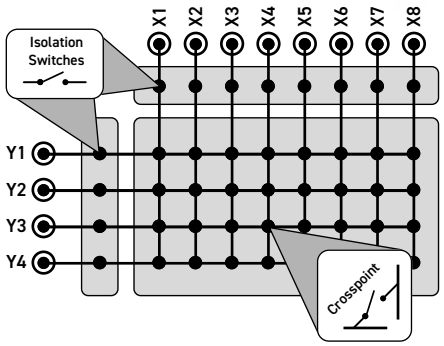
PXI/PXIe Expandable RF Matrix

4x-727A/728A/729A

- Available as PXI or PXIe Modules
- 16x4, 16x2 & 8x4 RF Coaxial Matrices
- 300 MHz Usable Bandwidth (50 Ω)
- 50 Ω & 75 Ω Versions Available
- Easy to Use Loop Thru Option Allows Unlimited X Axis Expansion
- High Density SMB & Multiway Connector Versions
- 75 Ω Version Suitable for Telecoms & Video Switching
- VISA & IVI Drivers Supplied for Windows
- PXI Versions Supported by PXI or LXI Chassis
- Selected Builds Supported by ***eBIRST*** ™
- 3 Year Warranty

The 40-727A/728A/729A (PXI) and 42-727A/728A/729A (PXIe) are high density RF matrix modules suitable for switching up to 300 MHz in 50 Ω or 100 MHz in 75 Ω. They are available in 50 Ω or 75 Ω versions with SMB connectors or in 50 Ω versions with a multiway connector. They provide a simple and scalable bidirectional matrix for RF signals and are intended for the construction of high performance switching systems. All X and Y connections have isolation switches. These can be used to disconnect the matrix from the test fixture to maximize isolation and RF performance.

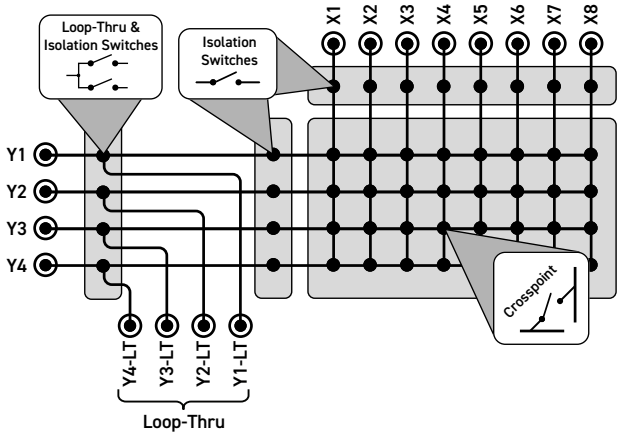


Microwave Multiplexer (Part No. 4x-729A) in 8x4 Format without Loop-thru

Updated Product

These modules are based on the established 40-727/8/9. As well as having PXIe options, they use Pickering reed relays throughout giving improved operation speed and reliability.

