



D6000 SERIES

SIL CERTIFIED GALVANIC ISOLATORS

COMPANY PROFILE

TECHNOLOGY FOR SAFETY

G.M. International S.r.l. designs, engineers, and manufactures electronic equipment for process control since 1993.

Line of products include galvanic isolators, trip amplifiers, Ex barriers, temperature multiplexers, power supplies and SIL 3 relays, that are delivered to customers worldwide.

G.M. International's headquarters and manufacturing facilities are in Italy, close to Milan. Direct subsidiaries are present in Houston (USA), Dubai (UAE), Shanghai (China) and Moscow (Russia). A network of agents and distributors supports customers around the world.



RESEARCH AND DEVELOPMENT

G.M. International gives strategic importance to R&D activities and strives to have products conforming to the latest standards. Research, development and manufacturing are strengthened through large investments.

Over 20% of the company employees are devoted to research, development and engineering of our products. R&D personnel work closely with other company teams and keep close relationships with customers worldwide, combined with our many years of experience in all fields of applications are key factors to deliver products that meets customers requirement and anticipate market trends.

Ongoing trainings are also relevant in enhancing the company's efficiency and performance.

QUALITY AND RELIABILITY

Quality is very important to achieve customer satisfaction and market success.

G.M. International's products satisfy customers' expectations and meet the specifications of international standards. Safety, performance, reliability and product documentation are the basic principles of product Quality.

MANUFACTURING EXCELLENCE

Having complete control on the manufacturing process ensures the highest level of quality and guarantees the most flexibility for all customers' requirements with improved delivery time for big or small orders alike.

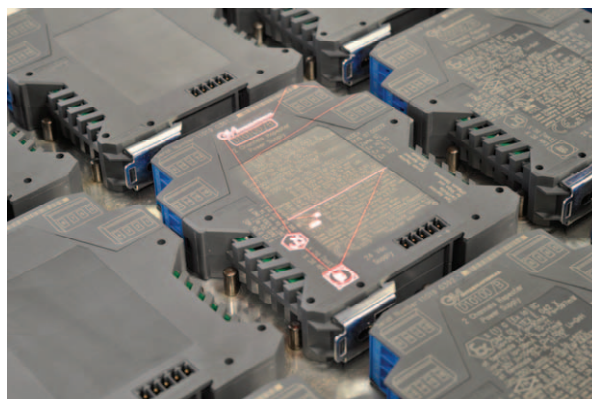
Manufacturing equipments are constantly renewed and updated; Automatic Test Equipment, specifically developed by our engineering team, are constantly checked and calibrated against traceable standards to ensure accuracy and repeatability.

Our modules use embedded Planar Transformers to guarantee the highest reliability, the best accuracy and stability as well as low manufacturing costs. We strive to use the best industry components, qualified as a minimum for operations up to 85°C, and use advanced designed techniques to improve performances and price.

Automated assembly lines using the latest technology allow us to improve quality, delivery time and to lower manufacturing costs. Investments are made in the production line to keep abreast with the latest technology.

The entire production goes through rigorous and automated test and calibration procedures.

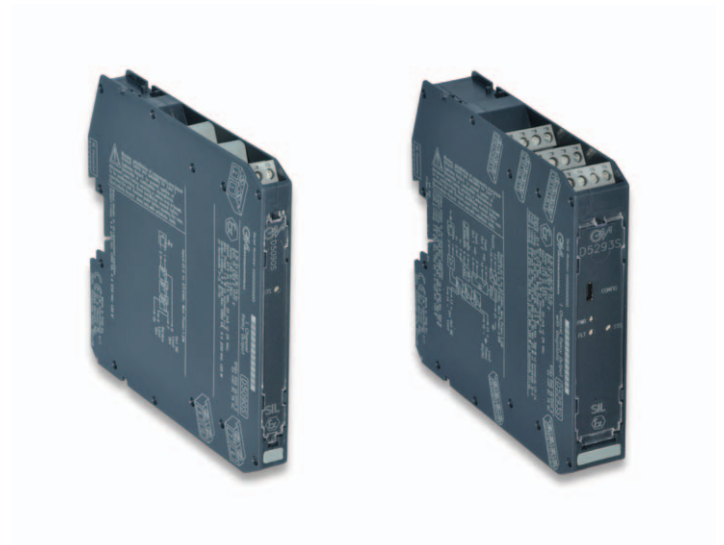
Test bench calibration is verified several times during the day to guarantee correct and repeatable results. Our actual, verified according to ISO 9000:2008 records, field return rate is better than 0,1%.



