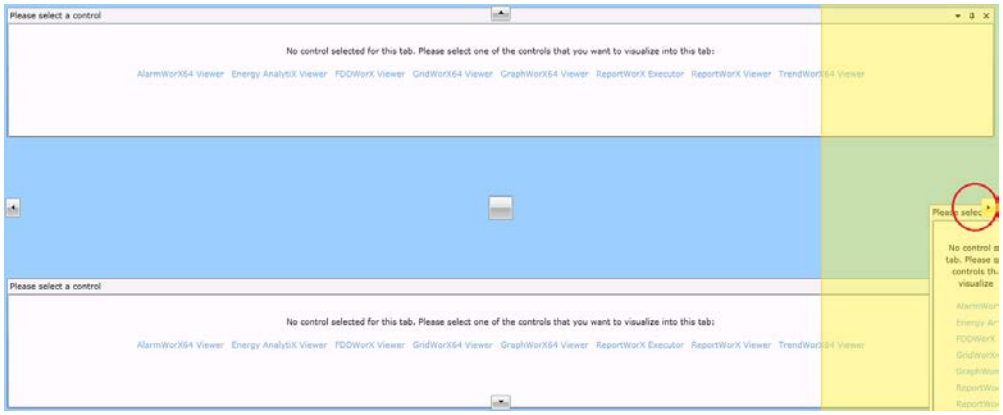


Figure L4.6 - Relocating the Middle Zone

11. Again using the same technique, 'grab' the tab (header) of the **Upper Left Zone** and anchor it to the **Center** anchor.

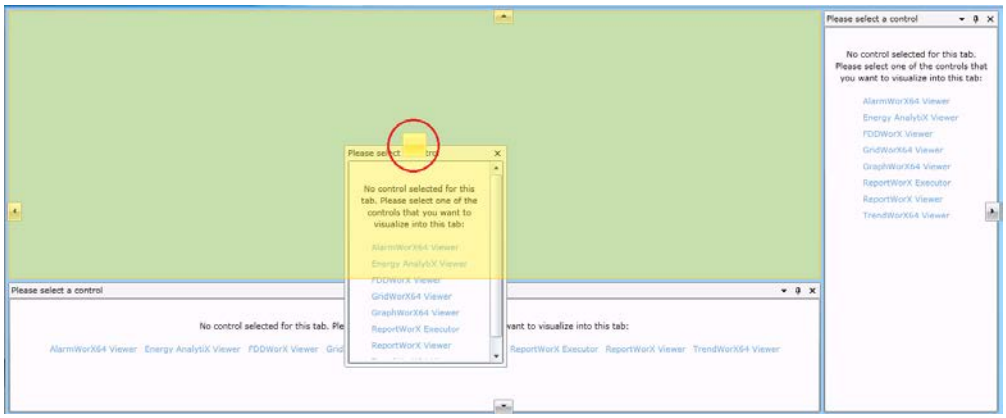


Figure L14.7 - Relocating the Upper Left Zone

12. The final **icTonics Layout** should resemble the figure below.

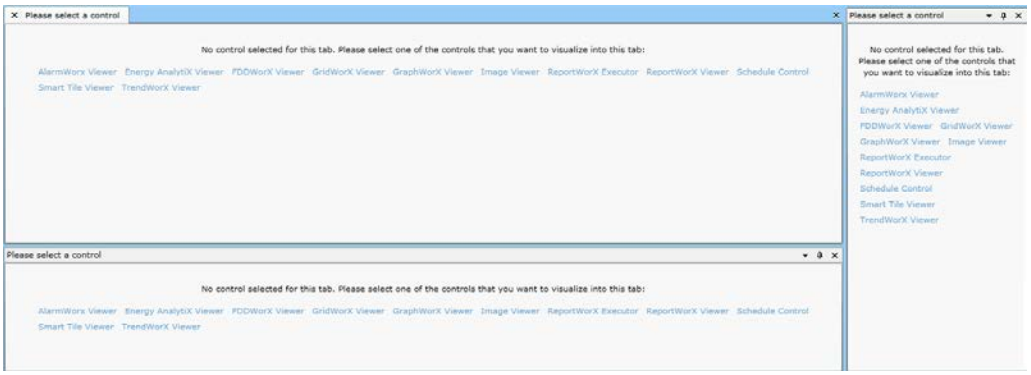


Figure L14.8 - Complete icTonics Layout

14.2.5. Adding Viewer Web Parts to Zones

In GENESIS64 version 10.8, we support eleven different viewers. Each of the zones has the ability to be defined as any available viewer type.

In this lab, we'll be implementing the GraphWorX64, TrendWorX64 and AlarmWorX64 viewers.

Note: After inserting a viewer into the portal, if the viewer needs to be **edited**, right-click on the viewer and select "**Tabbed Document**". Then click on the **Gears icon** .

14.2.6. GraphWorX64 Viewer

1. From within the **Upper Left Zone**, click on the **GraphWorX64 Viewer** blue text.

2. This launches the **Configure Web Part** dialog. Enter the following information:

   - **Title**: GraphWorX64 Viewer
   - **Name**: icTonicsTankMonitor
   - **URL**: http://ComputerName/PubDisplay/icTonicsTankMonitor.gdfxs
     - **ComputerName** will be replaced with the **Local Computer Name**.

   Note: If you get a notification that contains the text "**Please run SQL Setup utility**" when you attempt to browse, you can manually type in the URL as a workaround. The setup utility resides under Start → All Programs → ICONICS → Tools and is called SQL Server Setup. Ask your instructor for assistance as warranted.

3. The completed dialog should resemble the following image, except for the computer name, of course.

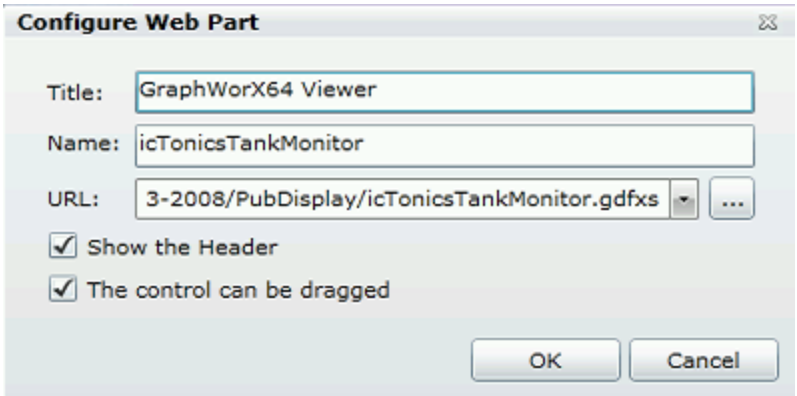


Figure L14.9 – Configuring the GraphWorX64 Viewer Web Part

4. Click **OK**.

5. Your current PortalWorX-SL view should resemble the figure below.

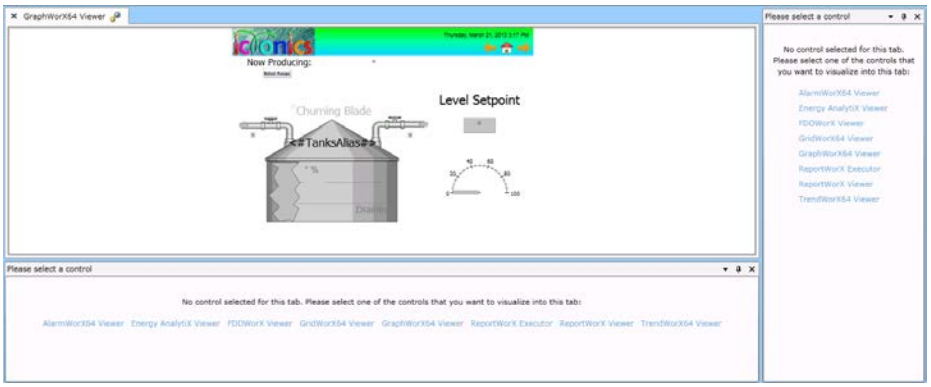


Figure L14.10 – GraphWorX64 Viewer

14.2.7. TrendWorX64 Viewer

1. From within the **Right Zone**, click on the **TrendWorX64 Viewer** blue text.

2. This launches the **Configure Web Part** dialog. Enter the following information:

   - **Title**: TrendWorX64 Viewer
   - **Name**: icTonicsTrendViewer
   - **URL**: http://ComputerName/PubDisplay/icTonicsTrendViewer.twxxs
     - **ComputerName** will be replaced with the **Local Computer Name**.

3. The completed dialog should resemble the following image. Of course, the URL will be different.

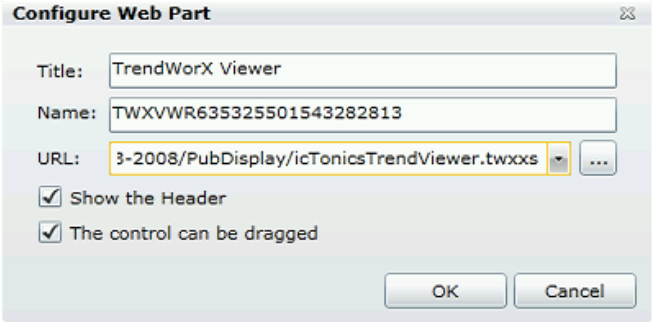


Figure L14.11 – Configuring the TrendWorX64 Viewer Web Part

4. Click **OK**.

5. Your current PortalWorX-SL view should resemble the figure below.

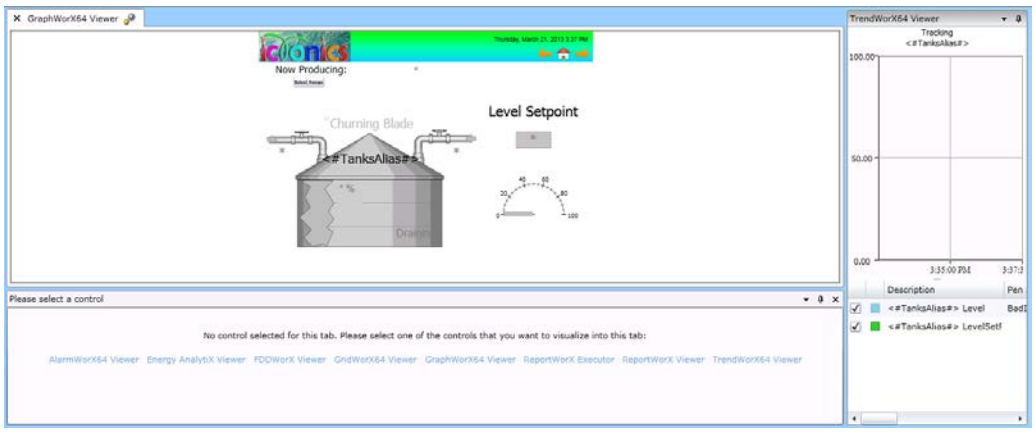


Figure L14.12 – GraphWorX64 and TrendWorX64 Viewer Web Parts

14.2.8. AlarmWorX64 Viewer

1. From within the **Bottom Zone**, click on the **AlarmWorX64 Viewer** blue text.

2. This launches the **Configure Web Part** dialog. Enter the following information:

   - **Title**: AlarmWorX64 Viewer
   - **Name**: icTonicsAlarmViewer
   - **URL**: http://ComputerName/PubDisplay/icTonicsAlarmViewer.awxxs
     - **ComputerName** will be replaced with the **Local Computer Name**.

3. The completed dialog should resemble the following image, except for the computer name, of course.

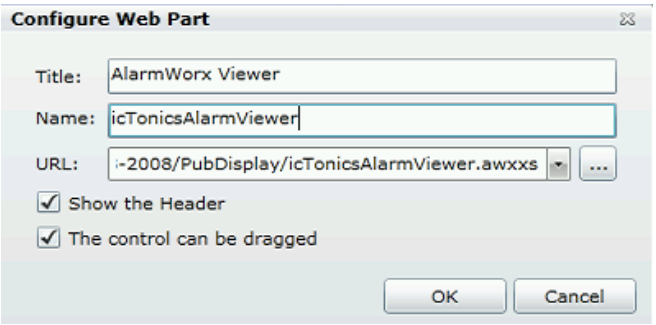


Figure L14.13 – Configuring the AlarmWorX64 Viewer Web Part

4. Click **OK**.

5. Your current PortalWorX-SL view should resemble the figure below.

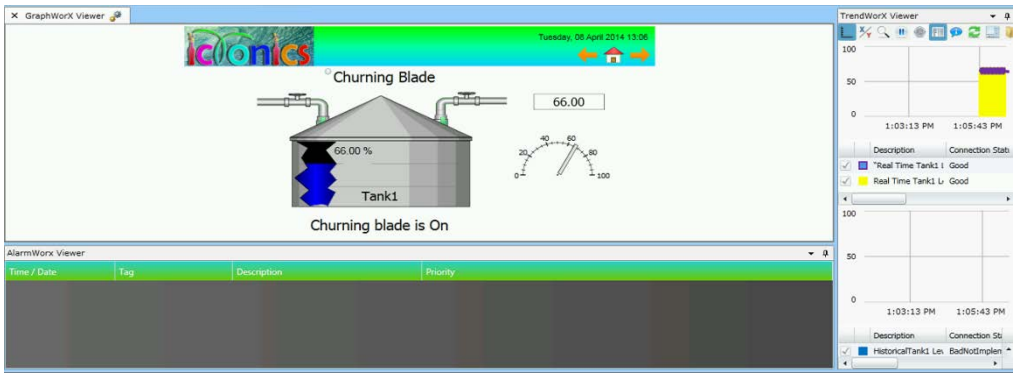


Figure L14.14 – GraphWorX64, TrendWorX64 and AlarmWorX64 Viewer Web Parts

14.2.9. Saving your Layout

1. From within PortalWorX-SL, click on the **File** selection in the upper left.

2. Click on the **Save** selection.

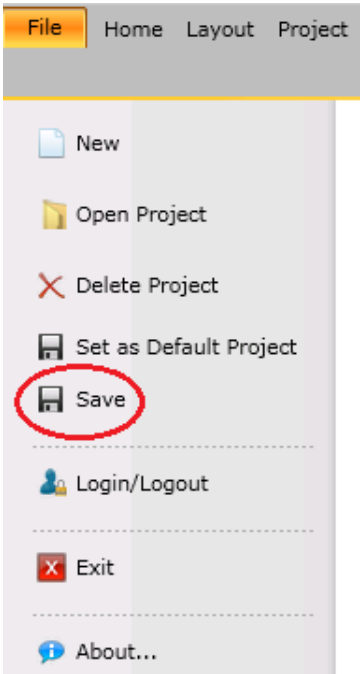


Figure L14.15 –Saving the icTonics Layout

3. Select the **Layout** tab.
4. Hover over each of the entries in the **Existing Layouts** section.
5. Verify your **icTonics Layout** exists.

This concludes this lab.

Security 15

GENESIS64 uses a security model that is both granular and additive. The system is installed as part of the GENESIS64 installation, but it is not activated. Before creating an Administrative user, you do not need to log in to run the Security Configurator.

You can set individual rights and access based on users and groups, create named policy settings that can be applied to users and groups, and control access to individual applications, features, systems, and more. These settings can also be time based.

A security system administrator configures the system by adding users and assigning them specific privileges. Administrators may also associate a user with groups that have pre-assigned privileges so that the user has the effective rights of all the groups to which the user belongs to, in addition to the user's own privileges.

The Security Server offers a powerful way to configure access to your applications. All actions that can be performed by a user in any GENESIS64 application can be controlled via the Security Server.

After completing this chapter, you should know how to:

- Create an Administrative user in GENESIS64 Security Server.
- Create standard user accounts with GENESIS64 Security.
- Set up security groups and users.
- Create account policies.
- Set security privileges to define what a user can do.
- Log in and log out from the system.
- Use Active Directory accounts.

15.1 Security System Components

The security system contains two components: the Security Server and the Security Server configurator that manages user logins and the various clients contained within GENESIS64 (GraphWorX64, TrendWorX64, AlarmWorX64, and so on). Any user login or logout that causes a change in security status is immediately posted to the affected clients.

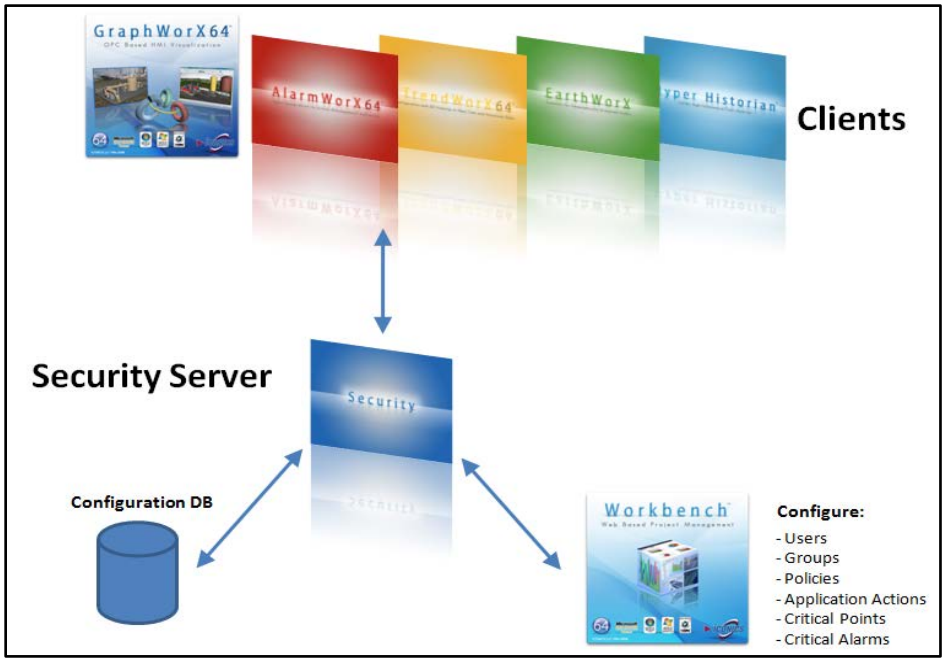


Figure 15.1 - Security Server and Clients Architecture

Note: Security assumes the least restrictive permissions. (Out of the box, there is no security).

Security settings for the server are set from the **Security Server configuration forms**, an example of which is shown in Figure 16.2. To launch the Security Server from the Windows desktop, click **Start** → **All Programs** → **ICONICS** → **Tools**, then select the **Security** command. Alternatively, you can click on the "Security Server" icon in the Project Explorer of the GENESIS64 Workbench, as shown in Figure 15.2.

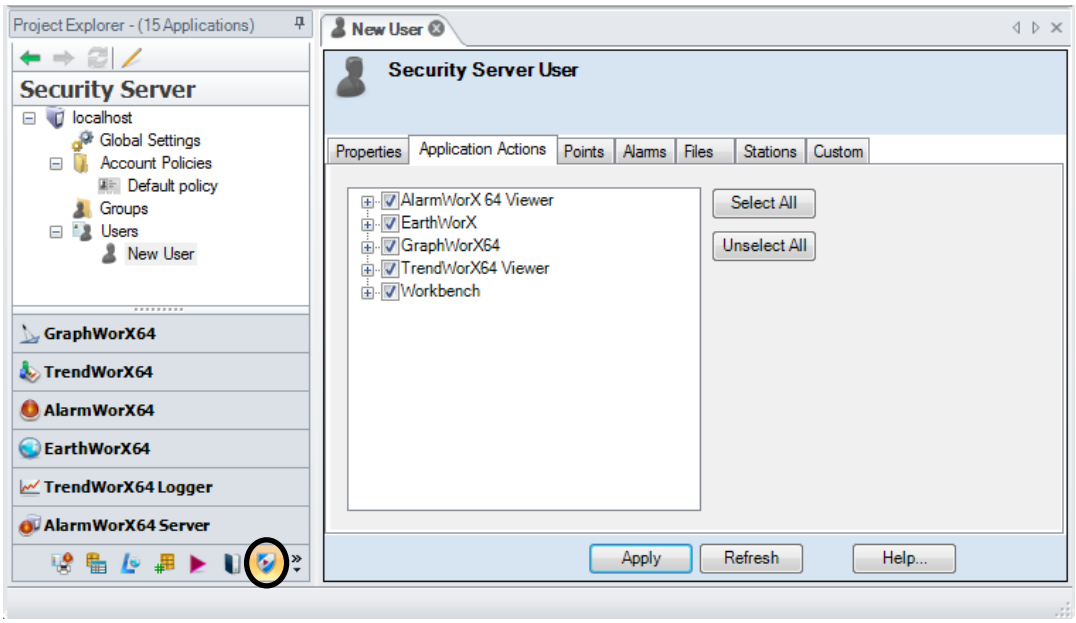


Figure 15.2 - The Security Server Configurator

15.2 Global Settings

Global Settings apply to the entire security server regardless of the security configuration. In the Global Settings, you can configure general settings of how the security server behaves as well as critical alarms and points.

You can access global security settings by double-clicking on **Global Settings** in the Security Server's navigation pane. The Global Settings **General** tab, shown in Figure 16.3, provides controls for how you want to display user information when you log in, how the user logs in (for example, with Windows), and where the security system obtains the list of security users.

You can choose to take advantage of already GENESIS64 users already setup in Windows' Active Directory instead of creating users in the security system by providing the necessary domain credentials, and then simply give these domain users or groups the proper permissions.

Figure 15.3 - General Settings

The following properties may be set on the General tab:

- **Security Active**: A checkmark here enables the use of the Windows domain services for account login. When this setting is enabled, users with matching user names and domain names will automatically be logged into the Security Server. This eliminates the need for users who have already authenticated with their Windows domain to enter a user name and password a second time to gain access to the Security Server.
- **Provide list of existing users in the login dialog box**: When this box is checked, the Security Login dialog box displays all users in the User Name dropdown list. This option is useful for touch-screen systems.
- **Show last logged user in login dialog box**: When this box is checked, the Security Login dialog box displays the name of the last user that successfully logged-in in the User Name field.
- **Allow Simultaneous Login**: When this box is checked, different users can log into the same computer to use GENESIS64. When one user logs out, the other user can continue using GENESIS64.
- **Time window for interacting with critical objects**: This is the number of seconds after logging in that a user will be allowed to manipulate a critical point before being required to log in again. (Critical points are described in the next section.)
- **Security Mode**: You can choose to authenticate using either the ICONICS Security Server database or the Active Directory.

While using the Active Directory mode, it is possible to use groups and users defined in the domain to create your security settings. The Security Server is able to read data coming from Active Directory. Since we are connected to the Active Directory constantly, whenever there is a change in users and groups in the domain, the Security Server automatically gets the update. To preserve domain security, you will not be able to add active directory users or groups within the Workbench from a domain node. The Domain Administrator will need to access the domain controller in order to alter domain accounts.

Clicking on the "Active Directory Settings" button next to the Security Mode allows you to configure domain connection settings and credentials, as shown in Figure 16.4.

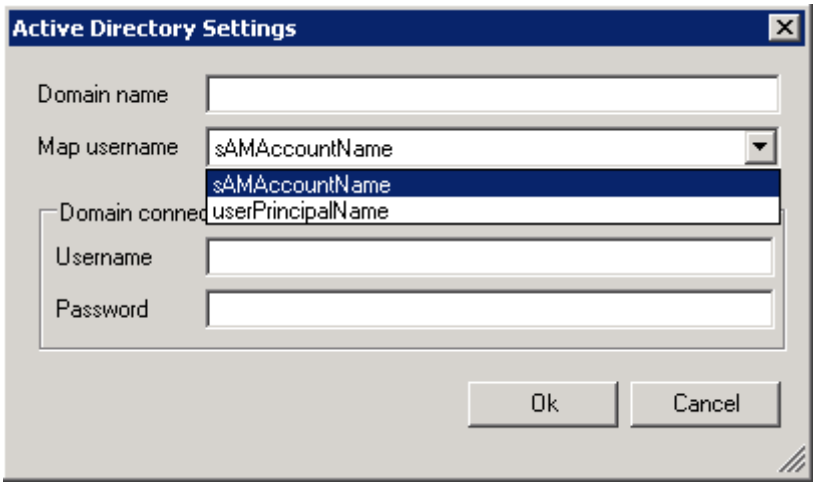


Figure 15.4 - Active Directory Settings Dialog box

- **Domain name**: the name of the domain that you wish to synchronize with
- **Map username**: sAMAccountName or userPrincipleName, as shown in Figure 14.4. The
  - **sAMAccountName:** is the name of the Windows account in the domain.
  - **userPrincipleName:** is the Internet login style based on the RFC 822 standard, and is typically the e-mail address in the form of username@domain.com.
- **Domain connection credentials**: Login credentials for the domain. You should enter credentials that can query the Active Directory here.

15.2.1 Critical Points

On the **Critical Points** tab of Global Settings, shown in Figure 16.5, you can designate some subset of writable points (OPC data items) as Critical Points. In order for a user to write a new value to a critical point, the following two conditions must be met:

- The user must be granted rights to the critical point via user or group configuration or via one of the explicit groups to which the user belongs.
- The user must have logged in within the **Time window for interacting with critical events** configured on the **General** tab of the Global Settings dialog box.

If the first condition is met, but not the second, the client application (for example, GraphWorX64) will launch the **Security Login** dialog box, requiring the user to login again and the second condition. This identifies and authenticates the user who is writing the value.

Critical points use the same *include/exclude lists with wildcards* concept as the Points configuration (which we will discuss in detail in section 16.6.2) in the user and group properties dialog boxes. This lets you specify multiple tags without listing them individually.

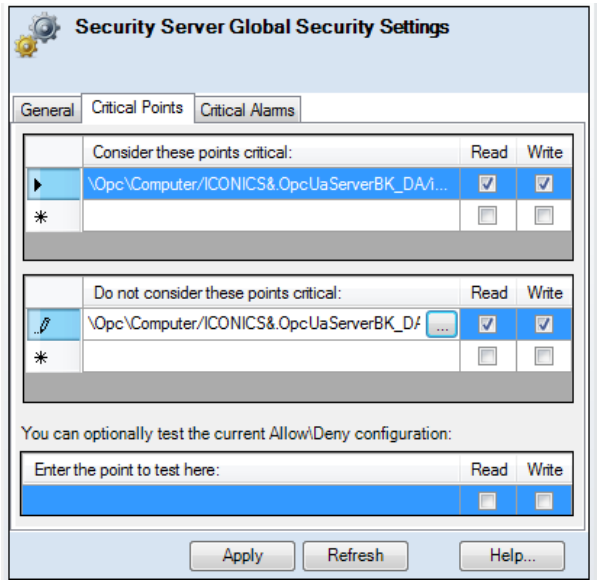


Figure 15.5 - Critical Points Settings

Note: If neither the 'Read' nor the 'Write' checkboxes are checked, then the request will be denied.

15.2.2 Critical Alarms

In the **Critical Alarms** tab of Global Settings, shown in Figure 16.6, you can designate a subset of alarms as Critical Alarms. When acknowledging a critical alarm, a user must login again immediately before acknowledging it, thus identifying and authenticating the user who acknowledges the alarm.

Critical alarms use the same *include (allow ack)/exclude (deny ack) lists with wildcards* concept as the Alarms configuration (which we will also discuss later in section 16.6.3) in the user and group properties dialog boxes. This allows you to specify multiple alarms without listing them individually.

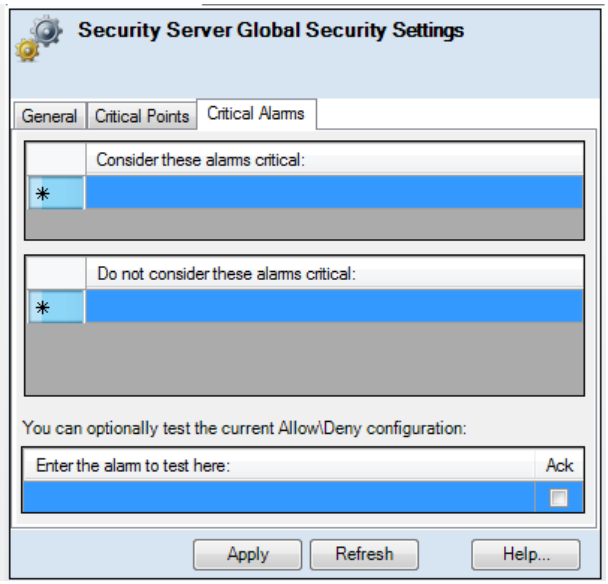


Figure 15.6 - Critical Alarms Settings

15.3 Security Objects and Their Relations

Security is created by adding security objects to the system. There are three types of security objects: Account Policies, Groups, and Users, as reflected on the navigation tree. There is an intricate relationship between these objects. Let us first understand the difference between a group and a user and how they relate before we talk about account policies.

15.3.1 Group

A group is a collection of users that share the same privileges. By default, there are no groups and any newly created group has the least-restrictive permissions possible, meaning the group is allowed to do everything. You can edit these security settings.

After a group is created, you can add users as members of the group. You can add any user to any number of groups, but only users can belong to groups. That means you cannot have a group belonging to another group. However, you can duplicate a group and then make changes to the duplicate if you want to create similar groups.

15.3.2 User

A user is an account that has a name, password, and specific privileges. When you first open the default Security Server, there are no users defined. The first account you create is the Security System Administrator account. After you apply the configuration for this account, the Security Server requires you to login to it to continue, which you should do in order to create additional user accounts.

Like groups, by default, a new user has the least-restrictive permissions possible, meaning the user is allowed to do everything. You can edit these security settings. Just as in a group, you can duplicate a user and make changes to it accordingly for users with similar settings.

When you define a user account, first you must fill in the Name and Password fields on the **Properties** tab, as shown below. You can use the Properties tab to change account policies or, by checking the **Account locked** checkbox, quickly disable a user account.

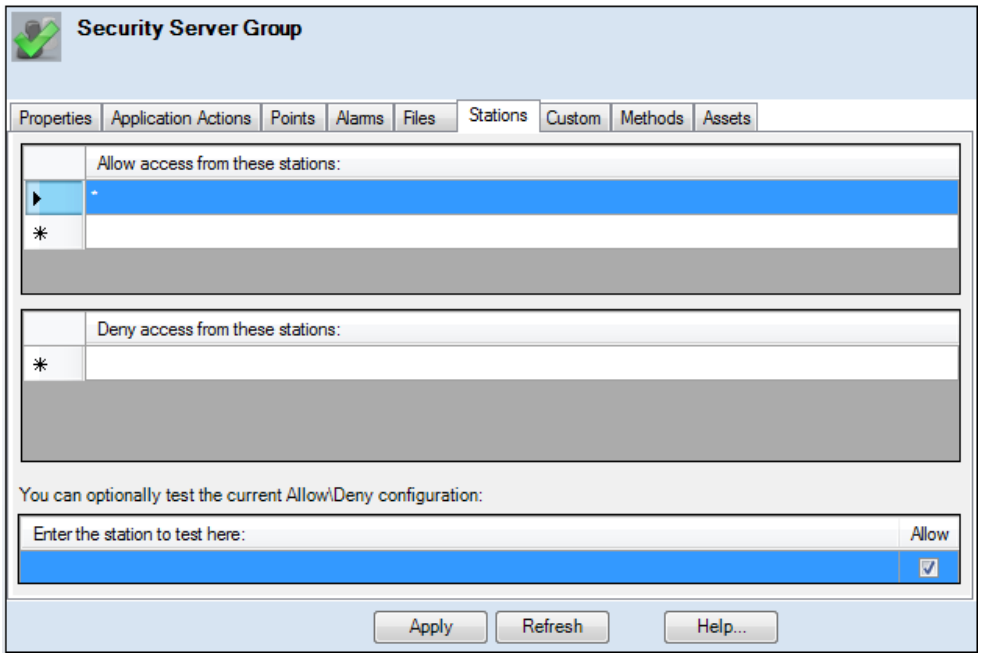


Figure 15.7 - User Properties Tab

This Figure shows the Properties tab for a user account. A group account would have a **Properties** tab with only the **Name** field for the account showing. Groups do not have passwords or an account policy, and they cannot be locked. The Root and Default Assets are referring to AssetWorX and what should appear for specific users.