40-727A-002-L RF Matrix Module with MS-M Multi-way Coaxial Connector



Microwave Multiplexer (Part No. 4x-729A) in 8x4 Format with Loop-thru

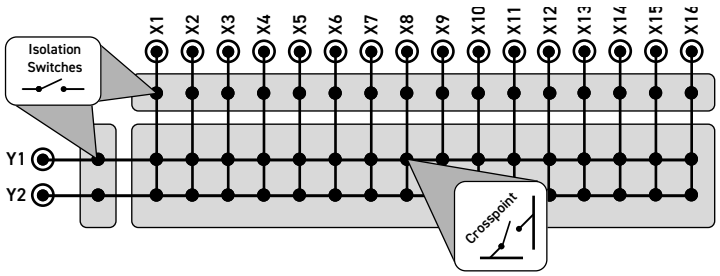
Issue 1.1 July 2022

Matrix Operation

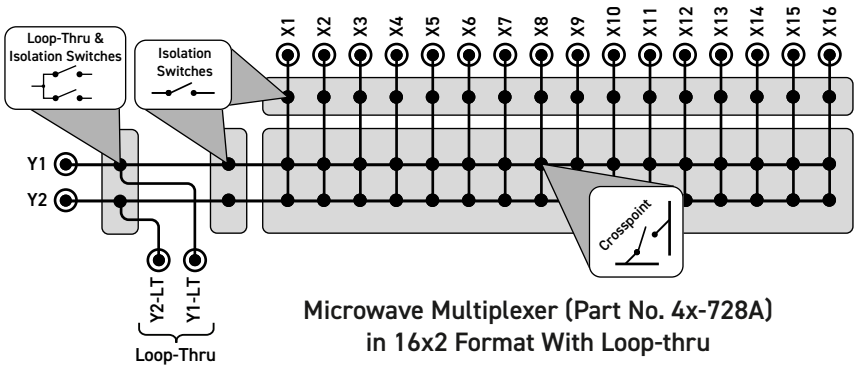
The 4x-727A/728A/729A are designed for X to Y connections with maximum bandwidth. They can also support X to X connections in the same module or between multiple modules (using loop-thru option) - see user manual.

They are based on the same architecture as the popular 40-725 RF matrix, but have optional Y loop-thru allowing easy expansion with minimum loss of bandwidth.

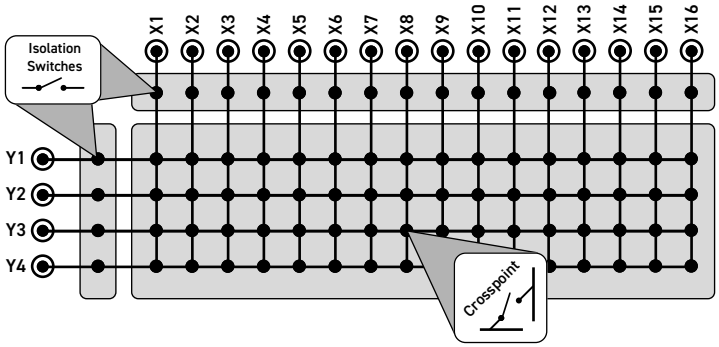
40-727A-001-L
16x4 RF Matrix Module with
SMB Connectors and
Loop-thru on Flying Leads



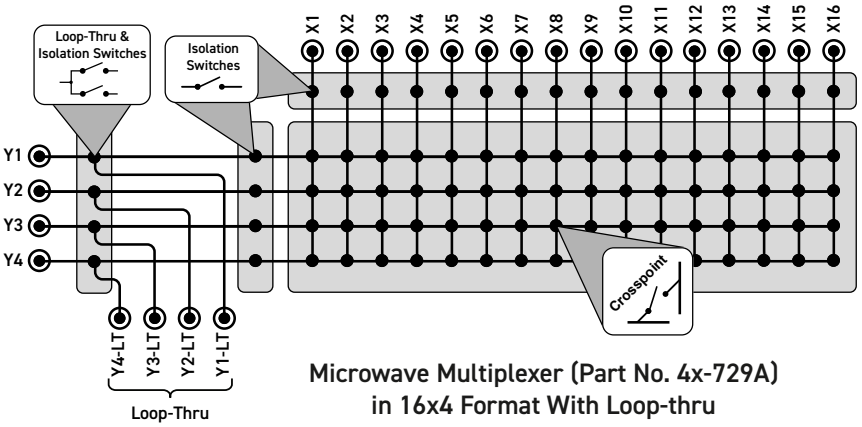
Microwave Multiplexer (Part No. 4x-728A)
in 16x2 Format Without Loop-thru