D6000 SERIES

Enhanced
Galvanic Isolators

Suitable for
SIL 2 and **SIL 3** applications



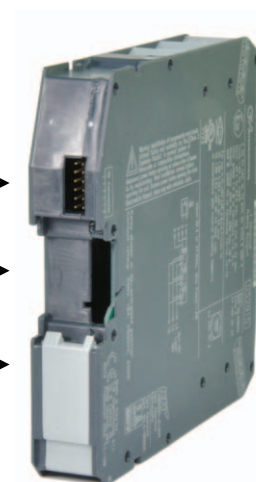
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CHARACTERISTICS

Universal mounting enclosure

All D6000 Modules can be mounted on
DIN-Rail, Power Bus and Termination Boards.



Termination Board connector

Power Bus connector

DIN-Rail lock

Guides for Termination
board mounting

Control room Terminal blocks
with engraved identification

120 mm

123 mm

12 mm
2 channels

Lexan detachable front cover

LEDs for power, status and fault indication
are visible through the transparent cover

Modules are SIL 2/ SIL 3 certified

Field Terminal Blocks indicator

Laser engraving

on entire enclosure and terminal blocks to
provide accurate, safe and permanent marking
of schematic diagrams, connections and
instructions.

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HIGH INTEGRITY GALVANIC ISOLATORS

High performance

- High signal transfer accuracy and repeatability.
- Advanced circuitry provides very low heat dissipation, ensuring modules run cool despite their high density and functionality.
- SMD manufacturing for a long, reliable life.
- Complete absence of electrolytic capacitors ensures minimum 20 years lifetime.

Wide functionality

- Wide range of digital and analog I/O.
- Three port galvanic isolation to eliminate noise, ground loop problems.
- Line fault alarm detects open or short circuit of field cables.
- Optional power bus DIN-Rail connector.
- Standard Termination Board with SUB-D connector and customized Boards compatible with major I/O cards.
- EMC Compatibility to EN61000-6-2, EN61000-6-4, EN61326-1, EN61326-3-1 for safety system.

Save up to 50% space



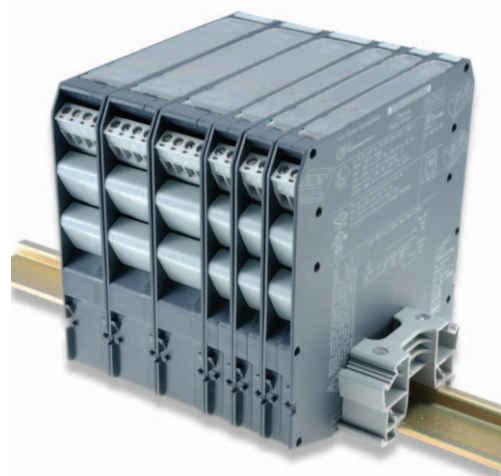
3 or 6 mm per channel + Ultra-low power consumption

General features

- Modules suitable for applications up to SIL 3 level according to IEC 61508, IEC 61511.
- Independent power supply circuit for each channel.
- Dual channel units are equivalent to two single units because of the absence of common circuitry.
- Single channel versions available when required, to provide single loop integrity.
- Configuration components are easily accessed by removing the side cover.
- DIP switch configurability for easy field setup.
- LED indication for power, signal status and line fault conditions.
- Modules accept DC power supply over a wide range for 24 Vdc (20-30 Vdc) applications.
- Wide operating temperature range: -40 to +60/+70 °C.

High packing density

- 35 mm (Top Hat) DIN-Rail.
- Ultra slim 2 channels 12 mm wide DIN-Rail or 8 channels into 22 mm
- Termination Board mounting modules.
- Power and fault on bus connectors.
- 3/6 mm per channel means more than 50% space reduction