15.3.3 Groups and Users

When it comes to the hierarchy of users versus groups, users always belong to groups. Or in other words, you can add users to any group. When you assign a user to a group, you are *extending membership* to the user. You extend membership either by altering the user account or by altering the group account. This is done in the Security Server using the **Membership** menu item from the object's right-click menu in the navigation tree control. Shown in Figure 15.8 is the Membership menu item for a group; a similar menu appears for a user.

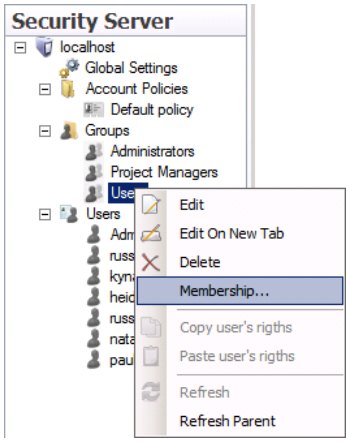


Figure 15.8 - Membership Command

Selecting **Membership** for a group opens the Group Properties dialog box, shown in background. You can then add users to a group by clicking on the "Add" button and selecting the users to be added, also shown in Figure 15.9.

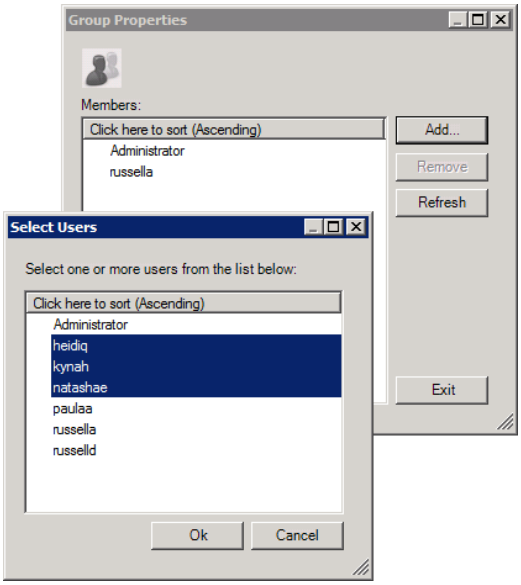


Figure 15.9 - Adding Users to a Group

The steps for associating groups to a user account are nearly identical. When you select the **Membership** command from the user account's right-click menu, you will see a dialog box for User Properties that is nearly identical to the Group Properties dialog box. Associate groups to a user by clicking Add and select the groups, as seen below.

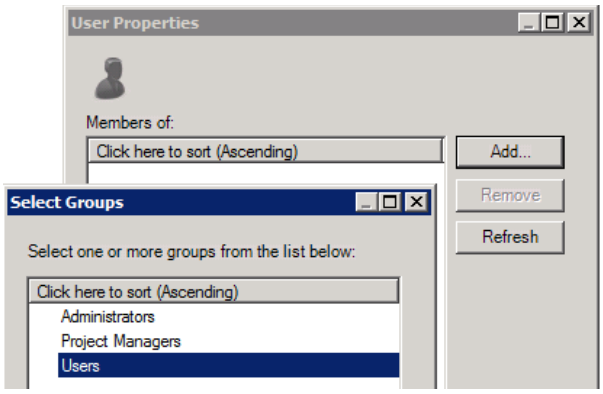


Figure 15.10 - Selecting Groups for a User

15.3.3.1 Permissions

When you add a user to a group, the user inherits the privileges of the group. For example, if the group has an *allow* permission to write to a certain process point, the users belonging to this group have permission to write to the point as well, without being specifically given the permission again in their user permissions.

A user's permissions are combined with the group permissions. This is important to remember because if you deny permission to the group, and then grant that same permission to a user of the group, the effect is that the user will be denied permission. A denied permission is always at the top of the permissions hierarchy.

15.3.4 Account Policies

Now that we understand groups and users and how they relate, let us look at Account Policies. An account policy is a set of rules that you can apply to any user. A default policy exists, but you can create additional ones. The Default Policy sets the base policy and is the one applied by default to any newly created user. You can create multiple account policies, but you can only apply one policy to any one user at a time.

Settings on the Account Policy form, as shown the Figure below, determine how passwords are used and whether user accounts automatically gets locked out after a series of incorrect login attempts.

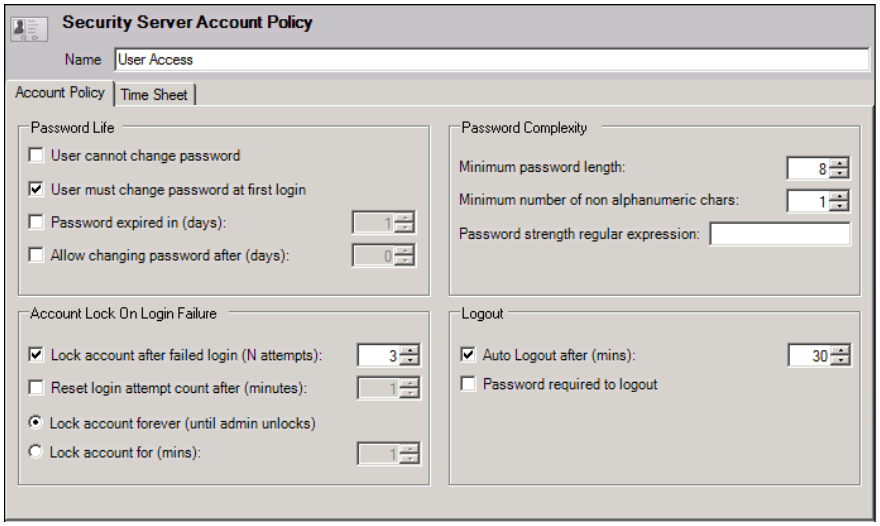


Figure 15.11 - Account Policy Settings

The four sections on the Account Policy tab are similar to the ones you would see in a Windows domain-based policy. The table below lists the fields and descriptions for the Account Policy tab in detail.

Table 15.1 - Account Policies

Security Option	Purpose
User cannot change password	If checked, the password can be changed only by an Administrator. If unchecked, the user can change it.
User must change password at first login	If checked, the user must change the password that the account starts with. If unchecked, the user does not.
Password expires in (days)	If checked, the user must create a new password after the current password has been used for the number of days specified. If unchecked, the user can use a password for as long as he or she wishes.
Allow changing password after (days)	If checked, the user cannot change the password again inside the number of days specified. If unchecked, the user can change the password again at any time.
Lock account after failed login (N attempts)	If checked, the account locks (and cannot be used) after anyone using the account to log in enters the wrong password the number of times specified. If unchecked, there is no limit.
Reset login attempt after (minutes)	If checked, the number of minutes (1 to 999) that must pass between any two login attempts to ensure that a lockout will not occur. If unchecked, the login does not reset after failed attempts.
Lock account forever (until admin unlocks)	If selected, when the number of failed logins is reached, the account is locked and requires a Security Server administrator to unlock the account.
Lock account for (mins)	If selected, when the number of failed logins is reached, the account is locked and cannot be logged in until this number of minutes has passed.
Minimum password length	The minimum number of characters required in the account's password.

Security Option	Purpose
Minimum number of non-alphanumeric chars	The minimum number of numeric characters or symbols (in addition to letters) required in the account's password. Setting this option to at least 1 is a good idea.
Password strength regular expression	A regular expression, which is the pattern describing a certain amount of required text of the account's password. (Its name comes from the mathematical theory on which it is based.) A few expressions are provided in the **Tip** at the end of this table.
Auto Logout after (mins)	If checked, the number of minutes (1 to 999) from the time of user login to the time the system automatically logs the user off. If unchecked, the user is never automatically logged out. By default, this feature is enabled and logout occurs after 60 minutes.
Password required to logout	If checked, a password is required to log out. If not checked, no password is required for logout.

Tip! You can use regular expressions to enforce password strength. Providing detailed information on regular expressions is out of the scope of this chapter, but you can find more details about regular expressions online. To get you started, you can try the strings below.

`^[a-zA-Z''-'\s]{1,40}$`
Sets a name up to 40 characters with some extra symbols such as apostrophe or comma. An example would be John Smith.

`^\d{3}-\d{2}-\d{4}$`
Useful for a social security number. An example would be 123-45-6789.

`(?!^[0-9]*$)(?!^[a-zA-Z]*$)^([a-zA-Z0-9]{8,10})$`
Sets a strong password between 8 and 10 characters which must contain at least

Each user is tied to one account policy. You may not apply an account policy to a group. As you now know, the account policy dictates how often a password needs to be changed, how complex it needs to be, as well as how to handle multiple login failures. You may need different account policies for different users but each user can use only one account policy.

Users with access to sensitive data should be subjected to more stringent policies than users who access less sensitive data. The following policies are recommended for users with access to sensitive data:

- Enforce a change of passwords after no more than 30 days; fewer for more sensitive data access.
- Lock the account after three or four failed login attempts, and force the locked out user to contact an administrator if access is not time-sensitive. For time-sensitive access, consider an appropriate timeout period in the **Lock account for** option.

- For the **Auto Logout after** option, set a reasonable logout time so that, if a user leaves a console unattended, the system cannot be compromised.
- Enforce password length and complexity. A password of six characters or more with mixed characters (alphabetic and numeric) is considered the minimum required to defeat brute-force attacks.

15.3.4.1 Time-Based Restrictions

The Time Sheet tab for account policies, shown in Figure 15.12, allows time-of-day restrictions on an hourly basis for users and groups. For hours that are selected (highlighted) in the lists, access is allowed. For hours that are not selected, access is denied. Figure 15.12 shows a configuration that allows access from 8AM to 2PM Monday through Friday.

You can use the **Shift** and **Ctrl** keys to make your selections. When you want to create a range or extend a range of selected time for *inclusion*, hold down the **Shift** key and click the start and end of the range. If you already have a range selected, hold down the **Shift** key then click on the point to which you would like to *extend* the selected range. Holding down the **Ctrl** key allows you to click and select *noncontiguous* areas of the time sheet.

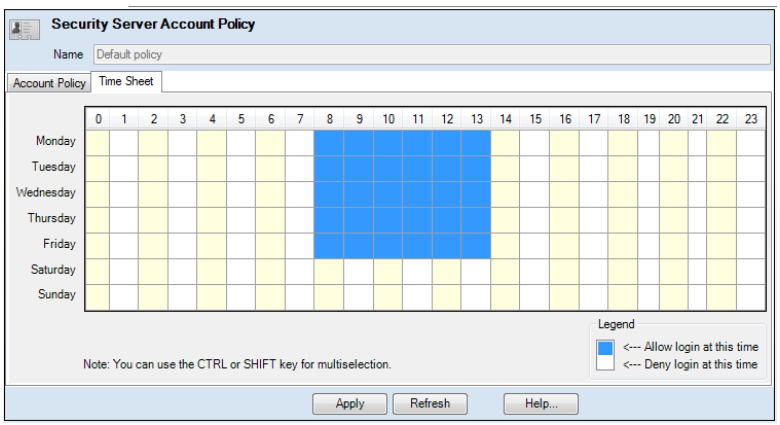


Figure 15.12 - Time Sheet Settings

15.4 Security Privileges

In Security Server, you configure users and groups using two separate forms. We have already looked at the Properties tab, which is similar for users and groups. These settings let you apply security privileges at either the group level or the user level. The Security Server uses the following rules for determining whether a privilege is extended to a user or denied:

- If a user lacks a privilege and is added to a group that has the privilege, the privilege is extended to the user.
- If a user has a specific privilege, but is added to a group where that privilege is denied, the user still has that privilege. *The **least** restrictive privileges apply.*

Application Action privileges may be extended or denied to users and groups based on the client application. The **Application Actions** tab, shown in Figure 15.13, is where these privileges are configured. Each GENESIS64 application exposes its own set of actions and you have fine control over each particular action. When you create a new account, all application actions are enabled. You should begin the configuration of an account by visiting the Application Actions tab and setting the proper application restrictions.

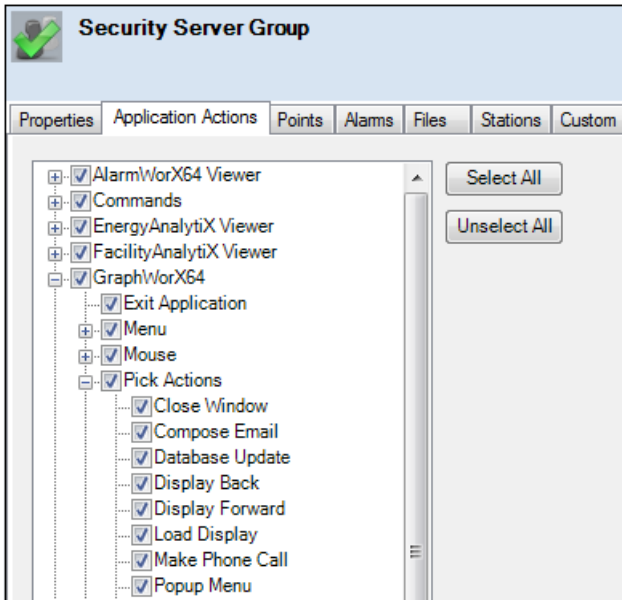


Figure 15.13 - Security Role Application Actions

For example, you can expand the **TrendWorX64 Viewer** node and uncheck the **Export Data** item to prevent the user from being able to export data. This lets you set up security so that some users can perform actions that others cannot.

15.4.1 Process Points

A user or group can be denied access to certain OPC points. You do this by placing OPC point addresses with or without wildcards in the *include* or *exclude* list of a user or group. Then, before a GENESIS64 client reads a value from or writes a value to an OPC server, the OPC point address is sent to the Security Server to determine if the operation should be allowed based on the currently logged-in user and or the groups to which the user belongs.

Use the **Points** tab, shown in Figure 15.14, to configure which OPC output points are allowed to be read from and written to by the user or group.

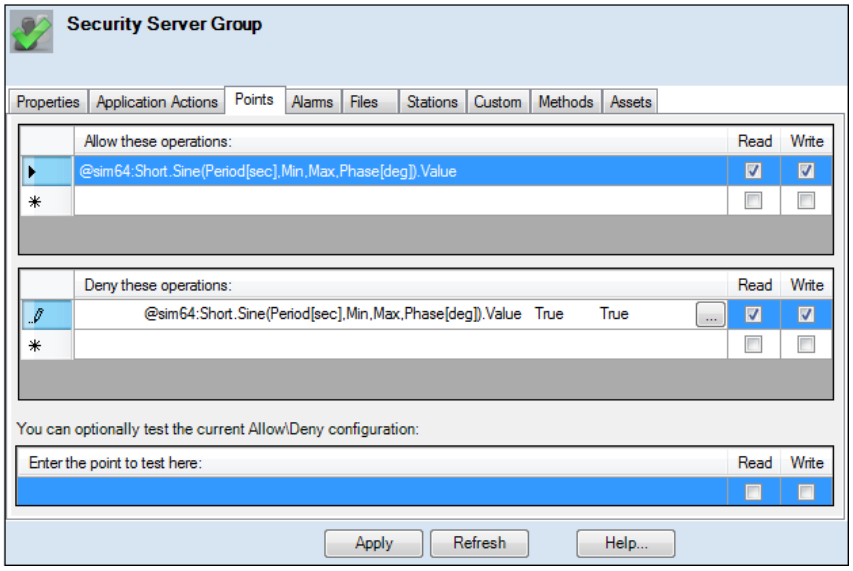


Figure 15.14 - Security Role Points Tab

The Points tab is divided into two sections: Include (**Allow these operations**) and Exclude (**Deny these operations**). To add additional criteria, click on the next blank line and enter the required string. During runtime, when a GENESIS64 client sends an OPC point address to the Security Server for access testing (to see if it is granted or denied), the Security Server compares the OPC point address to the include and exclude lists as described below for each active user and group until access is granted:

- Security Server compares the OPC point address with each string in the *include* list until a match is found. If no match is found, access is denied.
- If a match is found in the *include* list, Security Server compares the OPC point string with each string in the *exclude* list. If no match is found in the exclude list, access to the point is granted, and no further testing of active groups and users is performed. But if a match is found, access is denied.

Please see section 15.6.6 for more information about “Permissions” and section 15.6.7 for more information about “Wildcards and Performance Optimization”. Information in these sections will help you form a strategy for setting up the Allow and Deny lists.

15.4.2 Alarms

You can also protect individual alarms and groups of alarms by placing alarm names, with or without wildcards, into the include list (to **allow acknowledgement**) or the exclude list (to **deny acknowledgement**) for a user or group. GENESIS64 applications will query the Security Server for alarm access before acknowledging an alarm. The **Alarms** tab, shown in Figure 15.15, is used to allow or deny user acknowledgement of alarms during runtime.

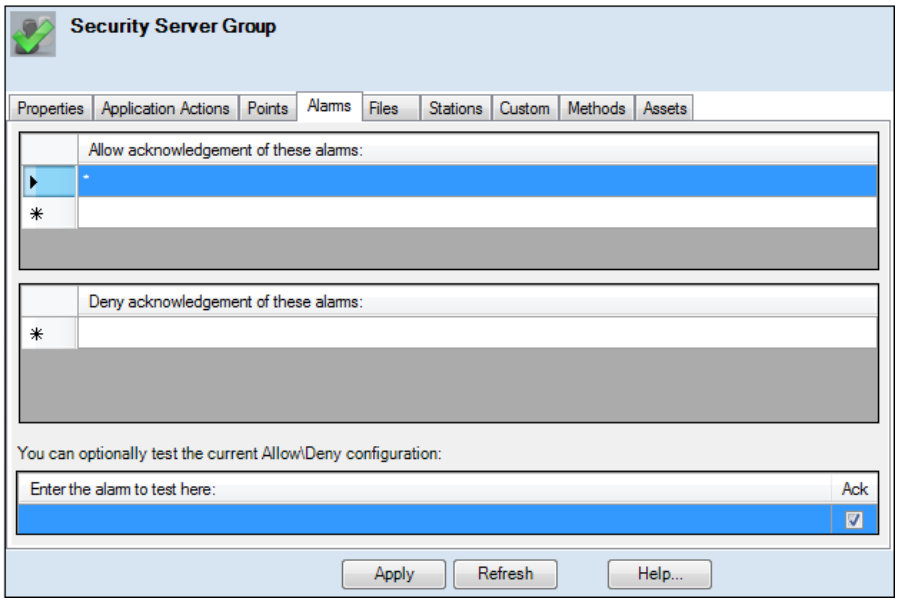


Figure 15.15 - Security Role Alarms Tab

The runtime processing and wildcard pattern matching for the Points tab apply here as well. Please see section 15.4.7 for more information about “Wildcards and Performance Optimization”.

15.4.3 Files

You can also protect individual files and groups of files by placing file names, with or without wildcards, into the include list (to **allow** access) or into the exclude list (to **deny** access) for a user or group. When opening a file, Security Server checks for GENESIS64 permission to see if the user has permission to read, write, and/or modify the file. Files that are typically secured in this way are GraphWorX64 display files.

You can grant file permissions for the following actions:

- **Read** lets a user open existing files in runtime and configuration mode.
- **Write** lets a user create and save new files.
- **Modify** lets a user modify and save existing files.

The **Files** tab, shown in Figure 15.16, controls access to files that GENESIS64 applications may open at runtime. Entries here would be used to restrict certain users or groups from viewing, for example, specific GraphWorX64 displays.

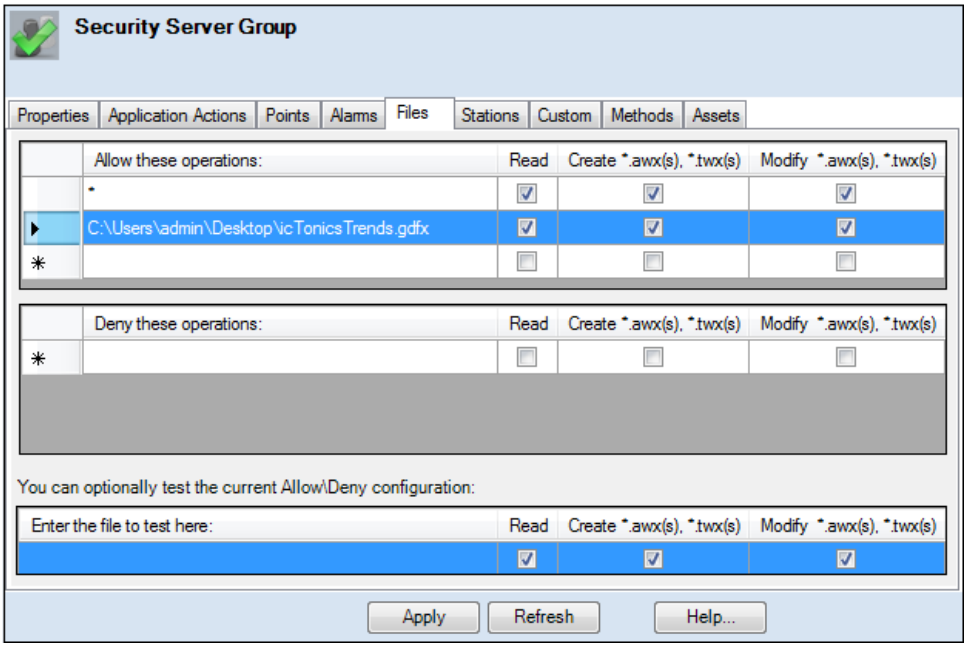


Figure 15.16 - Security Role Files Tab

The runtime processing and wildcard pattern matching for the Points tab apply here as well with the following differences:

- The pattern matching is done on the file extension, separate from the file name, to match the DOS wildcard semantics. For example, the wildcard string to indicate *all* files is *.*
- File names entered without a path are considered a match no matter what directory they are in.

Please see section 15.6.7 for more information about “Wildcards and Performance Optimization”.

15.4.4 Stations

Use the **Stations** tab, shown in Figure 15.17, to grant access to (allow login) or restrict access from (deny login) specific nodes on the network. Each node on a Microsoft network is identified by a unique computer name.

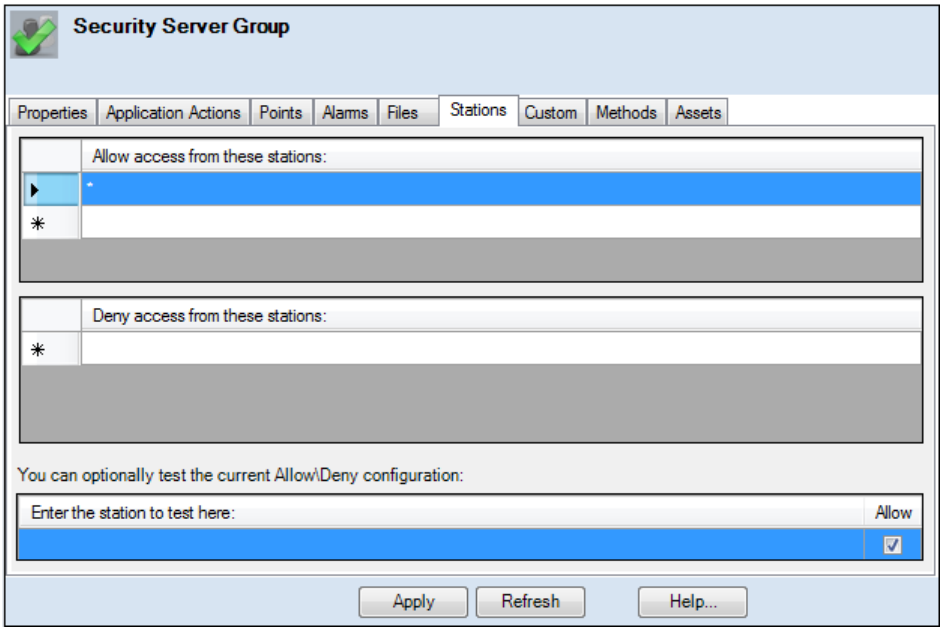


Figure 15.17 - Security Roles Stations Tab

To add a station to either list, click on the Ellipsis button. This displays the Select a Station dialog box, as shown in Figure 15.18. Select the Station Name from the dropdown list, or enter the name or system IP address to define the station criteria. Then click on "OK".

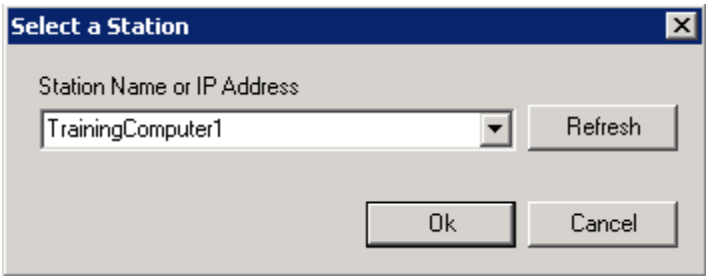


Figure 15.18 - Select a Station Dialog Box

15.4.5 Methods

Use the **Methods** tab to grant or restrict access to executing specific methods from being run by specific users or groups.

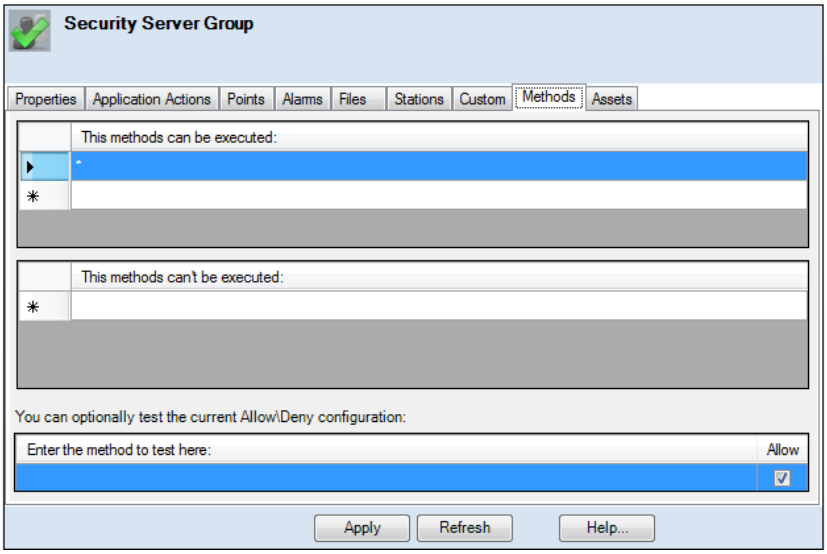


Figure 15.19 - Method Security

15.4.6 Assets

Use the **Assets** tab to grant or restrict access to seeing (Visualize) or utilizing (Execute) Assets from AssetWorX and any associated commands connected to the asset.

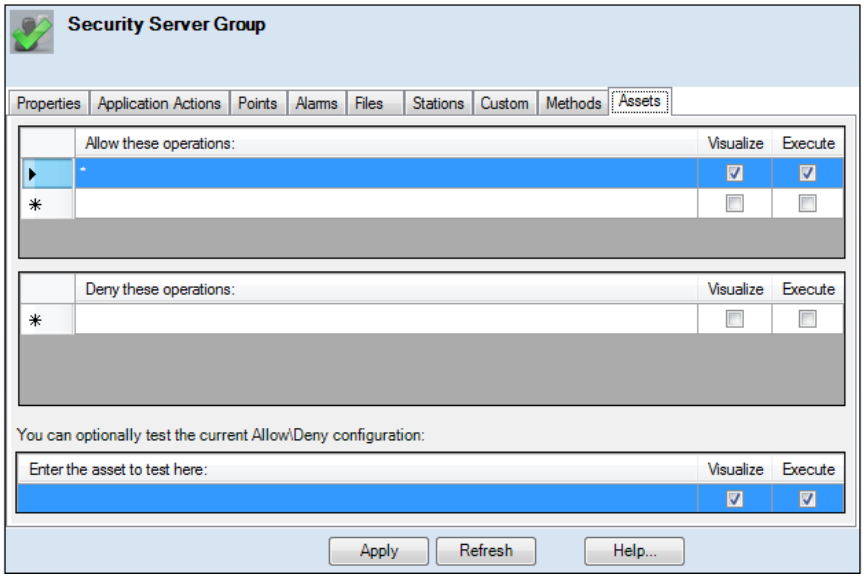


Figure 15.20 - Asset Security

15.4.7 Permissions

Permission to access a certain resource is granted to a user only after a security check is performed. The security check verifies the user's permission for the resource, as well as his or her groups' permissions on that resource. It is important that you understand how the system evaluates the permissions so that you set them up correctly. You should keep in mind the following security behaviors when setting up permissions.

A group identifies permissions for its user members. When a user, who is a member of multiple groups, tries to access a resource, the least restrictive permission in place for that resource is used. For example, group G1 *allows* write access to Tag1, while group G2 *denies* write access to Tag1. If User1 is a member of *only* G1, he will be able to write values to Tag1. If he is member of *both* G1 and G2, he will still be able to write values to Tag1 because the he was allowed access from G1 (that is, the least restrictive permission) is used.

Explicit permissions set for the user are combined with the user's group permissions. Following the example above, if User1 has explicit access that allows him to write to Tag1 and he is a member of G2, he will be allowed to write a value to Tag1, because the user setting overrules the group one.

Restrictions posed by the Allow list overrule permissions granted in the Deny list. This means that if a resource is in both lists, the user will be allowed to access the resource. Although it may seem strange that a resource would be in both lists, this is likely to happen when you use wildcards. For example, if you want to deny a user access to resource R1 only, you might put 'R1' in the Deny list and the wildcard character '*' in the Allow list (which also matches with R1). As a result, the system will find R1 in both lists, and will deny access to R1 because the Deny list overrules the Allow list.

15.4.8 Wildcards and Performance Optimization

The previous sections described the use of wildcards in place of tag names, file names, and other strings. Using wildcards lets you represent a swath of resources with just one string, letting you save time when configuring security. However, saving time is not the only advantage to using wildcards.

It is important to note that the system will always perform a security check when a user tries to access a resource. For example, when a user performs an action to read a tag value, the system uses the information in the user's Allow and Deny lists, as well as the Allow and Deny lists for the user's group. A comparison with all the strings in these lists is needed to check for access permissions. If there are many strings in those lists, the whole system slows down. Additionally, because access to a tag is granted *now* may be denied a second *later* (because the security privileges may have changed), a security check is performed each time the user accesses the tag, further slowing the system.

For this reason, having fewer strings to compare would improve overall performance. Therefore, it is always a good idea to try to use wildcards and to set up your system with these limitations in mind. Here are some examples of wildcard characters:

- **?** Any single character
- * Zero or more characters
- **#** Any single digit (0..9)
- **[charlist]** Any single character in *charlist*
- **[!charlist]** Any single character not in *charlist*

15.5 Logging-in and Logging-out

After the Security System has been set up, it will be necessary for users to log into the system to do their work and log out when they have completed their work so that their access can be authenticated based on the permissions granted to them. Authentication is handled by the Security Login dialog.

In GENESIS64, it is possible to log in and log out in both GraphWorX64 and the Workbench. It does not matter where users log in, they will be able to use all the GENESIS64 applications they have permission to access. The same is true for logging out; a logout takes effect throughout all GENESIS64 applications.

15.5.1 Security Login Dialog

To authenticate yourself, you must invoke the **Security Login** dialog, which you can launch from within the Workbench or GraphWorX64.

Open the Security Login dialog from the Workbench's File menu. Go to the Login\Logout button, as shown in Figure 15.21. There are times when the Login/Logout button has a submenu where you can select Client Login to log in to the client. And before you open any files, some providers' Home ribbons have a Login button, too.