Microwave Multiplexer (Part No. 4x-728A)
in 16x2 Format With Loop-thru



Microwave Multiplexer (Part No. 4x-729A)
in 16x4 Format Without Loop-thru



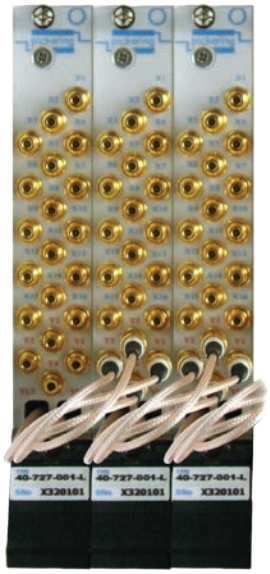
Microwave Multiplexer (Part No. 4x-729A)
in 16x4 Format With Loop-thru

Y Axis Loop Thru Option

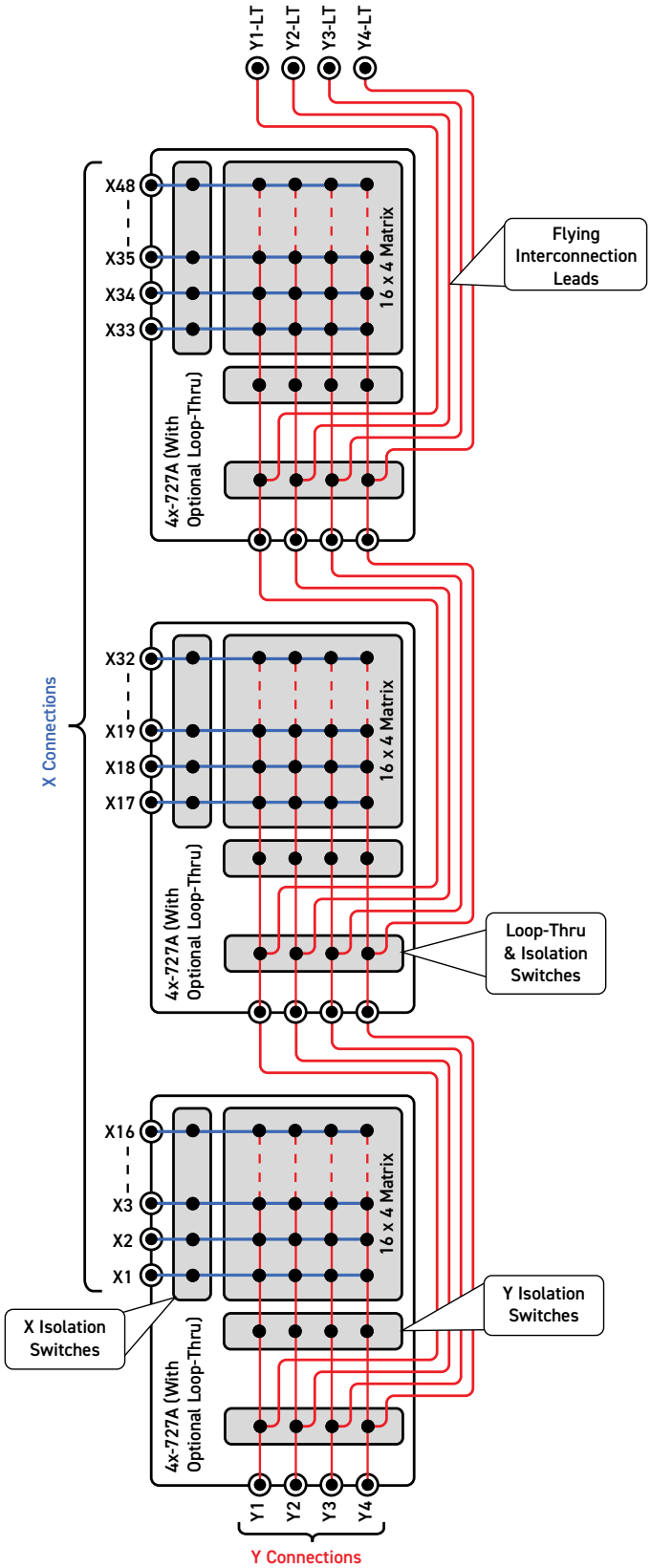
The easy to use loop thru option allows 4x-727A/728A/729A modules to be cascaded to form larger matrices whilst minimizing impact on RF performance.

