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KEYSIGHT TECHNOLOGIES

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Signametrics
Precision Instruments for the PC

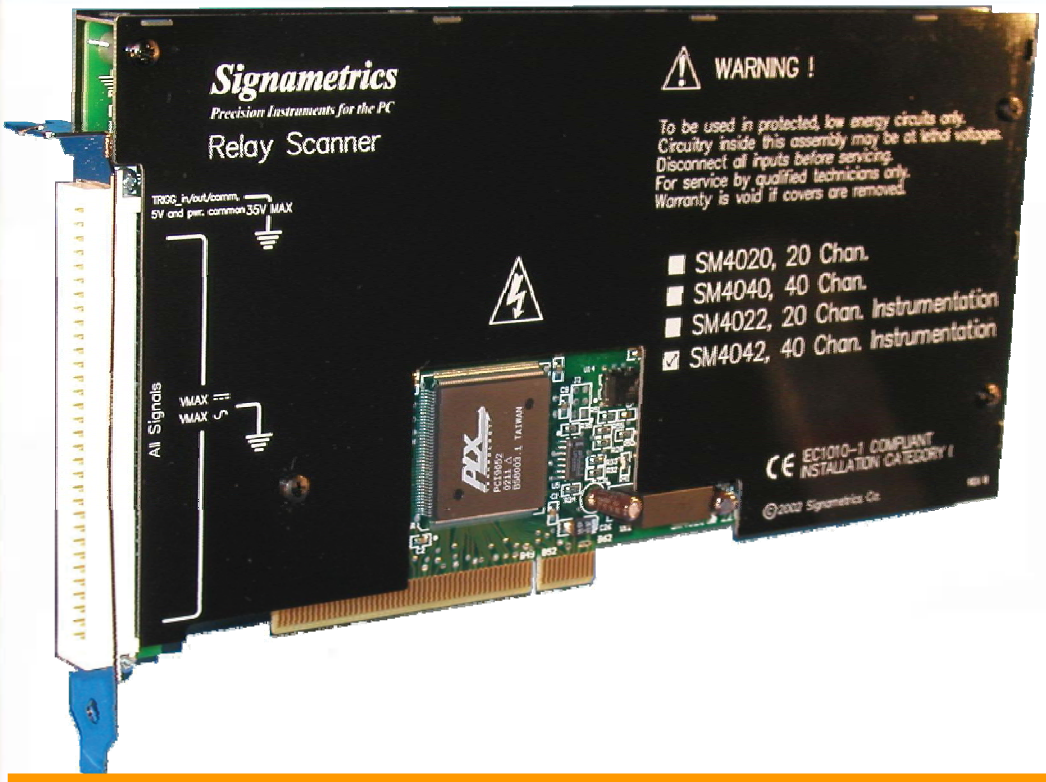
SM4020, 4022, 4040 and 4042 PCI relay Multiplexers

20 and 40 Channel Relay Switching modules for PCI

Features

- **PCI plug-in models**
- **Relay Multiplexer**
- **Reconfigurable on the fly**
- **Auto Scanning**
- **On-board Controller**
  - **Autonomous operation**
  - **Complex Operations**
  - **High Level Commands**
- **Flexible Architecture**
  - **40 chan. 2-Wire Mux.**
  - **20 chan. 4-Wire Mux.**
  - **10 chan. 6-Wire Mux.**
  - **Matrix**
  - **Two groups of 20:1**
  - **Four groups of 10:1**
  - **Single-ended 80:1**
- **Lowest Thermal EMF**
- **Lowest noise**
- **Isolated power and controls**
- **Instrumentation quality**
  - **SM4022, SM4042**
- **Low Cost models**
  - **SM4020, SMU4040**
- **Variable Actuation time**
- **Variable Actuation delay**
- **Break-Before-Make**
- **Triggered operations**
- **Sync output.**
- **Contact Cleaning**
- **Self tests**
  - **Shorts and opens**
  - **Stuck relay**
  - **Contacts resistance**
  - **Bounce & settle time**
- **Universal Software driver**
  - **Linux & Windows**
  - **Fast to install - tiny footprint**
  - **Compatible with most S/W**
  - **Stand alone – no dependencies**
  - **Excel, Word, MatLab, LabView, C, C++, C#, LabWindows, VB…**

To preserve the accuracy of a DMM with more than 3-1/2 digits, use Instrumentation type switch.



