

- Dual or Quad Channel Resistor Module
- Fitted with Electromechanical Relays
- Short and Open Simulation
- Simple Software Control Through Resistance Calls
- Provides Fully Isolated Variable Resistors
- Option of Added SPDT Uncommitted Relays
- Option of Increasing The Length of Resistor Channels
- Special Versions With Non Standard Resistors Built To Order
- VISA, IVI & Kernel Drivers Supplied for Windows Plus Soft Front Panel
- Supported by PXI or LXI Chassis
- 3 Year Warranty



The 40-293 is a Programmable Resistor with either two or four resistor channels in a single PXI module. The module is ideal for simulating sensors for control and management systems or verifying system response in design or manufacturing test.

The 40-293 can be supplied with 8xSPDT electro-mechanical relays. These can be used for extending the resistor channels or adding fault conditions. Each relay has a footprint for the user to fit a resistor. The relay can be used to switch the resistor in and out of circuit or provide a short circuit.

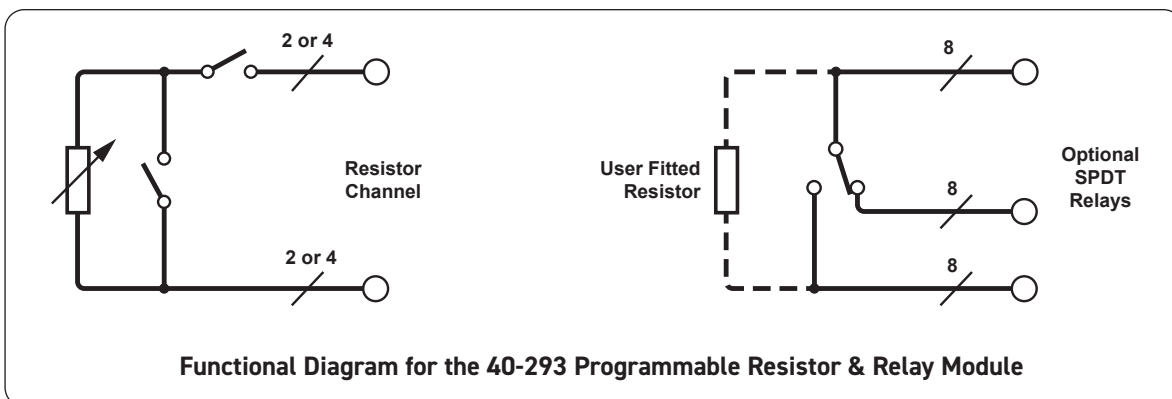
Software control of the 40-293 is simplified by the use of resistor value calls. The module sets the channel resistance closest to programmed value and the user can interrogate the module to find the actual setting used. Alternatively, individual relays within the resistor chains can be operated to set the channel resistance.

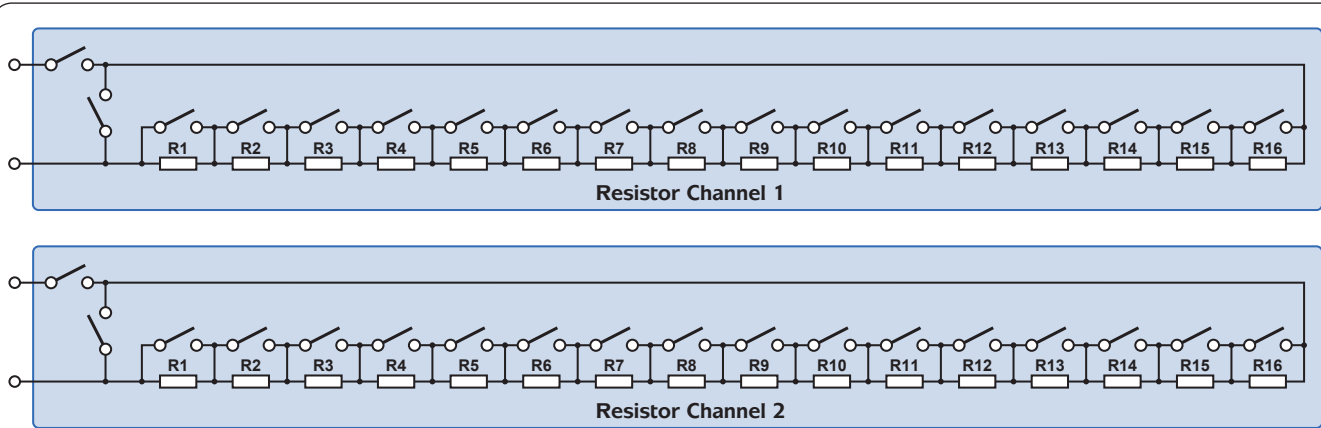
Versions with other resistance values can be provided to meet specific requirements. This includes the fitting of an offset resistor to set the minimum resistance. If versions are required with different resistance ranges, please contact the Pickering Interfaces' Sales Office for assistance.

