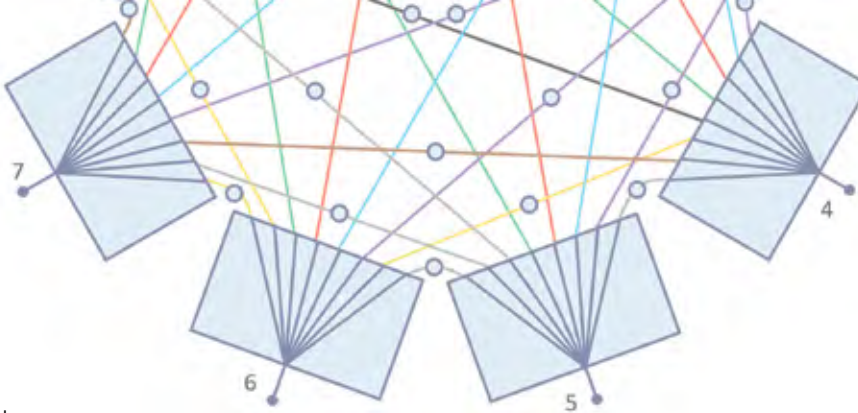


# TEST SOLUTIONS



# 2017 TEST SOLUTIONS



## Introduction

Rapid growth in the number and variety of wireless applications and connected devices in the market has driven the need for more innovative, and highly customized test solutions. Customers are looking for equipment to multiplex application-specific test systems across multiple DUTs, which requires signal routing, distribution and conditioning functions in a variety of configurations.

At Mini-Circuits, our experience in the test space has evolved according to the needs of our customers, following a progression from test accessories like cables, adapters, and attenuators, to benchtop programmable test modules, to modular and fully customized rack-mountable systems. The diversity of customer test requirements has led us to build our business in this area around principles of competence, flexibility, and speed.

Customers are looking to the industry to partner with them to define the test solution for their needs. This requires the competence and expertise of our applications engineers to understand customers' needs and develop a clear system definition. The specifications for these solutions are usually being defined concurrently with the design process, which requires our organization to be agile in design and fabrication of a wide range of unique, user-defined solutions in a very short period of time.

The turnaround time on these test systems directly affects customers' time to market, so they're depending on us to deliver a tailored solution, fast. To support speed and flexibility, we have capitalized on a building-block approach to developing custom equipment for each customer's unique needs. Our wealth and variety of components and subassemblies in stock allows us to create integrated assemblies for a wide range of custom specifications with exceptionally fast turnaround times.

This 2017 Test Solutions Product Guide showcases some of our newest, most advanced, and most popular test systems developed to date. We hope this information gives you some ideas about how Mini-Circuits can help improve efficiency and save cost for your test setup. Reach out to [testsolutions@minicircuits.com](mailto:testsolutions@minicircuits.com) for information about anything you see here or any unique requirements you might have. We're here to support you!

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## What's New?



▶ **High-Order Switch Matrices with Touch-Screen Control and Cloud-Sandbox Capability**  
(See pp. 4-7)



▶ **Multi-Channel Attenuator Modules with SPI Interface for Cascadability**  
(See pp. 8-11)



▶ **N Port Mesh Networks with Programmable Attenuator on Each Path**  
(See pp. 12-15)



▶ **Compact Modular Test Systems with User-Configurable Front-Panel Layout**  
(See pp. 18-19)





## ZT-20X6NB 0.6 - 6 GHz

### 20x6 Non-Blocking Full Access Switch Matrix

#### Functional Description

Mini-Circuits' ZT20X6NB is a high-performance, 20 x 6 non-blocking switch matrix, covering the key worldwide telecom bands from 600 MHz to 6 GHz. The system comes housed in a compact, 5U height, 19-inch rack-mountable chassis with all 26 RF connections (N-type) easily accessible on the front panel.