The versions with SMB connectors have built in Y loop-thru cables fitted to the front panel which are simply plugged into the Y connectors of the adjacent matrix module. Multiway connector versions include pins for loop-thru on the front panel connector.

The loop thru system is designed to provide an extended connection from Y to X, it also supports an X to X connection where the X connections are in different modules.



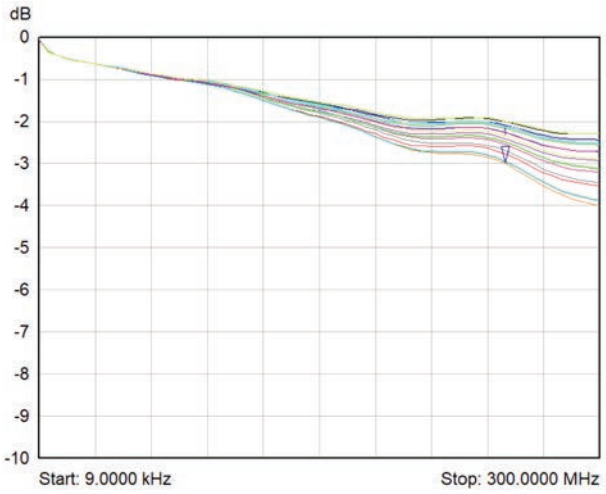
48x4 RF Matrix Created from 3-off 4x-727A-001-L (Loop-Thru cables interconnect each 16x4 Matrix module)



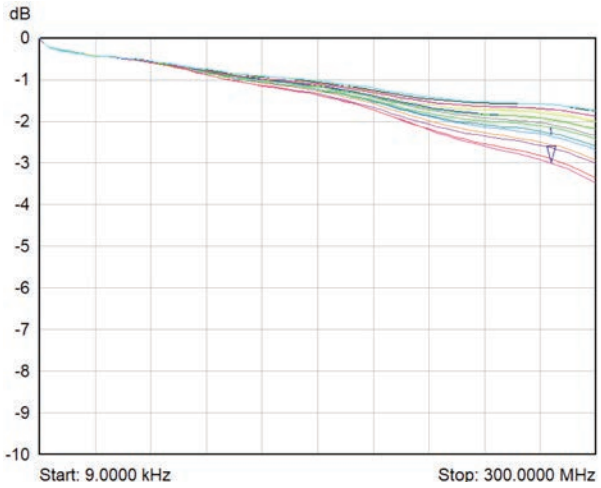
3 off 4x-727A-001-L 16x4 RF Matrix Modules Interconnected as a 48x4 Matrix

RF Performance Plots for 4x-727A 300 MHz RF Matrix

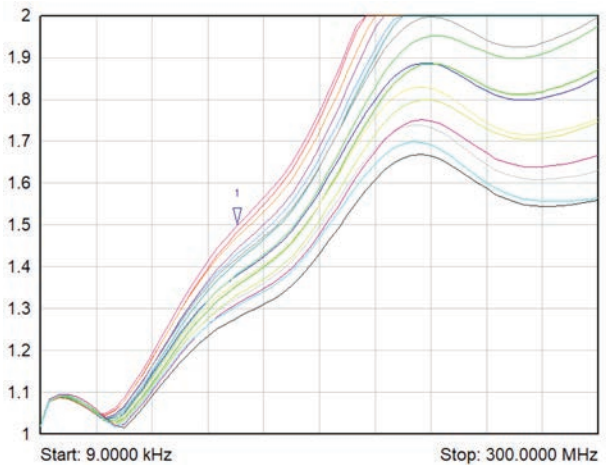
Typical curves are shown for matrix rows/columns with 1 crosspoint set. For optimum insertion loss and VSWR, ensure only one crosspoint is set in any one row/column. **Multiple crosspoints can be set on one row or column but this will seriously degrade RF performance.** Performance is also dependent upon the area of the matrix where the crosspoint is set. Best performance is obtained at the corners (for example X1-Y1), worse performance is obtained in the center (X8-Y2). This is outlined in the insertion loss and VSWR plots which also include the performance of a typical signal path between X4 and Y2. For more information on how performance is distributed throughout the matrix, please refer to the user manual.