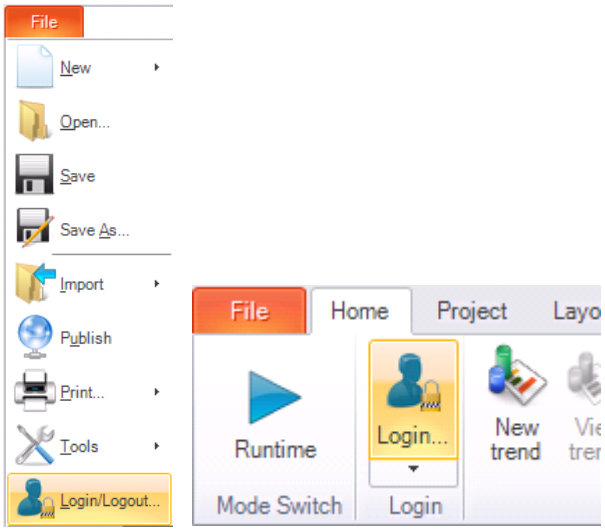


Figure 15.21 - Log In from the File Menu (Left) or the Home Ribbon (Right) when Available

Once the Security Login is open, as shown in Figure 15.22, users can enter their login information, and then click on **Log In** to authenticate. If the information they provide is correct, they are logged in to the system. Otherwise, they will be notified of that the user name and password are not correct.

The Security Login dialog stays open so users can try again. Remember, though, that if user security may be set up to lock out users who don't gain entry after a prescribed number of failed attempts.

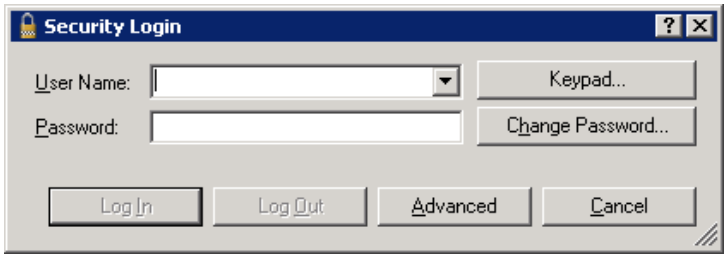


Figure 15.22 - The Security Login Dialog

On this dialog, it is also possible to show a **Keypad** window for touch screen systems. This can be helpful if you do not have a keyboard available.

You can also use the Security Login dialog to change your password. You will be asked to type your current password, and then to type a new password twice for confirmation.

To log out, use the Security Login dialog by clicking on the "Log Out" button. Depending on how your security profile is set up, you might be asked to enter your password to log out as well.

Clicking on the "Advanced" button lists the users who are currently logged in, the time at which each logged in, and the time at which each will be automatically logged out if the account remains inactive for a prescribed period of time, as shown in below.

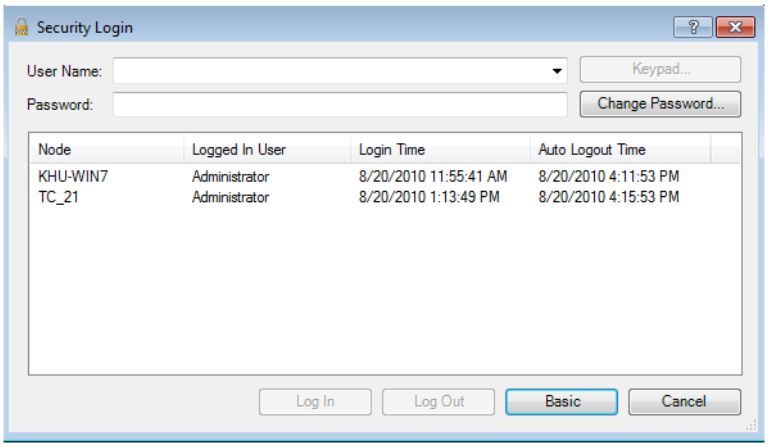


Figure 15.23 - The Security Login dialog in Advanced Mode

15.5.2 Multiple Logins

As you may have noticed in Figure 15.23, it is possible for more than one user to log in from the same node. This happens when a user logs in while another user has already logged into the system. It is important to note however, that only the last user that logged in is the active user, leaving other logged in users in a stand-by mode.

Using multiple logins is helpful if you need someone with additional permissions to perform a task you do not have rights for, or when you are getting help from an Administrative user. For example, someone with administrative rights may come to your machine to perform a task that requires administrative permissions. He would log in with his credentials, do what he needs to do, and then log out, returning control to you.

15.6 Advanced Settings

The GENESIS64 Security System also includes some advanced features that you may find useful when working with GraphWorX64 and other client applications.

15.6.1 Hiding GraphWorX64 Layers Based on Security

GraphWorX64 displays typically contain data that is accessible to one employee but not another. Creating different displays for each user or group would be time-consuming and it would be difficult to maintain solutions created in this way.

To help you in this task, GraphWorX64 allows you to show and hide layers based on users' security permissions. In this way, you can create a single display with information separated into layers that shows or hides depending on the logged-in user's credentials.

In the example in Figure 15.24, a layer called SecuredLayer contains critical information that needs to be secured. Non-critical information resides in a separate layer.

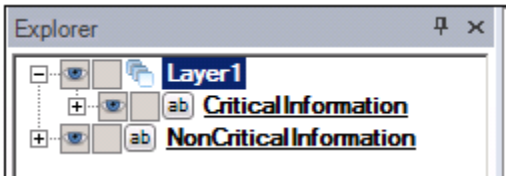


Figure 15.24 - Creating a secured layer

For the SecuredLayer to follow security rules, its **HideWhenSecurityDenied** property must be set to True in its Properties tab, shown in Figure 15.25.

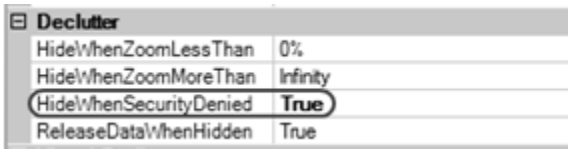


Figure 15.25 - Setting HideWhenSecurityDenied Property

What this achieves is that the critical information will be hidden to a user whose security denies it from viewing the layer. However, you still need to configure the Security Server to allow or deny a user access to the SecuredLayer.

This can be done in the Files tab of a user or group. By default, one layer is always accessible to everyone, but you can easily deny a user access to it by adding the layer to the list of denied points, using custom syntax.

The custom syntax you use in the list of denied files is ***FileName|LayerName*** – consisting of the file name and the layer name separated by a pipe (|) symbol. In the security example below, the GraphWorX64 display file is called MyDisplay.gdfx, and the layer is called SecuredLayer. Access to this critical layer is denied to this user.

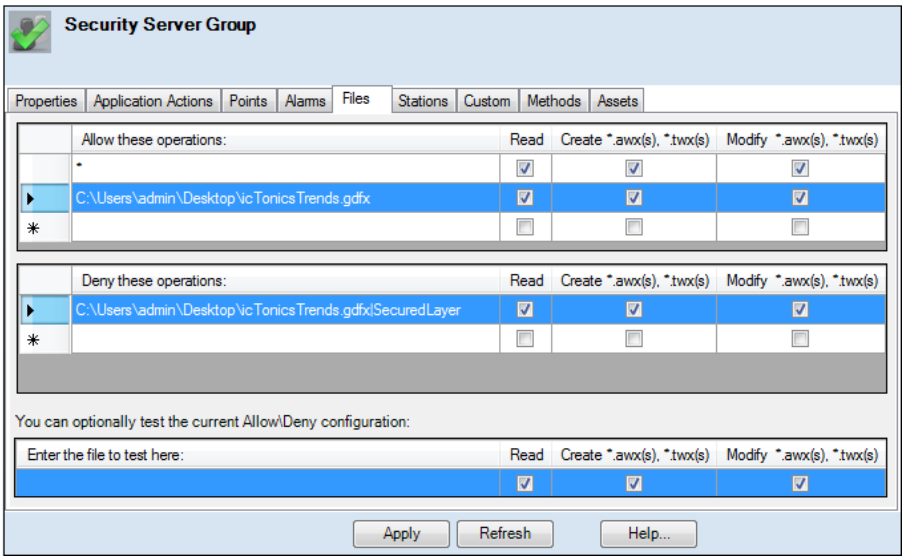


Figure 15.26 - Denying a User Access to a Secured Layer

With these settings, when this user accesses MyDisplay.gdfx, the layer called SecuredLayer will not be displayed. Restoring access to this user is as easy as modifying this Security form.

15.6.2 The ?DataPoint:TAGNAME Feature

We have just seen how to show and hide a layer depending on the Security permissions for a specific user. This can be a useful feature, but there are details it does not address. For example, how you do the following:

- Hide an individual object that cannot be part of a layer, such as a 3D object in a 3D View control.
- Have a specific dynamic be based on security permissions. For example, how to change the background color to red for a data source that the user can only read, and to green for a data source that the user can also write values to.
- Use scripting to return information about the user's security permissions for certain data sources.

To address these needs, GENESIS64 Security System provides an advanced feature that lets you query the user's security status of a single point by reading another point.

Suppose you want to know the current user's permissions for the following point: **@sim64:Float.Sine(10,0,100,0).Value**. If you create a Process Point using that tag name as the point's data source, you can see the point's value in runtime mode. If you modify the tag name by preceding it with **?DataPoint:** you will get a different value: a bitmask of the user's permissions for that point. Consider the following example in Figure 15.27, which shows the point's value in the top line and the security value (that is, the user's permissions) in the bottom line.

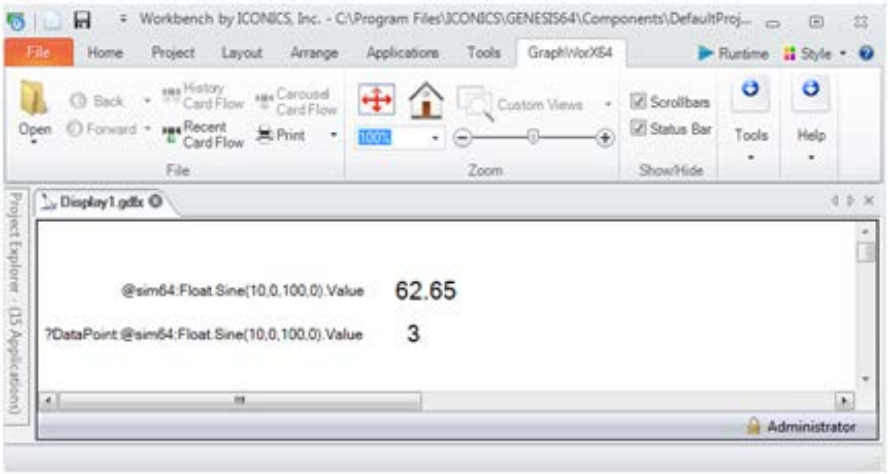


Figure 15.27 - Accessing Security Information

As you can see, the security value is 3. The possible values are:

- **3**: the user can both read and write to the point (the write bit is set to 1, the read is bit set to 1, which is '11' in binary, or 3 in decimal).
- **2:** the user can only write to the point (the write bit is set to 1, the read is bit set to 0, which is '10' in binary, or 2 in decimal).
- **1**: the user can only read the point (the write bit is set to 0, the read bit is set to 1, which is '01' in binary, or 1 in decimal).
- **0:** the user has no access to the point (both bits are set to 0).

In this example, the value is 3, therefore we know the user has both read and write permissions to the point.

> ***Tip!*** If you would like the process point to show up with meaningful text instead of numbers that represent the different states, try using state fields.

15.6.3 Hiding or Showing Objects Based on User Permissions

Now that we have seen how to read the security permissions of a user for a specific point, we will use this information to show and hide a 3D object.

> **Note:** You cannot use GraphWorX64 layers to show or hide 3D objects based on security; instead, you must show and hide 3D objects individually. The same is true of all other GraphWorX64 objects.

Before we begin, it is important to note that a point does not need to exist in any OPC server in order to set security permissions on it. However, the Security Server, when asked, will tell us if a certain user has permissions to read or write to the point.

With this in mind, there are two scenarios to consider:

- Scenario 1: Prevent an object from showing when the user lacks permissions to access the object's data sources. For example, you do not want to show a boiler if the user has no access to its temperature data source.
- Scenario 2: Set security permissions based on the confidentiality of the data, and set it independently from other factors.

In the first scenario, you would use an existing data source. However, in the second scenario, you would use a non-existent point, giving it a custom name that is meaningful for your application but does not match the name of any existing data source. For example, you might want to be able to set permissions easily for highly-secured objects, one type of object is called CriticalObject. You can use CriticalObject as the custom name of a non-existent data source that you use only for the purpose of evaluating user permissions to access the object.

Let us take a look at an example of how you might set this up.

First, you set up russella's permissions to deny him read/write access to the non-existent point, which in this example is called CriticalObject. The non-existent point acts as a real data source, but if you try to read its value, you will not get a valid value because the point does not exist.

In Figure 15.28, you can see the non-existent CriticalObject point added to the list of denied data sources for russella, and the user is denied both read and write access. If you refer back to the user permissions values on page 15-27, you will see this means that this sets the user's security permissions value for the CriticalObject point to **0** (zero).

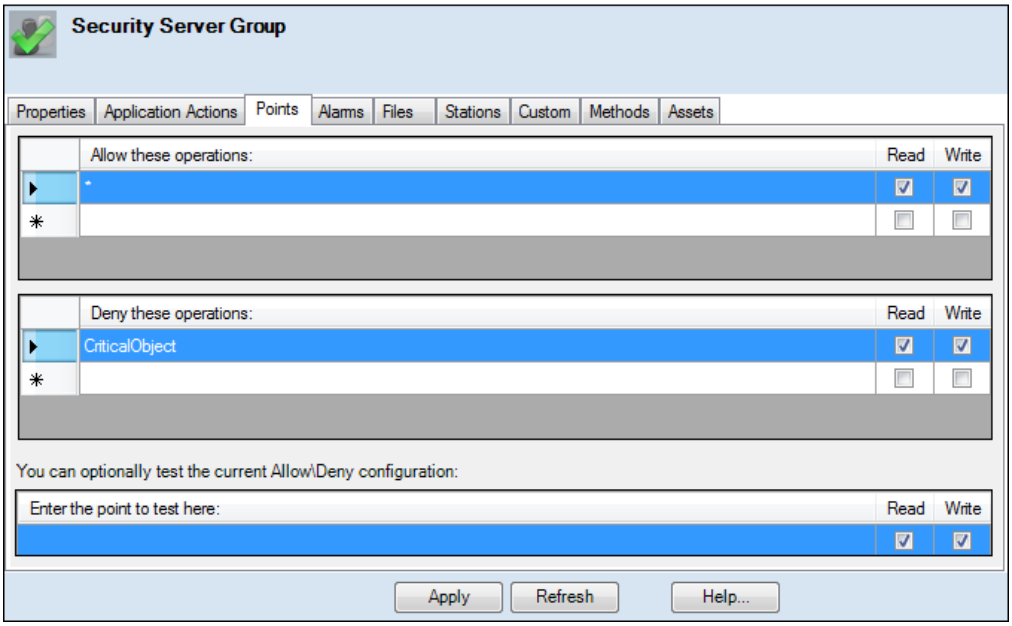


Figure 15.28 - Preventing the User from Reading and Writing to CriticalObject

Next, configure a GraphWorX64 display that contains the 3D objects you will show or hide depending on the user's permissions.

In Figure 15.29, the 3D objects are a donut and a sphere. The sphere is selected. Note the following settings for the sphere, which are shown on the right:

- Its data source is **?DataPoint:CriticalObject**. This means it will retrieve the user's security permissions for CriticalObject.

- Its **HideWhen** dynamic is set to hide the sphere when the data source value (which in this case is the user's security permissions) is equal to 0, which means the user has no read and write permissions.

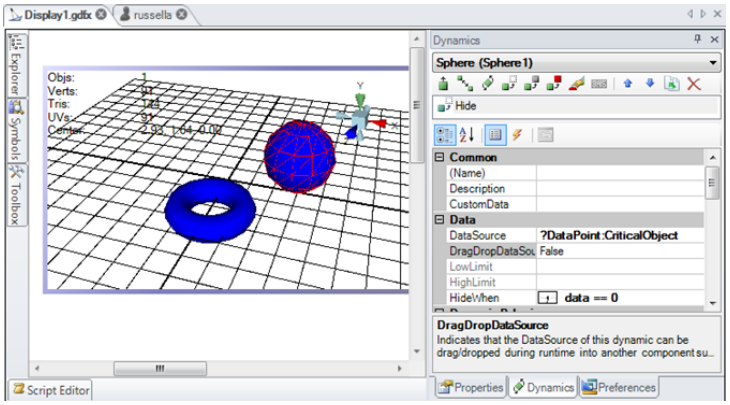


Figure 15.29 - Using a Hide Dynamic Combined with Security Settings

If you login with Administrator privileges, you will see that for administrators, the display shows all of the objects in the 3D View control, as shown in Figure 15.30.

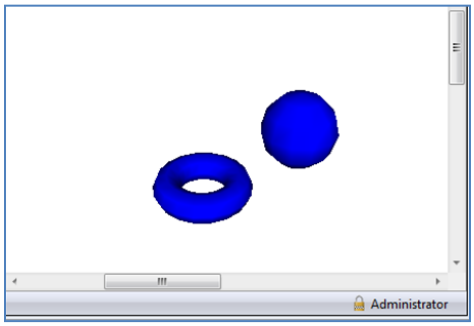


Figure 15.30 - 3D View Seen Using an Administrator Account

Now, if you log in as russella, you can see that the content has changed to reflect the permissions granted to russella; the sphere is no longer visible, as shown in Figure 15.31.

> ***Tip!*** When you are in GraphWorX64, you can easily tell who is currently logged into the system. The lower right corner of the display shows the logged in user.

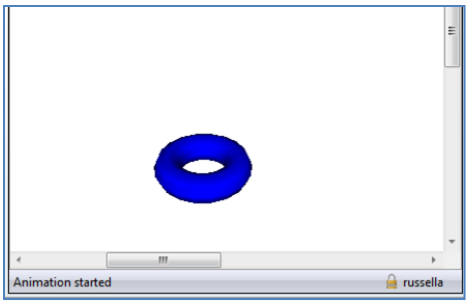


Figure 15.31 - 3D View Seen Using User Account russella

This advanced feature gives you very granular control over what users can see in a GraphWorX64 display. You can use **layers** for an easy-to-configure and powerful security integration, and you can use the **?DataPoint:** feature when layers are not sufficient.

15.6.4 Layers

Layers can be used to display information selectively based on selections made by the runtime user, or based on the security levels that are currently active in runtime. Additionally, layers can be used to de-clutter the screen content based on zoom level.

When you create a new GraphWorX64 2D display, any object that you draw or add to the work surface is placed on a *primary layer* of the display. The primary layer provides the same capability as a background in a paint program. This primary layer always exists and is visible, but is not shown in the hierarchy of objects, groups, and layers that appear in the Object Explorer.

But you can add other layers to a display. To add another layer to a display, click on the "Layer" button in the Shapes section of the Home tab, as shown in Figure 15.32. Notice that this is a 2D feature that applies to 2D displays.

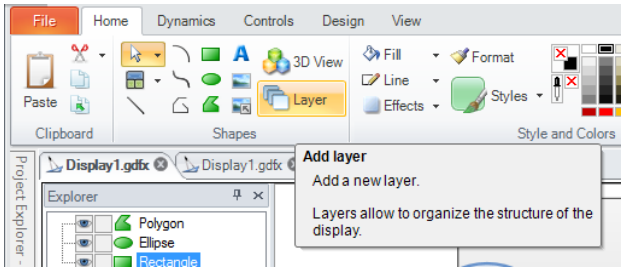


Figure 15.32 - How to Add a Layer

The new layer is added to the top of your drawing, no matter what the currently selected object is, and is numbered sequentially as "Layer *n*", where *n* is numbered numerically starting at one.

You can select any number of layers at a time. When highlighted in *gray*, a layer is active; when highlighted in *blue*, a layer is selected.

To move a layer up or down in the Z-order, click the layer until its highlighting turns from grey to dark blue, then drag the layer object in the object Explorer to the new position and release the mouse button. Figure 15.33 shows Layer4 (which is selected) being moved into a new position below Layer2 in the Explorer.

Figure 15.33 - How to Move a Layer Before (Left) and After (Right)

You can also nest layers using sub-layers, as shown in Figure 15.34. To create a sub-layer, select the layer that will contain the sub-layer (or select an object contained inside that layer), then click the "Add Layers" button. You can also drag a layer in the Explorer to the position in the hierarchy that you want the sub-layer to occupy.

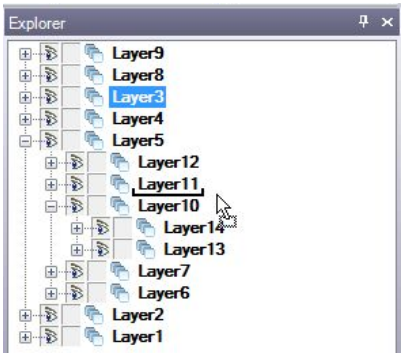


Figure 15.34 - Layers and Sub-layers in the Object Explorer

Layers can be renamed in the Object Explorer. Each layer's name must be unique. Layers can be hidden and locked just like any other object.

To add objects and groups to a layer, add them to or draw them in the contents area. Then move them into a layer by dragging the object in the Explorer, or by cutting it from one layer and pasting it into another.

Objects appear in the content area regardless of the layer they belong to. In Figure 15.33, all three objects in the content area are selected; the Rectangle and Ellipse belong to Layer 3, but the Label object belongs to Layer 2.

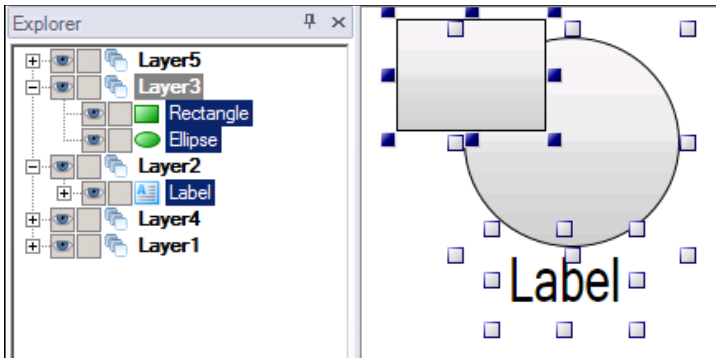


Figure 15.35 – Objects in Layers

Figure 15.36 shows a layer's properties in the Properties explorer. Notice the properties in the **Declutter** section. This set of options allows you to hide or show the selected layer in runtime depending on the zoom level being used by the operator.

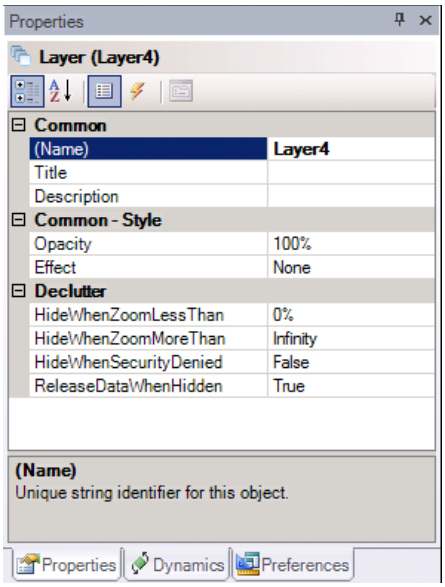


Figure 15.36 - Properties of a Layer

15.7 FrameWorX64 Server

FrameWorX64 is the core GENESIS64 product that, among other things, handles aliasing, security, and data exchange between GENESIS64 applications. There is just one communication means between the client applications and FrameWorX Server. By default, the FrameWorX Server is local on each GENESIS64 node. You must configure the default FrameWorX Server using the **Platform Services Configuration** option.

The **Passwords** tab, **Allowed Clients** tab and **Unsecured Clients** tab within the **Platform Services Configuration** tool are relevant to security considerations.

Passwords Tab

The **Passwords** tab allows users to specify credentials for different modules to connect to various servers. Currently, FrameWorX Servers and OPC XML DA servers are supported. Use * for the credentials to be used for all target addresses. These credentials are used for the modules running on the local computer.

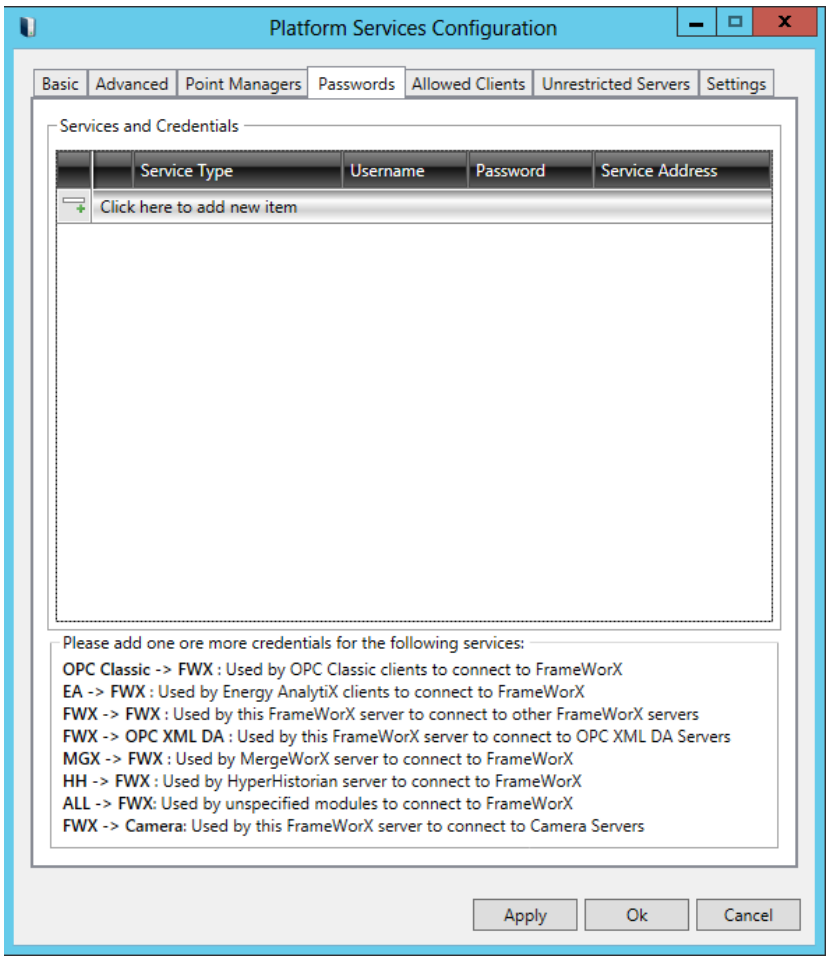


Figure 15.37 - Passwords Tab in the Platform Services Configuration Window

Allowed Clients Tab

The **Allowed Clients** tab allows users to define which client computers are allowed to connect to the FrameWorX Server. Clients from other nodes will not be allowed. The client computer must match both lists: the Allowed IP Address Ranges (IPv4 and IPv6) and the Allowed Computer Names. Use * for any name. Use IPv4 and IPv6 addresses (Windows uses IPv6 internally). All clients are allowed by default.

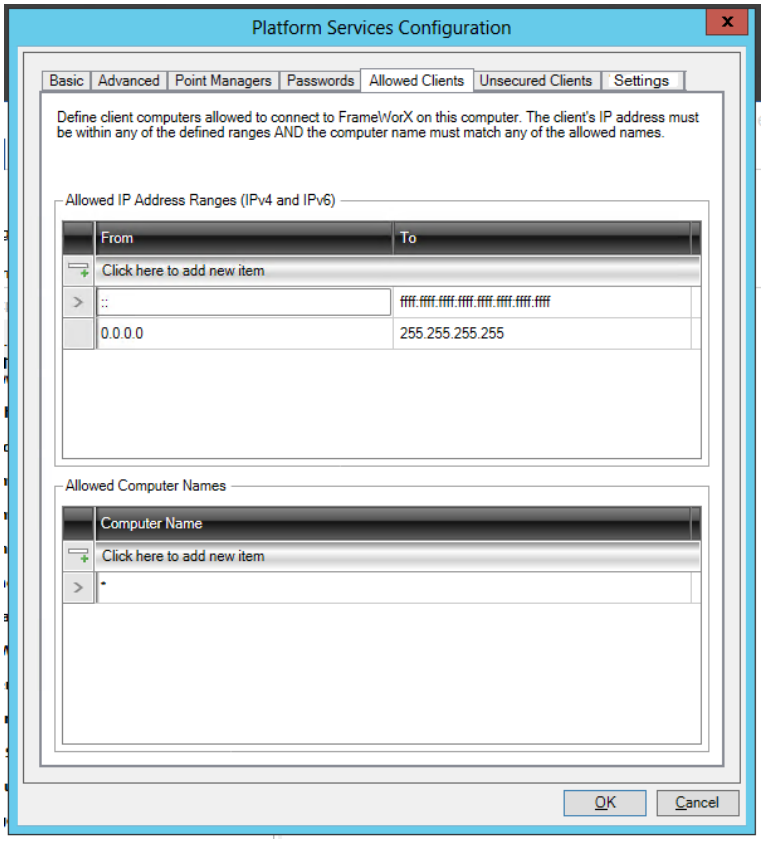


Figure 15.38 - Allowed Clients Tab in the Platform Services Configuration Window

Unsecured Clients

The **Unsecured Clients** tab allows users to define which FrameWorX Servers (acting as clients) can connect to the FrameWorX Server with no security restrictions. The client computer must match both lists: the Unsecured IP Address Ranges (IPv4 and IPv6) and the Unsecured Computer Names. Use * for any name. Use IPv4 and IPv6 addresses (Windows uses IPv6 internally). Unsecured access is only allowed for other FrameWorX Servers acting as clients. There are no unsecured clients by default.

This setting is related to setting a user name/password for FrameWorX Server to FrameWorX Server communication. When a FrameWorX Server connects to another FrameWorX Server, it is treated like other client (unless configured), i.e. it gets the permissions of the default user.

There are two ways to get better permissions:

1. Set up a user name/password for FrameWorX Server to FrameWorX Server communication on the ‘client’ FrameWorX Server. The ‘client’ FrameWorX Server then logs in using that user name.

2. Set up the ‘client’ FrameWorX Server as an unsecured client on the ‘server’ FrameWorX Server. The ‘server’ FrameWorX Server then will not check the security for the ‘client’ FrameWorX Server.