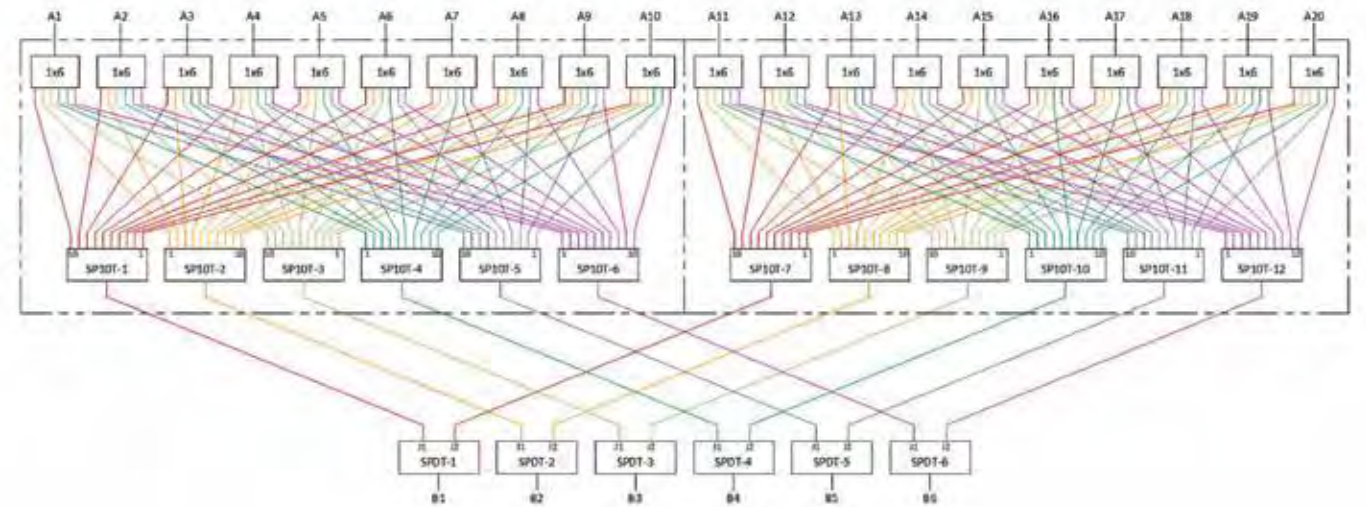
This bi-directional switch matrix can be programmed to connect the 6 "B" ports to any combination of the 20 "A" ports. The non-blocking configuration makes the matrix ideally suited to a wide range of multi-user and multi-device test systems. In cellular test systems for example, the matrix would allow 6 separate test stations to access any of 20 base-station channels, without affecting any other test stations. Multiple ZT-20X6NB matrices can be combined to construct complex, high volume test environments.

The system includes both USB and Ethernet control interfaces along with a built-in touchscreen, providing a range of flexible control options. Software support is provided through our easy-to-use GUI application for remote control over a network, or local control through USB. ActiveX and .NET API objects (for Windows environments) and HTTP/Telnet support ensure compatibility with most common programming environments.

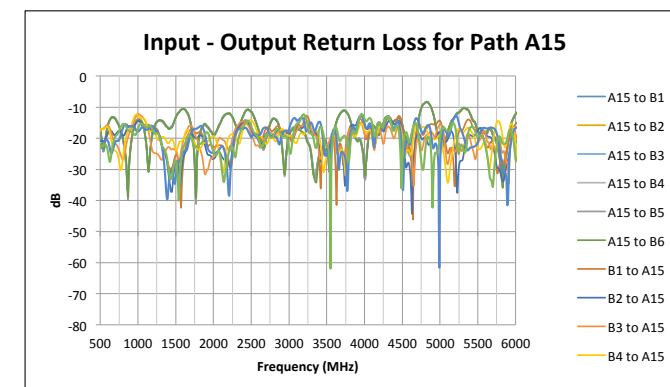
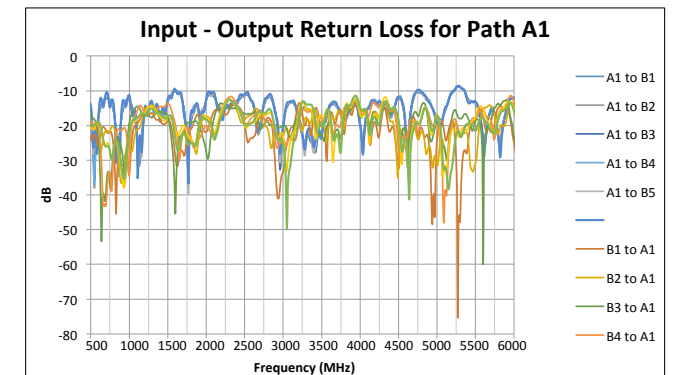
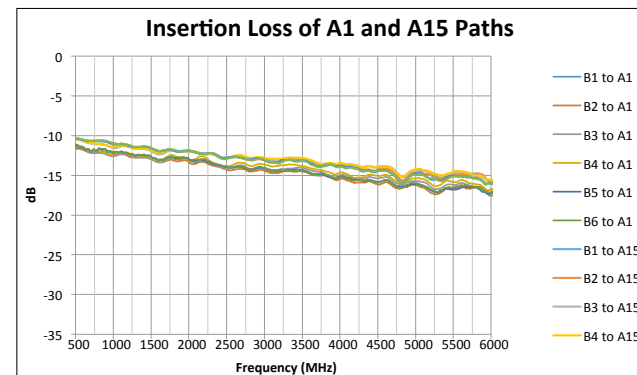
#### Electrical Specifications (5°C to 45°C)