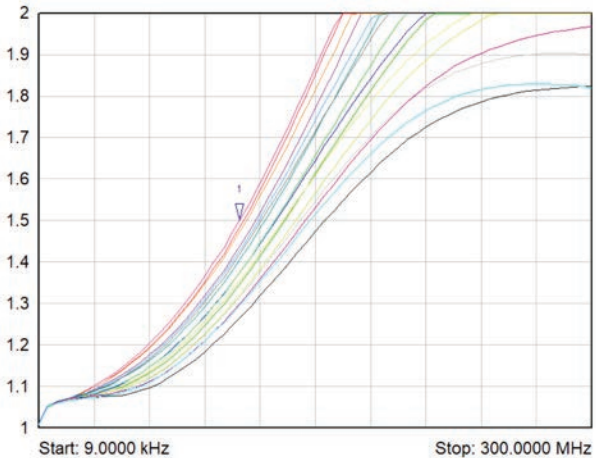
4x-727A 50 Ω Insertion Loss For Y Loop-Thru Paths



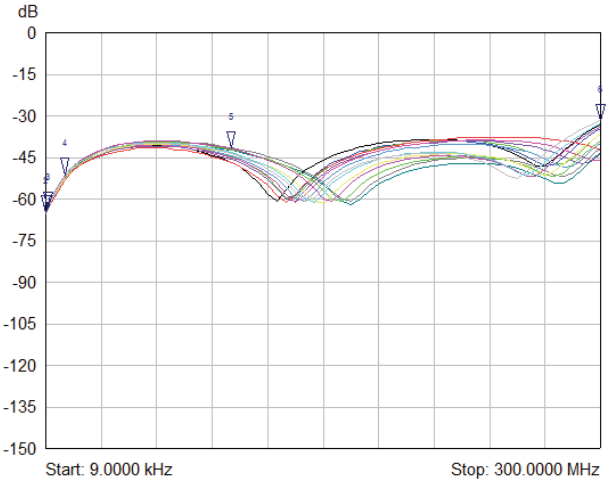
4x-727A 50 Ω Insertion Loss For X to Y Signal Paths



4x-727A 50 Ω Loop-Thru Paths VSWR



4x-727A 50 Ω VSWR For X to Y Signal Paths



4x-727A 50 Ω Crosstalk Between Signal Paths

Relay Type

The 4x-727A/728A/729A are fitted with ruthenium sputtered reed relays. A spare reed relay is built onto the circuit board to allow easy maintenance with minimum downtime.

All reed relays are manufactured by our Relay Division. For more information please vist: pickeringrelay.com

General Matrix Switching Specification

Maximum Switch Voltage: Maximum Switch Current: Maximum Switch Power:	100 V 0.5 A 10 W
Characteristic Impedance:	50 Ω or 75 Ω
On Path Resistance: Off Path Resistance: Thermal Offset:	<1000 mΩ $>10^8$ Ω <50 µV
Expected Life:	$1x10^9$ operations
Operate Time:	<1 ms, 0.5 ms typical

RF Specification

Maximum Bandwidth (-3 dB):	Usable to 300 MHz, 50 Ω Usable to 100 MHz, 75 Ω
Insertion Loss (typical):	3 dB for 50 Ω at 300 MHz† 3 dB for 75 Ω at 150 MHz†
VSWR (typical):	1.8:1 for 50 Ω at 150 MHz† 1.8:1 for 75 Ω at 60 MHz†
Crosstalk (typical):	>30 dB at 300 MHz
Isolation (typical):	>60 dB