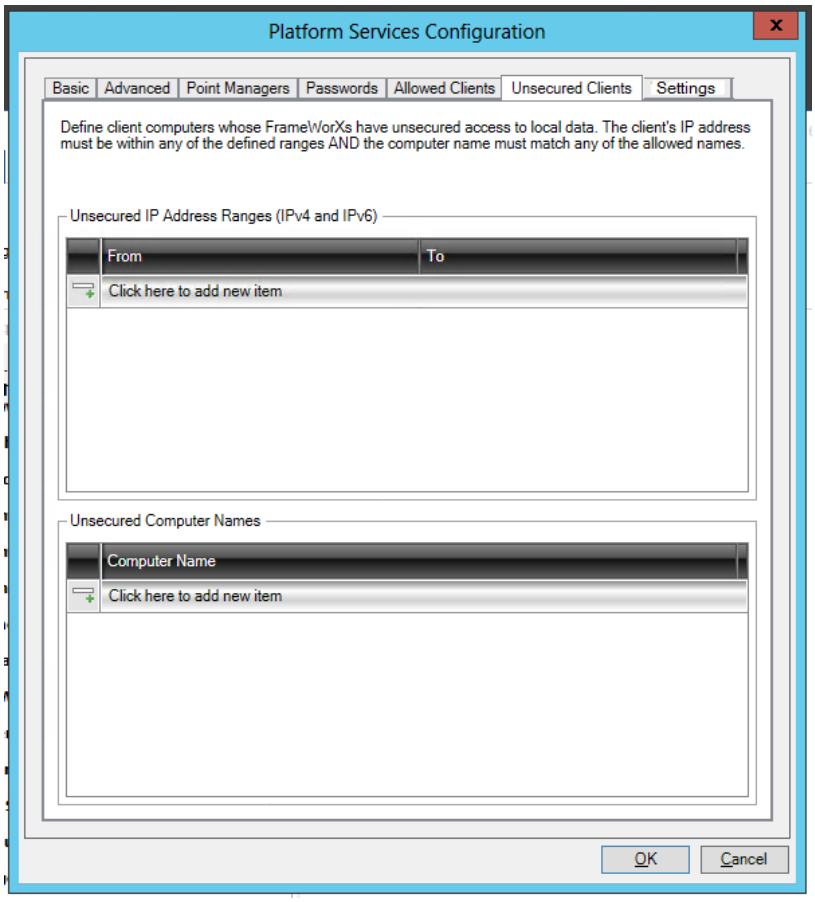


Figure 15.39 - Unsecured Clients Tab in the Platform Services Configuration Window

Lab: Security L15

15.1 Lab Overview

Many companies require security to prevent outsiders from looking at and controlling their displays as well as to give different permissions to different people within the company. IcTonics is no exception! They are looking for additional security features as well. In this lab, we will secure the icTonics project using secured layers. Note that users will assume the least restrictive permissions. Also note that Deny overrides Allow.

Estimated time to complete this lab: 30 minutes

15.1.1 Task Checklist

In this lab, you will complete the following tasks:

- Create a secured layer.
- Create a popup display to view trends.
- Define users.
- Create a security group.
- Add users to a security group.
- Configure application actions.
- Configure a secured layer.
- FrameWorX64
    - Communication Outline
    - Node Discovery
    - Testing
- Platform Services Configuration

15.1.2 Support Files

To complete this lab, you will need the following file(s):

- icTonicsHome.gdfx
- icTonicsTemplate.tdfx

15.2 Security Users

On the icTonics production floor, there are operators and administrators. The administrators have full permissions. However, the operators are not allowed to configure applications or close and exit Runtime in the GraphWorX64 display. In this section, we will add an administrator that can do everything as well as an operator who has limited permission on the system.

1. Open the **Workbench-SL** if you have closed it from the previous lab.
2. In the Provider Explorer, click on the **Security Server** icon.
3. Next, we will add a user. Expand the localhost, right-click on Users and select **Add User**.
4. Name this user **Administrator** and click **Apply**.
5. Set the password to **admin**.

   Note: When you apply these changes and the user is added, you will see that your configuration is now grayed out. This is because security immediately applies once you add a user.

6. Click **OK**.
7. Now you are going to **log in** as **Administrator**. If the login dialog does not appear, you can access it from the File menu and select Log In\Log Out → Security Login.
8. From within the **Security Login** dialog, enter the user name and password that you just created for the administrator.

   Note: Passwords are case sensitive. User names are not.

9. Now, add another user named **Operator** and set **operator** as the password.
10. We will continue by setting some application action for the user Operator.
11. Under the **Application Actions** tab, uncheck **Workbench-SL**. This will restrict the operator from entering the Workbench-SL to change configuration settings.
12. Expand the **GraphWorX64** section, and uncheck **Exit Application** so that the operator cannot close a Runtime GraphWorX64 display.
13. Expand the **Menu** subtree and uncheck the **Exit Runtime** option as well.

14. Select the **Files** tab. In the **Deny These Operations** section, enter ***.*|SecuredLayer**. Remember to include the pipe character (|) before the layer's name. Leave the checkmarks in the Read, Create, and Modify checkboxes. As a result, when you log in as the user called Operator, you will not see the layer called SecuredLayer.

15. **Check** the **Read**, **Create** and **Modify** checkboxes. This will disable (deny) these attributes.

16. Click on **Apply** to save the configuration.

17. Open your **icTonicsHome** display. Verify that the **Tank Monitor** button is under the **SecuredLayer**. Make sure that you do not add the Login button to the secured layer, though. **Save** the display.

18. If you are not already logged out, log out now by going to **File → Log In/Log Out → Server Login**, and in the dialog box that appears click on the **Logout** button.

19. Confirm that you are logged out by looking at the status in the bottom-right corner of GraphWorX64. (When a GraphWorX64 display is open, look in the GraphWorX64 status at the bottom of the display.) It should look like this: Not Logged In. If you see a user ID there, log out again.

20. While you are not logged in, return to GraphWorX64 and put the **icTonicsHome** display into **Runtime**. You should see an **Access Denied** screen.

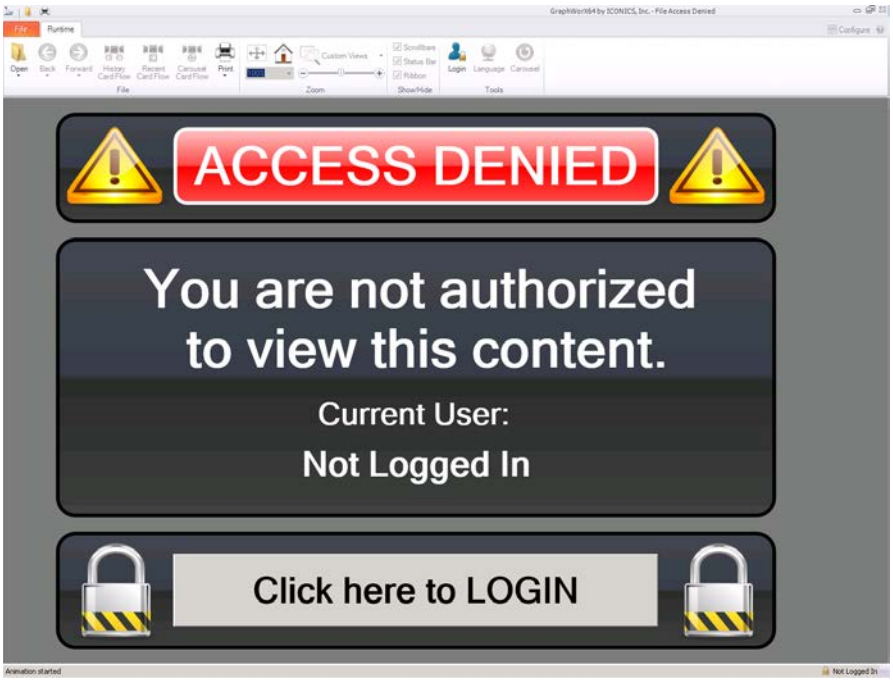


Figure L15.1 - Access Denied

21. Click on this screen's **Login** button and log in as **Operator**. You should not see the **Tank Monitor** button.

22. Notice that when you are logged in as Operator, you cannot exit the application because the Configure button is grayed-out.

23. Launch the **Security Login** dialog and login as **Administrator**. You should now see the Tank Monitor button and you should also be able to go back into Configuration mode.

15.3 Security Groups

It is possible that you will have more than one operator, so you will need logins for each user. However, configuring security for each user individually would be very inefficient. In this section, we will create a user group, configure security settings for the group, and associate users with this group. The users will then inherit the group's permissions.

1. Return to the **Security Server**. From within the expanded explorer tree, right-click on **Groups** and select **+ Add Group**.

2. **Name** this group **Operators**.

3. In the **Application Actions** tab, give this group the same action permissions that you gave to the user called Operator. (Do not configure the Read, Create and Modify permissions that you gave to user Operator.)

4. Click on **Apply** to save the configuration.

5. Create a new user call **Operator2** and set **operator** as the password again.

6. Go to the **Application Actions** section and click on the **Unselect All** button so that there are no application permissions defined.

7. Click **Apply**.

   Note: Depending on the GENESIS version, you may get a message giving you a warning that the user will not have any application permissions. Click on **Yes** to acknowledge the message.

8. Right-click on the Operators **group** and select **Membership**.

9. From within the **Set the membership** dialog, expand the user dropdown list and select Operator.

10. Click on the green plus + sign to **add** the **operator** user to the **group**.

    Note: To remove a user from the group, select the user name and hit the delete key.

11. **Add Operator2** to the group also and click **OK** to close the dialog.

12. You should see a dialog informing you the **Operation** was **Successful**. Click **OK**.

13. You can confirm that the two users are in the Operators group by right-clicking on either a user or the group and selecting membership.

14. To test the defined functionality, you will need to log out. You can go ahead and do this now.

    Note: If you are still logged in as both users, you will have to log out twice.

15. Open the **icTonicsHome** display and go into **Runtime**. You should be blocked by the **Access Denied** display because you are not logged in.

16. Click on the button to log in. **Login** as the **Operator2** user.

17. You should then see the **Tank Monitor** button as you would if you were logged in as Administrator. But you cannot exit the Runtime.

18. Log in as **Operator** again. Even though we did not deny access to the Operators group for the secured layer, the user inherits the permissions from the group. Therefore, the user called Operator can still can see the layer. That is because we specifically denied this access for the Operator but not for the group.

15.4 FrameWorX64 Communication Outline

Once security is enabled on a FrameWorx64 server, clients expecting to retrieve data from said FrameWorX64 sever are required to be authorized through the GENESIS64 Security system. The following procedures are intended to outline key elements in the FrameWorX64 configuration that should be considered when security is enabled. This section focuses on three of the commonly used FrameWorx64 connect types.

- OPC Classic → FWX
- FWX → FWX
- HH → FWX.

Each of the entries in this section will be discussed on more detail as we proceed.

Note: On site, you may need Windows administrator privileges or assistance from a Network, Firewall or SQL Server administrator to perform some of the actions listed below.

ICONICS software has been 'Network Aware' nearly since the company started in 1986 and our engineers have done a great job making GENESIS network implementation simple. However, computer networking by nature is complex. Cabling, routers, firewalls and security, just to name a few, are all components that comprise a network today. Coordination with a variety of specialized administrators, including those handling Windows and SQL Server, may be necessary in order to successfully facilitate what you intend to accomplish.

Considerations:

- GENESIS64 Security is not involved when browsing for tags using the Data Browser. Jan, Is this true?
- It is recommended that each GENESIS64 node that will be included in a pool of nodes that will be communicating to remote FrameworX64 services share the same GENESIS64 Security database. Sharing the same security database can be accomplished in a variety of ways.
    - Using the GENESIS64 database Export and Import utilities. This **Does Not** require authorization from the remote FrameworX64 server.
    - Sharing the GENESIS64 Security SQL Server database, allowing remote connections to this security database and utilizing the GENESIS64 Connect Database feature. This **Does** require authorization from the remote FrameworX64 server.
    - Using SQL Server backup and restore utilities.This **Does Not** require authorization from the remote FrameworX64 server.

Network Discovery Prerequisites:

- Any network node that is intended to be a FrameworX64 Server or Client must be 'Discoverable' on the local area network. In order to accomplish this, check to see:
    - Do all the FrameworX64 nodes belong to the same Windows Domain or Workgroup?
    - Can Windows discover each GENESIS node on the LAN?

Utilities (expected to be executed by a network administrator):

- Windows Network Discovery.
- DOS Commands such as NSLookup, IPConfig and Ping. Network administrators may have additional tools at their disposal.

GENESIS64 Utilities:

- TraceWorX64
- MonitorWorX Viewer
- Dataspy64
- License Utility

15.5 FrameWorX64 Node Discovery

GENESIS64 leverages the Windows networking platform for FrameWorX64 discovering computers on the network. Essentially, if Windows does not discover nodes on the network, FrameWorX64 will not discover the nodes either. Communications may, or may not, be accomplished using IP addresses. However, this is not the preferred method.

1. We will start by attempting to discover the GENESIS64 nodes in the 'Network Neighborhood'.
2. Open the Windows file explorer and navigate to **C:\Program Files\Common Files\ICONICS\FWX64\BIN**.
3. Double-click on **Dataspy64.exe**
4. Double-click on **Network Neighborhood** and expand the **Entire Network** entry.
5. The following figure displays in Dataspy: the nodes on the Foxboro, MA, USA training facility network.

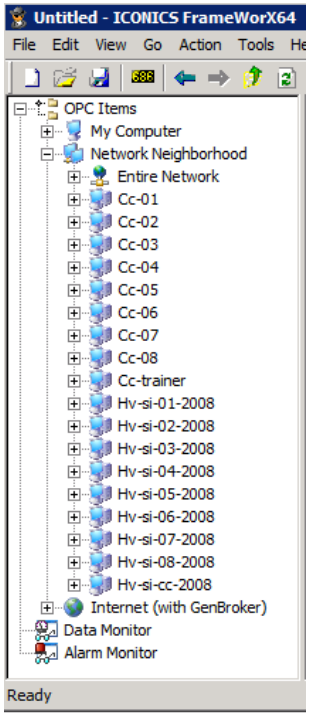


Figure L15.2 – ICONICS Training Facility Network Neighborhood

6. If you did not discover all the GENESIS64 nodes, consider this outline for troubleshooting.

7. Operating System-level Troubleshooting:

    a. Does network discovery in Windows File Explorer find all GENESIS nodes?
        i. Yes.
            1. Go to FrameWorX Testing.
        ii. No.
            1. Check your **Domain** controller or **Workgroup** configuration.
                a. Are all the GENESIS64 nodes in the same Domain or Workgroup? You may consider creating a new Workgroup for GENESIS64 nodes.
            2. Is Windows **Network Discovery enabled** under Network and Sharing Center → Advanced sharing setting?
            3. Is there a **Firewall** that may be blocking this functionality?
            4. When network discovery is functional, proceed to FrameWorX Testing.

15.6 FrameWorX64 Testing

Following the steps in this lab will demonstrate the effects GENESIS64 Security has on remote FrameWorX64 communications. By now, your instructor should have assigned at least two nodes for testing. You will have to substitute the Server and Client references in this lab with actual computer names assigned by your instructor. Let's get started.

Note: At least two nodes are required to perform the following steps. As a matter of reference in this procedure, the two nodes will be referred to as **Server** (FrameWorX64 server) and **Client** (FrameWorX64 client). For documentation purposes:

- Server = Hv-si-08-2008
- Client = Hv-si-03-2008

Firewall:

Depending on your Firewall Rule Base, there could be constraints on the ports that GENESIS will be using for communications (ports **8778** and **38080**, for example). In order to avoid unnecessary complication, we will **Turn Off** the **Firewalls** for both the Server and the Client.

1. On each computer, select Control Panel → Windows Firewall → Turn Windows Firewall on or off.
2. Select the **Turn off Windows Firewall** for both the **Private** and **Public** networks and click **OK**.

Note: On site, a Firewall Administrator could open the ports that FrameWorX64 uses for communications, rather than shutting the firewall off completely. Contact ICONICS support if this is necessary.

Client GraphWorX64 Display:

1. On the **Client** node, launch **GraphWorX64** and save the display as C:\Training**FWXTest.gdfx.**
2. Add a **Process Point** to this blank display. This launches the Data Browser.

   Note: When selecting the following tag, select the **Sine Folder** (not the Sine tag) and the **VerySlowXL359** tag is at the bottom of the tag list.

3. From within the **Data Browser**, browse to Home → FrameWorX Network → Hv-si-08-2008 → Opc Classic Server → My Server → Simulations → Float → Sine → VerySlowXL359.

4. Click **OK**.

5. Go into **Runtime**. The tag will not update and there will be an asterisk on the screen indicating a communication failure.

   Note: In the following step, if you do not see a tooltip in Runtime, go back into the GraphWorX64 configurator and, from the Display Canvas, set the **ShowToolTips** property to **True**.

6. Hover the mouse over the process point. As seen in the figure below, notice the **BadUserAccessDenied** entry in this message. This indicates the Server is not allowing the Client access to read the tag value.

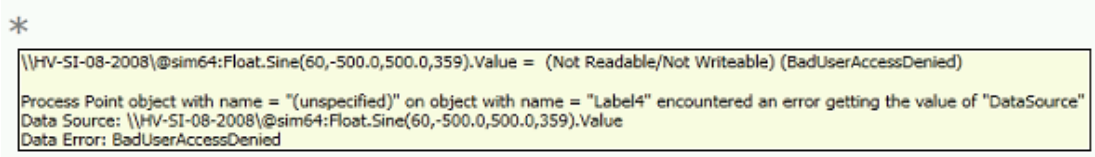


Figure L15.3 – Server Denies Client Access

Server Security Database Export (FYI Only - Not needed in the training).

You only have to perform this section if the Security databases on the Client and Server differ.

If this lab was executed from beginning to end on each client and server computer being used for FrameWorX64 communication, the security database configuration should be identical on both computers. If a student decided to use (create) user names and/or password different than what the lab called for, this will need to be accounted for as we proceed. Having said this, and in order to be sure the security databases are identical, we will use the GENESIS64 export and import utility.

1. On the **Server**, open **Workbench-SL**.

2. Select the **Security** provider.

3. Expand the **localhost** tree.

4. Right-click on the **IcoSec** (or Active) database and select **Export Sub-Tree**.

5. Leave the **default** setting in the **Export Options** dialog and click **OK**.

6. Click **Close.**

7. In the Export Sub-Tree dialog, click on the file name.
8. Select **Save As** and save the file as **C:\Training\Hv-si-08-2008.csv**
9. Close the **Sub-Tree** dialog and **Click** the **Open Folder** button.
10. Right-click on the **Hv-si-08-2008.csv** file and select **Copy**.

    Note: If you are attending class in Foxboro, the instructor can assist in mapping the C$ drive of the Client computer. Otherwise, you can use a flash drive to move the file.

11. **Paste** the **Hv-si-08-2008.csv** file into the Client's **C:\Training** folder.

Server Security Database Import (FYI Only - Not needed in the training).

You only have to perform this section if the Security databases on the Client and Server differ.

1. On the **Client**, open **Workbench-SL**.
2. Select the **Security** provider.
3. Expand the **localhost** tree.
4. Right-click on the **IcoSec** (or Active) database and select **Import**.
5. Leave the **Default** settings in the **Import a file into the database** dialog and click on the **Browse** button.
6. Select the **C:\Training\Hv-si-08-2008.csv** file and click **Open**.
7. Click **Upload**.

Note: There are other techniques available, other than export/import, which will allow for security database replication. You may consider researching a technique that works best for your application.

8. Click **Close**.

15.7 Platform Services Configuration

Now that we have ensured that the records (User and Group info) in the Server Security database also exist in the Client Security database, we can continue. Be sure that the user name (Administrator) and password (admin) exist. We will use this credential pair for the Client FrameWorX64 configuration.

FrameWorX64 Configurator:

In this section, we will configure the Client user name and password to gain access and authorization to retrieve data through **FWX → FWX** from the Server to the client. Let's check it out.

1. On the **Client** (HV-SI-03-2008), select **Start** and type in **frameworx** in the **Search programs and files** field.
2. In the list of programs, select the **FrameWorX Server Configurator**.
3. The following figure shows the **Platform Services Configuration** dialog.

Note: From within the Basic tab, you could configure a Remote License Server. See the GENESIS64 online Help for more information.

4. Click on the **Passwords** tab.

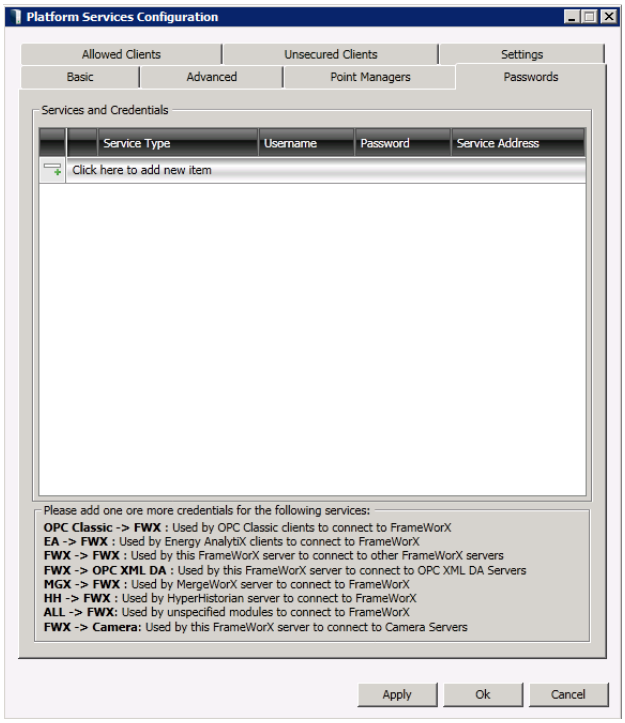


Figure L15.4 – FrameWorX64 Authentication Configuration

5. Add a new item and specify the **Service Type** as **FWX → FWX**.

6. Enter the Username **Administrator** and the Password **admin**.

Note: To remove an entry from the list in this dialog, select the entry and hit the delete key.

7. Leave the **Service Address** as ***.**

8. Click **Apply** and **OK**.

Note: FrameWorX64 service-related changes may require a **Restart** of the **FrameWorX64** service for the changes to take effect.

9. We will proceed to restart the **FrameWorX64** service on the **Client.**

10. Click on **Start** and enter **Services.msc**. Hit **Enter**. This launches the Windows Services dialog.

11. From the **Client**, within the **Services** dialog, right-click on the **ICONICS FrameWorX64** service and select **Restart**.

12. Once the restart is complete, on the **Client**, return to the **GraphWorX64** display and **Log in** as Administrator.

13. You should see the data updating in the display.

This concludes this lab.

GraphWorX64 Shortcuts

Shortcut Key	Function	Config Mode	Runtime Mode
F1	Help	✓	
F4	Properties window	✓	
Alt + F4	Close a display	✓	
Alt + F11	Script editor	✓	
Alt + HA	Arrange menu	✓	
Alt + C (Runtime)	Configure mode		✓
Alt + C (Config)	Controls Menu		
Alt + D	Dynamics menu	✓	
Alt + E	Design menu	✓	
Alt + F	File menu	✓	✓
Alt + H	Home menu	✓	✓
Alt + O	Open menu		✓
Alt + P	Print menu		✓
Alt + R	Runtime mode	✓	
Alt + T	Tools menu	✓	✓
Alt + V	View menu	✓	✓
Alt + Y	Dynamics menu	✓	
Ctrl + A	Select all objects	✓	
Ctrl + C	Copy	✓	
Ctrl + D	Duplicate selected object(s)	✓	
Ctrl + F	Find	✓	
Ctrl + G	Group into symbol	✓	
Ctrl + H	Replace	✓	
Ctrl + N	New file	✓	
Ctrl + M	Toggle between runtime mode and configuration mode	✓	✓
Ctrl + O	Open file	✓	✓
Ctrl + P	Print file	✓	✓
Ctrl + R	Runtime Window Properties Mode	✓	
Ctrl + S	Save file	✓	
Ctrl + T	Toggle toolbars	✓	
Ctrl + U	Ungroup symbol	✓	
Ctrl + V	Paste object	✓	
Ctrl + W	Show whole display	✓	✓
Ctrl + X	Cut object	✓	
Ctrl + Z	Undo	✓	
Ctrl +]	Bring forward	✓	
Ctrl + [	Send backward	✓	

Shortcut Key	Function	Config Mode	Runtime Mode
Ctrl + Numpad +	Zoom in	✓	✓
Ctrl + Numpad –	Zoom out	✓	✓
Ctrl + Alt + C	Set current active layer	✓	
Ctrl + Shift + A	Space evenly across	✓	
Ctrl + Shift + B	Align bottoms	✓	
Ctrl + Shift + C	Align centers	✓	
Ctrl + Shift + D	Space evenly down	✓	
Ctrl + Shift + H	Make same height	✓	
Ctrl + Shift + L	Align lefts	✓	
Ctrl + Shift + M	Align middles	✓	
Ctrl + Shift + O	Make same height and width	✓	
Ctrl + Shift + G	Snap to grid	✓	
Ctrl + Shift + R	Align rights	✓	
Ctrl + Shift + T	Align tops	✓	
Ctrl + Shift + U	Undo zoom	✓	✓
Ctrl + Shift + W	Make same width	✓	
Ctrl + Shift +]	Bring to front	✓	
Ctrl + Shift + [	Bring to back	✓	
Shift + resize	Preserve aspect ratio while resizing an object	✓	
Shift + object creation	Create an object with equal width and height	✓	

Delimiters and Syntaxes

Historical Datasource Prefixes	Module
@ICONICS.TWXSQLSvr64.1\	TrendWorX64 Historical Tag
awx:	AlarmWorX64 Historical Tag

Datasource Prefixes	Provider
ac:	Equipment Property from AssetWorX
lic:	License FrameWorX Plug-in tags
sim64:	Simulation FrameWorX Plug-in tags
localism:	Simulation tags from GraphWorX64
rdcy64:	Redundancy FrameWorX Plug-in tags
bacnet:	ICONICS Bacnet OPC Server FrameWorX Plug-in tags
snmp64:	ICONICS SNMP Server FrameWorX Plug-in tags
exp64:	Global Expression FrameWorX Plug-in tags
grp64:	Group FrameWorX Plug-in tags
vset64:	Value Set FrameWorX Plug-in tags
rgs64:	UDM Register FrameWorX Plug-in tags

Beginning Delimiter	End Delimiter	Function
/?	?/	Equipment Class Alias definition from AssetWorX
{{	}}	OPC Tag delimiters in an expression
<#	#>	Global Aliasing delimiters
/+	+/	Language Aliasing delimiters
“	”	String literal in a process point
<<	>>	Local aliasing delimiters
A:AliasName	Allows dynamic global aliasing definition. The Complete syntax is *A:AliasName=“AliasValue”/ThemeScope;*. ThemeScope can be, but not limited to the following: Not defined – Relative to current document level 0 0 – Machine Level 1 – Process Level 2 – Document Level 0 3 – Document Level 1 +1 – Relative to current document level 1 +2 – Relative to current document level 2	

Glossary

3D Visualization is a three-dimensional rendering of a GraphWorX64 display or TrendWorX64 trend.

Account Policy is a set of rules that define login and logout policies and *Time-based Restrictions* for set of users and/or groups.

Address Space is an organizational scheme for objects. An address space is used in OPC UA for objects, properties, and relationships.

Alarm Area, or Area for short, is a logical folder grouping option that allows you to categorize and organize your alarms. You can have any number of areas and subareas. You can also associate alarms to any number of areas as you wish. Areas can be used for filtering alarms.

Alarm Filter is a rule that controls which alarms display in the viewer in runtime and how they display.

Alarm Indication Dictionary contains a set of conditions along with symbols or icon to display when the condition for the alarm becomes true.

Alarm Logger Columns are defined within an *Alarm Logger Configuration*. A column represents an alarm attribute that you would like the log into the database. The name of the column is the name of the table field.

Alarm Logger Configuration stores information such as the subscription the alarm and/or event server and the database to which you want to log the alarm information. You can configure as many alarm logger configuration as you please, but you must add it under an *Alarm Logger Node* to make the configuration active. This should not be confused with the Alarm Logger Configuration Database. You can only have one *active* alarm logger configuration database at a time.

Alarm Logger Node refers to a computer where you want to use the *Alarm Logger Configurations*. The node is typically the local computer name or IP address where the AlarmWorX64 Logger is installed.

Alarm State Value is used by digital alarms to identify the state that will trigger an alarm. Since the alarm is digital, the two values that this state can have is 1 or 0.

Alarm Subscription is the connection between the alarm client and the alarm server. This determines which alarms the server will send to the client.

Alarm Tag is an OPC AE tag that defines an alarm. You can associate an OPC DA or OPC UA tag to monitor the values. Inside this tag, you can set up the different alarm types.

Alarm Template is optionally used as a basis for creating and maintainin alarm tags. Instead of modifying each OPC alarm tag individually, you can maintain the alarms uniformly from the alarm template. In the configuration form of an alarm tag created from a template, values that the alarm template populates are highlighted in pink. An alarm template must be used when using the *Tag Import Wizard* to create multiple alarm tags at a time.

AlarmWorX64 is a set of applications that can be used to monitor device conditions and events. The applications are the Alarm Server, Alarm Logger, and Alarm Viewer. Once alarms are configured in the server, you can log the data using the Alarm Logger or view it through the AlarmWorX64 viewer. The AlarmWorX64 viewer can run within the Workbench, or as a viewer within GraphWorX64.

AlarmWorX64 Logger subscribes to an OPC Alarm and Events server and stores data in a database, providing a permanent copy of alarm and event notifications.

AlarmWorX64 Server is the application used to generate alarms notifications. It receives OPC complaint DA or UA data and generates alarms based on configured information. It sends generated alarms to any subscribed clients.

AlarmWorX64 Viewer is a client application that subscribes to OPC UA or OPC AE serves. The viewer allows you to view alarms and events based on the *Alarm Subscription* and properties set in the viewer.

Alias Theme is a type of classification that links a global alias to one or more data values and bundle Global Aliases together.

Alias Value is a predefined value for a *Global Alias* that can resolve to during runtime when the correct theme is set.

Alignment is a way to organize display objects along a grid line in GraphWorX64.

Application Mode is the choice of mode in which GraphWorX64 configuration is done. The three modes work in tandem with an engineer's familiarity with GraphWorX64. They are: Basic mode (beginner level), Standard mode (appropriate for development of most applications), and Advanced mode (all available options are exposed to the developer).

AssetWorX is an application providing asset organization and logical hierarchy to GENESIS64. Along with GraphWorX64 it is a primary source for executing commands. AssetWorX is an ISA-95 compliant asset structure offered in conjunction or independent of standard tag based designs.

Chart is a container that holds one or more plots. Each tab in the TrendWorX64 Viewer can have any number of charts in it.

Client-Side Filtering is a type of alarm filter. You can create client-side filtering from OPC AE clients to limit the amount of alarm data going to the destination. Client-side filtering does not limit the server from sending the alarms to the alarm client.

Configuration Mode is a design mode for GENESIS64 in which displays are built. This mode can display sample data, but not live or historical data.

Content Area is the location where you can create, edit, and display different files in the Workbench. This area can span a configuration of multiple monitors.

Conversion Alias is a type of language alias. This type of alias converts one type of measurement unit to another. The final real-time value depends on *Unit Bindings* and *Unit Conversions* defined in the *Language Alias* configuration.

Critical Alarm is defined in the *Security Server*. When acknowledging *Critical Alarms* you must log in again and acknowledge the alarms within a defined period.

Critical Point is defined in the *Security Server*. When you try to write to this point, you must log in again and write to the point within a defined period.

Database Group is a hierarchical grouping in the TrendWorX64 configuration that allows you to connect to a database for storing data. You can also optionally connect to a secondary database for redundancy.

Data Aggregation is a feature of *UDM Registers*, which pools together OPC tag requests from clients to reduce I/O traffic to a hardware device.

Data Bridging is a feature of *UDM Registers*, which sends a device' s output to another device.

Data Collection Rate is the rate at which samples are collected (read) from the OPC server.

Data Entry Object is a *Process Point Object* that allows operators to enter data that can be written to the process point during runtime.

Data Prefetch is a feature of *UDM Registers*, which polls and collects output from a hardware device in anticipation of incoming client requests.

De-cluttering is a method of showing or hiding details of a display based on the zoom level using *Layers*.

Deviation Alarm is one of the alarm types. It uses two inputs and takes the absolute value of the difference between these two inputs. Alarms are generated when this difference exceeds the Hi and HiHi limit or falls below the Lo and LoLo limit.

Digital Alarm is one of the alarm types. It tags a Boolean tag or expression that evaluates to either 1 or 0 and triggers an alarm based on the *Alarm State Value* you entered.