The ***Signametrics*** SM4020/22/40/42 models offer a superior functionality and performance, at unmatched prices. These flexible relay switching modules are designed for applications requiring both, performance and ease of use. They can be reconfigured on-the-fly for 40:1 differential multiplexing, 20 channels 4-Wire multiplexers or any one of several pre-set configurations. They can also be set to a universal mode, in which each relay can be independently controlled.

In measurement applications, it is important to consider the error contribution of the switching subsystem. Using the wrong switch may result in errors several orders of magnitude greater than that of the measurement instrument. While the carefully designed Instrumentation Quality SM4022 and SM4042 models will have negligible signal degradation, even the low cost 4020 and 4040 models will perform 10 times better than most other PCI plug-in switches.

Built-in intelligence relives the host CPU, and facilitate for high level commands, making programming much simpler and faster. For instance, to multiplex a set of 4-Wire resistors, issue a configuration command to set it as a 4-Wire mux, followed by a sequence of commands to select various channels. All currently closed channel relays will open and the selected two channel relays corresponding to the 4-Wire connection will close. This is done within a single actuation time, and with a high level command, resulting in simple test procedure. It is possible to efficiently mix configurations, without sacrificing channels. Also, the number of channels per system is unlimited.

For Thermocouple (TC) multiplexing use the optional SM40T Isothermal-block. The SM40T has an active temperature sensor to reading cold junction temperature. The low thermal EMF of the 4022 and 4042 minimizes temperature error. Digital Multimeters such as the 2060 and 2064 from ***Signametrics*** have built-in Thermocouple linearization for most popular TC types.

As with the Signametrics DMMs, these units carry a 30 day no-risk trial period.

The software package included is complete, and does not require any additional drivers or packages. It is not in ***Signametrics*** interest to constrain users to a short list of S/W packages. Therefore the type of driver provided is universal. It allows these Switches to be controlled by a large number of software environments, including MS Word, Excel, Mat Lab, Visual Basic, C, C++, C#, LabWindows, LabView, ATEasy, Delphi and may other graphical and text based software packages. An added benefit of having no dependencies makes for a fast and easy installation and operation. In less than five minutes you will be controlling these switches.

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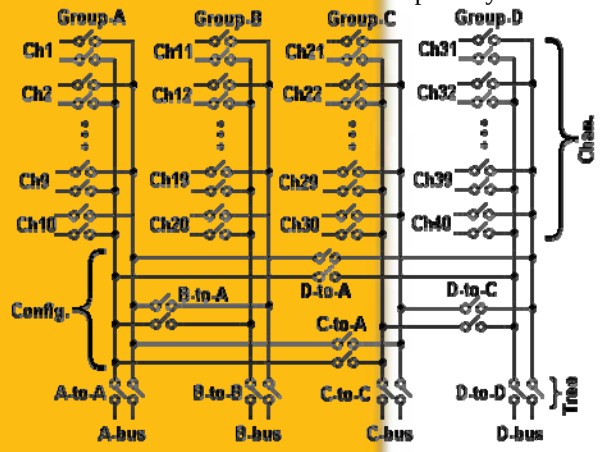
Specifications

Function	SM4020 Standard Scanner	SM4022 Instrumentation Scanner	SM4040 Standard Scanner	SM4042 Instrumentation Scanner
Number of differential channels	20	40	20	40
Number of 10:1 groups	two	four	two	four
Scanning Arrangement	Two groups of 10:1 differential		Four groups of 10:1 differential	
Thermal EMF offset (μV)	25	1.5	25	1.5
Maximum Switching DC Voltage (V)	110	220	110	220
Maximum Switching AC Voltage (V)	110	250	110	250
Maximum Switching Current (A)	1	1	1	1
Maximum Switching Current (A)	1	1	1	1
Typical inter-channel Capacitance	15pf	15pf	15pf	15pf
Insulation between open contacts (MΩ,)	>100	>1,000	>100	>1,000
Insulation; contacts to coils (MΩ)	>100	>1,000	>100	>1,000
Insulation; adjacent channels (MΩ)	>100	>1,000	>100	>1,000
No Load Life	$2X10^7$	10^8	$2X10^7$	10^8
Loaded Life @ 50Vdc, 0.1A	$3X10^5$	10^6	$3X10^5$	10^6
Trigger input	√	√	√	√
Trigger output	√	√	√	√
Thermocouple Cold Junction Capable		√		√
Typical Closure Time (ms)	12	4	12	4
Typical Release Time (ms)	5	2	5	2
Actuation Time (ms) [1]	15	5	15	5
Actuation Time Settable Range (ms)	1 to 850 in 0.25 steps			
AutoScan Period Range (ms)	1 to 850 in 0.25 steps			
Available Configurations	2-wire, 4-wire, universal, two-groups	2-wire, 4-wire, 6-wire, universal, two-groups, four-groups	2-wire, 4-wire, universal, two-groups	2-wire, 4-wire, 6-wire, universal, two-groups, four-groups
Available Scan Groups	A and B	A, B, C and D	A and B	A, B, C and D
Isolated Relay Coil Drive		√		√
Maximum number of relays closed	All	All	All	40
High Ohms range 1,000 Meg		√		√