Loop Thru RF Specification

Maximum Bandwidth (-3 dB):	Usable to 270 MHz, 50 Ω
Insertion Loss, X to Y path (typical):	3 dB for 50 Ω at 270 MHz†
Insertion Loss, Y to Y-LT path (typical):	0.85 dB at 300 MHz
Isolation (typical):	>60 dB

† RF performance is entirely dependent upon the combination of crosspoints selected, the figures shown are for one selected crosspoint on any X or Y channel only, refer to graphs. For further assistance on getting maximum performance from the 4x-727A/728A/729A please refer to the operating manual.

Power Requirements - 40-727A/728A/729A

+3.3 V	+5 V	+12 V	-12 V
140 mA	500 mA (72 Relays)	0	0

Power Requirements - 42-727A/728A/729A

+3.3 V	+12 V
380 mA	250 mA

Mechanical Characteristics

40-727A/728A/729A - Single slot 3U PXI (CompactPCI card).

42-727A/728A/729A - Single slot 3U PXIe, compatible with PXIe hybrid slot.

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.
Signals via front panel connectors:

- 4x-727A SMB versions: X and Y Signals via 20 front panel mounted coaxial connectors (Y loop-thru via 4 flying leads).
- 4x-728A SMB versions: X and Y Signals via 18 front panel mounted coaxial connectors (Y loop-thru via 2 flying leads).
- 4x-729A SMB versions: X and Y Signals via 12 front panel mounted coaxial connectors (Y loop-thru via 4 flying leads).
- 4x-727A/728A/729A Multiway versions: X, Y and Y loop-thru signals via one 26-pin high density MS-M RF multiway coaxial connector.

Operating/Storage Conditions

Operating Temperature:	0 °C to +55 °C
Humidity:	Up to 90 % non-condensing
Altitude:	5000 m
Storage Temperature:	-20 °C to +75 °C
Humidity:	Up to 90 % non-condensing
Altitude:	15000 m

Product Order Codes

PXI/PXIe 16x4 RF Coaxial Matrix:	
SMB 50 Ω	4x-727A-001
SMB 50 Ω with loop-thru on Y axis	4x-727A-001-L
Multiway 50 Ω	4x-727A-002
Multiway with loop-thru on Y axis	4x-727A-002-L
SMB 75 Ω	4x-727A-101
SMB 75 Ω with loop-thru on Y axis	4x-727A-101-L
PXI/PXIe 16x2 RF Coaxial Matrix:	
SMB 50 Ω	4x-728A-001
SMB 50 Ω with loop-thru on Y axis	4x-728A-001-L
Multiway 50 Ω	4x-728A-002
Multiway with loop-thru on Y axis	4x-728A-002-L
SMB 75 Ω	4x-728A-101
SMB 75 Ω with loop-thru on Y axis	4x-728A-101-L
PXI/PXIe 8x4 RF Coaxial Matrix:	
SMB 50 Ω	4x-729A-001
SMB 50 Ω with loop-thru on Y axis	4x-729A-001-L
Multiway 50 Ω	4x-729A-002
Multiway with loop-thru on Y axis	4x-729A-002-L
SMB 75 Ω	4x-729A-101
SMB 75 Ω with loop-thru on Y axis	4x-729A-101-L

Where **4x** specifies PXI or PXIe, for example:

40-727A-001 16x4 50Ω Matrix, SMB connectors in PXI format

42-727A-001 16x4 50Ω Matrix, SMB connectors in PXIe format

Support Products

eBIRST Switching System Test Tool

The 50 Ω versions of this product with SMB connectors and without loop-thru are supported by the *eBIRST* test tools, the required *eBIRST* tools are detailed below.