Pickering's Range of PXI Resistor Modules			
Model No.	Description	Channels	Range
40-280/1/2	Selectable	12 to 48	User Specified
40-290	Programmable Resistor	2	0.5Ω to 32kΩ
40-291		4	0.5Ω to 128Ω
40-292	Programmable Load	1	40Ω to 295Ω or 10Ω to 2.56kΩ
40-293	Programmable Resistor + SPDT	2 or 4	Up to 131kΩ
40-294	Programmable Resistor + SPST	2 or 4	Up to 131kΩ
40-295	Programmable Resistor	3, 6, 5, 10 or 18	Up to 16MΩ
40-296	Programmable Potentiometer	1, 2, 3, 4, 5 or 18	Up to 16MΩ
40-297	High Density Precision	3, 4, 6, 9 or 18	Up to 22.3MΩ
40-298			

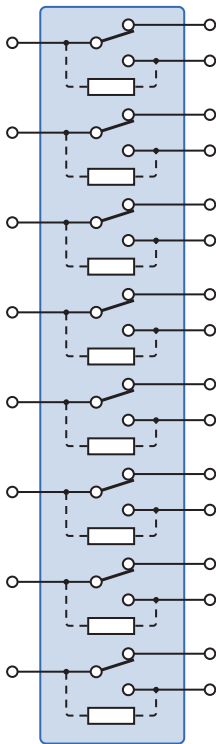
For improved accuracy each resistor channel has accurate calibration data stored on the module.

The module is supplied with VISA drivers and a soft front panel.

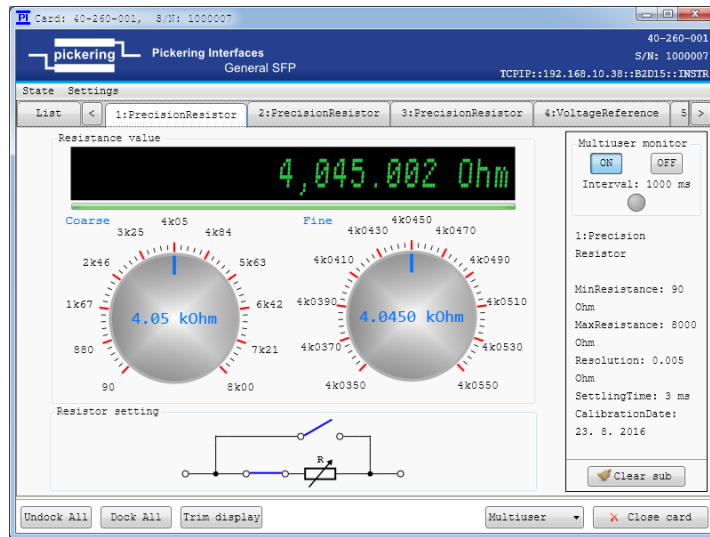




Schematic for 40-293-x3x Resistor Module



8 x SPDT Relay Option



Example Soft Front Panel for the Resistor Module

PXI Part Number (Number of Channels)	1Ω	10Ω	100Ω	1kΩ	10kΩ	100kΩ	1MΩ	10MΩ	Resolution
40-293-011(4) 40-293-111(4+8xSPDT)	█	█	█						0.25Ω
40-293-012(4) 40-293-112(4+8xSPDT)	█	█	█	█					0.5Ω
40-293-013(4) 40-293-113(4+8xSPDT)	█	█	█	█	█				1Ω
40-293-014(4) 40-293-114(4+8xSPDT)	█	█	█	█	█	█			2Ω
40-293-021(2) 40-293-121(2+8xSPDT)	█	█	█	█	█	█	█		0.25Ω
40-293-022(2) 40-293-122(2+8xSPDT)	█	█	█	█	█	█	█		0.5Ω
40-293-023(2) 40-293-123(2+8xSPDT)	█	█	█	█	█	█	█		1Ω
40-293-024(2) 40-293-124(2+8xSPDT)	█	█	█	█	█	█	█		2Ω
40-293-031(2) 40-293-131(2+8xSPDT)	█	█	█	█	█	█	█	█	0.25Ω
40-293-032(2) 40-293-132(2+8xSPDT)	█	█	█	█	█	█	█	█	0.5Ω
40-293-033(2) 40-293-133(2+8xSPDT)	█	█	█	█	█	█	█	█	1Ω
40-293-034(2) 40-293-134(2+8xSPDT)	█	█	█	█	█	█	█	█	2Ω