D6000 SERIES

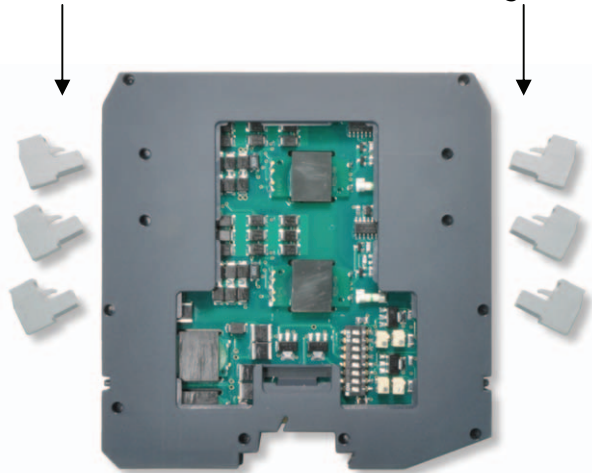
FEATURES

Enclosure Characteristics

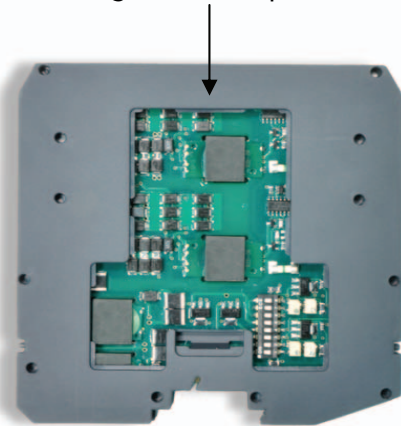
- High channel density result from innovative circuit design using advanced surface mount components.
- Plug-in screw terminal blocks to secure termination up to 2.5 mm².
- Configuration components are easily accessed by removing side cover.

Terminal blocks for
Field connections

Terminal blocks for
connecting to Control room



Detachable cover for access to
configuration component



Enhanced Power Bus mounting

Power Supply Voltage, 24 Vdc, can be applied to the module by connecting the voltage directly to the plug-in Terminal Block of each module, or via the Power Bus System.

The system consists of standard DIN-Rail modules mounted on standard DIN-Rail Bus connectors. The maximum allowed powering capacity is 8 A.

It is always possible to remove modules, without disconnecting the bus connector which remains attached to the DIN-Rail.

Cumulative Fault Alarm indication is provided on the Bus connection.

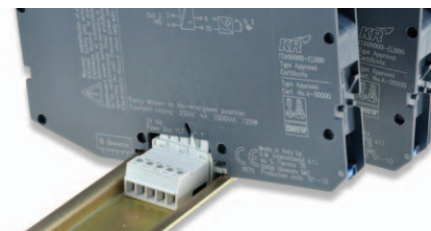
This signal can be fed to a common unit (D5202S) which provides:

- 1 SPST Relay contact for common faults and
- 1 SPST Relay contact for power good (supply within operating range).

The D5202S is capable of operating also as redundant 4 A supply module for the system.



Bus plug-in connector



Bus connector terminal



DIN-Rail stopper

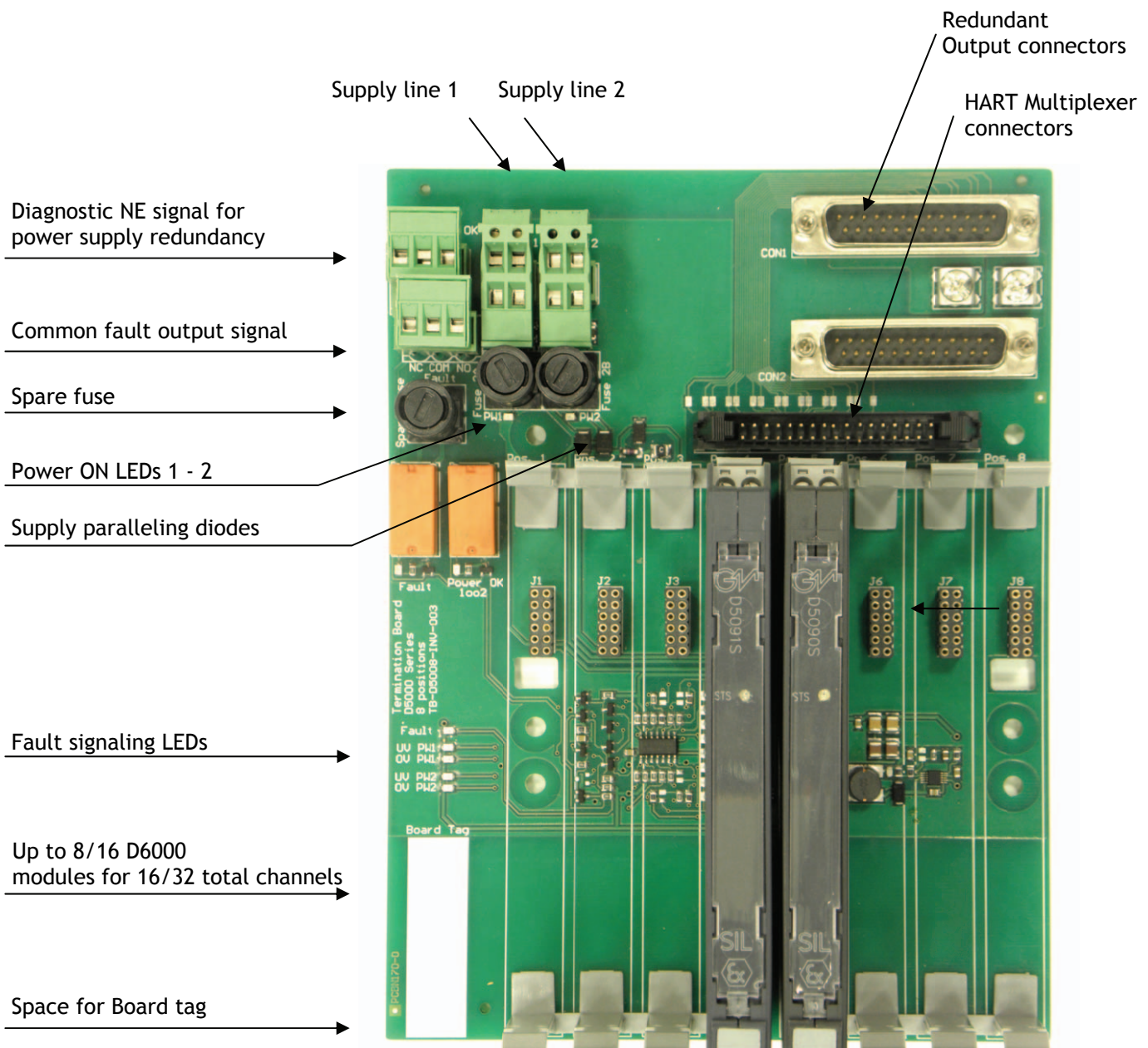
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D6000 SERIES

