

Switch Introduction

Introduction

To meet the needs of a wide range of uses in the measurement and automation field, switches come in a variety of types and sizes for versatile applications. It is important to understand the different types of switches available before selecting the most appropriate switch configuration.

Characteristics

Switches are generally separated into 3 forms, single-pole single-throw (SPST), single-pole double-throw (SPDT), and double-pole double-throw (DPDT). The pole is the source wire, while the throw refers to the switch position. A direct application of SPST switches is to close or open a circuitry (Figure 1). A SPDT switch has one source wire and two switch positions. The contact of the SPDT switch stays on the normally closed (NC) position. When the SPDT switch is excited, then the contact changes the position to the normally open (NO) position (Figure 2). The DPDT switch consists of 2 SPDT switches operating at the same time.

The other classification of switches is done by forms, Form A, Form B, Form C and Form D. Form A refers to a normally open SPST switch, while Form B refers to a normally closed SPST switch. In Figure 1, the normally open SPST switch is called a 1 Form A switch.

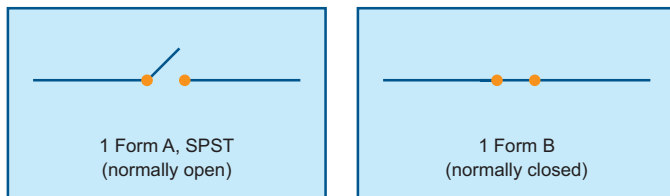


Figure 1 (Form A, Form B)

Form C is a single-pole double-throw (SPDT) switch with "break-before-make" functionality, while Form D is also a SPDT switch, but with "make-before-break" functionality. In Figure 2, the switch on the left is a "1 Form C", which chooses two signals to connect with the source wire; the switch on the right is a "2 Form C" switch, which is DPDT as previously described.

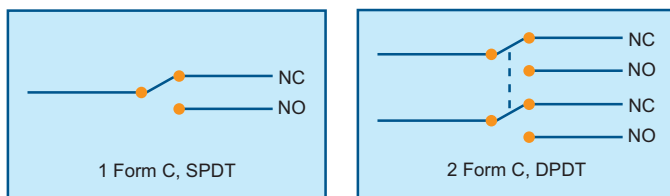


Figure 2 (Form C, 2 Form C)

Functions

General-Purpose (GP) Switches

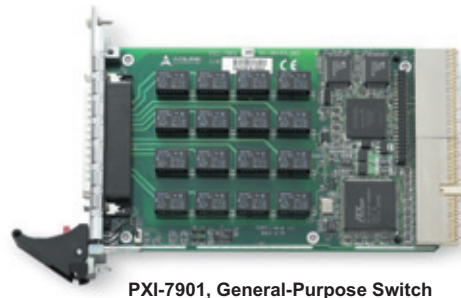
General purpose switches contain several independent relays which are isolated from each other. GP switches are commonly used to connect one input to one output and are usually built with Form A or Form C relays. The normal usage of GP switches is to turn on or turn off devices, such as motors, fans, heaters, and lights.

Multiplexers (MUX)

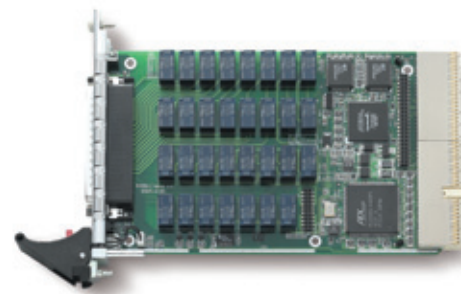
In test applications, the quantity of instruments is usually lower due to high cost. Thus, to connect multiple units under test (UUT) with the testing instrument, a multiplexer is always the choice to make the maximum utilization of the instruments. A 1-wire multiplexer routes single-ended signals to one point, and a 2-wire multiplexer selects differential signals. A 4-wire multiplexer is usually used to measure low resistance or RTDs. The instruments which are often used with multiplexer include DMM, digitizer and signal source, such as AWG, to provide both measurement and excitation.

Matrix

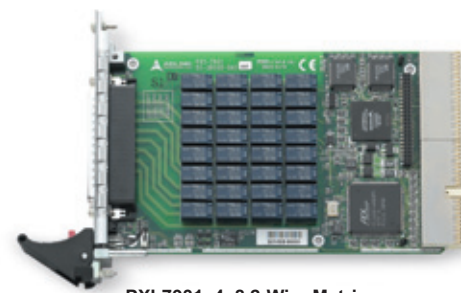
Matrix switches provide the most versatile switching capacity among these function topologies. In the matrix, any input can connect to any output individually or in combination. Unlike the multiplexer, the matrix could connect the source or measurement instrument to multiple UUTs at the same time. Matrix' advantage is the save of wiring. When users want to change the configurations of measurement or excitation, users just change the internal connection path, and do not have to manually reconfigure the wiring.



PXI-7901, General-Purpose Switch



PXI-7921, 24-CH 2-Wire Multiplexer



PXI-7931, 4x8 2-Wire Matrix

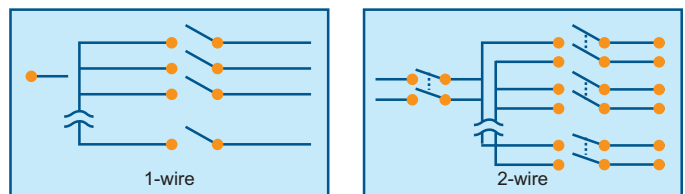


Figure 3 (Multiplexer)

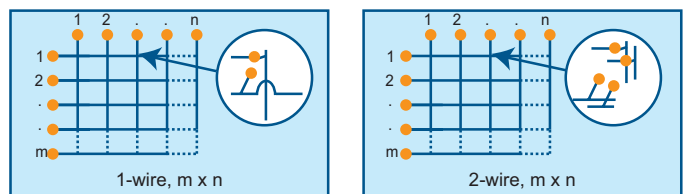


Figure 4 (Matrix)