[1] Actuation time is the time it takes to open any closed relays, and close the selected relay.



Switch diagram including Channel, Configuration and Tree relays.

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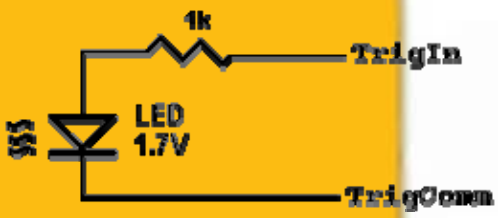
Trigger Inputs and Outputs

External Hardware Trigger Inuit

Input Characteristics

- **Input** LED (nominal 1.7V drop at 1mA) with a series 1kΩ resistor.
- **Input Signal requirements** >2.5 V, < 10 V to activate. < 1V to deactivate.
- **Isolation** Optically isolated from all other circuitry. Common line with Trigger Output.

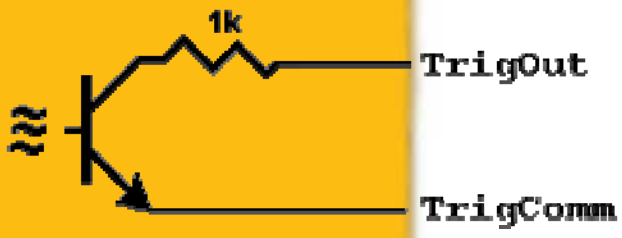


Trigger input equivalent circuit.

External Hardware Trigger Output

Output Characteristics

- **Circuit** Open collector NPN transistor with 0.4V saturation voltage in series with a 1kΩ resistor.
- **Collector Emitter Voltage** < 30 V
- **Output Current** ≤ 4 mA
- **Reverse Voltage** ≤ 7V
- **Isolation** Optically isolated from all other circuitry. Common line with Trigger Input.



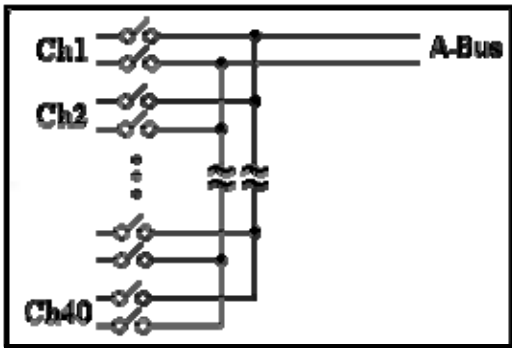
Trigger Output Optically isolator NPN circuit.

Configurations

The configuration sets the behavior of each of the sections. It is set by issuing “set configuration” command.

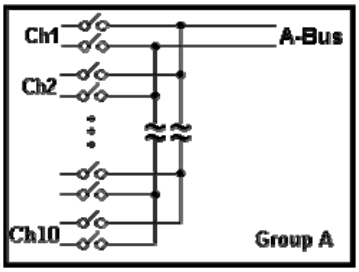
2-Wire Multiplexer Configuration

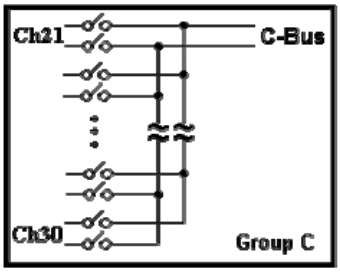
Issuing “select channel” command while in the 2-Wire configuration, results in the opening the currently closed channel and closure of the selected one. All within a single actuation time, and a break-before-make. Result is a switch behaving as a single 40 differential multiplexer. This can be expanded into an almost unlimited number of channels.