Display Refresh Rate is the rate at which the TrendWorX64 Viewer updates the viewer with new data. This rate along with the *Data Collection Rate* determines how much data is in the viewer buffer.

Distributed Control System (DCS) is a control system whereby the controllers are geographically distributed and independent. Data from these remote devices are usually collected by a central server.

Dynamic is an action property of an object that makes the object actionable or changeable. Dynamic actions include dimension, color, selectors, and other actions available in GraphWorX64.

Dynamics Explorer is the section of the Workbench where the properties of a dynamic can be modified.

EarthWorX64 is a geographical asset management application based on Bing technology. EarthWorX64 can run within the Workbench, or as a viewer within GraphWorX64.

FrameWorX64 is the ICONICS GENESIS64 OPC UA server. All communications between client applications and OPC data sources go through the FrameWorX64 server.

Freeze Mode is a runtime mode in which an operator has paused the TrendWorX64 Viewer to stop the scroll of the display's incoming data. When the operator ends Freeze mode, the data that has accumulated appears in the graph. Some Viewer options are available only in Freeze mode.

Function Key Action is a *Pick action* that applies only to the This Display object. At runtime, the action is triggered by the runtime operator pressing a function key.

GENESIS64 Controls is a set of controls in GraphWorX64 that allows you to create and view other data. The viewer controls include: AlarmWorX64, TrendWorX64, GraphWorX64, and EarthWorX64. Tool controls include: the Smart Pin, PushPin, Scale Control, and Pipe Control.

GenBroker is a service that uses COM/DCOM to communicate with GENESIS32 clients for backward compatibility.

GenEvent is an event generated by ICONICS. The event can be, but is not limited to, a write to OPC tag or a startup of a service.

GenTray is an application used to configure the *GenBroker* service that communicates with legacy OPC data sources.

Global Alias is a reusable variable that can have one or more values. A global alias is configured and stored in the Global Aliasing System (GAS) database is available for use with all GENESIS64 applications and can be assigned to a theme. A global alias created dynamically in a GENESIS64 file is available only in that file and does not have a theme.

GraphWorX64 is the GENESIS64 display technology that allows you to build *HMI* or *SCADA* GUIs (Graphical User Interfaces). GraphWorX64 is the lone GENESIS64 application that can run as a standalone application outside of the Workbench.

GraphWorX64 Content Area is the defined work surface where you can add GraphWorX64 objects. In this area, you can build your *HMI* display.

GraphWorX64 Template is a means for creating a uniform appearance among the displays that you create. A GraphWorX64 template has a file extension of .tdfx.

HMI stands for Human Machine Interface, a GUI display for automation and control software.

History Refresh Rate is similar to the *Data Refresh Rate*. However, instead of refreshing and updating the viewer with real-time data, the *History Refresh Rate* determines how often the viewer is updated with historic data.

Home Page is a dedicated space of GENESIS64 Workbench's content area reserved for a web-based display of your choosing. You can incorporate contents such as RSS feed or a web site into this page. It can be launched at Workbench startup or configured into a layout.

Hyper Historian is a high speed data logger that can store data to disk for later analysis.

Ideal Pen is a pen that allows for comparisons of past historical data to current historical data for the same historical pen.

Key Performance Indicator (KPI) is a set of variables used to determine the success of an operation. For example, managers may use KPIs to indicate if the resources in a plant floor are used to maximum productivity.

Language Alias is used for displays that have a trans-lingual requirement for users. At runtime, the language alias substitutes a string in one language for a string in another using the Language Aliasing System (LAS). You must predefine the languages, the strings you want available, and the language-specific translation of each string.

Layers are levels of a display that you can arrange objects into. You can hide or show layers under specified security or zoom conditions.

Legend is the key for a trend display. The legend includes data points and their marker colors in the display, and can be shown or hidden from view.

Limit Alarm is a type of alarm. When configured, it can generate alarms based on thresholds that you configure. The thresholds for this alarm type are LoLo, Lo, Hi, and HiHi. Values at LoLo or below generates a LoLo alarm; values between LoLo and Lo, including Lo generates a Lo alarm; values between lo and Hi (exclusive) are considered normal; values at Hi or above, but below HiHi generates a Hi alarm; values at HiHi or above generates a HiHi alarm.

Logging Group defines the table structure for the logged data. You can define the data collection rate, logging rate, and manage the database tables.

Markers are optional symbols displayed at each data point in a trend display.

Membership refers to the relationship between security groups and users. You extend *Security Group* membership to *Security Users* by adding users to the group.

Node Pairs refers to a primary server and its stand-by server when paired for the purpose of *Redundancy*.

Object Explorer, also known as the "Explorer" or "Project Explorer", is the panel inside GraphWorX64 that lists all objects, including hidden ones, in the currently open display. It is easier to select objects in a group if you select them in the Object Explorer rather than in the content area.

OPC AE stands for OPC Alarms and Events, which is used to monitor devices for conditions and provide a reporting function.

OPC Client can receive information from OPC Server if both use the OPC Foundation standards. GraphWorX64, AlarmWorX64, TrendWorX64, etc., are all examples of OPC Client.

OPC DA is OPC Data Access, which is used for reading real-time data.

OPC HDA is OPC Historical Data Access, which is a format that allows you to log data into data files either held in memory or written to disk as database files so that the data can be replayed or analyzed at a later time.

OPC Server can communicate with OPC devices through PLC or other I/O channels and can format the data into something that an OPC client can work with.

OPC stands for OLE for Process Control, which is a standard for connection and communicating with industrial automation devices based on the specification form OPC Foundation (OPC.org).

Pack and Go Wizard copies a project's resources into a file, making the project portable. The wizard can compress the project and encrypt the project.

Pens are the points that put values on a trend chart or graph. A pen is the connection to the trend display from the OPC UA, OPC DA, or OPC HDA data source.

Plot and Plot Type are a set of pens and the type of chart they will draw in a trend display.

Pick Action is a type of *Dynamic* used to assign a command to a shape or object that can open a display or a popup, download a value to an OPC Tag, run a script, or perform one of many other actions as the result of runtime user interaction with the object.

Pipe Control makes it easy to create pipes and elaborate plumbing schemes in a GraphWorX 2D display. You can easily animate an object so that, during runtime, it moves along the path of a 2D pipe.

Pivot Control allows the creation of simple, elegant menus in the ModernUI style. Each pivot page is a GraphWorX64 canvas allowing any control, object or dynamic to be placed inside. The Pivot Control supports click, touch, or swipe to navigate.

PLC stands for Programmable Logic Controllers, which are programmable devices used to provide industrial automation controls. OPC servers can connect to these devices to obtain human readable data.

Preferences Explorer is where you configure default settings and behaviors for display objects in GraphWorX64.

Printer Logging is an optional way of sending alarm events to a printer so that a written record is made of the log files.

Process Point Object or generally called a Process Point, is a dynamic that connects to an OPC DA or OPC UA data source to display the value inside a GraphWorX64 display.

Project is the founding concept of the GENESIS64 Workbench. A project is the set of applications and related resources (such as database configurations, services, and project files) that belong to and should be available to a single project inside the Workbench.

Project Explorer is the navigational component of the GENESIS64 Workbench. You can use the Project Explorer to navigation to different applications within the GENESIS64 Suite.

Project File is the wrapper for a set of displays and settings in GENESIS64 that can be opened and worked with as a set.

Properties Explorer allows you to configure properties of each object on your GraphWorX64 display. If there is no object selected, the properties shown are the properties for the This Display object.

PushPin Control is a simple shape with complex features, which you can add to an EarthWorX map or a GraphWorX display for identifying locations or assets.

Rate Limit Alarm is much like the Rate of Change alarm except that the change limit is not an absolute number – instead, it is expressed in terms of a positive or negative value.

Rate of Change Alarm is one of the alarm types. This type of alarm is generated when the OPC value changes faster than the rate you configure. The rate is calculated by taking the absolute value of the difference between the last two readings of an OPC tag, divided by the change in time (timestamps) from the last two reading. The rate you enter is the Limit per Second rate.

Reciprocal Conversion is a unit conversion that expressions an additional way of converting a *Unit Conversion* that you just defined. For example, after you define a unit conversion from Celsius to Fahrenheit, you must define its reciprocal converstions which are: Fahrenheit to Celsius, Celsius to Celsius, and Fahrenheit to Fahrenheit.

Redundancy is a means for establishing a parallel backup database to act as a stand-by for the primary database where data is actively being logged. A redundant stand-by can become active if the primary database becomes unavailable, reducing the risk of losing data due to loss of database availability. Databases, loggers, clients, licenses, and security can all be safe-guarded using redundancy.

Reference Object is the last object selected among many. When you arrange the selected objects, all objects are arranged based on the properties of the reference object.

Regular Expression is a syntax that can be used to define the required format of a secured password string. This is a standard syntax whose details can be easily found on the internet.

Ribbon is synonymous to the old style application menu at the top of an application. The GENESIS64 Workbench has a ribbon at its top with different tabs that change depending on the application you are working in and the object you have selected.

Runtime Preview Mode allows you to view how the GraphWorX64 display would look like in runtime. However, since this is only a preview, you can still edit the display because you are still in *Configuration Mode*.

Runtime Mode, as opposed to Configuration Mode, allows for viewing live or historical data. You may not edit data or make configuration changes in this mode in viewers. Some ICONICS servers, such as the AlarmWorX64 server, allow for updates to the configuration while the service is running.

Runtime Ribbon lets runtime users zoom in and out, access views, browse through display history, hide objects in the display, log in or out, open a Carousel of displays, and more. A GraphWorX64 tab appears on the ribbon, but if the display has Viewer controls in it, additional tabs can provide additional EarthWorX64, AlarmWorX64, or TrendWorX64 tools, depending on the Viewer that the runtime user clicks on.

SCADA, which stands for Supervisory Control and Data Access, is a system that provides the means to observe and control automated systems.

Scale Control provides a shortcut for creating a GraphWorX64 object that has a dial or ruler, such as a gauge, a thermometer, a scale, a clock or watch, a meter, a speedometer, or a visual counter.

Security Group is any group defined in the *Security Server* configuration. A security group has its own permissions, and it exists solely to provide those permissions to the *Security Users* in its *Membership*.

Security Permission is the application access and data access granted to a *Security User* or *Security Group*.

Security Server defines the security configuration for and prevents unauthorized user access in GENESIS64 resources.

Security User is any user defined in the *Security Server* configuration. A security user has its own *Security Permissions*, and can have *Membership* in a *Security Group* that has overriding Security Permissions.

Server-Side Filtering is a type of alarm filter. You can use this type of filtering to limit the number of alarms that the alarm server sends to the client. This is most useful for reducing network traffic when the alarm server and the alarm clients are on different machines.

Service Oriented Architecture (SOA) is a software architecture whereby each user does not start the software application individually. Instead, the software is started and managed by the operating system as services and can serve multiple users concurrently.

Side Panel is a section of the TrendWorX64 Viewer that gives runtime users access to multiple tabs in the Viewer.

Signal Name is the OPC tag path that you choose to log trend data.

Smart Pin Control is a collection of squares called SmartIcons that form a set of indicators for use in a high-level GraphWorX64 overview display or EarthWorX64 map. Each square's location in the Smart Pin grid is meaningful. SmartIcons are strategically arranged and attached to data sources to create a shape and color scheme that allows runtime users to easily monitor the status of multiple data sources.

Summary View can be made visible at the bottom of the TrendWorX64 Viewer, only in Freeze mode. It provides access to all collected data, and has features that give the runtime user detailed, time-specific access to collected data.

Symbol is a saved grouping of GraphWorX64 objects.

Symbols Library is a collection of symbols within GraphWorX64 designed to help you quickly build a display.

Tabs can be used for displaying multiple TrendWorX64 charts in one view. Using tabs with the *Side Panel* in a viewer gives runtime users easy access to the trend graphs on each viewer tab.

Table Management is a means for limiting the size of the table that is actively logging alarms, for managing the creation of new logging tables, and for archiving older logged events.

Tag Import Wizard is a tool for the mass-creation of multiple alarm tags in AlarmWorX64 or trend tags in TrendWorX64. This tool is helpful when you have hundreds or even thousands of OPC tags that you need alarm or trend tags defined for, and defining them one at a time will be too time-consuming. The AlarmWorX64 wizard uses a predefined *Alarm Template* for defining the alarm tags it creates; the TrendWorX64 wizard does not.

Tags, also known as Process Points, are a named data source formatted into an OPC communications standard.

Text Object allows you to enter static text into the text area in a GraphWorX64 display. This is similar to a text box or label in MS Word.

Time-based Restriction is that part of an *Account Policy* that limits user access to applications and data to specified days and times.

Time Date Object is a dynamic text object that displays the current date and time in a GraphWorX64 display during runtime.

Transitions are special effects (such as a fade out) applied to a GraphWorX64 display as it closes or loses focus when another display is opened in the same window. It is similar to transitions in MS Power Point.

Translation Alias is a type of language alias that is replaced by the equivalent string defined in the Language Alias System (LAS) configuration.

TrendWorX64 is a set of applications used to log numerical data into memory or database for historical viewing or data analysis. Included in TrendWorX64 is a historical server for logging data and a graphing and charting module for viewing data. The TrendWorX64 Viewer can run within the Workbench, or as a control within GraphWorX64.

TrendWorX64 Configuration houses the database groups, logging groups, and data tags for TrendWorX64. You can have only one active configuration at a time.

TrendWorX64 Logger is the application that collects OPC data and stores the information into a database. The *TrendWorX64 Configuration* dictates how the data collection and logging occurs.

TrendWorX64 Viewer is the control that allows you to view real-time or historical trend data in different chart types.

Trigger Limit Alarm is a type of alarm. It reports when the tag's value changes, and does not reset until after a runtime operator acknowledges it. With this alarm, there is no "normal" condition; any change in the value triggers the alarm. This type of alarm is useful for a tag whose value rarely changes.

UDM Expression is a function that takes an input, performs a specified calculation, and returns an output.

UDM Group is a collection of data tags that are manipulated as a single item, which are represented by a single group tag.

UDM Register is a named address into which you can store values.

UDM Trigger is a rule that defines conditions under which an event occurs. There are two types of triggers: data triggers and time triggers.

UDM Value Set allows you to write pre-configured sets of values into a group of data tags.

Unified Data Browser is a utility that can browse OPC data sources, select them, and return their addresses. It is also known as the Data Browser.

Unified Data Manager (UDM) is a front end to a set of SQL databases that store information used in GENESIS64 applications, including expressions and local aliases.

Unit Binding is the connection between a unit conversion and the languages it is valid for. Unit binding is maintained in the Language Alias System (LAS) configuration.

Unit Conversion is the definition of an equation for converting one unit of measure to another. It uses expressions when converting measurement units. It is maintained in Language Alias System (LAS) configuration.

UTC Time stands for Universal Coordinated Time. When using this time, you can be worry free about time zones and daylight saving time.

Views are pre-set scenes or snapshots inside a complex or oversized GraphWorX64 display or EarthWorX64 map that help runtime users navigate the display with ease and convenience. Views can also be useful to engineers in configuration mode for quickly moving to otherwise difficult-to-find objects in the display.

Web Publishing Wizard is the ICONICS GraphWorX64 tool that publishes displays as standard HTML pages.

Window Layout stores specific arranged files for the content area in the Workbench. Opening a layout opens the designated files in a designated arrangement. You can look at it as a *Workbench Template* with specific files assigned in the different areas.

Workbench is a centralized location where you can manage, configure, and run all of GENESIS64's applications, and most of its tools.

Workbench Template stores arrangement information for use with any files in the content area of the Workbench. Opening a template arranges any open files to fit the template.

WPF stands for Windows Presentation Foundation. You can insert *WPF* objects into any GraphWorX64 display.

X-axis and Y-axis are the vertical and horizontal bases for charts in TrendWorX64 Viewer. The axes can be made 3-dimensional, and can be swapped in runtime.

Z-order, in GraphWorX64, is the sequence of objects, from front to back, on the display surface. The Z-order of objects can be changed with the help of the *Object Explorer*.

GridWorX64

D

This chapter provides end-users with a basic understanding of GridWorX64. For more detailed information, procedures, etc., please refer to the main GENESIS64 Help file included with the product installation.

GridWorX64 allows GENESIS64 clients to natively access database information through the FrameWorX Server. GridWorX64 can visualize database data in the form of OPC-DA data or through the GridWorX64 Viewer Control in GraphWorX64. You can create basic read and write actions along with stored procedures against the connected databases. The functionality is similar to how the Data Mining OPC Server works in GENESIS32.

GridWorX64 consists of a GridWorX64 Server Configurator, GridWorX64 Runtime and a GridWorX64 Viewer. The GridWorX64 Server Configurator stores information in a database that is queried by the GridWorX64 Runtime Server as during operation. GridWorX64 Viewer is a client and allows you to see data from different databases.

If you have experience with GENESIS32, you can compare the following products:

- GridWorX64 Server Configurator – V9 Data Mining Configurator
- GridWorX64 Runtime – V9 DBOPC Server
- GridWorX64 Viewer – V9 DB Mining ActiveX

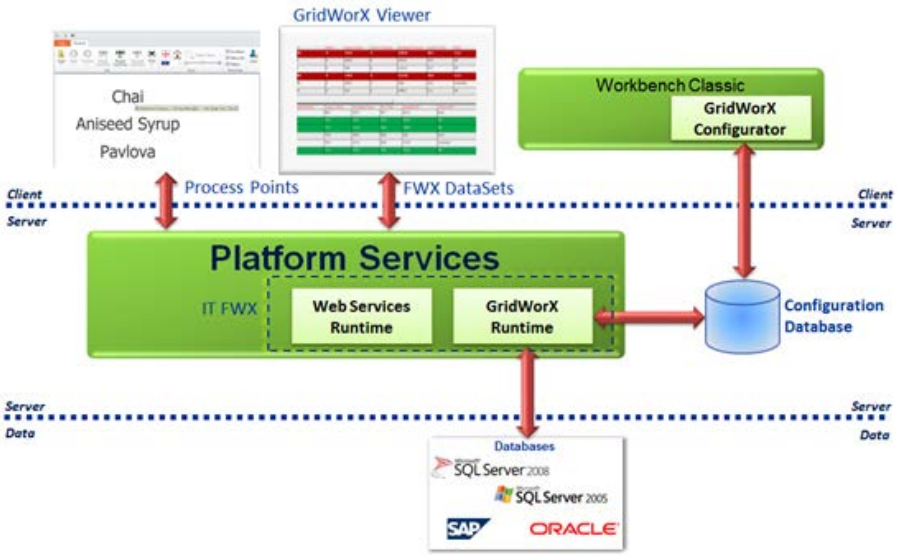


Figure D.1 – GridWorX64 Architecture

Using GridWorX64 you can access all the database sources listed below:

- MS SQL Server
- Oracle
- SAP
- 64-bit OLEDB
- 64-bit ODBC

Since there are no 32-bit OLEDB providers available in GridWorX64, Microsoft Access and 32-bit Microsoft Excel are not supported. However, 64-bit is supported.

D.1 GridWorX64 Server Configurator

GridWorX64 Server Configurator is integrated inside the Workbench and provides a configuration tool for connecting to various databases. Through the Workbench, you also have the capability of launching the Advanced Query Wizard for easier configuration of database connections.

To open GridWorX64 Server Configurator, go to Windows Start Menu →All Programs → ICONICS →Workbench. Expand the provider list in the Explorer tree on the left and click on the GridWorX64 Server icon to open the provider. Expand the GridWorX64 Server localhost branch on the left. You should see your GridWorX64 Server as shown in Figure D.2.

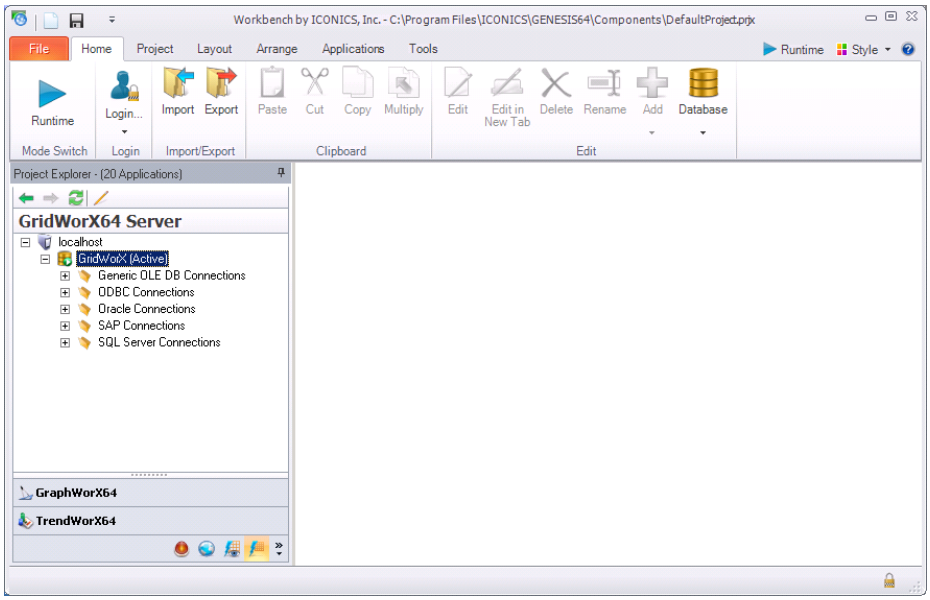


Figure D.2 – GridWorX64 Server

Expand the SQL Server Connections → Northwind. Inside the configuration, you can find four types of GridWorX64 objects:

- Database Connections
  - Data Sources
    - Data Items
  - Data Manipulators

Data Items can be created when you specify any parameter for Data Source. We will describe each data type detailed in following chapters.

D.1.1 Connections

Database Connection is a top-level object. It specifies the connection string to a target database. You can create as many database connections as you want. Multiple connections to the same database can be created, but they must all have a unique name. It's worth noting that if a functional connection fails during Runtime, then there is a mechanism that automatically reestablishes the connection.

To Connect to a SQL Server Database in GridWorX64:

To create a new Database Connection, open your Workbench GridWorX64 Server provider and right-click on the connection type you wish to create. We will the select SQL Server Connections type and the Northwind database will be used. For the remainder of this document, the SQL Server Connection type and the Northwind database will be used. Select "New Database Connection" from the dropdown list. You can alternatively select the Add button from the Ribbon Menu, as is shown in the figure below.

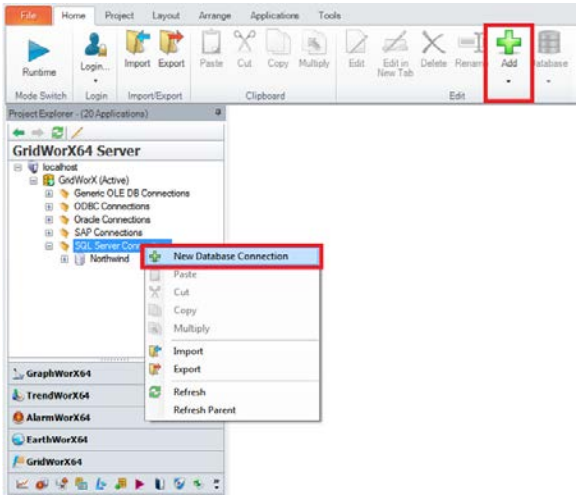


Figure D.3 – Adding New Connection

To build a Connection String, click on the Change Connection button and select one of your existing databases from the **Connection Strings** dialog box (the Northwind test database was installed during the GENESI64 installation). In the "Connection Strings" dialog, double-click on "SQL Server Connections". Click on the "Add Connection String" button to open up the "SQL Connection String" dialog box.

Enter your SQL Server name [for example, (localhost\sqlexpress)] and the proper login information. If done correctly, you will be able to retrieve a list of databases from the "Select the database on the server" dropdown list. If you choose the Northwind database, your finished connection string should look similar to the figure below. Be sure to click 'Apply' to save your changes.

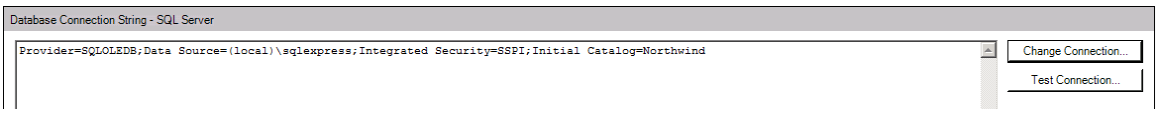


Figure D.4 – Connection Strings

Verify you have a successful connection by clicking on the "Test Connection" button.

D.1.2 Creating a Data Source (Simple SQL Designer)

A Data Source is a handle provided for the Unified Data Browser that is used to connect to a database table. The Data Source stores SQL commands to select, insert, update, and delete entries in the database table. SELECT configuration is required. Insert, Update, and Delete configurations are optional. Follow these instructions to create a Data Source.

From the GridWorX64 Server provider, right-click on the database connection and select 'New Data Source' from the drop down list. You have the ability to specify different kinds of commands. However, the SELECT command is the minimum required to configure a data source.

A Data Source is used to retrieve data from a database. Data is queried from the database and then cached in the server's memory to increase performance. This means that when one or more client request data for a particular Data Source, they will receive the cached data (if present in memory) instead of the live data from the database. This behavior can be configured using three different options:

- **No refresh** - Data will be cached in the server's memory and kept indefinitely, unless manually refreshed from a client (see @@Refresh on next page).

- **Periodic refresh** - Data will be cached in the server's memory for the specified amount of time, after which it will be discarded. A subsequent request will cause a new query to the database to fetch the data.

- **UDM Trigger** - Data will be cached in the server's memory and it will be discarded when the specified UDM Trigger is fired. A subsequent request will cause a new query to the database to fetch the data

Clients can also force the server to discard cached data if needed. Data Sources expose a special DA Point (@@Refresh) that can be written to inform the server to discard its cached data for the Data Source. This will force the server to query the database again to fetch the data on the next request. You should consider the effect on resource usage when specifying a refresh rate. Refreshing can consume a lot of memory and CPU cycles. Because the same resources are shared by other providers and clients, such as the alarm server, take caution to consider the true importance of frequently retrieving database data. That is why you can set server or client refresh rates separately.

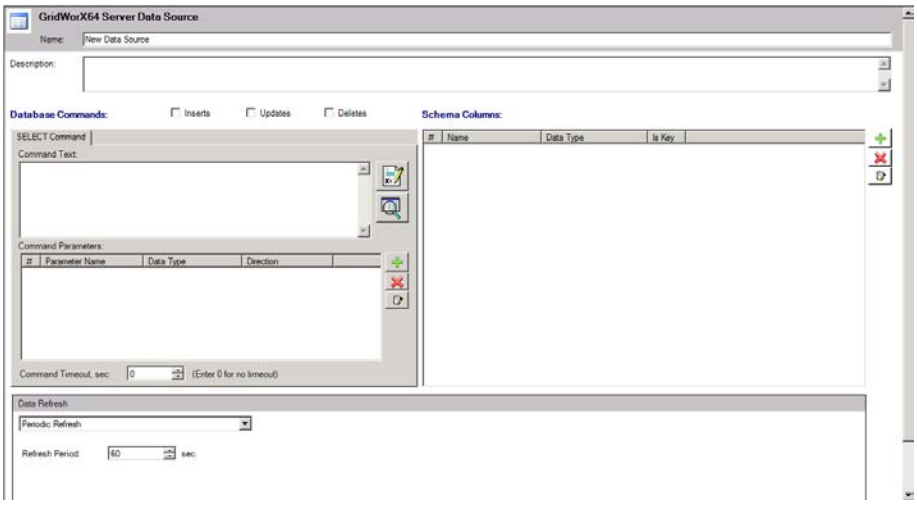


Figure D.5 – New Data Source Dialog

There are four commands available with the GridWorX64 Server Data Source:

- **Select** – The Select statement is required by every Data Source. Primary Key for this command is not required. However, if you intend to auto-generate updates, inserts or deletes, the primary key is required. Generally, selecting a Primary Key is a good idea.

- **Insert** – For inserting items into your connected database. When this is configured, GridWorX64 Viewer in Runtime allows writing. Primary Key for this command is required.

- **Delete** – For deleting items from your database. Primary Key for this command is required.
- **Update** – For updating items in your database. Primary Key for this command is required.

Upon selecting the checkbox to include other available commands, every additional command will add a tab to the Database Commands configuration dialog. Selecting the individual tabs allows the user to configure the selected command parameters. Within each tab, some additional configuration is required. However, most checkbox selections are optional.

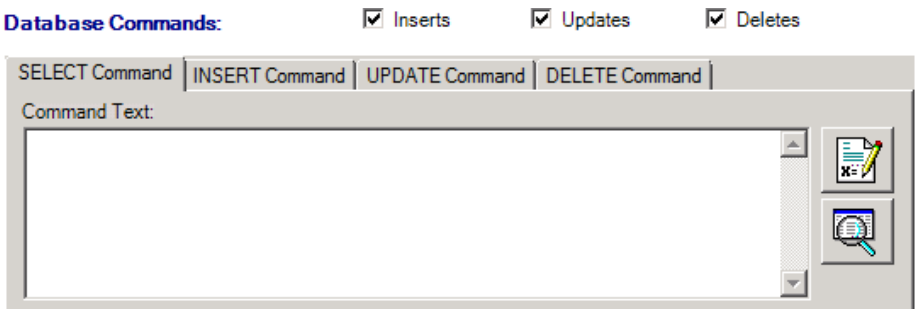


Figure D.6 - All Database Commands Selected

There are four command text editors available: Simple SQL Designer, Advanced SQL Designer, Stored Procedure Call and Manual SQL Editor. For the scope of this class, we'll focus on the Simple SQL Designer. Please refer to the GENESIS64 Help documentation for information on the additional text editors.

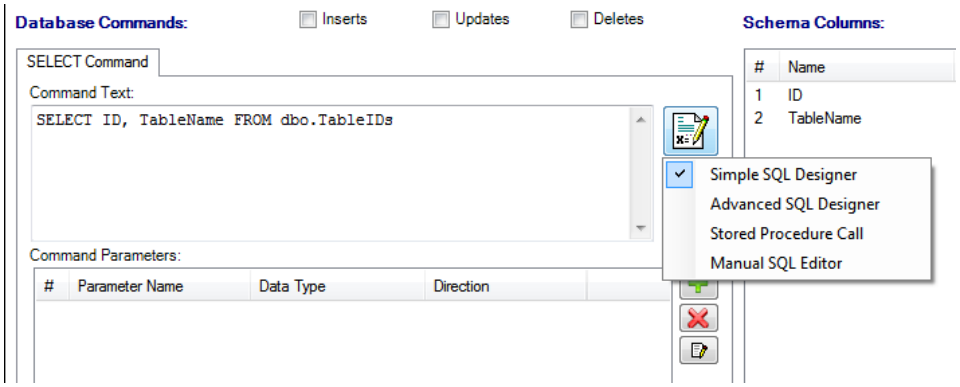


Figure D.7 – Simple SQL Designer Dialog

Inside the Simple SQL Designer, from the Select Table dialog, clicking on the Table Name ellipse button allows you to browse for the table you would like to work with. After specifying a table and clicking on "OK", through a checkbox selection interface you can choose table columns.

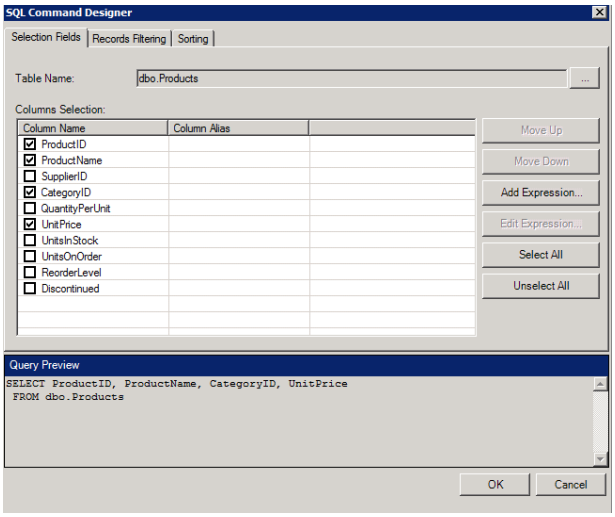


Figure D.8 - Selecting Columns from the Products Table

From the SQL Command Designer dialog, you can Add Expressions to perform calculations on the data retrieved from the table columns. The Expressions that are available and their usage are explained in the system help file.