TERMINATION BOARDS

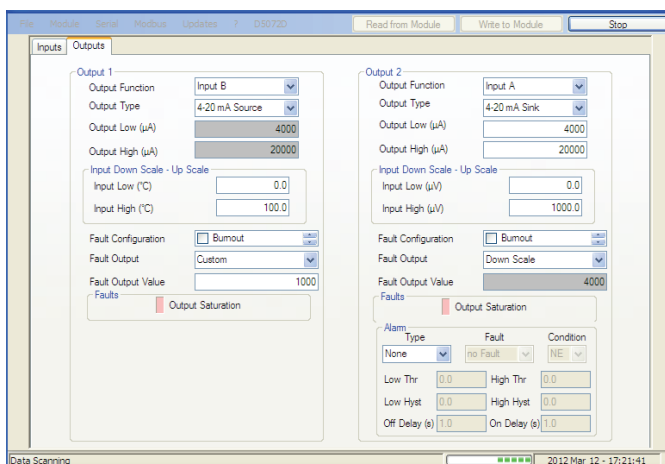
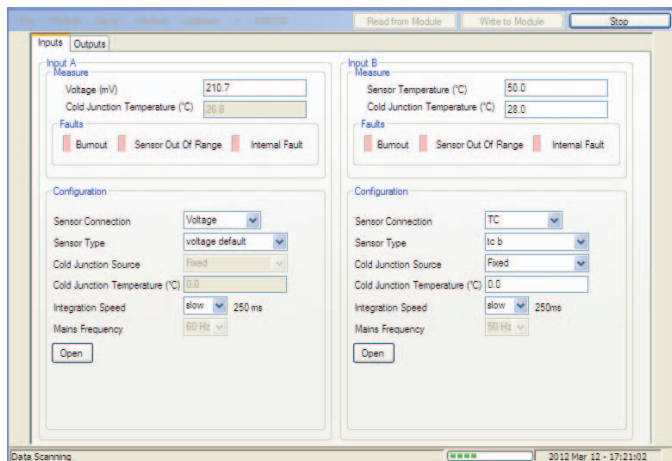
Characteristics

- Suitable to accept up to 8/16 D6000 modules 12mm wide, single and double channel.
- AI - AO - DI - Temperature: double channels.
- DO - Safety Relay: single channel.
- 24 Vdc redundant Power supply terminal blocks can be disconnected from the board without disrupting the power to other boards connected in series.
- Boards are available with custom connectors to directly interface most PLC / DCS / ESD systems.



D6000 SERIES

CONFIGURATION



SWC5090 Software

The SWC5090 software is designed to provide a PC user interface to configure suitable D6000, D6200 modules.

