- 8 x 4 Blocking R.F. Matrix Expandible to Over 300 Crosspoints
- Bandwidths to 1300MHz
- Built-in Automatic "Loop Through" Simplifies Construction of Large High Performance RF Matrices (With Minimal Signal Degradation)
- 50Ω or 75Ω Versions with a Choice of BNC, SMA or BT Type 43 Connectors
- Built-In Self Test
- Very High RF Isolation

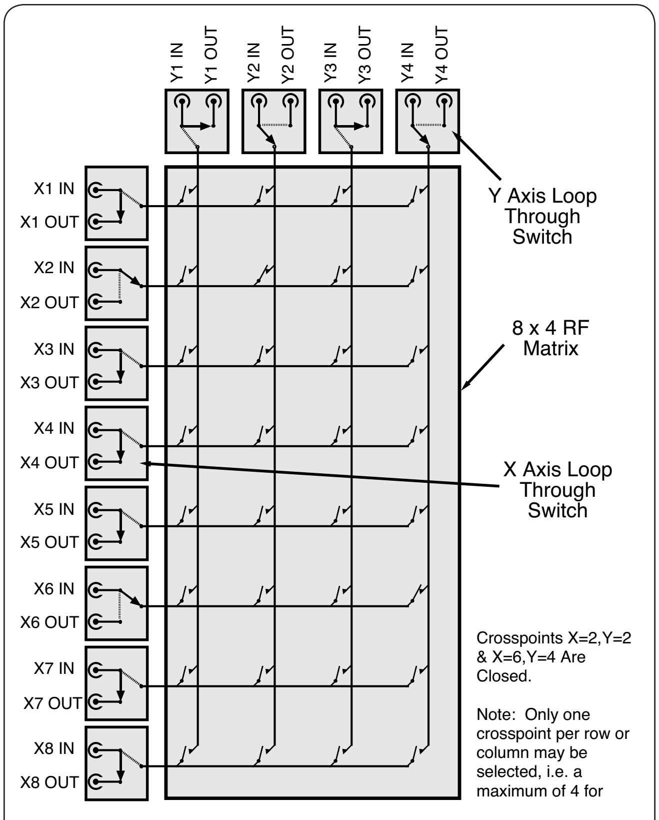
***Please contact Pickering for alternative PXI/LXI/USB solutions**

The Pickering Interfaces 20-750 and 20-750A series provides a range of high performance 8 x 4 RF Matrix Modules with a bandwidth 1300MHz with built-in expansion capability to beyond 300 crosspoints. Providing a sophisticated RF matrix offering high quality switching with versatile expansion capabilities together with a choice of connectors types in both 50Ω and 75Ω versions.

Applications include routing high frequency signals to and from oscilloscopes, network/spectrum analyzers, signal generators and synthesizers, switching high frequency logic and many other situations involving coaxial switching. 75Ω versions are suitable for telecommunications and high quality video switching applications.

Easy Expansion with Automatic "Loop Through"

Each X and Y input channel has an associated output channel, all unused input channels will automatically be switched to the corresponding output channel, this allows for simple expansion (with little performance loss) and permits the user to place matched terminations on all output channels if required.



Switching Diagram for the 20-750 RF Matrix Module

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RF Matrix Construction Using Model 20-750

Brief Description

A full blocking matrix like the one shown in the illustration on the next page (16 x 8) is very easy to construct. The 20-750 has been designed with expansion in mind, each module has a “loop through” switch on each coordinate axis, thus matrix modules may be daisy-chained with little performance loss. Other types of RF matrix units leave interconnection problems for the user to solve.

Simple Expansion

RF matrix systems may be expanded by simply adding more matrix modules and daisy chaining the additional modules onto your current matrix, performance will not be greatly reduced, furthermore existing software will need very minimal update (see below).

Automatic Termination of Unselected Lines

The “Loop Through” Switch capability on each matrix module means that if termination of all unused signals is required, then all the user must do is add a terminator to the “loop though” connector at the end of the coaxial daisy-chain. This terminator will then be automatically selected without any further software intervention.

Choice of Impedance and Connector Type

The 20-750 is available in either 50Ω or 75Ω versions with a choice of connector types. BNC versions are very popular, however BNC limitations reduce matrix performance, so for applications requiring maximum performance and reliability the SMA versions are usually preferred.