There are two more tabs (Records Filtering and Sorting) within the Simple SQL Designer dialog.

Records Filtering – Selecting this tab and clicking on the green plus sign launches the Filtering Criteria dialog box F, as seen in the figure below.

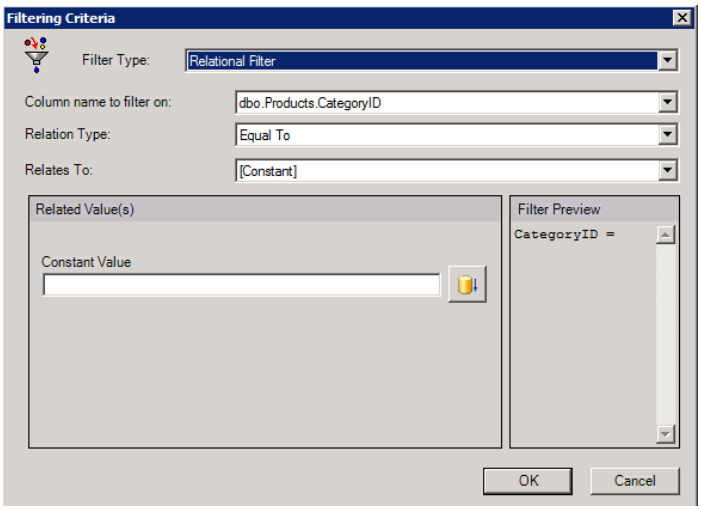


Figure D.9 - Data Source Filter

GridWorX64 supports two Filter Types: Relational and Expression. Within the **Relational** filter, most all of the fields requiring configuration are selectable through mouse clicks however the Related Values criteria will vary depending on the Relates To value selection. It's worth noting, by utilizing parameters you are able to change values in runtime. On the other hand, constants are static so your query returns the data based on the constant value you defined during configuration.

Expression Filtering - is outside the scope of this class, as it requires an elevated knowledge of both SQL scripting and the database schema.

Sorting - The last tab, sorting, will sort the records that are returned by the query based on the sorting definition during this configuration. There are four levels of sorting and each characteristic has an ascending and descending selection.

Data Source Testing – When the data source configuration is complete and you have returned the Database Command dialog box, click on the magnifying glass icon to execute the query you have created.

Data Items –are considered children of Data Source items and are used to define a list of preset parameter values. This gives you a way to assign a user-friendly name to customized data sources and use them without having to specify the parameter values. Setting of parameters on the data source is required in order for the data item selection to be available and selectable in the data item selection drop down list.

Creating a Data Item – after creating a data source with at least one parameter, you are able to right click on Data Source and select New Data Item from drop down list.

To Create a Data Item:

1. Right-click on the Data Source and select a new data item. You may want to change the name of this data item. In the figure below, it is changed to CategoryID.
2. Assign values in the Parameter Value field for all parameters.

Creating a Data Item

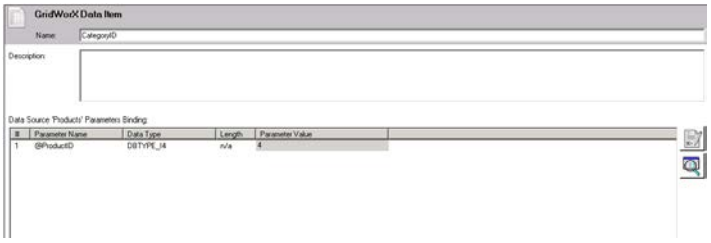


Figure D.10 - GridWorX64 Data Item Dialog Box

3. Click **Apply**. Click the Test Data Source icon to see your query results.

Data Manipulators - are objects in GridWorX64 that can manipulate database data and structure using stored procedures or simple SQL statements when your database server or engine does not support stored procedures. Data manipulation actions are typically executed manually by writing to the Data Manipulator's @@Execute DA process.

To Create a Data Manipulator:

1. Right-click on your database connection and select New Data Manipulator to open the GridWorX64 data manipulator screen.
2. Give a descriptive name to the data manipulator. For example, you might want to create a Data Manipulator which you can set to delete records from the Products Table.
3. Click the ellipsis button [...] and chose Browse Table for Delete to open the Select Table dialog box.

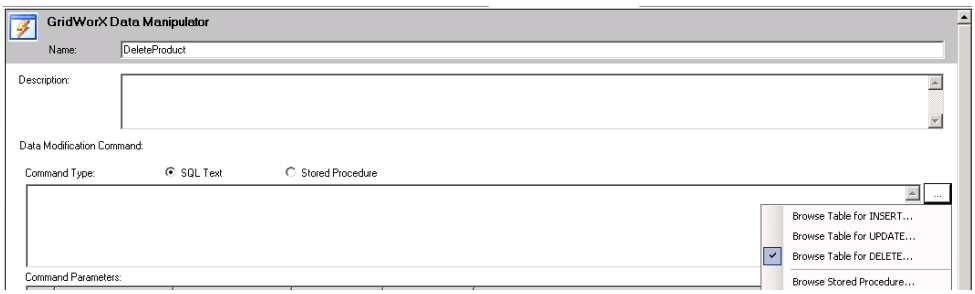


Figure D.11 – Creating a Data Manipulator

4. Select the table to be affected by this Data Manipulator. For example, to delete a record from the Products table, select Products in this dialog box.

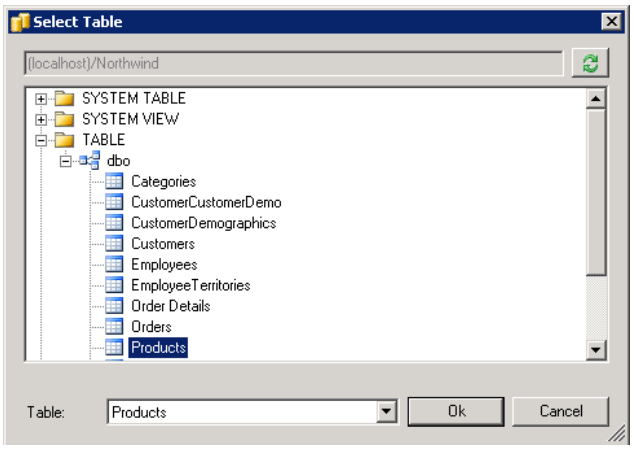


Figure D.12 – Select Table Screen

5. Click on "**OK**" to create the Data Manipulator.

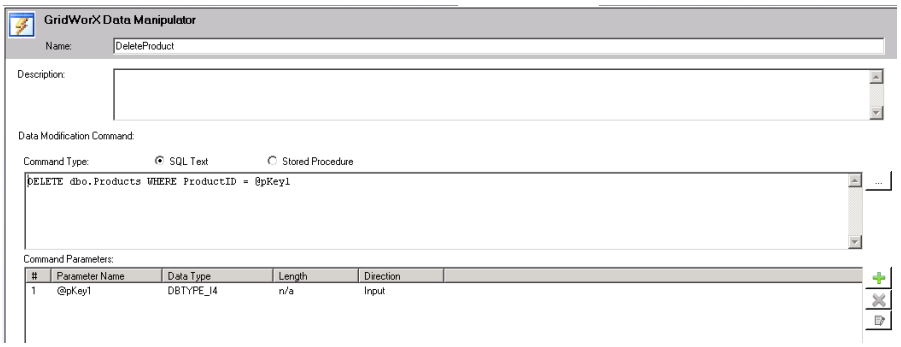


Figure D.13 - Data Manipulator Screen

GridWorX64 Runtime

The GridWorX64 Runtime allows GENESIS64 clients to natively access database information through FrameWorX Server. When the GridWorX64 Viewer client requests some data, GridWorX64 Runtime starts processing this request by checking the GridWorX64 Server Configurator settings. Providing this is a legitimate request, GridWorX64 Runtime retrieves data from a database and returns the data back to the client.

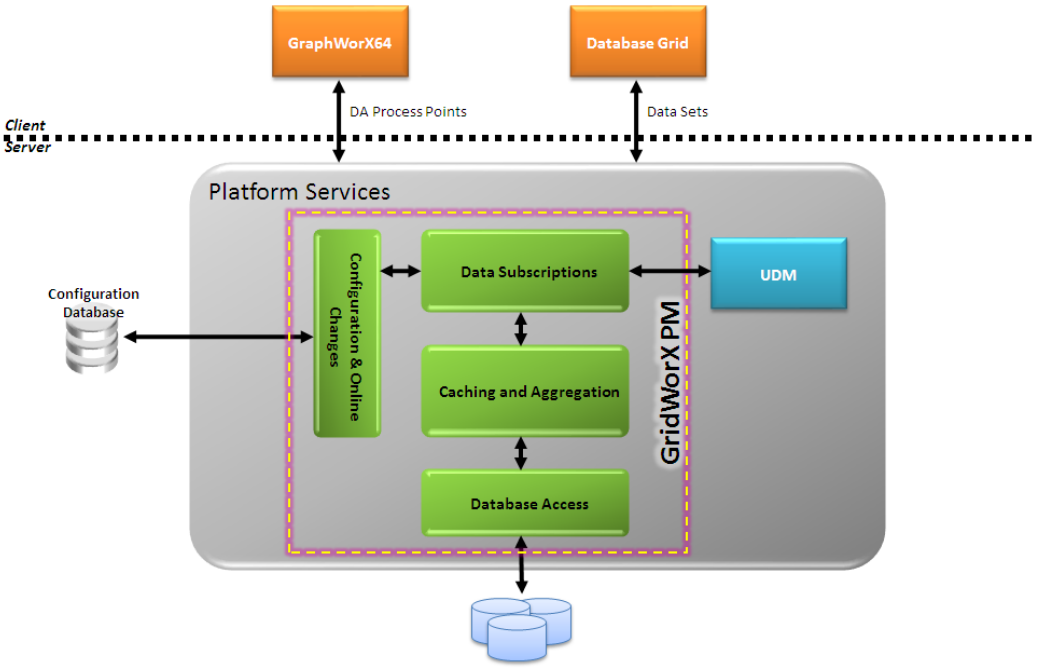


Figure D.14 - GridWorX64 Runtime Architecture

With GridWorX64, you can visualize database data in the form of OPC-DA or through the GridWorX64 Viewer Control. You can perform basic read and write actions along with stored procedures for connected databases. This application works similar to Data Mining OPC Server in GENESIS32.

You can create a GridWorX64 viewer by using the GridWorX64 provider in the GENESIS64 Workbench. You can also create a GridWorX64 Viewer inside GraphWorX64 by using the GridWorX64 Viewer Control available in GraphWorX64. Steps for creating each are described as follows.

D.2 Create a Grid Using GridWorX64

To create a grid using GridWorX64 in the **GENESIS64 Workbench**:

1. From the Windows desktop, open the Workbench by selecting Windows Start Menu →All Programs → ICONICS →Workbench.
2. In the Project Explorer, click on the GridWorX64 provider button bar to bring up GridWorX64.
3. On the ribbon's **Home** tab, click the **New Grid** button. This opens a new tab called New Grid with a grid on it.

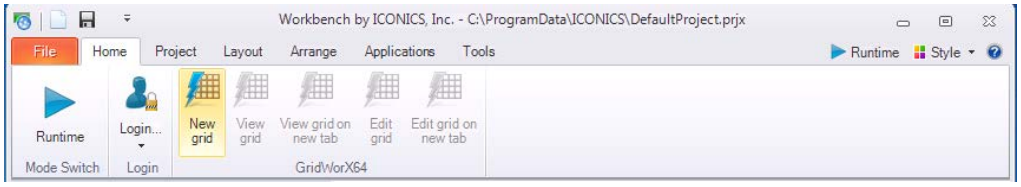


Figure D.15 – New Grid Button on Home Tab

4. Go to the **GridWorX64 Configuration** ribbon and click the **Configure Viewer** button. This opens the configurator where you can configure the grid.

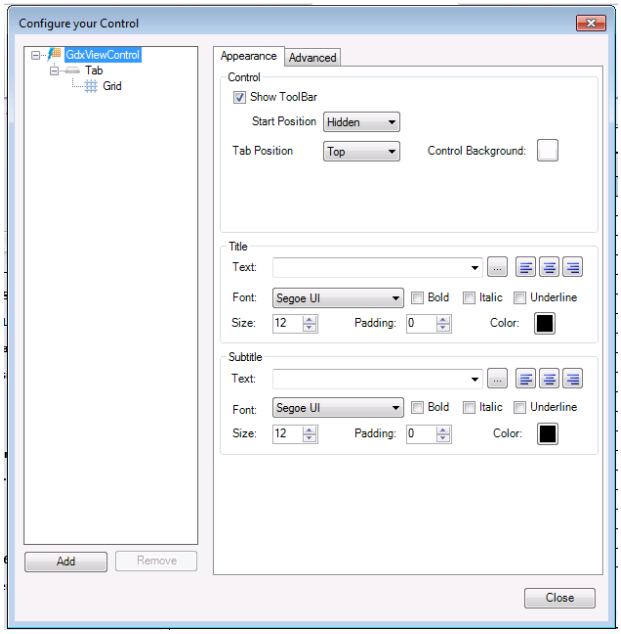


Figure D.16 - GridWorX64 Configuration

5. Close the configurator when you are done.
6. Use the File menu to save the project with the grid in it.

D.3 Create a Grid in a GraphWorX64 Display

To Create a GridWorX64 Grid **inside a GraphWorX64 display**:

1. From the Windows desktop, open GraphWorX64 by selecting Windows Start Menu →All Programs → ICONICS →Workbench → GENESIS64 → GraphWorX64 → GraphWorX64.
2. Create a new display or open an existing one.
3. On the ribbon, go to the **Controls** tab.

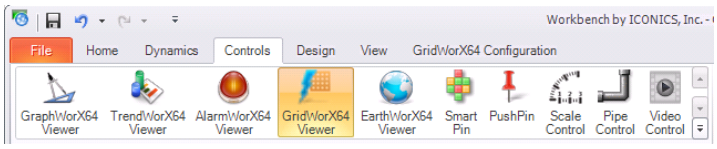


Figure D.17 - GridWorX64 Viewer Control in GraphWorX64

4. Click the **GridWorX64 Viewer icon**. This changes the cursor pointer to a crosshairs. Using the crosshairs, draw a rectangle on the display canvas where you want the grid to be added.

5. Go to the **GridWorX64 Configuration** ribbon and click the **Configure Viewer** button. This opens the configurator where you can configure the grid.

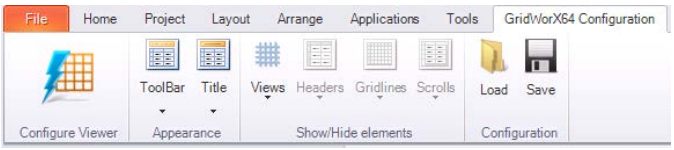


Figure D.18 - GridWorX64 Configuration Ribbon

The ribbon's buttons are used only in a GridWorX64 Viewer that has been added to the GraphWorX display. Each button on the ribbon, as well as the configurator that the ribbon opens, is described as follows.

- **Configure Viewer** opens the GridWorX64 Configurator in the form of the Configure Your Control dialog box, where you can configure basic read and write actions for the grid. In the configurator, you can add tabs to the control, and grids to each tab.

  The GridWorX64 configurator in GraphWorX64 display configuration has the following components:

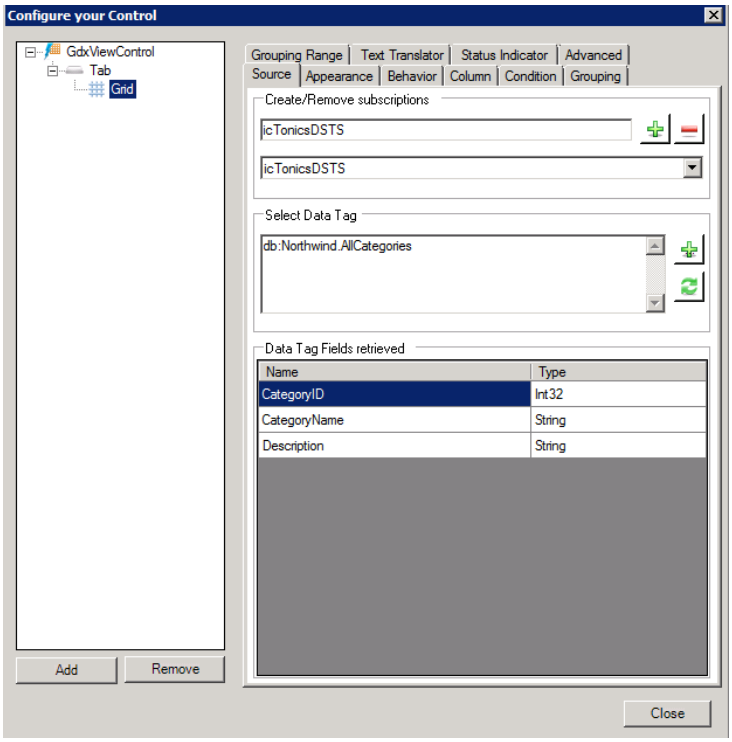


Figure D.19 - GridWorX64 Viewer Control Configuration Dialog

For the **Control**:

- The Appearance tab lets you configure the control's overall appearance.
- The Advanced tab gives you access to the control's properties. Helpful tool tips that appear on the tab describe selected properties.

For each **Tab**:

- The Appearance tab lets you configure the tab's appearance.
- The Advanced tab gives you access to the tab's properties. Helpful tool tips that appear on the tab describe selected properties.

The following tabs appear for each **Grid**:

- **Source** is where you select a subscription and Data Tag.
- **Appearance** is where you configure the grid's general appearance.
- **Behavior** is where you configure how the grid works under specified conditions.
- **Column** is where you conFigure Dach column to appear in the grid.
- **Condition** is where you configure the visual cues that display for all values in the grid; to do this, you specify the conditions under which a value appears normally and all levels under which the data escalates to warning and critical stages.
- **Grouping** is where you select the criteria on which to group columns in your grid.
- **Grouping Range** is where you group large volumes of information so that runtime users can find it more easily.
- **Text Translator** is where you can translate data values into words so that text, not the values themselves, appears in the grid.
- **Status Indicator** is where you can define sets of icons to be used in the grid.
- **Advanced** gives you access to the grid's properties. Helpful tool tips that appear on the tab describe selected properties.
- **Toolbar** lets you hide or specify the location of the GridWorX64 toolbar during runtime.
- **Title** lets you show and hide the title and subtitle of the data grid during runtime.
- **Views** lists the tabs (views) in the grid along with information about each, and lets you select one.
- **Headers** lets you choose the types of headers to display in the grid.
- **Gridlines** lets you hide and show gridlines in the grid.
- **Scrolls** lets you control when and whether the scroll bars are shown or hidden for the grid.
- **Load** lets you open a saved grid configuration.
- **Save** lets you save the current grid configuration.

For information on **Interacting with GridWorX64 –** Reading/Writing to a Cell in GraphWorX64, refer to Lab Appendix D of this manual for an example of how this interaction is performed.

Lab: GridWorX64 Configuration *LD*

D.1. Lab Overview

GridWorX64 was developed in order to visualize database data in the form of OPC-DA or through the GridWorX64 Viewer Control. You can configure basic read and write actions along with stored procedures for connected databases. How it works is similar to how Data Mining for the OPC Server works in GENESIS32.

Estimated time to complete this lab: 30 minutes

D.2. Task Checklist

In this lab, you will complete the following tasks:

- You will create a New Database Connection, Data Source, Data Item and Data Manipulator
- View your configured data in GraphWorX64 using the GridWorX64 Viewer Control or a Process Point

D.3. Support Files

To complete this lab, you will need the following file(s):

- Microsoft Northwind database that was installed with GENESIS64

D.4. GridWorX64 Configuration

In this lab, you will learn how to create a data source, data item and data manipulator in GridWorX64.

In this example, we will connect to Microsoft's Northwind example database in SQL Server. GridWorX64 also supports Generic OLE DB Connections, ODBC Connections, SAP and Oracle Connections. You can choose the appropriate option depending on what type of database you want to interact with. The configuration will differ when creating a database connection, but will be similar in creating a data source, data item and data manipulator.

D.4.1. Connecting to a Database

1. Open up Workbench by going to Start → All Programs → ICONICS GENESIS64 → Workbench.

2. In Project Explorer, expand the provider list in the explorer tree on the left and click on the **GridWorX64 Server** icon. Expand the GridWorX64 Server localhost branch.

   Under **GridWorX (Active)**, select **SQL Server Connections**. Right click and select **New Database Connection**.

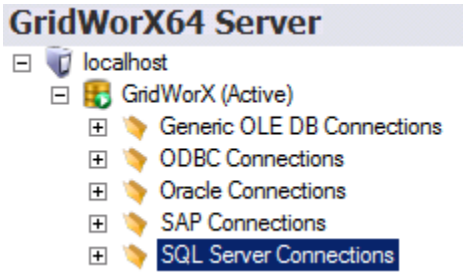


Figure LD.1 - GridWorX64 Server Explorer Tree

3. Name the Database Connection **icTonicsNorthWindDC** and click on **Apply**.

4. Click on the **Change Connection** button.

5. Next, we will create a connection string. In the **Connection String** dialog box, double click on **SQL Server connections**.

6. Click on the **Add connection string** button to open up the **SQL Connection String** dialog box.

7. Enter your SQL Server name, log in information and choose the Northwind database to connect to.

8. Your finished configuration should look like the figure below. Click on **OK**.

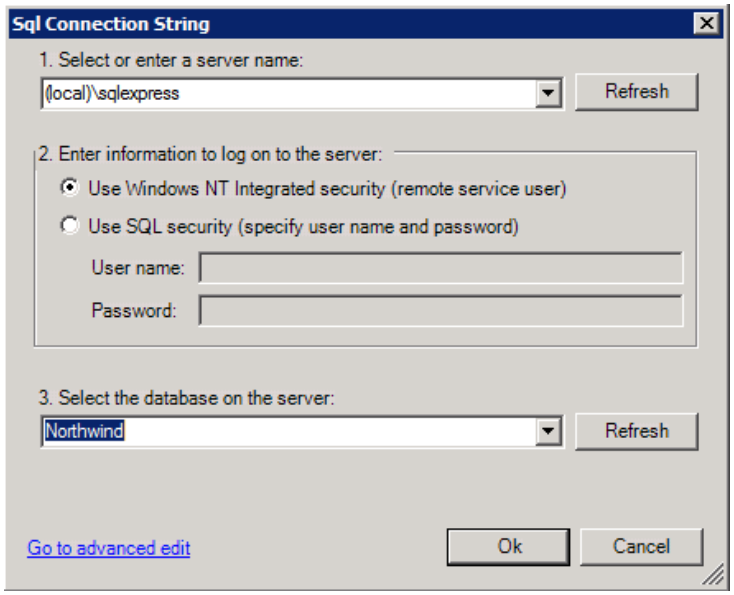


Figure LD.2 - SQL Connection String Syntax

9. Leave the default name **Northwind_1** and click on **OK**.

10. Click on the **Change Connection** button again.

11. Double-click on the SQL Server connection name and select **Northwind_1**. Click on **OK**.

12. ***Important***! Your "Database Connection String" must resemble the string below. If it does not, return to step 4 and then proceed.

    Provider=SQLOLEDB;Data Source=(local)\sqlexpress;Integrated Security=SSPI;Initial Catalog=Northwind

13. Click on the **Test Connection** button. If you do not see the **Connection test succeeded** message, then review your configuration. Then click on **Apply**.

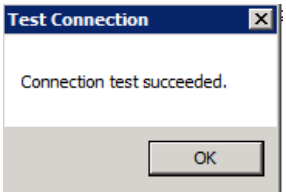


Figure LD.3 – Successful Connection Test Dialog box

D.4.2. Create a Data Source

A data source is a handle provided to the Unified Data Browser and is used to connect to a database table. It stores SQL command information to select, insert, update and delete records in a database table. "Select" configuration information is required. "Insert", "Update" and "Delete" configurations are optional.

To Create a Data Source:

1. In the **Project Explorer**, right-click on the database connection you created and choose **New Data Source**.
2. Name this data source **icTonicsProductsDS**.
3. From the **SELECT Command** tab, click on the **Edit Command Text** icon on the right and select **Simple SQL Designer** from the drop down. This will launch the **Simple SQL Designer** dialog box.
4. From the **Selection Fields** tab, click on the **Table Name**: ellipsis button.
5. From the **Select Table** dialog box, click on the + sign next to Table.
6. Select **Table → dbo → Products**. Click on **OK**.
7. Check the following columns: **ProductID, ProductName, CategoryID, UnitPrice**.

   Note: Notice the SQL syntax in the Query Preview pane.
8. Select the **Record Filtering** tab and click on to add a filter.
9. Change the **Relates To:** field to **[Parameter]**.
10. In the **Related Value(s)** section click on the icon to the right of the **Query Parameter** field.
11. With the **Parameter Name:** defined as **@CategoryID**, click on **OK**.

12. Your **Filtering Criteria** configuration should resemble the following figure. Click on **OK** to proceed.

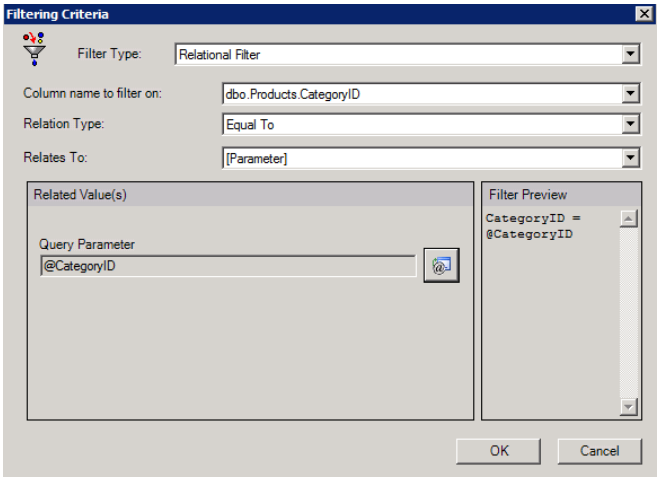


Figure LD.4 – Filtering Criteria

13. Notice there is also a **Sorting** tab. We'll be working with sorting later in this lab.

14. Click on **OK** to continue. At any time, if you receive a request to **Refresh Data Modification Commands**, click on '**Yes**, Proceed with Auto-Refresh'.

15. Check the **Updates** checkbox and click on the **UPDATE Command** tab.

16. Choose **SQL Text** as the **Command Type**.

17. Click on the ellipsis button and choose **Browse Table** from the dropdown list.

18. Expand **Table → dbo** and select the **Products** table.

19. Click on **OK**.

20. The four command parameters should be automatically populated as in the following figure.

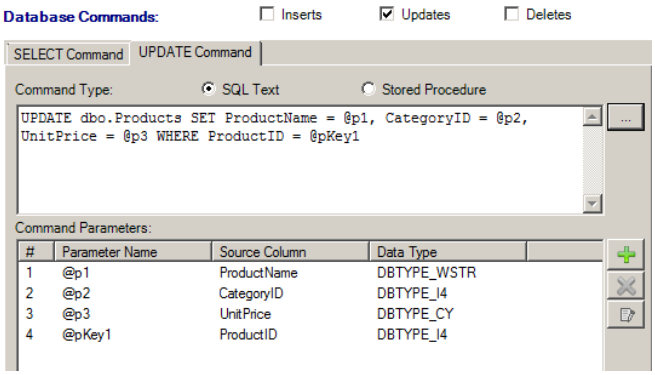


Figure LD.5 – Database Command

21. Click on **Apply** to finalize your configuration.

22. Let's execute the query to confirm proper operation.

23. Click on the **Select Command** tab. Click on the magnifying glass icon to execute this query.

24. Replace the **0** with **1** in the Value field and click on **OK**.

25. Your **Query Results** should look similar to the figure below. Note the values in the CategoryID column.

Query Results

Table: 12 record(s) returned

ProductID	ProductName	CategoryID	UnitPrice
1	Chai	1	18.0000
2	ChangWong	1	19.0000
24	Guaraná Fantástica	1	4.5000
34	Sasquatch Ale	1	14.0000
35	Steeleye Stout	1	18.0000
38	Côte de Blaye	1	263.5000
39	Chartreuse verte	1	18.0000
43	Ipoh Coffee	1	46.0000
67	Laughing Lumberjack Lager	1	14.0000
70	Outback Lager	1	15.0000
75	Rhönbräu Klosterbier	1	7.7500
76	Lakkalikööri	1	18.0000

Figure LD.6 - Data Source Query Results

D.4.3. Create a Data Item

A data item is an instance of a data source with parameters already set. This gives users an easy handle to choose a customized data source without having to remember the parameter values to choose. Please note, data items cannot be created unless your data source has a parameter defined.

To Add a Data Item:

1. Right click on the **icTonicsProductsDS** data source, click on **New Data Item**.
2. Name the data item **icTonicsDI**.
3. Assign a **Parameter Value** of **2** and click on **Apply**.

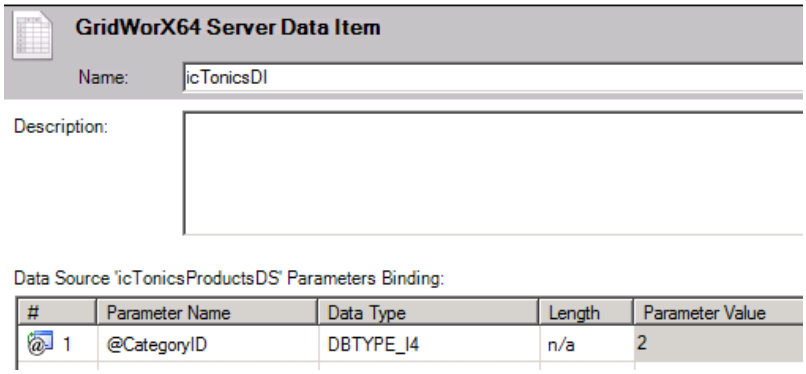


Figure LD.7 – Assigning a Parameter Value

4. You can click on the magnifying glass icon to preview the Query Results.

D.4.4. Create a Data Manipulator

Data Manipulator objects were designed to manipulate a database's data and/or structure using stored procedures or simple SQL commands when a database server or engine does not support stored procedures. Data manipulation actions are often executed manually using the @@Execute read/write process point and are typically initiated on a per-request basis. Let's create a data manipulator that will insert a record into the Categories table:

1. Right-click on the **icTonicsNorthwindDC** database connection you created and click **Add Data Manipulator**.

2. Name the data manipulator **IcTonicsInsertDM**.

3. Choose **SQL Text** as the **Command Type** and click on ellipsis [...] button on the right to choose **Browse Table for INSERT**.

4. Expand the **Tables** tree and select the **Categories** table. Click on **OK**.

5. Pictures are not currently supported by GridWorX64, so we'll have to modify the SQL statement and parameter list to accommodate. During the next steps, you will remove all references to the picture column.

6. From the **SQL statement** in the **Command Type** area, remove the **Picture** and **@p3** references.

7. From the **Command Parameters**, remove the **@p3** reference by selecting line #3 and clicking on the red X icon to the right.