It easily allows the user to:

- Read and write configuration parameters to the unit;
- Store and restore data to and from local hard drive for backup or archive;
- Load factory default configurations;
- Monitor real time Input values;
- Print a report sheet containing configuration parameters and additional information.

The SWC5090 is freely distributed at our website: <http://www.gmintsr.com>



PPC5092 USB Adapter

PPC5092 interface allows the configuration of D6000, D6200 modules via **SWC5090** software. Modules are supplied via USB for programming and therefore do not need any external power supply.

PPC5092 comes with mini-USB dedicated cable and CD-Rom containing SWC5090 software.

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
ANALOG IN		D6011S	4-20 mA		1		SIL 3
		D6011D	2-Wires Tx only; Smart compatible	4-20 mA (source only)	2	20-30 Vdc	SIL 3
		D6014S			1		SIL 3
		D6014D	4-20 mA	4-20 mA (source or sink)	2	20-30 Vdc	SIL 3
		D6014D	2-Wires Active or Passive Tx; Smart compatible		1		SIL 3
		D6212Q		Two duplicated outputs	4		SIL 2
		D6212Q	4-20 mA	4-20 mA + Modbus	2		SIL 2
		D6212Q	2-Wires Passive Tx	Two duplicated outputs + Modbus	2	20-30 Vdc	SIL 2
		D6212Q		One Triplicated + One single outputs + Modbus	1		SIL 2
		D6254S	4-20 mA 2-Wires Tx Active or Passive; Smart compatible	One Quaduplicated output + Modbus	1	20-30 Vdc	SIL 2
ANALOG OUT		D6020S	4-20 mA	4-20 mA	1		SIL 3
		D6020D	Analog Signal to I/P Converters, Electrovalves, Actuators and Displays; Smart compatible	Bus powered signal from DCS, PLC or other control devices. Two duplicated outputs.	2	20-30 Vdc	SIL 3



Configurable via PPC5092 with Software SWC5090



	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
DIGITAL IN		D6030S	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	1 SPDT (relay contact) + LED (fault status)	1	20-30 Vdc	SIL 3
		D6030D		1 SPST (relay contact) + 1 SPST (alarm or duplicator) + LED (fault status)	1		SIL 3
		D6030D		2 SPST (relay contact) + LED (fault status)	2		SIL 3
		D6031S	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	1 Open Collector + LED (fault status)	1	20-30 Vdc	SIL 3
		D6031D		2 Open Collectors + LED (fault status)	1		SIL 3
		D6031D		1 Open Collector + 1 O.C. (alarm duplicator) + LED (fault status)	2		SIL 3
		D6231E 	Voltage free Contact, Proximity Switch Line fault detection	8 Open Collectors + LED (fault status) + Modbus	8	20-30 Vdc	SIL 2
TEMPERATURE CONVERTERS AND TRIP AMPLIFIERS		D6072S 	Universal TC, 3/4-Wires RTD, Potentiometer, mV	4-20 mA (source or sink) + Modbus 1 Independent set point via 1 Solid State Relay	1	20-30 Vdc	SIL 2
		D6072D 	Universal TC, 3-Wires RTD, Potentiometer, mV	4-20 mA (source or sink) + Modbus	2	20-30 Vdc	SIL 2
		D6072D 		4-20 mA (source or sink) + Modbus Duplicator		20-30 Vdc	SIL 2
		D6273S 	Universal TC, 3/4-Wires RTD, Pot, mV	4-20 mA (source or sink) 2 independent set points via 1 SPDT Relay each + Modbus	1	20-30 Vdc	SIL 2



ACCESSORIES

Image	Code	Description
	JDFT049	12 mm Power Bus Connector for DIN Rail Mounting 1 needed for each BUS Module
	JDFT050	22 mm Power Bus Connector for DIN Rail Mounting 1 needed for each BUS Module
	MCHP196	Bus End Stopper One for each end of Bus Required
	MOR017	Plug-in terminal block male, horizontal out, for Power Bus
	MOR022	Plug-in terminal block female, horizontal out, for Power Bus
	MCHP184	Grey Terminal Block Plug 12 mm
	MCHP186	Grey Terminal Block Plug 22 mm
	OPT5096	Kit for Bus Mounting: 1 x MOR017, 1 x MOR022, 2 x MCHP196
	PPC5092	PC Adapter required to configure programmable units; Mini USB Male to USB Port
	SWC5090	PC Software for Configuration

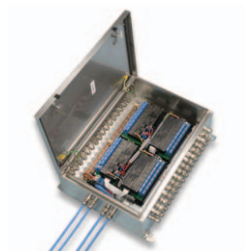
D6000

PRODUCTS



■ D1000 INTRINSICALLY SAFE ISOLATORS

Ex/SIL certified isolators/barriers, trip amplifiers, temperature converters.
DIN-Rail, Power Bus and Termination Board mounting. Up to 4 channels in 22 mm.