Very Straightforward Software Control

Programming the RF Matrix is very simple, to operate a crosspoint only the x and y coordinates within the whole matrix need be known, the exact location of matrix modules and switches is not required. To program an RF Matrix only three commands need be used:-

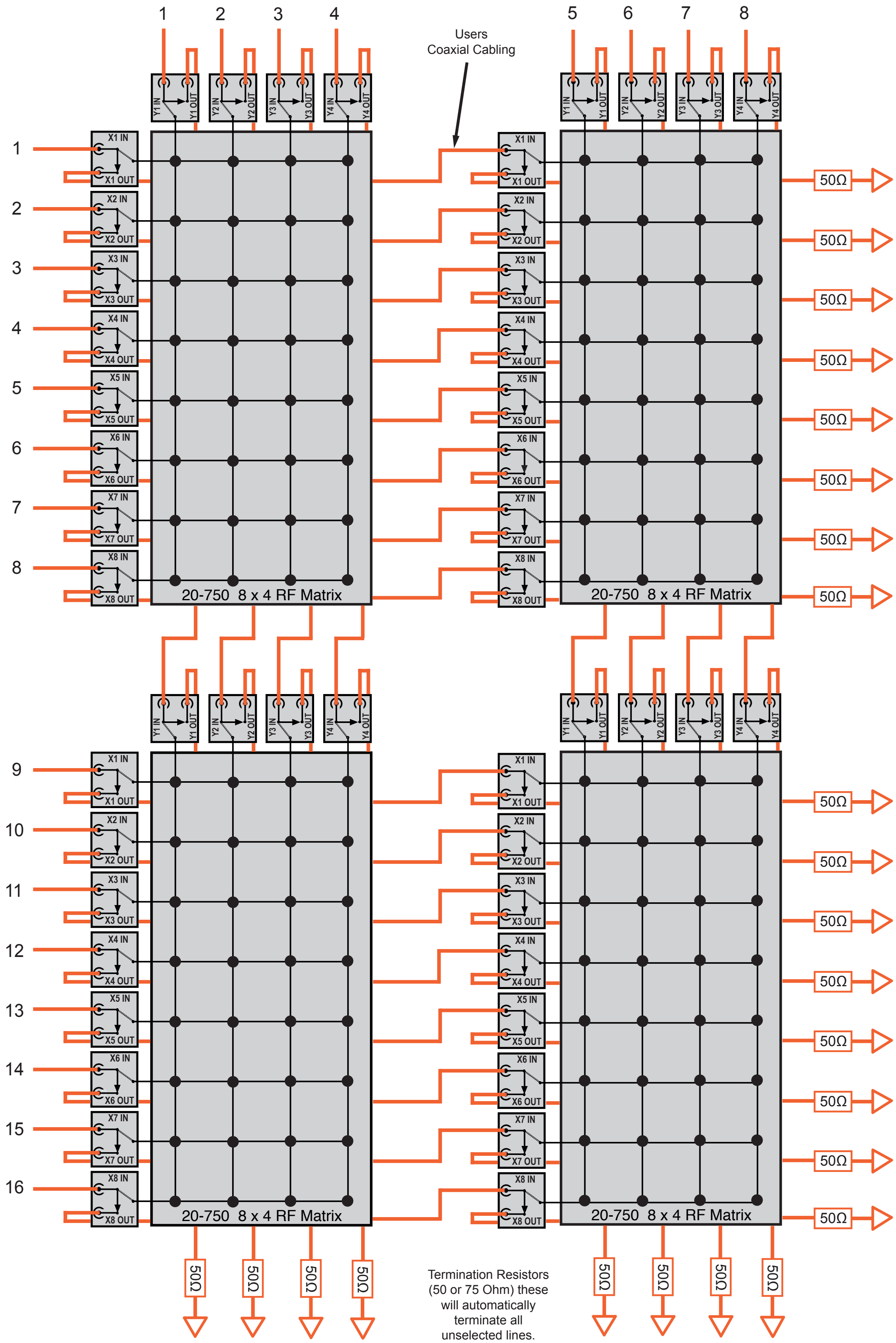
`MCLOSE a,x,y`	This closes the crosspoint at coordinate **`x,y`**.
`MOPEN a,x,y`	This opens the crosspoint at coordinate **`x,y`**.
`RESET a`	Clears all crosspoints on the addressed matrix.

Each matrix comprises of up to 30 matrix modules (e.g. from 8 x 4 up to 64 x 16), the location of each matrix module within the whole matrix is determined by DIP switches set on each module.

Thus the complex nature of programming the RF matrix is completely shielded from the user!