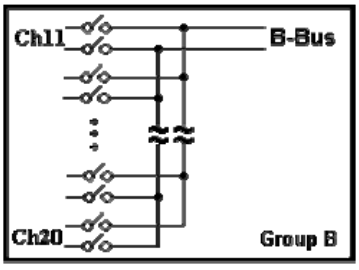


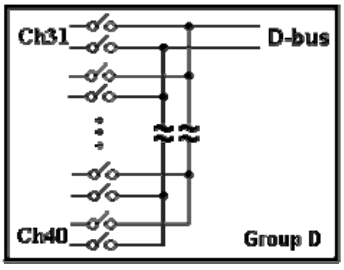
Four Groups Configuration

Each of the four groups acts as independent 10:1 differential multiplexer. Or four 2-Wire multiplexers as described above.









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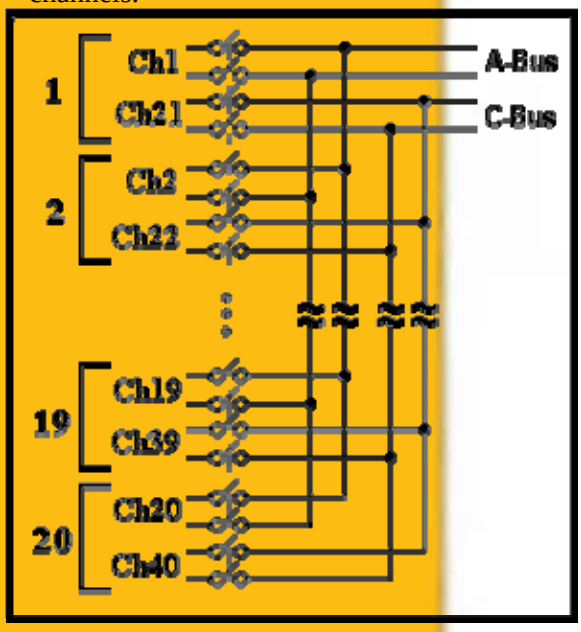
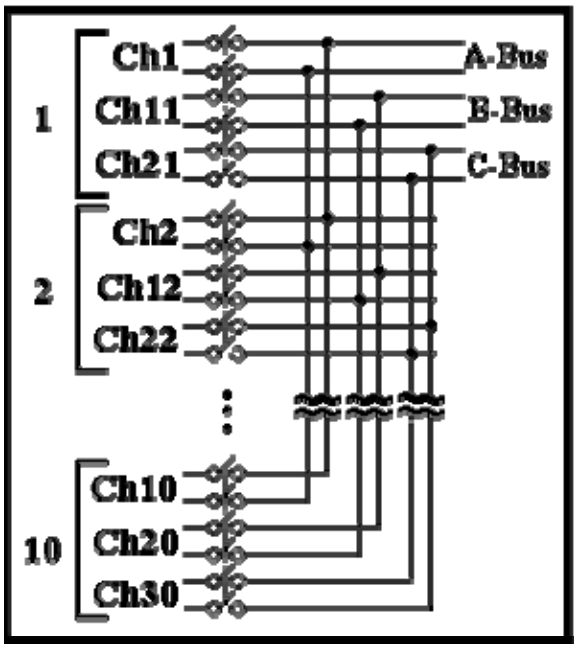
Four Wire Configuration

Issuing “select channel” command while in 4-Wire configuration, opens the currently closed channel relays, and closes the two channel relays associated with the selection. All within a single actuation time, and break-before-make. Result is that four lines are selected simultaneously to complete the 4-Wire channel connection to the A-Bus and C-Bus. 20uch channels are available, expandable to an unlimited number of 4-Wire channels.