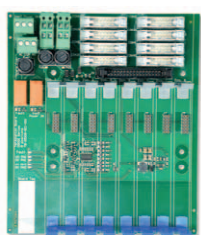
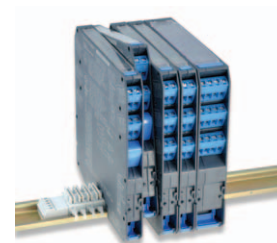


■ D2000M INTRINSICALLY SAFE MULTIPLEXER

Ex certified Multiplexer systems for acquiring temperature and digital signals from Zone 0. Redundant supply and communication with field units. Modbus Output.

■ D5000 INTRINSICALLY SAFE ISOLATORS

Ex/SIL certified isolators/barriers, trip amplifiers, temperature converters.
DIN-Rail, Bus and Termination Board mounting. 8 channels in 22mm.



■ CUSTOM TERMINATION BOARDS

Engineered following customer specific requirements. Models already available for ABB, Yokogawa, Invensys, Triconex, Honeywell, Emerson systems.



SIL 3 SAFETY RELAYS

Complete range of Safety relays for ETS/DTS applications.
Models with Load and Line monitoring available. Various configurations.

PSD1200 NON INCENDIVE POWER SUPPLIES

Zone 2 Installation, 24 Vdc, 250 W Output. Alarm functions.
High efficiency. Built-in paralleling and load sharing features.



PSS1250 POWER SUPPLY SYSTEM

Safe Area/Zone 2, 19" rack modular system for up 3600 W. 24 Vdc Output.
Fully redundant, SIL rated. Diagnostic module. Modbus Output.

EIADP1000 ADAPTERS FOR ELCON INSTRUMENTS

Ex certified Adapters for discontinued Elcon Series 1000 models.
Pint to pin compatible, delivered fully assembled and programmed.



T3000 INTRINSICALLY SAFE LOOP POWERED INDICATOR

4.5 Digits. Pipe, wall or panel mounting. IP65 Enclosure.
Installation in Zone 0 or Div. 1, Field configurable. Low power consumption.

DTM8000 CONTINUOUS DIGITAL ALARM MONITOR

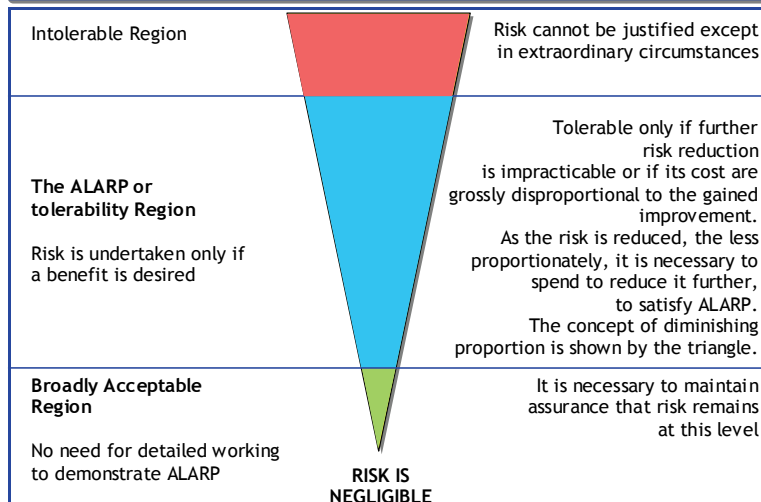
Continuous Smart Alarm Monitor for up to 48 Channels.
Designed for critical applications requiring low delays for alarm and operation.