RF Matrix Example Application:

16 x 8 RF Matrix with 1GHz Bandwidth, Constructed Using Four 8 x 4 Matrix Modules.



The Following Notes may be of Interest for RF Switching Applications:

- When setting up large RF switching systems (e.g. multiplexers and matrices) it is often preferable to use SMA or SMB connectors for improved return loss performance. BNC connectors have poorer and much less consistent return loss characteristics particularly at frequencies above 1GHz.
- Many RF switching modules feature automatic matched termination of all unused channels, this ensures that an unused channel will be correctly terminated to minimise unwanted reflections.
- Pickering may be able to build RF switching systems for non-standard impedances, e.g. 93Ω , please contact sales office to discuss your requirement.
- RF Matrices may be constructed in a variety of ways depending upon the versatility, size, performance, software complexity and cost constraints of the application. Few RF matrix applications are alike, choice of construction includes:-

    1. Full access matrix constructed using interconnected 20-750 matrix modules. Here any combination of crosspoints may be selected simultaneously, please refer to 20-750 application note for further details.

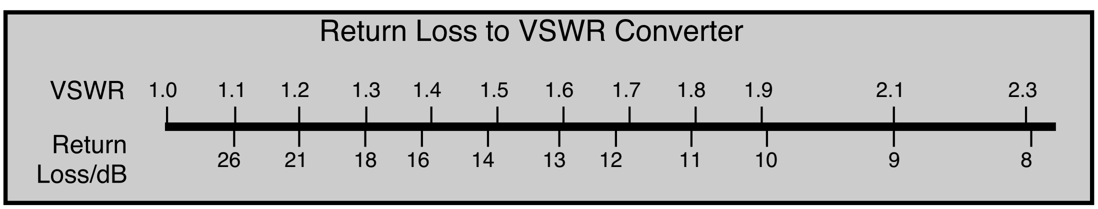
    2. Single crosspoint matrix constructed using back to back multiplexers, easy to construct and low cost, but can only switch one channel at a time.

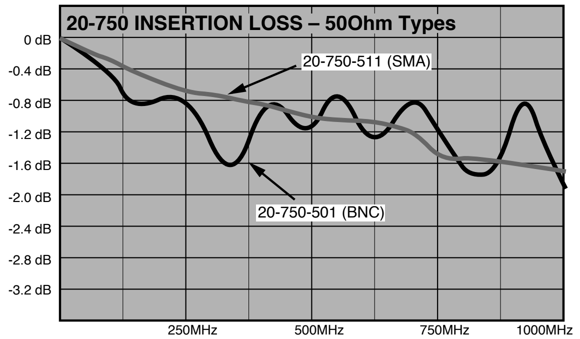
    3. A hybrid of a core matrix fed by multiplexer modules. This technique is a mixture of the above two, several crosspoints may be simultaneously switched, however it still does not have as much versatility as the first method. If a very large matrix is to be constructed (e.g. 100 x 100) then the first method will usually prove too unwieldy, therefore a hybrid is the most likely choice.

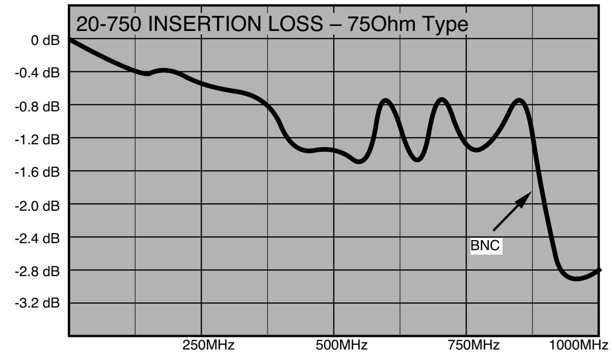
- RF switching modules may also be used for very high isolation low frequency applications – also look at our 20-520 matrix modules.
- Binary tree construction: It is very important when constructing RF switching networks to eliminate stubs (e.g. using coaxial T junction connectors), a binary tree construction (using changeover relays) is the most popular method.
- Pickering Interfaces can supply highly detailed plots and information for specialised areas that may be of interest for a particular application.