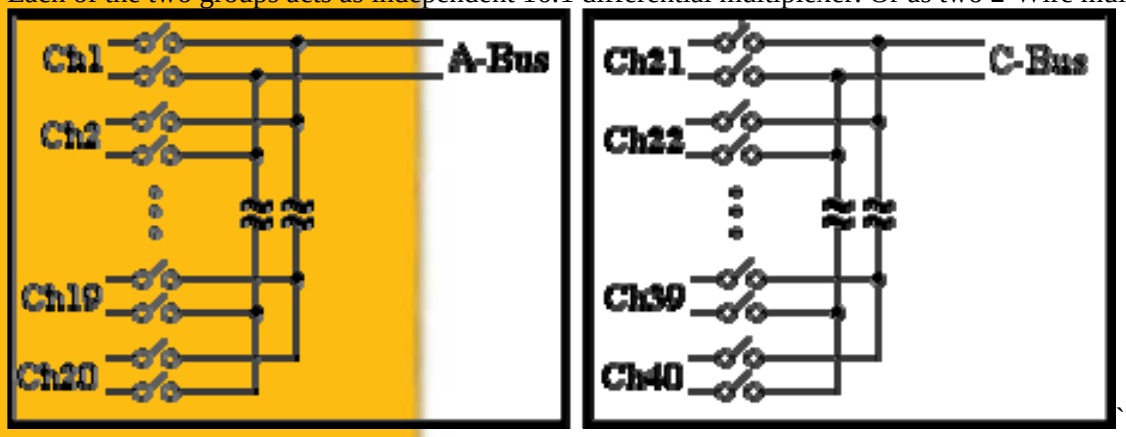
Six Wire Configuration

6-Wire multiplexing is widely used in in-circuit testing. Issuing “select channel” command while in the 6-Wire configuration, results in the opening any currently closed channels and closure of three channel relays. All within a single actuation time, and a break-before-make. Result is a switch behaving as a 10 channel 6 Wire multiplexer as below. In addition there is one free group of 10 making a 10:1 mux.



Two Groups Configuration

Each of the two groups acts as independent 16:1 differential multiplexer. Or as two 2-Wire multiplexers as described above.



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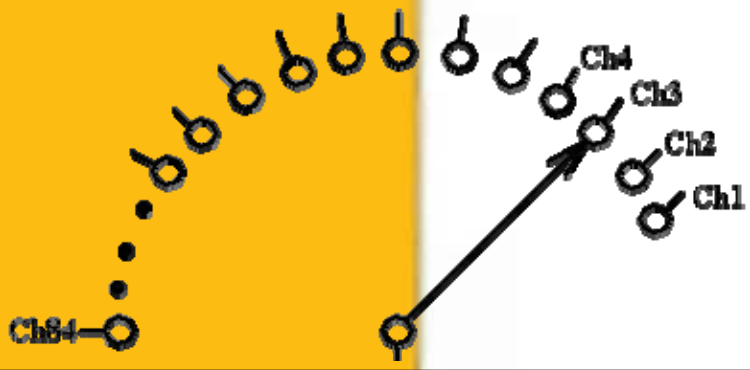
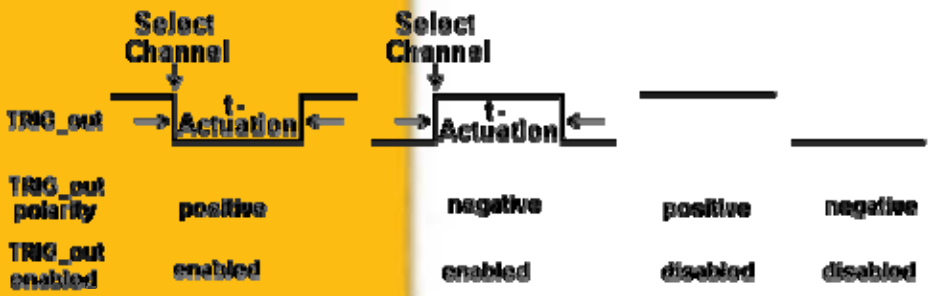
Selector Application

This point-to-point configuration allows any one of 68 lines to be selected. It requires setting up the unit to Universal configuration and shorting the Ahi and Clo lines, which are the collector of this selector. Each relay line, be it the Lo or Hi terminals, can be selected (up to 68 lines.