8. In the **Data Source to refresh upon execution:** dropdown, select **icTonicsProductsDS**.

9. The following two figures depict the starting and finished configurations. Click on **Apply**.

Data Modification Command:

Command Type: ◉ SQL Text ○ Stored Procedure

```
INSERT INTO dbo.Categories (CategoryName, Description, Picture) VALUES(@p1, @p2, @p3)
```

Command Parameters:

#	Parameter Name	Data Type	Length	Direction
1	@p1	DBTYPE_WSTR	15	Input
2	@p2	DBTYPE_WSTR	1073741823	Input
3	@p3	DBTYPE_BYTES	2147483647	Input

Figure LD.8 - Starting Data Manipulator Configuration

Data Modification Command:

Command Type: ◉ SQL Text ○ Stored Procedure

```
INSERT INTO dbo.Categories (CategoryName, Description) VALUES(@p1, @p2)
```

Command Parameters:

#	Parameter Name	Data Type	Length	Direction
1	@p1	DBTYPE_WSTR	15	Input
2	@p2	DBTYPE_WSTR	1073741823	Input

Figure LD.9 - Ending Data Manipulator Configuration

D.5. Interacting with Data from GraphWorX64

The GridWorX64 Viewer control allows you to view database information in a GraphWorX64 display. We'll continue by using the elements you've created thusfar to create a user interface that can read and write information to and from the Categories database. The figure below is an example of what your icTonicsGridView display might look like when you're done.

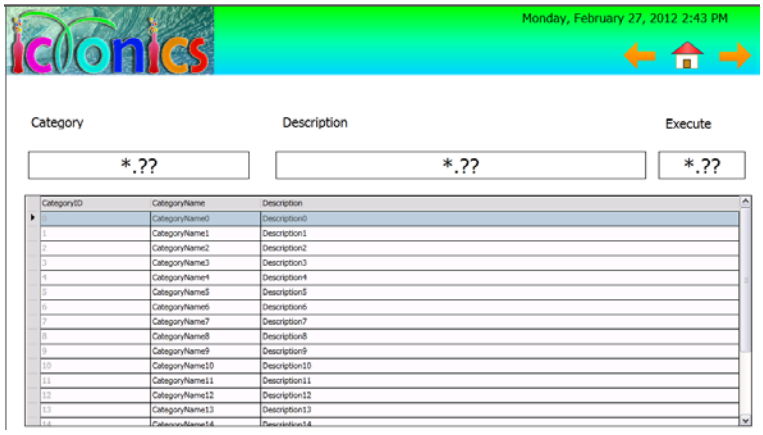


Figure LD.10 - Example icTonics Gridview Display

D.5.1. Adding GridWorX64 Viewer

1. Open up Workbench by going to Start → All Programs → ICONICS Workbench.

2. In Project Explorer, choose **GraphWorX64** from the list of providers on the left. Click on "**New Display**" from the ribbon bar. As we did previously, add the icTonics template by clicking on the Design tab and selecting the **icTonics template**.

3. Select the **Controls** tab in the ribbon bar and click on the **GridWorX64 Viewer**.

4. Click anywhere on the empty display to size and drop the control into it.

D.5.2. Configure a GridWorX64 Viewer for Database Data.

1. Double-click on the GridWorX64 Viewer control to bring up the **Configure your Control** dialog box.

2. From the tree on the left, click on "**Grid**" and select the **Source** tab. Under the **Create/Remove Subscriptions** section, click on the icon to create a new subscription. Choose **Data Set Tag Subscription** from the dropdown list.

3. Click on **Home → Databases → SQL Server → Northwind → Data Sources → AllCategories**. Note that the AllCategories data source is associated with the Northwind samples created by the GENESIS64 installation. Then click on **OK**.

4. Change **New Subscription** to the name subscription name **icTonicsDSTS**.

5. Click on the icon to refresh the data tag fields retrieved. Your finished configuration should resemble the figure below.

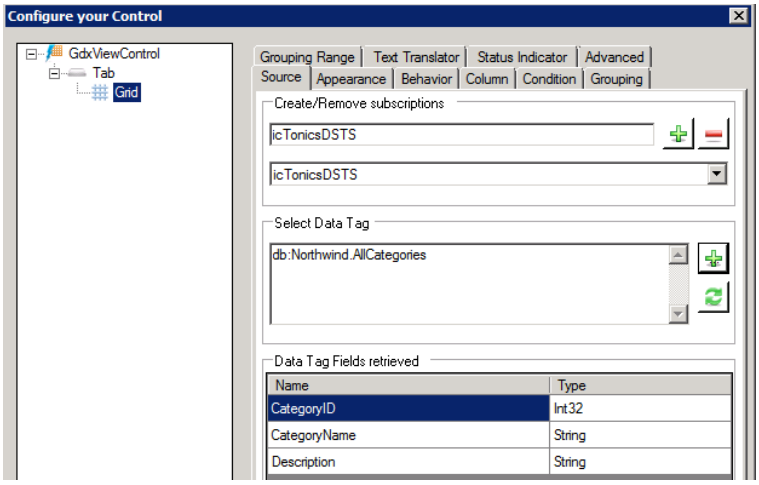


Figure LD.11 - GridWorX64 Viewer Source Configuration

6. Click Close to save this configuration. Save this display with the name **icTonicsGridView.gdfx**

7. Go into **Runtime** and you should see query results similar to the figure below.

CategoryID	CategoryName	Description
1	Beverages	Soft drinks, coffees, teas, beers, and ales
2	Condiments	Sweet and savory sauces, relishes, spreads, and seas...
3	Confections	Desserts, candies, and sweet breads
4	Dairy Products	Cheeses
5	Grains/Cereals	Breads, crackers, pasta, and cereal
6	Meat/Poultry	Prepared meats
7	Produce	Dried fruit and bean curd
8	Seafood	Seaweed and fish

Figure LD.12 - GridWorX64 Control Query Results

8. Since we included the update command in the data source, if you double-click on any cell (other than the CategoryID, which is the key) you should be able to edit the values. After editing, pressing the Enter key will write the changed value to the database.

D.5.3. Configure Data Entry Fields

We can connect the data source, data item and data manipulators that we created to GraphWorX64 Process Points or Data Entry fields. Let's examine how to use data entry dynamic objects to read and write to and from a database.

1. Let's add three data entry fields to the display to write information to the Categories table.

2. With the **icTonicsGridView** display open in configuration mode, click on the **Dynamics** tab and select the **Data Entry** object from the "Text Objects" section.

3. Place the object in the display above the GridWorX control. From the Data Browser, select **Home → Databases → SQL Server → icTonicsNorthwindDC → Data Manipulators → IcTonicsInsertDM → Parameters → @p1** and click on "**OK**". Your DataSource will look like this: **db:icTonicsNorthwindDC.icTonicsInsertDM.@p1**

4. Place a **Text Label "Category"** above the data entry field you just added.

5. Add a **second** data entry to the right of the first. From the **Data Browser** click on "**OK**".

6. From within the **Dynamics** tab, edit the **DataSource** string to this: **db:icTonicsNorthwindDC.icTonicsInsertDM.@p2**

7. Place a **Text Label "Description"** above the data entry field you just added.

8. Add a **third** data entry to the right of the first two. From within the **Data Browser**, double click on the **icTonicsInsertDM**, and then click on the **@@Execute** element. This is a Boolean tag that will trigger writing the data to the database. Click on "**OK**".

9. From within the Dynamics tab, confirm the **DataSource** string looks like this: **db:icTonicsNorthwindDC.icTonicsInsertDM<@p1=, @p2=>.@@Execute**

10. Place a **Text Label "Execute"** above the data entry field you just added.

    Note: You can **Execute** using a **Button** with a pick action **Write Value** and an **OnUpValue** of **True**.

11. You can use other GraphWorX64 tools such as alignment, text labeling, sizing, etc… and GridWorX64 Viewer features such as you'll find on the Configure your Control/Appearance tab to spruce up the display if you like. When you're done, save the display and go into Runtime.

12. Type the word 'ICONICS' into the Category field and hit Enter. Type in 'GENESIS64' into the Description field and hit Enter. Type a value of 1 into the Execute field and hit Enter. Note the "**Successfully wrote**" message in the lower left corner of the viewer.

13. Your update to the table should be apparent after the next table refresh.

D.5.4. Using Filters in Runtime

1. Let's exit Runtime and return to the GraphWorX64 Configuration mode. In this section, we will add a **filter** to show products whose **CategoryID** is less than **5** as below.

2. Double-click on the **GridWorX64 Viewer** to open up the **Configurator** again. Select the **Grid** in the tree on the left and click on the **Behavior** tab.

3. Checking the **Automatically update data after**: checkbox will allow you to alter the refresh rate of the grid in runtime. Since the data grid refresh is fairly resource intensive, you should configure this parameter wisely.

4. To the right of the **Select Default Filter** field, click on the to create a new filter. Name the filter **CategoryIDLessThan5**.

5. In the **Configure the filter** dialog box, double click on **CategoryID** and click on the **Relational** button. Select the **< Less than** sign. Place the cursor to the right of the < sign and type in the value **5**.

6. Your completed configuration should look similar to the follow figure. Click on **OK**, then close the configurator and enter **Runtime**.

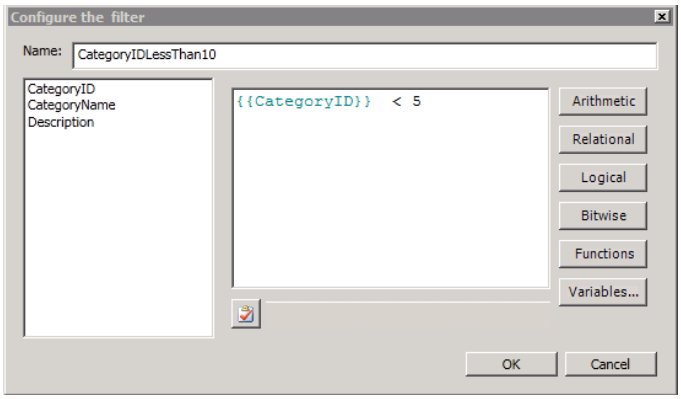


Figure LD.13 - Setting a Behavior Filter for a GridWorX64 Viewer

7. Notice that, when the filter is applied, you will only see the **CategoryID** records 1 through 4.

8. Right-click on the GridWorX64 control (except for the title bar) and select "Filters". Uncheck **CategoryIDLessThan5** and click on **OK**. The Viewer will show all the records again.

   Note: This is client-side filtering and does not alter the *Select* statement issued to the database by the GridWorX64 Server.

Lab: Recipes (Value Sets) *LE*

E.1. Lab Overview

As you can imagine, icTonics makes a few different beverages, each with a different recipe. They have given us these recipes and would like us to create a scenario where the operator can change the production recipe with the click of a button. This will help them with transitions from making one beverage to another.

Estimated time to complete this lab: 20 minutes

E.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Create a value set folder.
- Create value sets that act as Recipes.
- Edit the displays to allow for setting Recipes.

E.1.2. Support Files

To complete this lab, you will need the following file(s):

- icTonicsTankMonitor.gdfx

E.2. Value Sets

Value Sets allow you to write different preset values to different OPC tags with a click of a button. In this section, we will add recipes as value sets and allow for changes in recipes during Runtime.

1. Open the Workbench if you closed it from the previous lab.
2. Select the Unified Data Manager (UDM) in the Project Explorer.
3. You should see a UDM configuration database called **icTonicsUDMConfig** (Active) in the Project Explorer. Expand this configuration and right-click on the "**Value Sets**" folder.
4. Add a folder and name it **icTonicsRecipes** then click on **Apply** to save it.
5. Right-click on the **icTonicsRecipes** folder in the Project Explorer and add a **Value Set**. Name this new item **Mixers**.
6. Click on the **ValueSet Tags** tab. Double-click under **Alias** and type in **LevelSetPoint**. Double-click in the Tag Name field and click on the ellipsis [...] button to bring up the Data Browser and select the **LevelSetPoint tag**.
7. Leave the '**Is Array**', '**Low Bound'** and '**Length'** fields as default.
8. Repeat step 6 for the **Producing**, **Syrup, Syrup Valve, Water, WaterValve and ChurningBlade** tags. Your finished configuration should look similar to Figure LE.1.

ValueSet Properties | ValueSet Tags | ValueSet Values

ValueSet Tags

	Alias	Tag Name
	LevelSetPoint	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.LevelSetPoint.Value
	Producing	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.Producing.Value
	Syrup	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.Syrup.Value
	SyrupValve	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.SyrupValveStatus.Value
	Water	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.Water.Value
	WaterValve	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.WaterValveStatus.Value
	ChurningBlade	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.Tank1.ChurningBladeStatus.Value

Figure LE.1 - ValueSet Tags

9. Click on the **ValueSet Values** tab. Under **Value**, type in **Chocobeer**, and give it the same value in the **Name Field** (notice that this happens for you) and **Producing** field.

10. Repeat the above steps to insert two more value sets, **CocoFizz** and **Frappe**.

11. Enter the corresponding values according to the chart below so that your finished configuration looks like Figure LE.2.

ValueSet Properties | ValueSet Tags | ValueSet Values

ValueSet Values

Value	Name	LevelSetPoint	Producing	Syrup	SyrupValve	Water	WaterValve	ChurningBlade
Chocobeer	Chocobeer	64	Chocobeer	43	1	72	1	1
CocoFizz	CocoFizz	46	CocoFizz	0	0	28	1	1
Frappe	Frappe	78	Frappe	66	1	0	0	1

Figure LE.2 - ValueSet Values

12. Click on "**Apply**" to save the value set.

13. Make sure the icTonicsUDMConfig configuration is active.

E.3. Changing Recipes in GraphWorX64

1. Open the **icTonicsTankMonitor.gdfx** and add a Process Point near the top of the display.

2. Select the **Tank1 Producing** tag in the Data Browser and click on **OK**.

3. Add a **Text** object to the left of the process point and add the text **Now Producing**.

4. Add a button to the right of the process point and select **Popup Menu** as its Command.

5. In the button's **MenuItems** property, click on the ellipsis [...] button to bring up the **Edit Menu Items** dialog box.

6. Add a menu item for each of the recipes you created and enter the recipe's name as each item's **MenuText**. Keep the **Edit Menu Items** dialog box open.

7. Change the **Menu Items** command to **Write Value** for each menu item and set each one's **DataSource** to point to **@vset64:icTonicsRecipes.Mixers.Value**.

   Note: From within the **DataSource** field, you can click on the ellipsis [...] to launch the **Data Browser** and select **Home → OPC Classic Servers → My Server → Value Set** and the item you want to connect to.

8. Under the **CommandParameters**, enter the appropriate **OnUpValue** for each one.

   Note: Since the values we are writing to the tag are strings, be sure to enclose them in double quotes (e.g. "**Frappe**") so that the values are properly written to the destination.

9. You should have three menu items, one for each recipe, when you are done. Click on "**OK**" to close the dialog box.

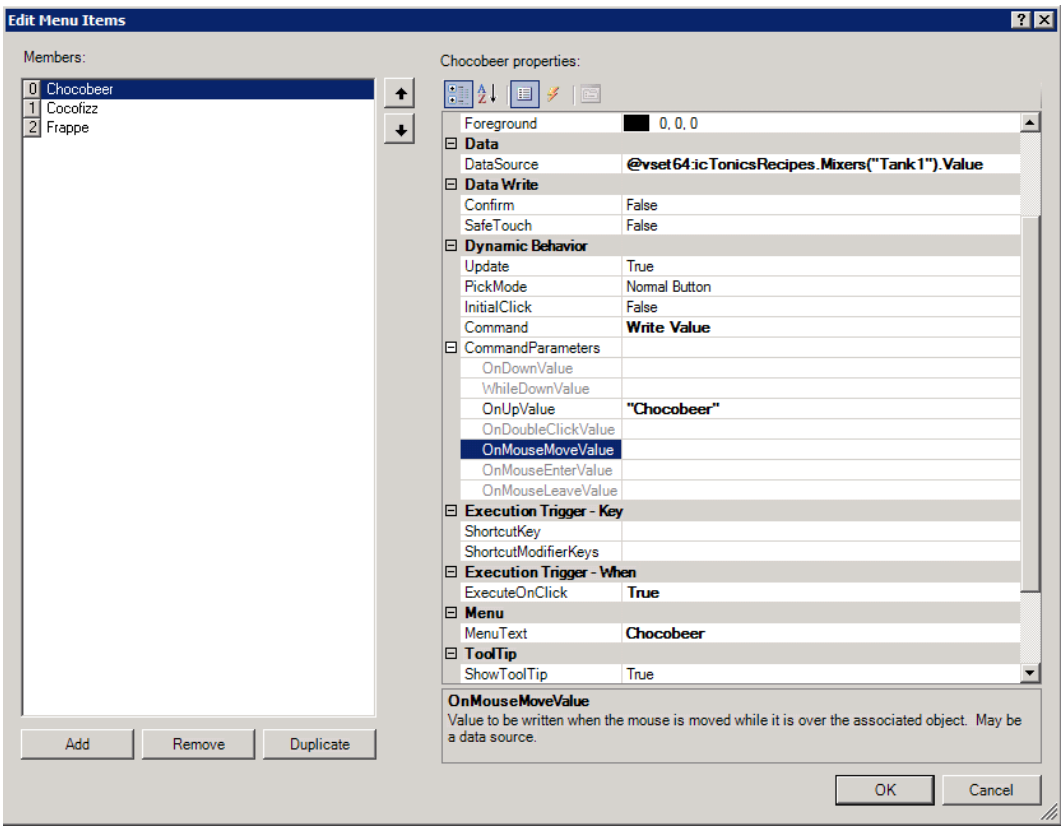


Figure LE.3 - Value Set: Write Value and Menu Text

10. Go to the button's properties and change the **Text** to **Select Recipe**. Make your finished display look like the one shown in Figure LE.4, and save it.

11. Add two more **Process Points**: one to show the **Syrup** and the other to show the **Water**.

12. Now you can go into Runtime and try changing the recipe. As you change the recipe, the tag should change to show the beverage type that is currently in production.

    Note: The Alarm Viewer in your display may be different from the following figure, depending on what filter you're currently using. Try double-clicking on the viewer and clicking the button in the popup toolbar to manipulate your filter.

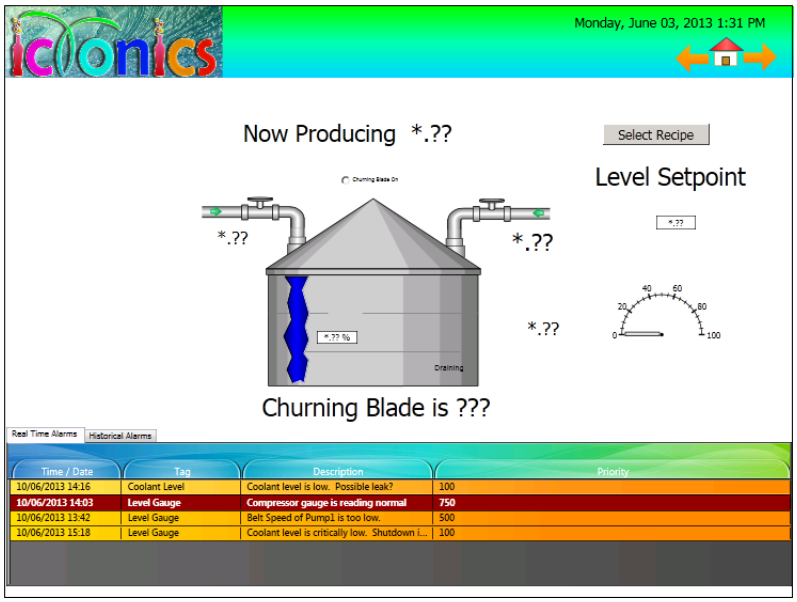


Figure LE.4 - icTonicsTankMonitor Display

E.4. Using Parameters

If you have some time, you can add a parameter to the Value Set. This way, when we try to change tanks later, we will be able to use the parameter to set a dynamic tag value.

1. In the value set you previously created, from the **ValueSet Properties** tab, add a parameter named **Tank1**, and change its Type to **String**.

Parameters

	Name	Type	Padding Align	Padding Char	Number Of Places
	Tank1	STRING	LEFT	_	0
▸*					

Figure LE.5 - Parameters

2. On the **ValueSet Tags** tab, change (without the quotes) the part of the tag where it says "**Tank1**" to **"<<Tank1>>"** to use the parameter we set in the Properties tab.

ValueSet Properties | ValueSet Tags | ValueSet Values

ValueSet Tags

Alias	Tag Name
LevelSetPoint	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.<<Tank1>>.LevelSetPoint.Value
Producing	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.<<Tank1>>.Producing.Value
Syrup	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.<<Tank1>>.Syrup.Value
SyrupValve	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.<<Tank1>>.SyrupValveStatus.Value
Water	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.<<Tank1>>.Water.Value
WaterValve	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.<<Tank1>>.WaterValveStatus.Value
ChurningBlade	@ICONICS.IconicsOPCUAServer.V5\icTonics.Tanks.USA.Foxboro.<<Tank1>>.ChurningBladeStatus.Value

Figure LE.6 - ValueSet Tags with Parameter

3. We will need to change the tags in the GraphWorX64 display to give a parameter value.

4. In the **icTonicsTankMonitor.gdfx** display, select the "**Select Recipe**" button, and click on the **Menu Items** collection to bring up the **Edit Menu** Items dialog box.

5. Change the data source in each of the menu items to include a parameter value. You can either reselect the tag, or simply add "**("Tank1")**" (without outside quotes) after "**Mixers**" in the **DataSource** field. The syntax should look like this: **@vset64:icTonicsRecipes.Mixers("Tank1").Value**

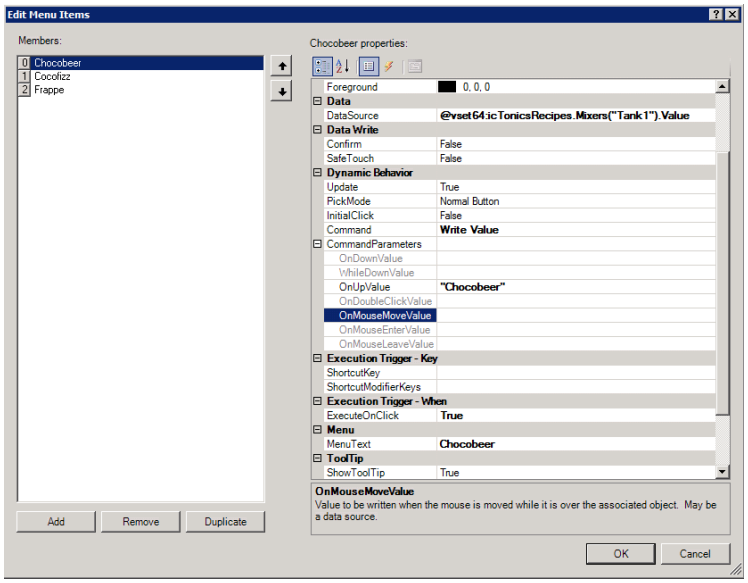


Figure LE.7 - Change Tag Name

6. Try running the display again, it should work just the same as if you did not have parameters.

Lab: Pivot Tables LF

F.1. Lab Overview

Pivot controls are designed to allow content on the screen to be organized logically without cluttering. You can create a touch-friendly approach to display development that can be consistent across 'Any Glass' including MobileHMI. This modern approach to content organization is highly scalable simply by adding more pivot items. You can also use the Select Element pick action command to select individual pivot items.

When the lab is complete, the configuration of the Pivot Control should resemble the figure below.

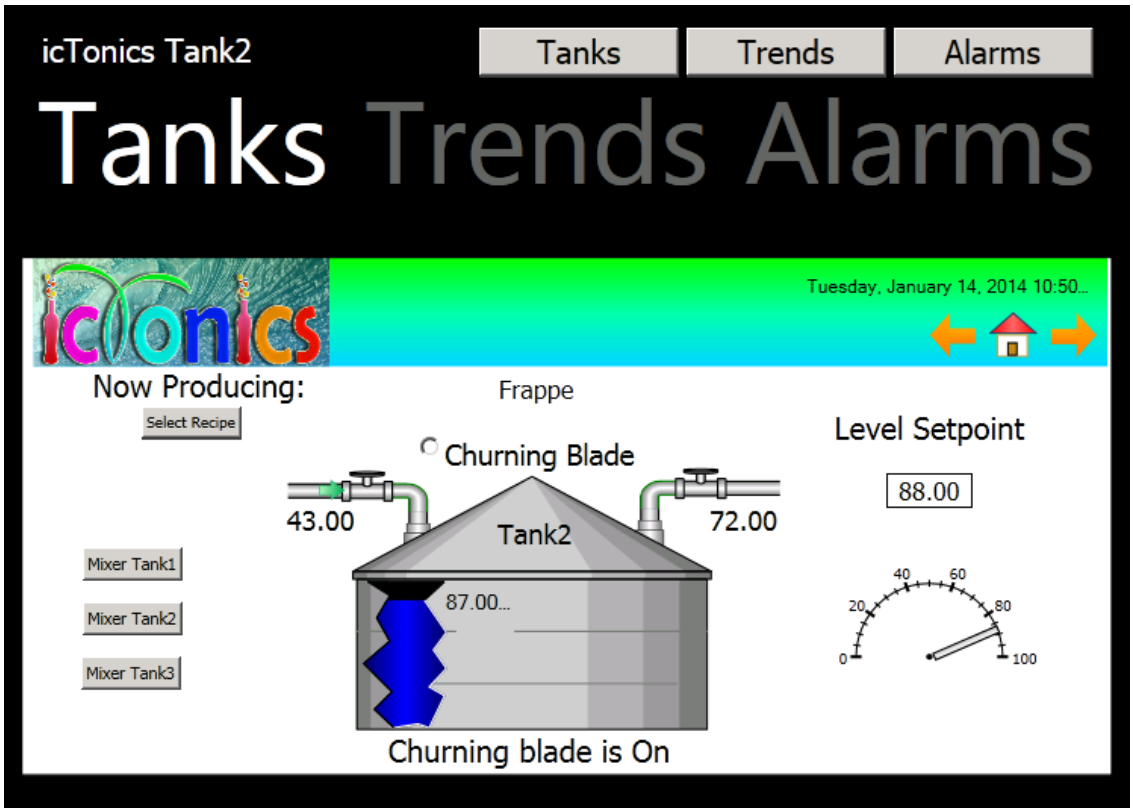


Figure LF.1 - Complete Pivot Control Display

Estimated time to complete this lab: 25 minutes

F.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Create a display using the Pivot Control .
- Create four pivot items.
- Insert various content into each pivot item.
- Use the Select Element pick action.

F.1.2. Support Files

Note: Since the GraphWorX64 training is an extension of the GENESIS64 Standard training, you should concur that Lab1 of the GENESIS64 Standard training manual has been complete prior to continuing.

Note: Some of the Pivot Control features implemented in this lab were added in GENESIS64 10.8. If you're running an earlier version of GENESIS64, some of the features may not work properly.

To complete this lab, you will need the following file(s). Be sure these files exist in the c:\training folder before continuing.

You do not need any additional supporting files to complete this lab.

- PC_icTonicsAlarmViewer.awxx
- PC_icTonicsTankMonitor.gdfx
- PC_icTonicsTrendViewer.twxx

Note: You must save and re-open the display in order to refresh the display and reflect some updates.

F.2. Creating a New Display

Adding a Pivot Control to a Display:

1. On the left-hand side of the Workbench, from within the **Project Explorer**, select the **GraphWorX64** provider.

2. Right-click on **My Computer** and select **New Display**.

3. Click on the **File** tab and select **Save As**…

4. Give the display the **File name**: **Pivot_icTonicsTankMonitor**.
5. From within **GraphWorX64**, click on the **Controls** tab.
6. Click on the **Pivot Control**.
7. Move the mouse cursor to the content area. You should see a cross hair as a cursor symbol. Hold the left mouse key down, then drag and size the control until it covers about 60% of your content area. Then release the mouse key.
8. You should see a black box with the word TITLE in the upper left.
9. With the **Properties** tab selected on the right, define the following elements in the Pivot Control.
   - Name: **pc_Name**.
   - Text: **"icTonics <#TanksAlias#>"**
   - Width: **700**
   - Height: **500**

   Note: <#TanksAlias#> is a global alias that is defined in the global alias configurator. We will use the resolved alias value in the Title of the pivot control.
10. Feel free to move the control so the entire control is visible in the content area.

Adding Pages to the Pivot Control:

1. Double-click in the lower, black area, in the Pivot Control until the control is surrounded by **Red Handles** and the **Pivot Control tab** appears.
2. As indicated in the figure below, the ribbon should be displaying the **Add** and **Remove Page** tools.

Figure LF.2 - Pivot Control Tab and Ribbon

3. Click on the **Explorer** tab in the lower left. You should see the single element in the tree called '**pc_Name**'.

4. Click on the **Add Page** icon **3 times**.

5. From within the **Explorer**, click on the **Plus Sign (+)** to the left of the pc_Name.

6. Click on the bottom **PivotItem**. As shown in the figure below, the **left-hand page** should be **highlighted**.

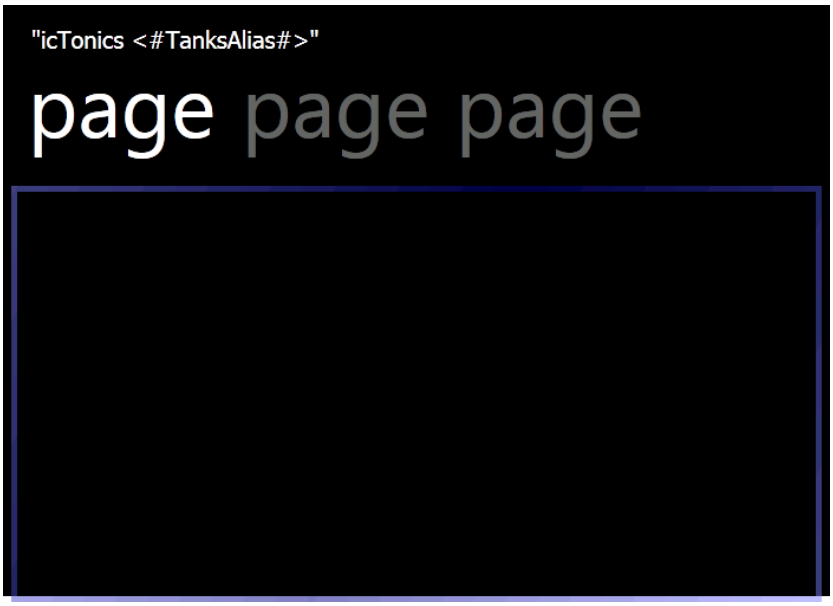


Figure LF.3 - PivotItem Page Layer Selected

7. **Rename** each **PivotItem** by either slowly clicking on the name in the explorer tree or by filling in the **Name** field in the **Properties**.

8. As defined in the step below, also enter the same names in the **Text Property** for each item.

9. In the **Name** and **Text** properties for the three pivotitems, enter the respective values below. The name and text values will be the same.

   - Bottom Page: **Tanks**
   - Middle Page: **Trends**
   - Top Page: **Alarms**

10. The result should resemble the following figure.

Figure LF.4 - PivotItem Pages with Names Defined

11. Expand the **Tanks PivotItem** tree and select the **Layer** tree node.

    Note: You will see a blue outline surrounding the page in the pivot control.

Adding a GraphWorX64 Viewer to the PivotItem Page:

1. Select the **Controls tab**.
2. Select the **GraphWorX64 Viewer** control
3. Starting in the upper left, **draw** and **expand** the GraphWorX64 Viewer control to occupy the page area defined by the **blue outline**. Review the following figure for more information.

   Note: Padding the border slightly is also fine.