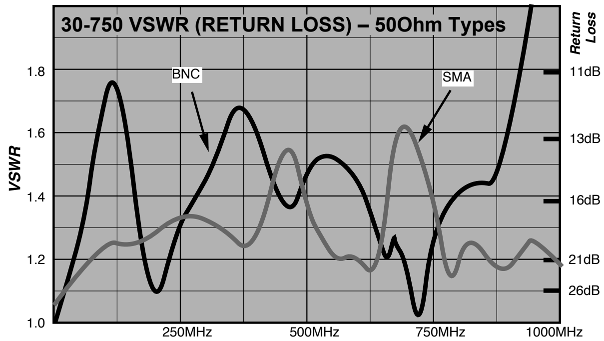
Further information:

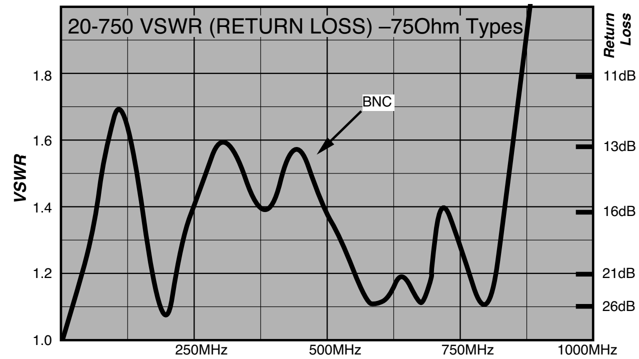
The above notes may be of some help, but please feel free to contact our technical sales office to discuss your RF/Microwave application in further detail.

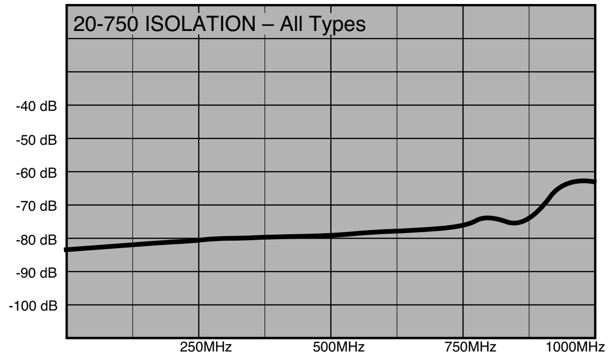


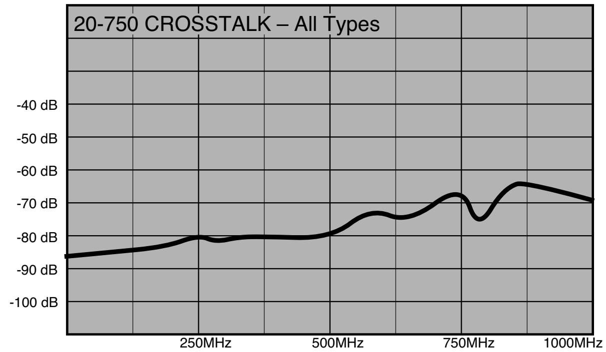




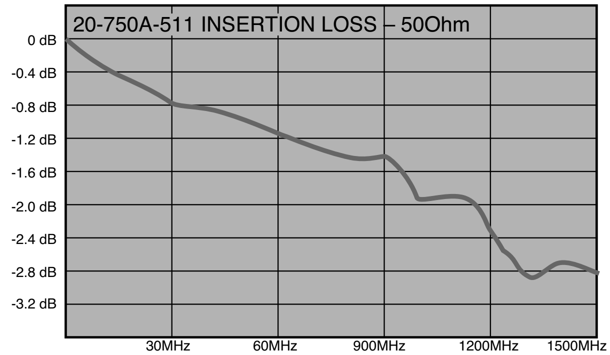


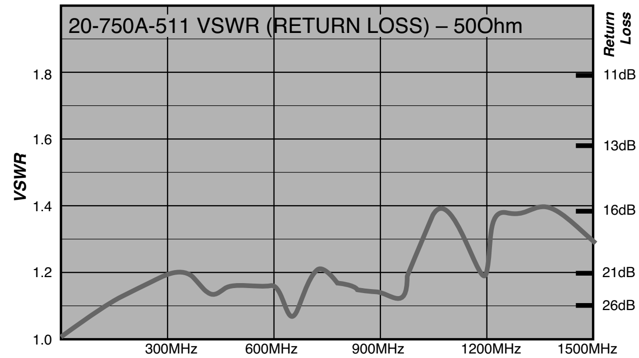




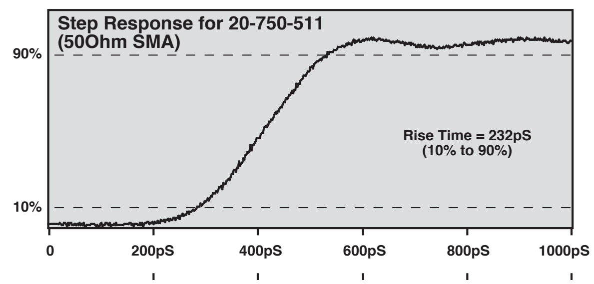


Typical RF Performance Plots for 20-750





Typical RF Performance Plots for 20-750A-511



Typical Step Response Plot for 20-750

Relay Type

This matrix is constructed using electromechanical coaxial relays giving consistent reliable performance from DC to 1.3GHz.