Test Tool: 93-005-001

Adaptor: 93-005-202A

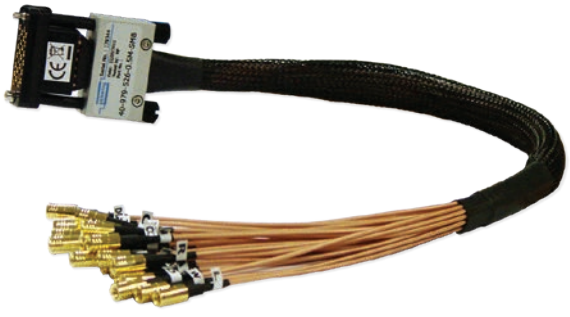
Termination: 93-005-101

For more information go to pickeringtest.com/ebirst

Connection Accessories

For a complete list of connection accessories and documentation for versions of the 4x-727A/728A/729A module with SMB connectors, please refer to our RF connectors datasheet (90-011D).

For versions of the module with a 26-pin MS-M RF multiway coaxial connectors, please refer to our MS-M RF connectors datasheet (90-017D).



Side View of the RF Matrix - 16x4 PXI Version With SMB Connectors and Loop-thru

Product Customization

Pickering 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 relay types
- Mixture of relay types
- Alternative number of relays
- 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.

Supported by *eBIRST* - Switching System Test Tools

The 50 Ω SMB versions of these modules without loop-thru are supported by our *eBIRST* test tools. These tools can quickly determine if a switching system has faults, identifies the location of the fault at relay level and allows the user to take fast corrective action. For more information go to pickeringtest.com/ebirst

42-727A-001 PXIe RF Matrix
16x4 SMB Version Without Loop-thru

PXI & CompactPCI Compliance - 40-727A/728A/729A

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

Uses a 33 MHz 32-bit backplane interface.

PXIe Compliance - 42-727A/728A/729A

The module is compliant with the PXIe Specification 1.0. Local Bus, Trigger Bus & Star Trigger are not implemented.

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.

The 4x-727A/728A/729A are part of a range of matrix modules suitable for RF applications.

Pickering's Range of PXI & PXIe RF Matrix Modules			
Configuration	Frequency Range	Connectors	Model No.
32x8 - Loop-thru Option 32x4 - Loop-thru Option 16x8 - Loop-thru Option 16x4 - Loop-thru Option	300 MHz (50 Ω) (150 MHz with Loop-thru)	SMB	4x-724
16x4 - Loop-thru Option	300 MHz (50 Ω) 100 MHz (75 Ω)	SMB or 26-pin MS-M mult-way	4x-727A
16x2 - Loop-thru Option			4x-728A
8x4 - Loop-thru Option			4x-729A
Single or Dual 2x2 with Loop-thru	2.5 GHz (75 Ω)	SMB or MCX	4x-837A
Single or Dual 2x2 with Loop-thru	2.5 GHz (50 Ω)	SMB or MCX	4x-877A
4x4 (solid state switching)	10 MHz - 8 GHz (50 Ω)	SMA	4x-884B

Chassis Compatibility

The PXI versions of this module are 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

The PXIe versions of this module are compatible with the following chassis types:

- All chassis conforming to the 3U PXIe specification
- PXIe and Hybrid Peripheral slots in a 3U PXI Express (PXIe) chassis

Chassis Selection Guide

PXI and PXIe (with PXIe and/or Hybrid slots) Chassis from any Vendor:

- Mix our 1000+ PXI/PXIe switching & simulation modules with any vendor's PXI/PXIe 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 PXI Switching & Simulation Modules:

- Choose from 1000+ Pickering PXI 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. These accessories are detailed in Connector Accessories data sheets, where a complete list and documentation can be found for each accessory.