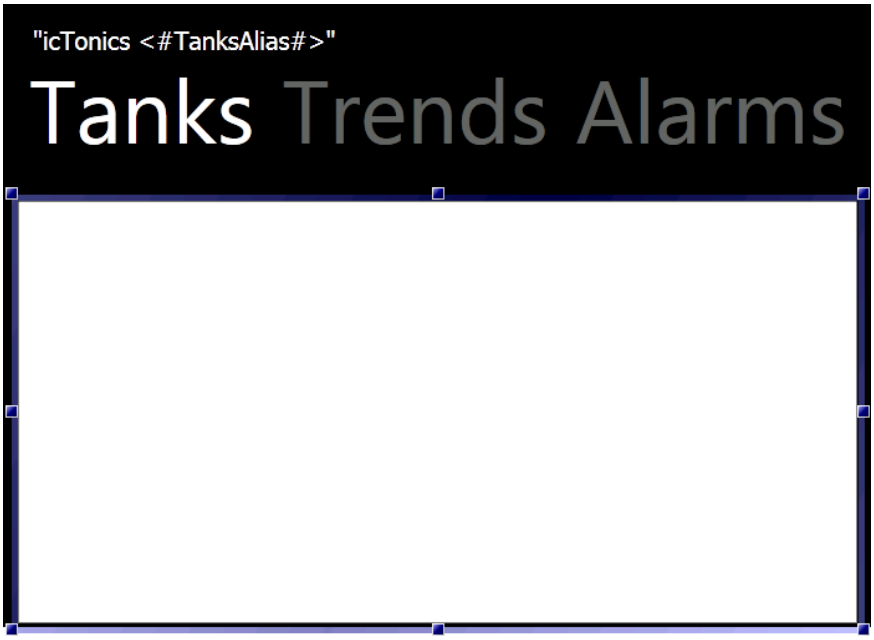


Figure LF.5 - PivotItem Page Layer with GraphWorX64 Viewer

4. In the **GraphWorX64 Properties** on the right-hand side, locate the **Source** field in the **Misc** section.
5. Using the dropdown on the right-hand side of the Source field, select **Browse Files.**
6. Locate and select the **C:\Training\PC_icTonicsTankMonitor.gdfx**. Your display should resemble the following figure.

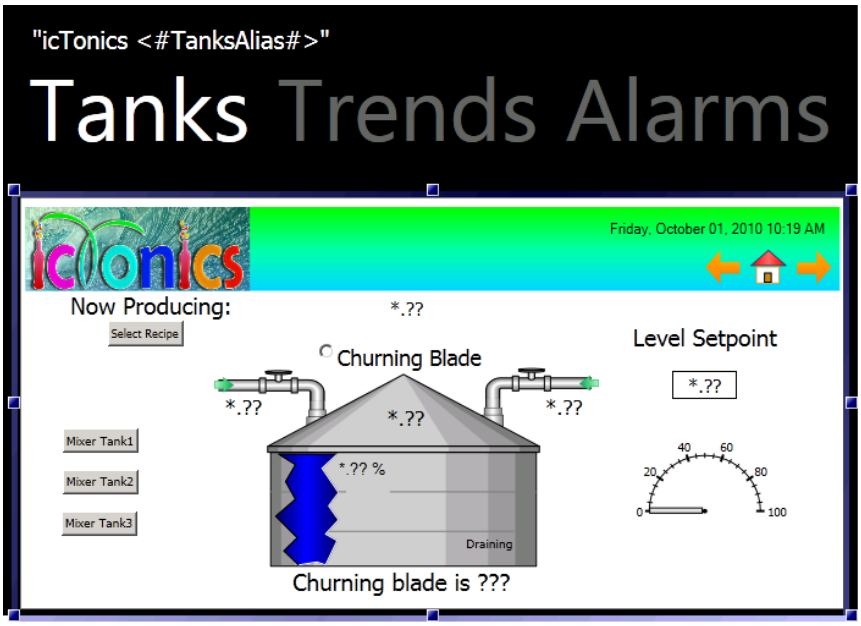


Figure LF.6 - The Tanks Page Defined with a GraphWorX64 Viewer

Adding a TrendWorX64 Viewer to the PivotItem Page:

1. In the explorer on the left, expand the **Trends PivotItem** tree and select **Layer**.
2. In the top, your display with the word **Trends** should be highlighted in **White Text**.
3. Select the **Controls tab**.
4. Select the **TrendWorX64 Viewer** control
5. As you did previously, starting in the upper left, **draw** and **expand** the TrendWorX64 Viewer control to occupy the page area.

   Note: Padding the border slightly is also fine.
6. From within the **Explorer**, under the **Trends Page → Layer** tree node, select the **TrendWorX64 Viewer** tree node.
7. Click on the **Configure Viewer** icon from the upper left ribbon.
8. From within the '**Configure your Control**' dialog, check the '**On startup load the configuration from this file**' checkbox.
9. As shown in the following figure, you will see the **Warning** dialog.

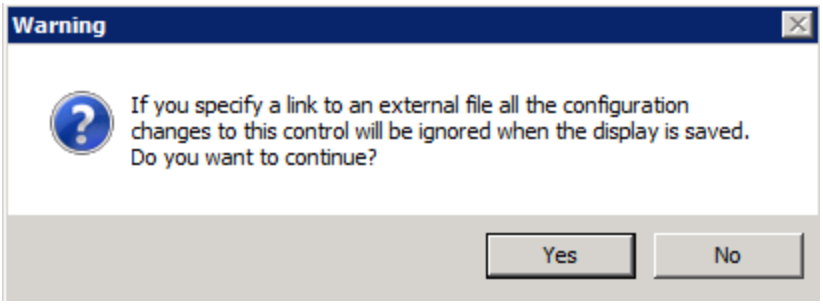


Figure LF.7 - Warning Dialog.

10. Click **Yes**.

11. Click on the **Ellipsis** to the right of the two green arrows icon. Notice the arrow designation in the figure below.

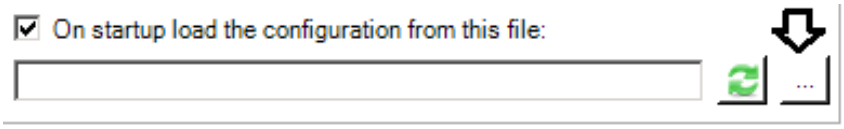


Figure LF.8 - Highlighted Ellipsis Button

12. Select the **C:\Training\PC_icTonicsTrendViewer.twxx** file.

13. Click **Close**.

    Note: It's always good practice to save your work periodically or at least before you enter Runtime.

14. Click on the **Floppy Disk** icon to **Save** the display.

15. Your completed configuration should resemble the following figure.

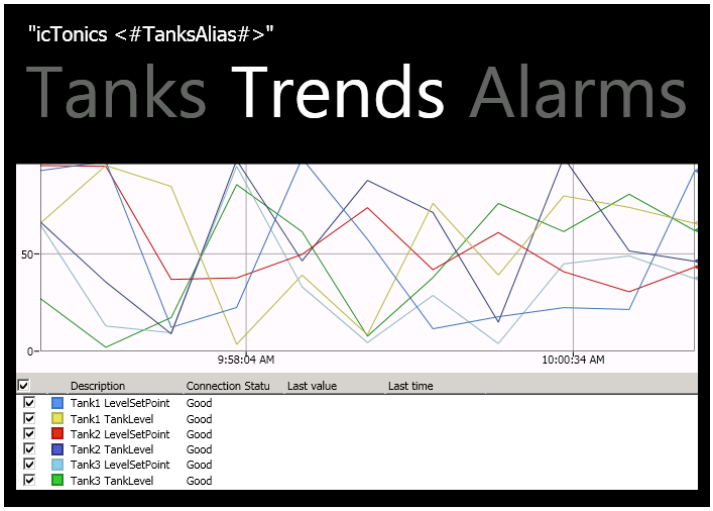


Figure LF.9 - TrendWorX64 Viewer in a PivotItem Layout

Adding an AlarmWorX64 Viewer to the PivotItem Page:

1. In the explorer on the left, expand the **Alarms PivotItem** tree and select **Layer**.
2. In the top, in your display, the word **Alarms** should be highlighted in **White Text**.
3. Select the **Controls tab**.
4. Select the **AlarmWorX64 Viewer** control
5. As you did previously, starting in the upper left, **draw** and **expand** the AlarmWorX64 Viewer control to occupy the page area.

   Note: Padding the border slightly is also fine.
6. From within the **Explorer**, under the **Alarms Page → Layer** tree node, select the **AlarmWorX64 Viewer** tree node.
7. Click on the **Configure Viewer** icon from the upper left ribbon.
8. From within the '**Configure your Control**' dialog, check the '**On startup load the configuration from this file**' checkbox.
9. As shown in the following figure, you will see the **Warning** dialog.

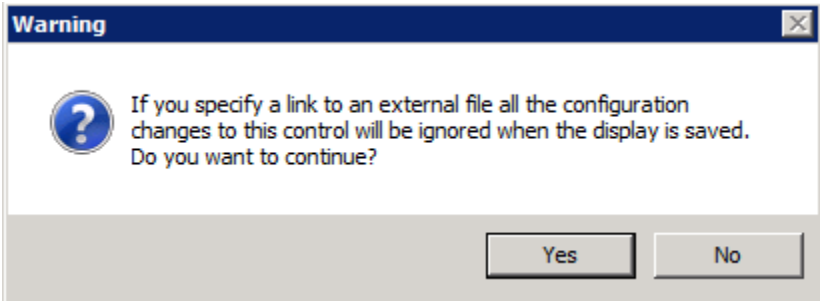


Figure LF.10 -Warning Dialog

10. Click **Yes**.
11. Click on the **Ellipse** to the right of the two green arrows icon. Notice the arrow designation in the figure below.

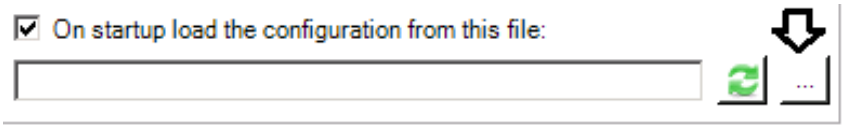


Figure LF.11 - Highlighted Ellipsis Button

12. Select the **C:\Training\PC_icTonicsAlarmViewer.awxx** file.

13. Click **Close**.

    Note: It's always good practice to save your work periodically or at least before you enter Runtime.

14. Click on the **Floppy Disk** icon to **Save** the display.

15. Your completed configuration should resemble the following figure.

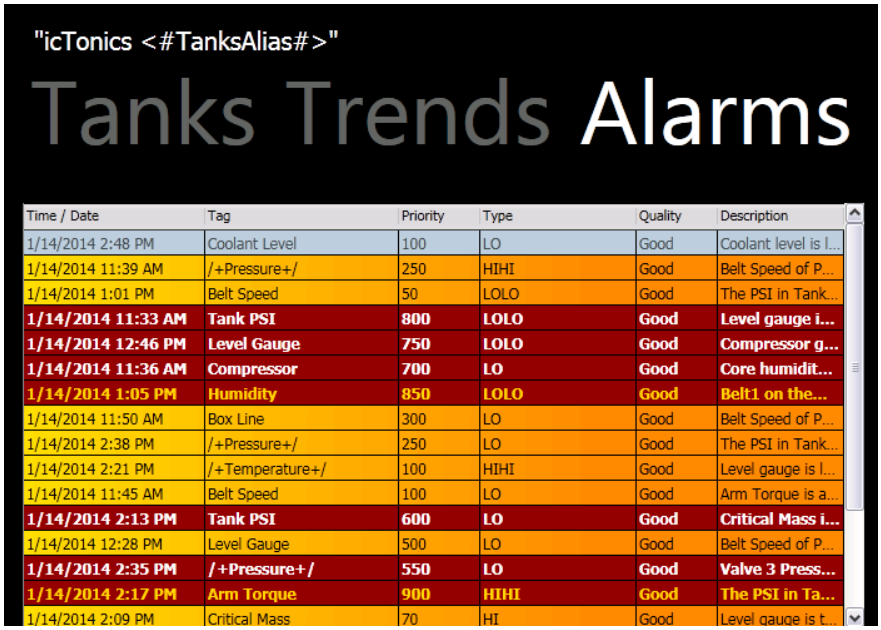


Figure LF.12 - AlarmWorX64 Viewer in a PivotItem Layout

Adding Buttons in the Pivot Control:

1. Select the **Properties** tab from the explorer on the right.

2. Return to the **Display Canvas** by clicking in the white area outside the pivot control until you see Display Canvas displayed as the header of the properties explorer.

3. Select the **Dynamics** tab.

4. In the **Buttons** section, click on the '**ab**' button.

5. As seen in the following figure, place three buttons in the upper right section of the pivot control and **Label** them accordingly.

   Note: You can double-click on buttons to edit the labels.

   - **Tanks**

- **Trends**
- **Alarms**

Note: Feel free to select all three buttons and use the **Alignment** tools on the **Home** tab in the **Arrange** section to make for a clean look and feel.

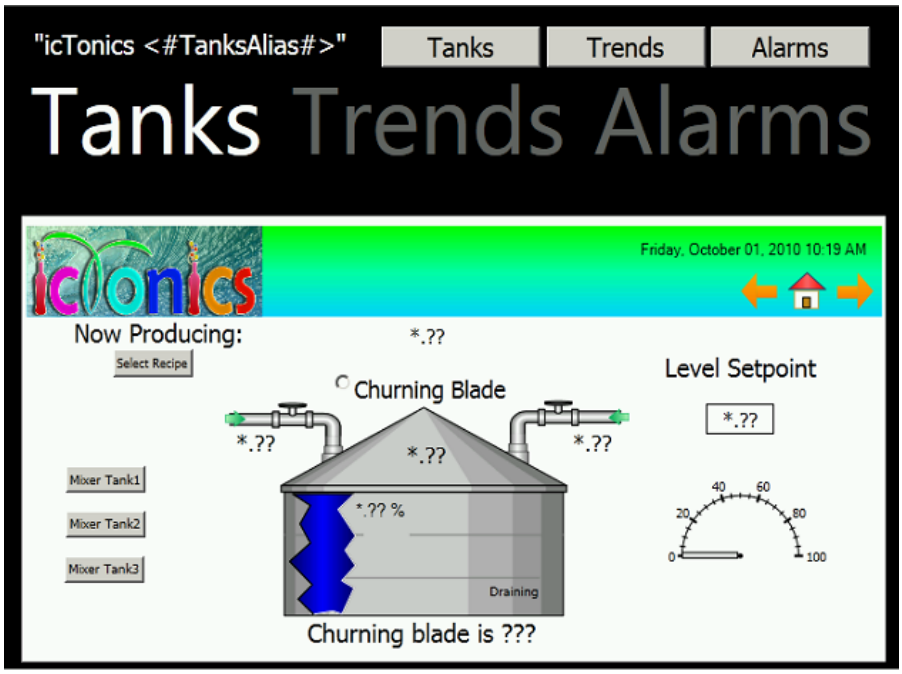


Figure LF.13 - Select Element Buttons

6. We will proceed by defining the three properties described below for each button.

7. Select the **Tanks** button.

   - **Command: Select Element –** This command allows you to define which element in the pivot control you will act on.
   - **ElementName:** This property defines which PivotItem this command will be working with.
   - **Target:** This is the name of the Pivot Control you will be focusing on.

8. The **Tanks** button **Command**, **ElementName** and **Target** properties should resemble the following figure.

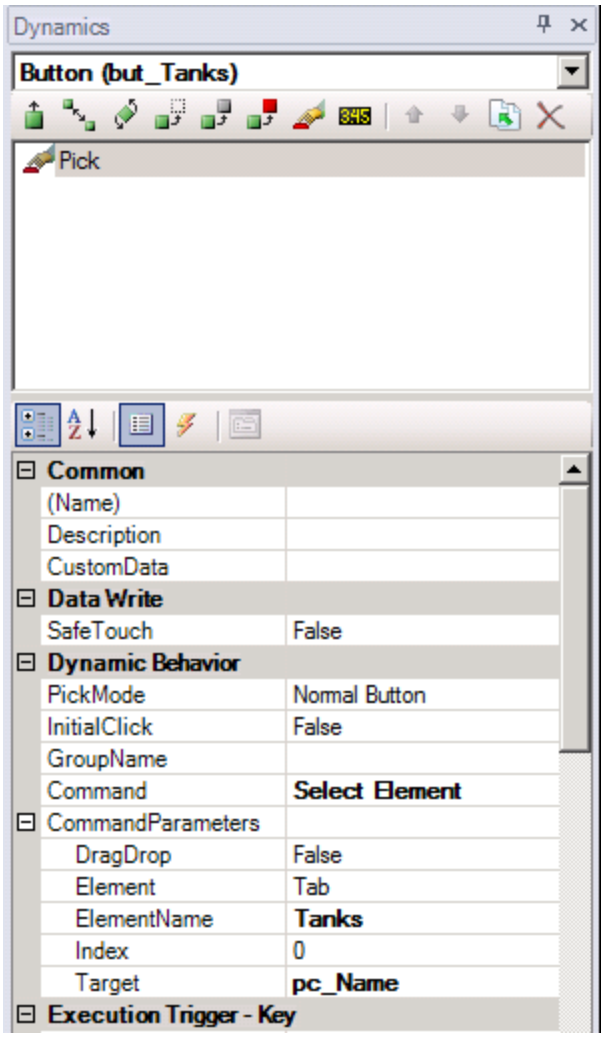


Figure LF.14 - The Tanks Button Properties

9. Configure the remaining two buttons **ElementName** values accordingly.

Runtime Testing:

1. **Save** the display.

2. Click on the **Runtime** selection in the upper right.

   Note: You can also toggle between Runtime and the GraphWorX64 editor with **Ctrl-M**.

3. Notice the **Title** in the upper left **changes** when you have the Tanks page layout selected and you click on a '**Mixer Tank**' button in the **Graphworx64** display.

4. If you have the appropriate valusets in the Unified Data Manager, you can select a recipe for each tank.

5. Or, you can manually enter values into one of the tanks '**Level Setpoint**' field and hit enter. Remember, when the tanks level exceed 80, this will generate an alarm.

6. Click on the **Trends** button. You should see the change reflected in the TrendWorX64 viewer.

7. Click the **Alarms** button. You could implement a filtering using global aliasing so that you would only see the alarms for the selected tank.

8. You can also select the **PivotItem text** (rather than the button) to change the view in the pivot control.

9. If you have extra time, add global aliasing definitions to the TrendWorX64 and Alarm viewers.

This Concludes This Lab.

Lab: Remote Configuration

LG

G.1. Lab Overview

In today's globalized business environment, companies need to provide a window into production information that transcends geographical boundaries. It is extremely important for icTonics' personnel to be able to view and control the production from a remote location because their personnel travel frequently. They would also like to allow the managers to view and control the plant at home in case emergencies arise late at night. We will provide them with this ability by publishing our displays and allowing the displays to work on remote computers.

Estimated time to complete this lab: 20 minutes

G.1.1. Task Checklist

In this lab, you will complete the following tasks:

- Publish displays
- View displays in Internet Explorer

G.1.2. Support Files

To complete this lab, you will need the following file(s):

- icTonicsHome.gdfx
- icTonicsTankMonitor.gdfx
- icTonicsTrends.gdfx

G.2. Viewing Displays in Internet Explorer

In order to view displays remotely over the internet, we will need to publish the displays to a web server first. In this section, we will publish a display and then try to view it on the local training computer.

Test Website Functionality

1. Before we start publishing the display, let us go a few steps further to verify that your machine is ready for publishing.

2. First, determine your hostname by going to **Start → Command Prompt** to launch a Windows command prompt. (Alternatively, you could go, Start → Run, and then type in "cmd" (without quotes) and hit enter.)

3. Type **hostname** and the enter key. The hostname below is HV-01. Leave the command prompt open for future testing.

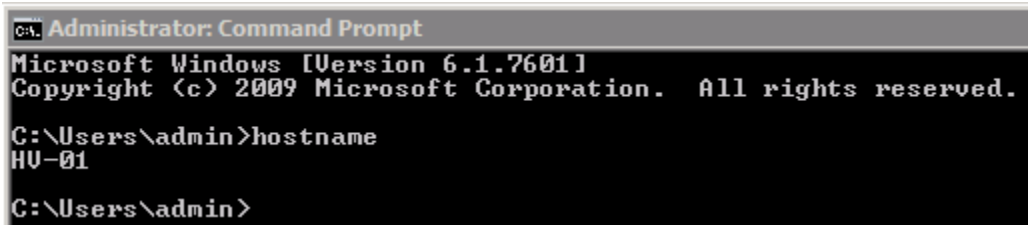


Figure LG.1 - Windows Command Prompt and Hostname Command

4. Launch the Internet Explorer and type http://hostname (e.g. http://HV-01) into the address field. If you see the following picture after you launch the URL, it means your Internet Information Services (IIS) is working.

5. Close the Internet Explorer.

Figure LG.2 - IIS

Add FTP Publishing to the Default Web Site

1. From Start → Administrative Tools → Internet Information Services (IIS), open the IIS Manager. If there are two selections open in the IIS manager, choose the one WITHOUT the 6.0 in its name.

2. Expand the Connections navigation tree on the left and then right-click on the "Default Web Site".

3. Select "**Add FTP Publishing**".

4. Select '**No SSL**" and click on "Next". Select **Anonymous** and **Basic**. From the Allow Access to: dropdown list select **All Users.** Select **Read** and **Write.** Then click on "Finish".

   NOTE: For testing purposes we have opened up the security. You may consider different settings in a production facility.

5. Under the "Manage Web Site" section on the right, click on "Restart".

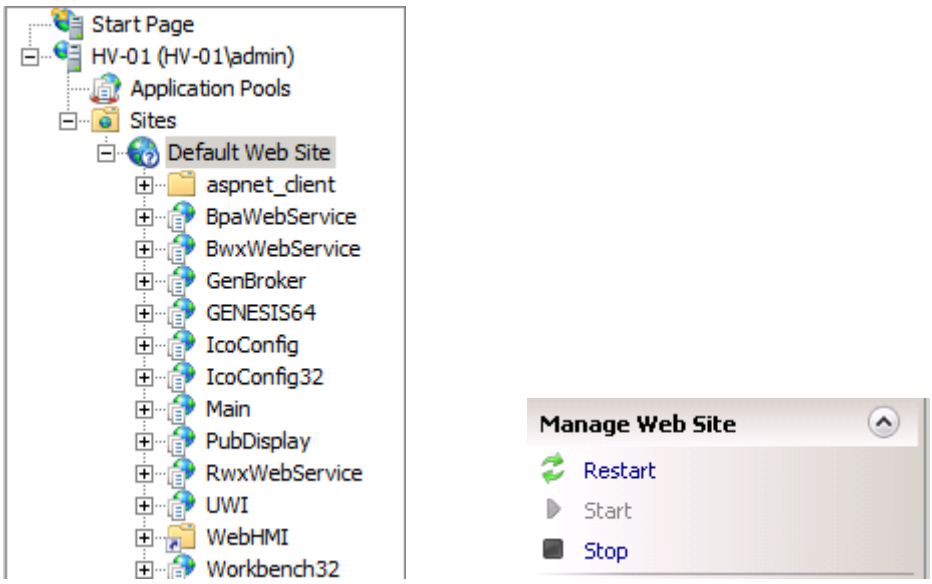


Figure LG.3 – Manage Web Site - Restart

Test Ftp Connectivity

1. From the Command Prompt type in **ftp** *hostname* and press the enter key. A user login prompt should be displayed. Login with the user account that you use to login to your OS. If the command prompt returns this message "**230 User logged in**" after you enter your username and password it means your ftp connectivity is working. If any of the above steps do not work properly, ask our instructor for assistance. Close the Command Prompt window.

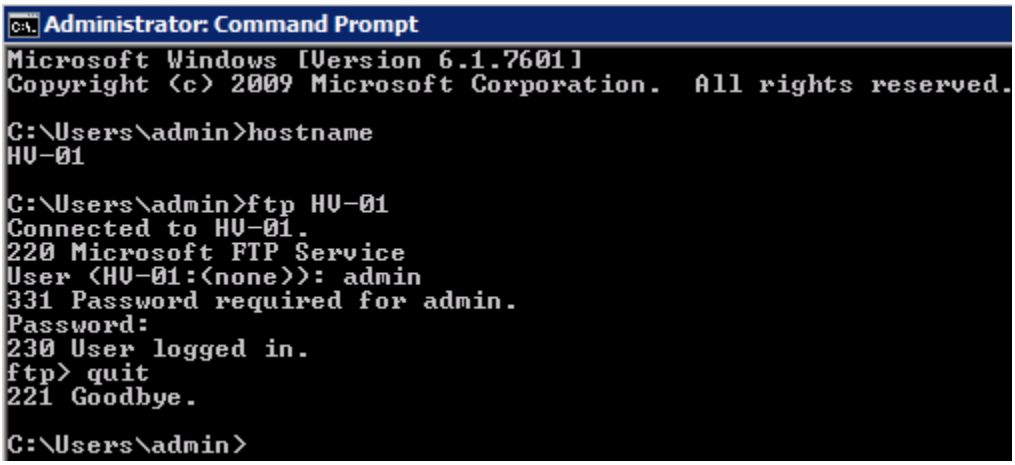


Figure LG.4 - Ftp Connectivity Test

Publish a Display

1. Open Workbench Classic if you closed it from the previous lab, then open the **icTonicsHome** display.

2. From the **File** menu, select **Publish**.

3. In the **Web Publishing Wizard** that opens, click on **Next**.

   In the **Select a File** dialog box, enter or browse for the Input File. Because the display is already open in the Workbench, the icTonicsHome.gdfx display should appear as the Input Fil". If it does not, click on the Browse button to navigate to it and select it.

4. Make sure there is a checkmark in the **Enable Multiple Display Support** checkbox and click on **Next**.

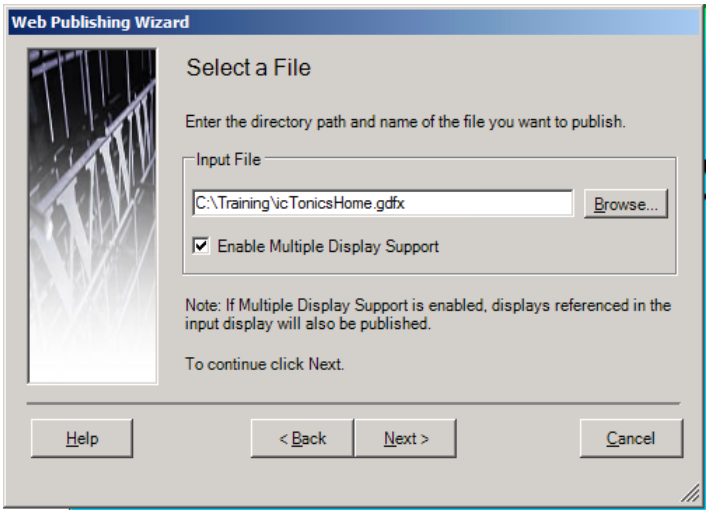


Figure L14.5 - Web Publishing Wizard: Select a File

Note: You will now see a progress window. Notice that although we have only selected to publish the icTonicsHome.gdfx display, it published the icTonicsTankMonitor.gdfx and icTonicsTrends.gdfx displays, too. This is because we checked the Enable Multiple Display Support checkbox. This allows you to publish displays that have links (such as our Load Display pick action) to the files being published.

5. Click on **Next** to select the web server to publish the three files.

6. In the **Select a Publishing Location** dialog box you should see something like ftp://HV-01/Pubdisplay. Go to step 8.

7. Alternatively, you could select **New**.

   - In the **Web Server Configuration** dialog box that opens, change the Protocol to "ftp" if it is not already selected and type in your computer name (hostname) in the "Host Name or IP Address" section.

   - In the Virtual Directory section, point it to "/PubDisplay"; the PubDisplay FTP site was setup during the GENESIS64 installation.

- Put a checkmark in the "**Save This Web Server with a Friendly Name**" option and type in "icTonics Web Server" in the field below it. The next time we publish the displays, we can just choose this one. Your finished configuration should look similar to Figure LG.6.

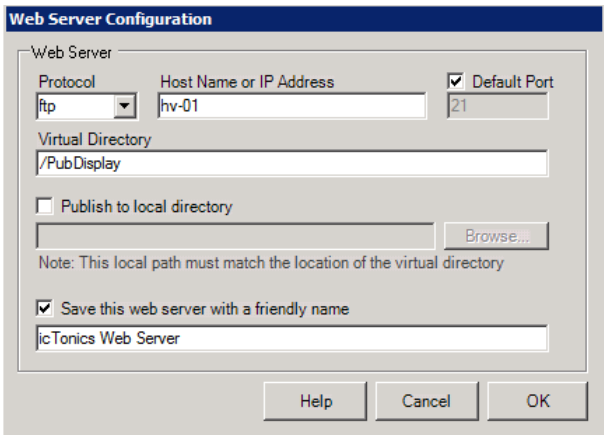


Figure LG.6 - Web Server Configuration

- Click on OK to finish the server configuration and return to the **Select a Publishing Location** dialog box.

8. Click on **Next** to proceed.

9. In the **User Name and Password** dialog box, enter a local administrator user name and password, and then click on the **Publish** button.

10. It may take a while to publish, but once it finishes you should see a dialog box indicating the status of the publishing as shown in the Figure below.

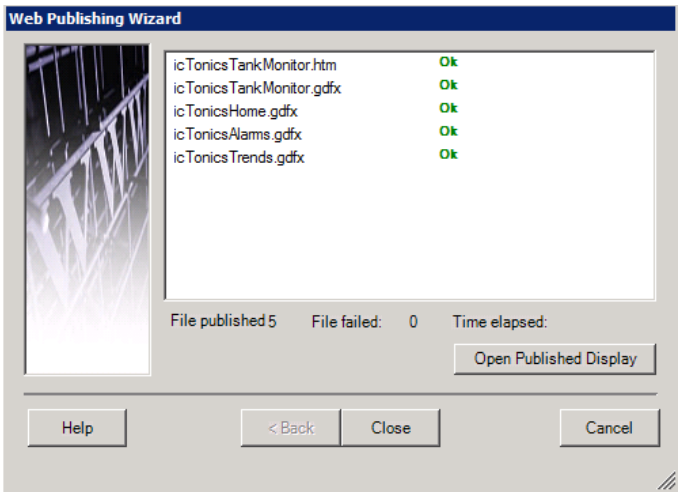


Figure LG.7 - Publishing Wizard

Note: If the publishing results give any warning or error, you can place your mouse over the warning or error and the tooltip will give you more details.

11. Launch an **Internet Explorer** session.

12. Under **Tools → Internet Options → Security → Trusted Sites** add your ServerName to the list of trusted sites.

13. You can view your displays in Internet Explorer by going to **http://*HostName*/PubDisplay/icTonicsHome.htm**. Feel free to navigate it as you would a regular display.

G.3. Remote Workbench

In some cases, engineers may need to travel to different places, leaving the environment where they created the displays. In such cases the engineers can use the remote configuration capability to continue their work from a remote location. They can even use a 32-bit machine. This section will walk you through the necessary setup to configure a project on a remote 32-bit machine.

1. Check that you have .NET Framework 4.0 installed on the client machine. You can do this by going to the **Add/Remove Programs** (or Programs and Features) in the Control Panel. Depending on the OS, it could be under the installed program list or in the Windows Features list.

2. If you are using a 64-bit machine, you can go to **http://*ServerName*/GENESIS64/websites/PubDisplay/Workbench.htm** (where *ServerName* is the hostname of your server machine) to bring up the workbench and begin configuration.

Visualize Your Enterprise™

100 Foxborough Blvd., Foxborough, MA 02035
508.543.8600 • FAX: 508.543.1503
www.iconics.com • E-mail: info@iconics.com

© 2014 ICONICS, Inc. All Rights Reserved.
Specifications subject to change without notice.