SIL LEVELS ACCORDING IEC 61508 / IEC 61511

SIL Safety Integrity Level	PFDavg Average probability of failure on demand per year (low demand)	RRF Risk Reduction Factor	PFDavg Average probability of failure on demand per hour (high demand)
SIL 4	$\geq 10^{-5}$ and $< 10^{-4}$	100000 to 10000	$\geq 10^{-9}$ and $< 10^{-8}$
SIL 3	$\geq 10^{-4}$ and $< 10^{-3}$	10000 to 1000	$\geq 10^{-8}$ and $< 10^{-7}$
SIL 2	$\geq 10^{-3}$ and $< 10^{-2}$	1000 to 100	$\geq 10^{-7}$ and $< 10^{-6}$
SIL 1	$\geq 10^{-2}$ and $< 10^{-1}$	100 to 10	$\geq 10^{-6}$ and $< 10^{-5}$

TOLERABLE RISKS AND ALARP (ANNEX 'B')



IEC 61508-61511

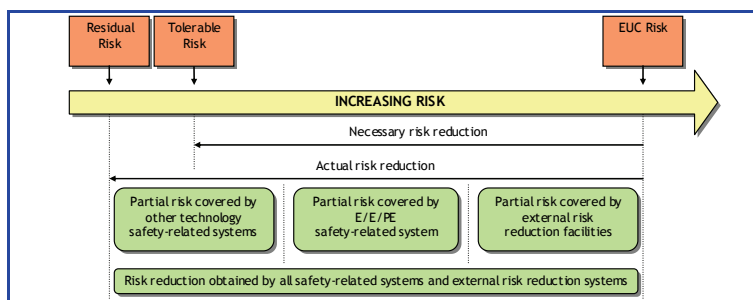
FACTS AND FORMULAE

IEC 61508 and IEC 61511 standards represent a milestone in the progress of industry in the achievement of supreme levels of safety through the entire instrumented system lifecycle. The benefits of these new standards include details and a greater effectiveness for what concerns:

- the definition of risk reduction and related requirements;
- system design and implementation;
- documentation management;
- safety assessment and validation;
- plant maintenance;
- cost management.

The majority of our products are SIL 3 or SIL 2 certified.

RISK REDUCTION



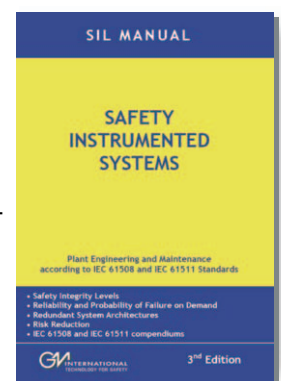
AVERAGE PROBABILITY OF FAILURE ON DEMAND (PFDavg)

PFDavg	Tolerable accident frequency Frequency of accidents without protections = $\frac{1}{RRF}$	
	Simplified equations	
	Without common causes	With common causes (Beta factor)
1001	$\lambda_{DU} \times \frac{TI}{2}$	-
1002 1002D	$\lambda_{DU1} \times \lambda_{DU2} \times \frac{TI^2}{3}$	$\frac{[(1-B) \times (\lambda_{DU} \times TI)]^2}{3} + \frac{(B \times \lambda_{DU} \times TI)}{2}$
1003	$\lambda_{DU1} \times \lambda_{DU2} \times \lambda_{DU3} \times \frac{TI^3}{4}$	$\frac{[(1-B) \times (\lambda_{DU} \times TI)]^3}{4} + \frac{(B \times \lambda_{DU} \times TI)}{2}$
2002	$(\lambda_{DU1} + \lambda_{DU2}) \times \frac{TI}{2}$	$[(1-B) \times (\lambda_{DU} \times TI)] + \frac{(B \times \lambda_{DU} \times TI)}{2}$
2003	$\left[(\lambda_{DU1} \times \lambda_{DU2}) + (\lambda_{DU1} \times \lambda_{DU3}) + (\lambda_{DU2} \times \lambda_{DU3}) \right] \times \frac{TI^2}{3}$	$[(1-B) \times (\lambda_{DU} \times TI)]^2 + \frac{(B \times \lambda_{DU} \times TI)}{2}$
1001 ($E_t \neq 100\%$)	$\lambda_{DU} \left[\left(E_t \times \frac{TI}{2} \right) + (1-E_t) \frac{SL}{2} \right]$	TI: Proof Test time interval Et: Test Effectiveness λ_{DU} : dangerous undetected failures

Safety Instrumented Systems

The experience in safety and electronics acquired during the years has lead us to the writing of a comprehensive manual on IEC61508 and IEC 61511. This effort has already proven to be a great benefit for engineers, maintenance personnel and whoever wishes to approach the concept of functional safety.

The manual is available on request in English, Spanish and Italian language.