Graphical Representation of the 40-293 Resistor Module Range

Relay Type

The 40-293 is fitted with electro-mechanical relays with Palladium-Ruthenium Gold covered contacts. A spare relay is built onto the circuit board to allow easy maintenance with minimum downtime.

Programmable Resistor Specification

Accuracy of Resistance Call:	$\pm 1\%$ \pm Resolution †
Accuracy of Resistance Readback:	$\pm 0.3\%$ $\pm 0.1\Omega$ †
Max Switch Voltage:	100V*
Max Power:	0.5W
Residual Resistance, typical (when chain resistance is set to 0 Ω):	1 Ω (40-293-x1x) 1.5 Ω (40-293-x2x) 2 Ω (40-293-x3x)
Operate Time:	3ms ‡
Expected Life, Low power load:	>1x10 ⁸ operations
Expected Life, Full power load:	>1x10 ⁵ operations

* For full voltage rating, signal sources must be fully isolated from mains supply and safety earth.

† Valid between $\pm 10^\circ\text{C}$ from calibration temperature (factory calibrated at 21°C).

‡ The total operate time when setting a resistance may be longer depending upon the change requested due to relay sequencing.

Uncommitted SPDT Relay Specification

Switch Type:	Electro-mechanical
Contact Type:	Palladium-Ruthenium, Gold Covered Bifurcated
Max Switch Voltage:	100VDC*
Max Power:	60W/62.5VA
Max Switch Current:	2A
Max Continuous Carry Current:	2A
Max Pulsed Carry Current Example (for a single switch path):	6A for 100ms (up to 10% duty cycle)
Initial Path Resistance, On:	0.2 Ω
Path Resistance, Off:	>10 ⁹ Ω
Minimum Voltage:	100 μV
Operate Time:	3ms
Expected Life (operations)	
Very low power signal load:	>10 ⁸
Low power load (2W):	>1.5x10 ⁷ (0.1A 20VDC)
Medium power load (30W):	>5x10 ⁶ (1A, 30VDC)
Full power load (60W):	>1x10 ⁵ (2A, 30VDC)

* For full voltage rating, signal sources to be switched must be fully isolated from mains supply and safety earth.

Note: When user defined resistors are fitted to SPDT relays, the above ratings may be affected, refer to fitted resistor ratings.

Power Requirements

+3.3V	+5V	+12V	-12V
0	0.5A	0	0

Mechanical Characteristics

Single slot 3U PXI (CompactPCI card).

3D models for all versions in a variety of popular file formats are available on request.

Connectors

PXI bus via 32-bit P1/J1 backplane connector.

Resistor channel signals via front panel 37-pin male D-Type connector.

Operating/Storage Conditions

Operating Conditions

Operating Temperature: 0°C to +55°C

Humidity: Up to 90% non-condensing

Altitude: 5000m

Storage and Transport Conditions

Storage Temperature: -20°C to +75°C

Humidity: Up to 90% non-condensing

Altitude: 15000m

PXI & CompactPCI Compliance

The module is compliant with the PXI Specification 2.2. Local Bus, Trigger Bus and Star Trigger are not implemented.

Uses a 33MHz 32-bit backplane interface.

Safety & CE Compliance

All modules are fully CE compliant and meet applicable EU directives: Low-voltage safety EN61010-1:2010, EMC Immunity EN61326-1:2013, Emissions EN55011:2009+A1:2010.