Specification (All Versions)

Characteristic Impedance:	50Ω or 75Ω
Isolation (at 2000MHz):	>60dB
Crosstalk (at 2000MHz):	>50dB
Maximum Voltage:	100V DC
Maximum Power:	10W
Maximum Carry Power (900MHz):	15W
Maximum Switch Current:	0.1A
On Path Resistance:	<500mΩ
Off Path Resistance:	>10^8Ω
Differential Thermal Offset:	<20μV
Switching Time:	20ms
Expected Life (Low power):	>$2x10^7$ operations
Expected Life (Full power):	>$3x10^5$ operations

Specification (50Ω BNC Version)

Rise Time:	<0.5ns
Max Insertion Loss (0 to 1000MHz):	<3dB
Max V.S.W.R. (0 to 800MHz):	1:1.8

Specification (50Ω SMA Version)

Rise Time:	<0.5ns
Max Insertion Loss (0 to 1000MHz):	<3dB
Max V.S.W.R. (0 to 1000MHz):	1:1.8

Specification (75Ω BNC Version)

Rise Time:	<0.5ns
Max Insertion Loss (0 to 1000MHz):	<3dB
Max V.S.W.R. (0 to 800MHz):	1:1.8

Expanded Matrix Typical Performance (50Ω SMA)

Typical performance figures are given below for expanded matrix modules (SMA versions) with both 2 and 4 modules chained together (losses due to coaxial cabling were small).

	2 Modules	4 Modules
Typ Insertion Loss (0 to 1000MHz):	<2dB	<3.5dB
Typ V.S.W.R. (0 to 1000MHz):	<1:1.8	<1:2.0

Please contact the factory if more detailed information on expanded matrix performance is required.

Programming

The 20-750/750A Matrix module is simple to program using the following commands:-

ARESET a	Open all switches on device **a**
DIAGNOSTIC?	Report any Self Test errors
DELAY t	Force a minimum delay of **t** milliseconds between two instructions
MCLOSE a,x,y	Close switch at coordinates **x,y** on matrix a
MOPEN a,x,y	Open switch at coordinates **x,y** on matrix **a**
RESET	Open all switches on all modules
VIEW? a	View status of device a

Self Test

Self-Test is invoked at power on and may also be operated under software (***TST?**) or via a recessed push button. Self-Test pass is indicated on a front panel LED with a full pass/fail description available using the **DIAGNOSTIC?** command. Self-Test comprises 2 levels:

- **Logic Test**
- **Relay Coil Test**

Mechanical Characteristics

All modules conform to the 6U height (262mm) Eurocard standard with dimensions: 160mm deep and 2.4 inches wide (12HP).

Connectors

The 20-750 RF Matrix Module is available with BNC, SMA, or Type 43/SMZ connectors. Other connector types may be available to order, please contact the sales office for details.

Operating/Storage Conditions

Operating Conditions

Operating Temperature:	0°C to +55°C
Humidity:	Up to 95% non-condensing
Altitude:	5000m

Storage and Transport Conditions

Storage Temperature:	-20°C to +75°C
Humidity:	Up to 95% non-condensing
Altitude:	15000m

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

RF Matrix, 50Ω:	
800MHz, BNC	20-750-501
1300MHz, SMA	20-750A-511
RF Matrix, 75Ω:	
800MHz, BNC	20-750-701
1000MHz, Type 43/SMZ	20-750-711

Product Customization

Pickering System 20 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.

Mating Connectors & Cabling

50Ω SMA to SMA Lead, 1m Length	10-981-510
50Ω BNC to BNC Lead, 1m Length	10-980-510
75Ω BNC to BNC Lead, 1m Length	10-980-710
75Ω SMZ to SMZ Lead, 0.5m Length	10-988-705

For other connection accessories for this series of modules please refer to the 90-011D RF Cable Assemblies data sheet where a complete list and documentation can be found for accessories, or refer to the Connection Solutions catalog.