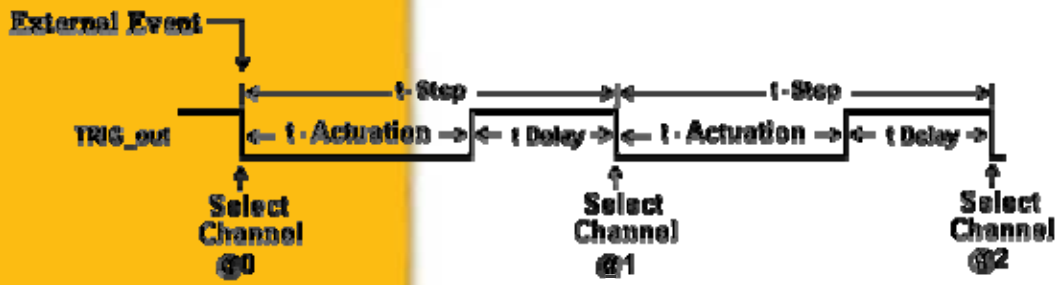
Trigger Output

The trigger output signal may be used to synchronize multiple switches and also trigger another device such as DMM to make a measurement after a selected channel is fully settled. It can be enabled or disabled, set to an active high or low.



Scanning Operation

There are two Scan operations. Both use an on-board Scan List. Auto Scan operation may be initiated by an external event such as a Trigger input, or by software command. A sequence of channel switching is followed in accordance with an on-board Scan List. Both **t-Step** and **t-Actuation** values are under software control.



The Channel numbers to be scanned are placed in the on-board Scan List memory. The scan sequence may include channels from multiple 4030 and 4032 units.

The Single Step Scanning operation is an additional method, in which switching step occurs as a result of a special software command, SCANStep(). This helps debug and verify a switching system.

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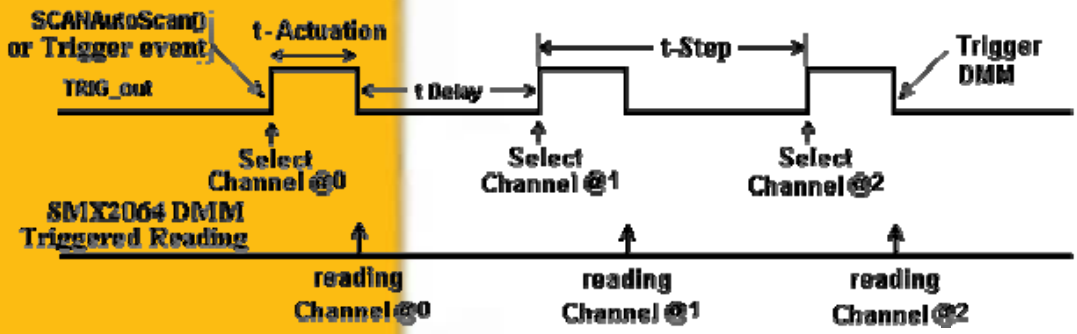

A 2064 class DMM and a 4042 switch can operate independently. A trigger event or a software command initiates the scan and measure process. The 4042 selects a channel from the Scan List, triggers the DMM to take a measurement, and repeats this process until the list is exhausted. No computer intervention is necessary.

The Scan list, resides in the on-board memory, stores the sequence of channels to be switches. Multiple 4040 and 4042 units store the sequence reflecting their participation in the overall scan. The table below depicts the values required to be stored in three SM4042 units in order to accomplish a specific scan sequence. Once an Auto Scan is initiated, these channels are switched as specified.

	Scan Table Entries							
Scanner Number	@0	@1	@2	@3	@4	@5	@6	@7
SM4042 #0	0	0	8	0	0	0	0	1
SM4042 #1	3	35	0	18	0	0	0	0
SM4042#2	0	0	0	0	4	5	6	0
Selected scanner# / Channel	#1 / Ch3	#1 / Ch35	#0 / Ch8	#1 / Ch18	#2 / Ch4	#2 / Ch5	#2 / Ch6	#0 / Ch1

Additional Operations

The **Shorted Channel Locator** operation allows the identification of a shorted input channel. Each channel is selected and tested sequentially, until a short is detected between the Hi and Lo terminals of the channel. The channel number of the first shorted channel is returned.

Relay contact cleaning is performed by a **Self Cleaning** function. It is accomplished by shaking each relay at varying rates and repeatedly interrupting an internal high voltage source. The result is an effective removal of deposits such as oxidation, polymers and other contaminants from the contact area.

The built in **Integrity test provides** a quick method to identify open, short and excessive actuation times type of failures.

A built in **Bounce Test** provides means to measure the amount of time it takes each relay to close. It measures the time from the application of the coil drive to the time there is no longer variation in the contact resistance.