Product Order Codes

0.25Ω Resolution

Range	No. of Channels	Order Code, No SPDT Relays	Order Code, With SPDT Relays
1Ω to 63.7Ω	4	40-293-011	40-293-111
1.5Ω to 1.02kΩ	2	40-293-021	40-293-121
2Ω to 16.3kΩ	2	40-293-031	40-293-131

0.5Ω Resolution

Range	No. of Channels	Order Code, No SPDT Relays	Order Code, With SPDT Relays
1Ω to 127Ω	4	40-293-012	40-293-112
1.5Ω to 2.04kΩ	2	40-293-022	40-293-122
2Ω to 32.7kΩ	2	40-293-032	40-293-132

1Ω Resolution

Range	No. of Channels	Order Code, No SPDT Relays	Order Code, With SPDT Relays
1Ω to 255Ω	4	40-293-013	40-293-113
1.5Ω to 4.09kΩ	2	40-293-023	40-293-123
2Ω to 65.5kΩ	2	40-293-033	40-293-133

2Ω Resolution

Range	No. of Channels	Order Code, No SPDT Relays	Order Code, With SPDT Relays
1Ω to 510Ω	4	40-293-014	40-293-114
1.5Ω to 8.19kΩ	2	40-293-024	40-293-124
2Ω to 131kΩ	2	40-293-034	40-293-134

Accessories:

Calibration lead for 4-wire resistance measurement of the Programmable Resistor Channels using DMM - 37-pin D-type socket to shrouded 4mm bayonet plugs,

1 meter length: 40-975-037-02-1m

Mating Connectors & Cabling

For connection accessories for the 40-293 series please refer to the [90-007D](#) 37-pin D-Type Connector Accessories data sheet where a complete list and documentation can be found for accessories, or refer to the Connection Solutions catalog.

Other Resistor Modules

Pickering Interfaces manufacture a range of variable resistor modules in the PXI format. If you have a requirement for a variable resistor module please contact your local sales office with the information below and we will advise you on the best solution for your application.

Lowest Resistance †	<input type="text"/>
Highest Resistance	<input type="text"/>
Resistance Resolution	<input type="text"/>
Overall Accuracy	<input type="text"/>
Maximum Power/Current	<input type="text"/>
Number of Channels (variable resistors)	<input type="text"/>

† Resistance is as measured across the user connector terminals, minimum resistance must have a non-zero value.

Product Customization

Pickering PXI modules are designed and manufactured on our own flexible manufacturing lines, giving complete product control and enabling simple customization to meet very specific requirements.

Customization can include:

- Alternative resistance range
- Alternative resolution
- Different number of channels
- Different performance specifications

All customized products are given a unique part number, fully documented and may be ordered at any time in the future. Please contact your local sales office to discuss.

Chassis Compatibility

This PXI module must be used in a suitable chassis. It is compatible with the following chassis types:

- All chassis conforming to the 3U PXI and 3U Compact PCI (cPCI) specification
- Legacy and Hybrid Peripheral slots in a 3U PXI Express (PXIe) chassis
- Pickering Interfaces LXI or LXI/USB Modular Chassis

Chassis Selection Guide

Standard PXI or hybrid PXIe Chassis from any Vendor:

- Mix our 1000+ PXI switching & simulation modules with any vendor's PXI instrumentation
- Embedded or remote Windows PC control
- Real-time Operating System Support
- High data bandwidths, especially with PXI Express
- Integrated module timing and synchronization

Pickering LXI or LXI/USB Modular Chassis—only accept our 1000+ PXI Switching & Simulation Modules:

- Ethernet or USB control enables remote operation
- Low-cost control from practically any controller
- LXI provides manual control via Web browsers
- Driverless software support
- Power sequencing immunity
- Ethernet provides chassis/controller voltage isolation
- Independence from Windows operating system



Connectivity Solutions

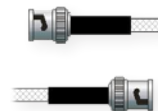
We provide a full range of supporting cable and connector solutions for all our switching products—20 connector families with 1200+ products. We offer everything from simple mating connectors to complex cables assemblies and terminal blocks. All assemblies are manufactured by Pickering and are guaranteed to mechanically and electrically mate to our modules.



Connectors & Backshells



Multiwire Cable Assemblies



RF Cable Assemblies



Connector Blocks

We also offer customized cabling and have a free online **Cable Design Tool** that can be used to create custom cable solutions for many applications.

Visit: pickeringtest.com/cdt to start your design.

Mass Interconnect

We recommend the use of a mass interconnect solution when an Interchangeable Test Adapter (ITA) is required for a PXI or LXI based test system. Our modules are fully supported by both Virginia Panel and MacPanel.