SAFETY:

FREEDOM FROM UNACCEPTABLE RISK



Boiling Liquid expanding Vapor Explosion (BLEVE)



Flash Fire



Jet Fire



Pool Fire



Fireball

AVAILABILITY AND RELIABILITY

Basic Concepts:

Failure Rate :

$$\lambda = \frac{\text{Failures per unit time}}{\text{Components exposed to functional failure}}$$

1 FIT = 1×10^{-9} Failures per hour

$$\text{MTBF} = \text{MTTF} + \text{MTTR} \quad \mu = \frac{1}{\text{MTTR}}$$

$$\text{MTTF} = \text{MTBF} - \text{MTTR} = \frac{1}{\lambda} \quad \lambda = \frac{1}{\text{MTTF}}$$

$$\begin{aligned} \text{Availability} &= \frac{\text{Operating Time}}{\text{Operating Time} + \text{Repair Time}} = \\ &= \frac{\text{MTTF}}{\text{MTTF} + \text{MTTR}} = \frac{\text{MTTF}}{\text{MTBF}} = \frac{\mu}{\mu + \lambda} = \\ &= \frac{\text{MTBM}}{\text{MTBM} + \text{MSD}} \end{aligned}$$

$$\text{Unavailability} = 1 - \text{Availability} = \frac{\lambda}{\mu}$$

Acronyms:

MTBF: Mean Time Between Failures

MTTF: Mean Time To Failure

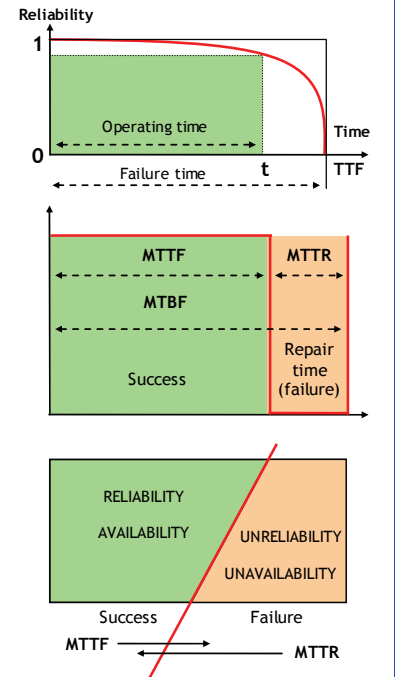
MTTR: Mean Time To Repair

MTBM: Mean Time Between Maintenance

MSD: Expected Mean System Downtime

λ : Failure rate

μ : Repair rate



SAFE FAILURE FRACTION (SFF) AND SIL LEVELS

SFF

$$\frac{\sum \lambda_{DD} + \sum \lambda_{SD} + \sum \lambda_{SU}}{\sum \lambda_{DD} + \sum \lambda_{DU} + \sum \lambda_{SD} + \sum \lambda_{SU}} = 1 - \frac{\sum \lambda_{DU}}{\sum \lambda_{TOT}}$$

Hardware fault
tolerance
0

Hardware fault
tolerance
1

Hardware fault
tolerance
2

TYPE A Components

< 60%	SIL 1	SIL 2	SIL 3
60% - < 90%	SIL 2	SIL 3	SIL 4
90% - < 99%	SIL 3	SIL 4	SIL 4
> 99%	SIL 3	SIL 4	SIL 4

TYPE B Components

< 60%	Not allowed	SIL 1	SIL 2
60% - < 90%	SIL 1	SIL 2	SIL 3
90% - < 99%	SIL 2	SIL 3	SIL 4
> 99%	SIL 3	SIL 4	SIL 4

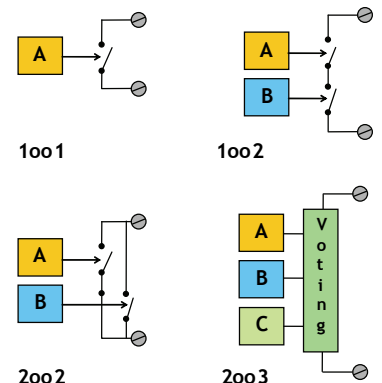
Failure rates categories: λ_{DD} : dangerous detected; λ_{DU} : dangerous undetected
 λ_{SD} : safe detected; λ_{SU} : safe undetected

MEAN TIME TO FAILURE SPURIOUS

MTTFs

1001	$\frac{1}{\lambda_S}$
1002	$\frac{1}{2\lambda_S}$
2002	$\frac{1}{2\lambda_S^2 \times \text{MTTR}}$
2003	$\frac{1}{6\lambda_S^2 \times \text{MTTR}}$

SYSTEM ARCHITECTURES





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www.gmintsr.com/?p=worldwide

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