Connectors & Backshells

Multi-way Cable Assemblies

RF Cable Assemblies

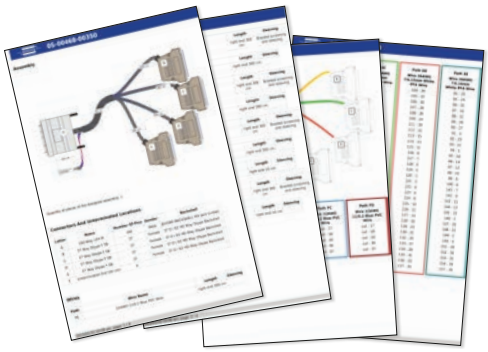
Breakouts

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.

- Fully supported on modern browsers and tablet operating systems.
- Built-in tutorials and videos allow you to get quickly up to speed.
- Store cable assemblies in the Cloud and develop over time.
- Each cable design has a downloadable PDF documentation file detailing all specifications

Start designing your custom cabling, go to pickeringtest.com/cdt



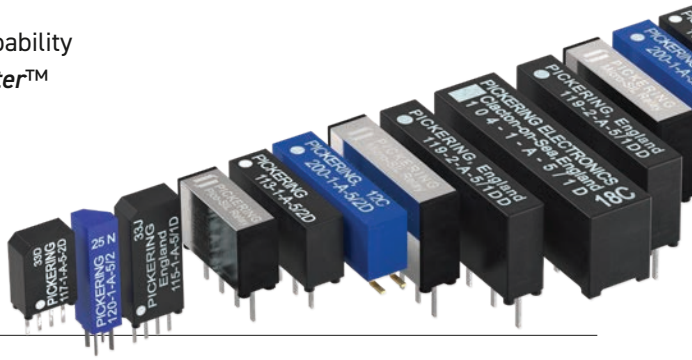
Mass Interconnect

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

Pickering Reed Relays

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

To learn more 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 more information go to 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, Simulink**
- **Marvin** ATEasy
- **MTQ Testsolutions** Tecap Test & Measurement Suite
- **Python**

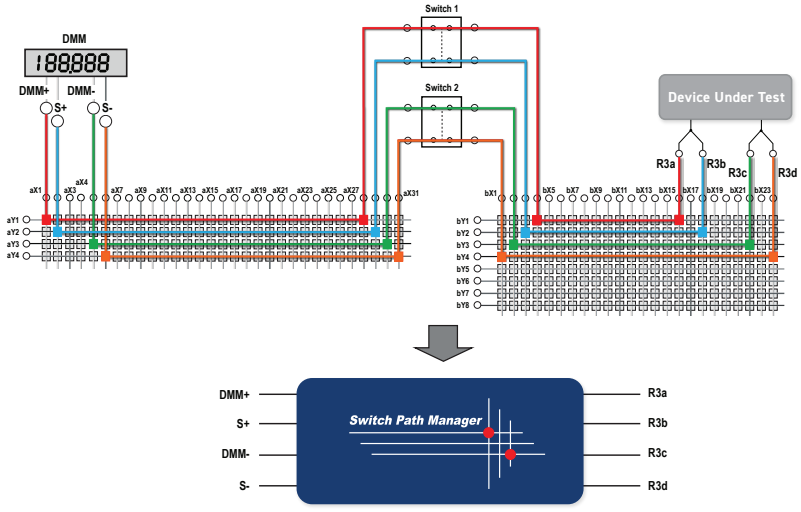
Drivers for popular Linux distributions are available, other environments are also supported, please contact Pickering with specific enquiries. We provide Soft Front Panels (SFPs) for our products for familiarity and manual control, as well as comprehensive documentation and example programs to help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

To learn more about software drivers and development environments 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 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 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 three years from the date of delivery to the original purchaser. Extended warranty and service agreements are available with various levels for 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 go to pickeringtest.com/support

Available Product Resources

We have a library of resources including success stories, product and support videos, articles and white papers as well as application-specific brochures to assist you. We have also published reference books on switching technology and the PXI and LXI standards.

To view, download or request any of our product resources go to pickeringtest.com/resources