Pickering Reed Relays

We are the only switch provider with in-house reed relay manufacturing capability via our sister company, Pickering Electronics. These instrument grade reed relays feature **SoftCenter®** technology, ensuring long service life and repeatable contact performance.

To learn more, please go to: pickeringrelay.com



Programming

Pickering provide kernel, IVI and VISA (NI & Keysight) drivers which are compatible with all Microsoft supported versions of Windows and popular older versions. For a list of all supporting operating systems, please see: pickeringtest.com/os

The VISA driver is also compatible with Real-Time Operating Systems such as LabVIEW RT. For other RTOS support contact Pickering. These drivers may be used with a variety of programming environments and applications including:

- **Pickering Interfaces Switch Path Manager**
- **National Instruments** products (LabVIEW, LabWindows/CVI, Switch Executive, MAX, TestStand, VeriStand, etc.)
- **Microsoft Visual Studio** products (Visual Basic, Visual C+)
- **Keysight** VEE and OpenTAP
- **Mathworks** Matlab
- **Marvin** ATEasy
- **MTQ Testsolutions** Tecap Test & Measurement Suite

Drivers for popular Linux distributions are available, other environments are also supported, please contact Pickering with specific enquiries. We provide Soft Front Panels (SFPs) for our products for familiarity and manual control, as well as comprehensive documentation and example programs to help you develop test routines with ease.

To learn more about software drivers and development environments, please go to:

pickeringtest.com/software

Signal Routing Software

Our signal routing software, Switch Path Manager, automatically selects and energizes switch paths through Pickering switching systems. Signal routing is performed by simply defining test system endpoints to be connected together, greatly accelerating Test System software development. To learn more, please go to: pickeringtest.com/spm



Diagnostic Relay Test Tools

eBIRST Switching System Test Tools are designed specifically for our PXI, PCI or LXI products, these tools simplify switching system fault-finding by quickly testing the system and graphically identifying the faulty relay.

To learn more, please go to: pickeringtest.com/ebirst

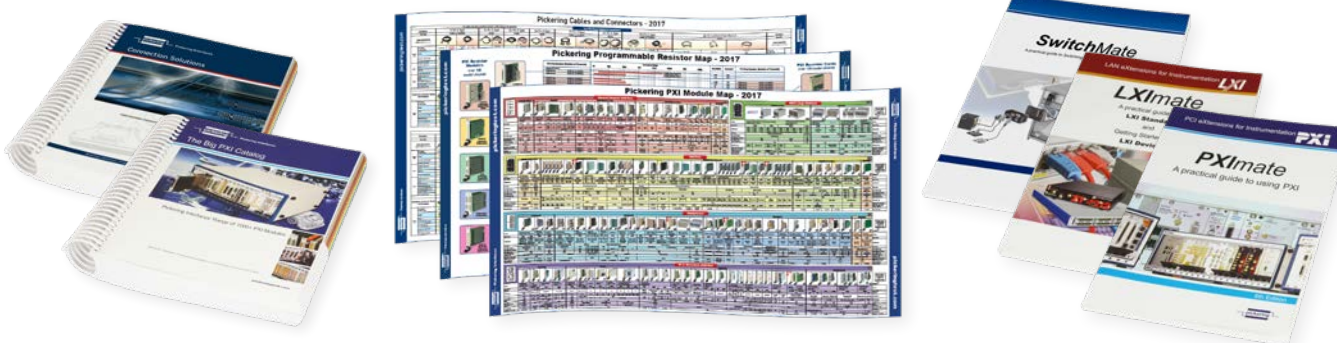


Three Year Warranty & Guaranteed Long-Term Support

All standard products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for a period of three years from the date of delivery to the original purchaser. Extended warranty and service agreements are available for all our modules and systems with various levels to suit your requirements. Although we offer a 3-year warranty as standard, we also include guaranteed long-term support—with a history of supporting our products for typically 15-20 years. To learn more, please go to: pickeringtest.com/support

Available Product Resources

We have a large library of product resources including success stories, product and support videos, articles, as well as complete product catalogs and product reference maps to assist when looking for the switching, simulation and cable and connector solutions you need. We have also published handy reference books on Switching Technology and for the PXI and LXI standards.



To view, download or request any of our product resources, please visit: pickeringtest.com/resources