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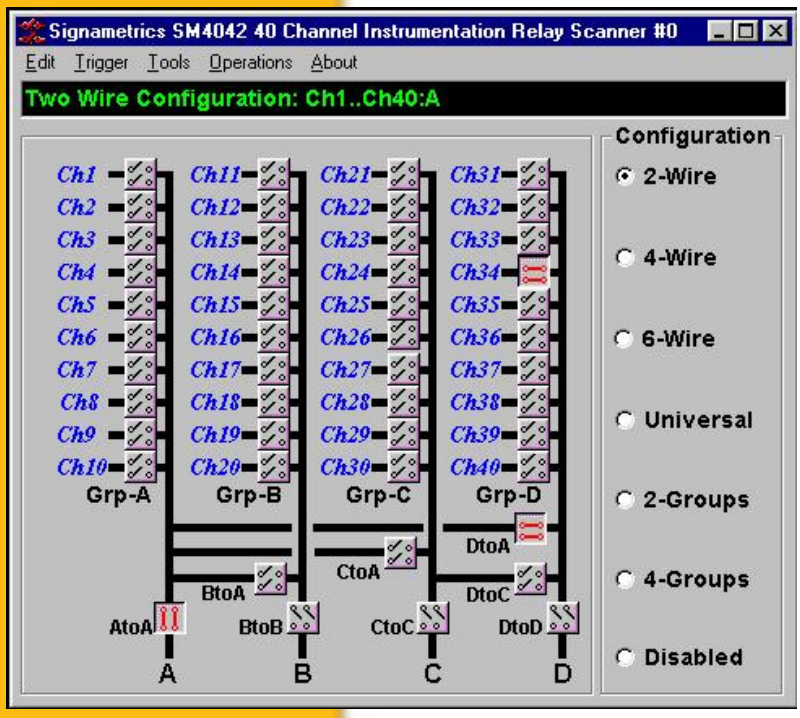
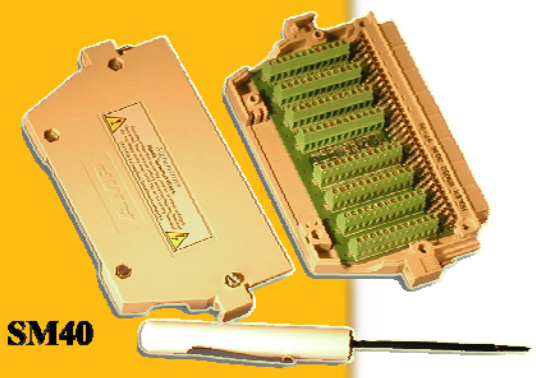


A graphical user interface allows access to most of the product's features. It is a useful tool to checkout the performance of the unit within minute from installation.

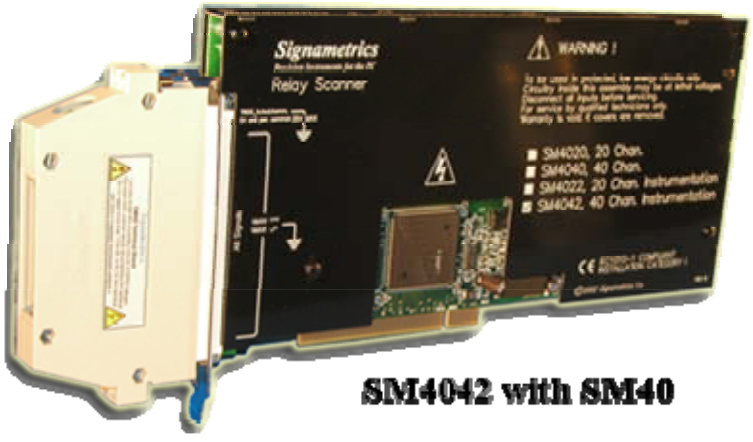
Optional accessories

Several accessories are available with the 4030 and 4032 models. These can be purchased directly from Signametrics, or one of its approved distributors or representatives:

- SMX40L - Loop back test module (places a short on all channels).
- SMX40 - Screw terminal module for making quick and easy connection to your application
- SMX40T - Screw terminal module with isothermal block and sensor for Thermocouples.
- SMX40Tool – A screw driver for use with the SMX40 and SMX40T.
- Extended Warranty



SM40



SM4042 with SM40

Signametrics reserves the rights to change any or all of the above without notice, and at any time.
See manual for more detailed specifications.

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