PARAMETER	TYPICAL VALUE	COMMENTS
Frequency	600-6000 MHz	
Input Power	33 dBm max	Average power per port into any A port
	26 dBm max	Average power per port into any B port
Insertion Loss	15 dB	@ 600-3000 MHz
	18 dB	@3000-6000 MHz
Return Loss	12 dB	
Isolation	80 dB	Between any pair of B ports when connected to different A ports
	80 dB	Between any pair of A ports

#### Functional Schematic



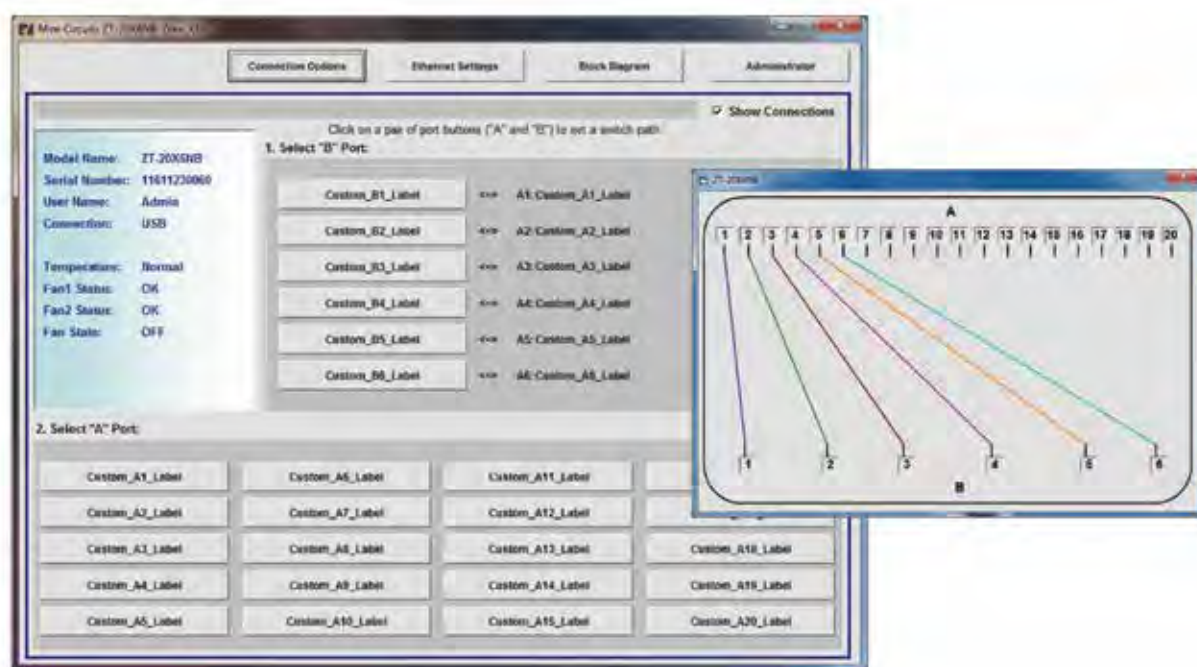
#### ZT-20X6NB Curves



## ZT-20X6NB User-Friendly GUI Control

The ZT-20X6NB comes supplied with Mini-Circuits' user-friendly GUI control software for Windows® systems. The GUI allows the user easy, point-and-click control to set any switch path and view system status including active switch paths, temperature, and fan operation.

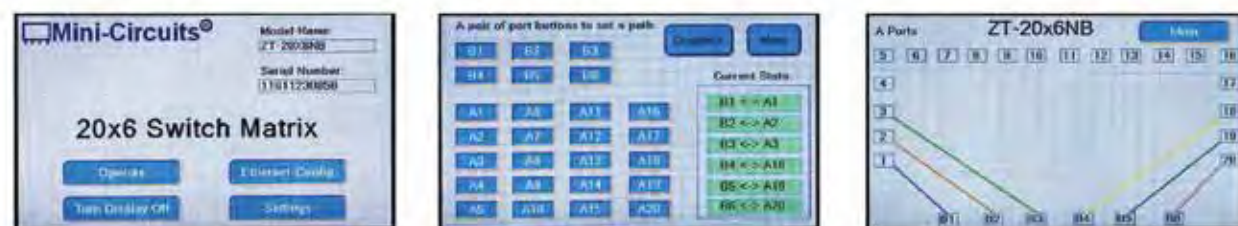
The program even provides multi-user support, allowing an administrator to set up multiple user profiles with custom port labels for each user and control over which switch ports are accessible to each user profile. This capability allows users at multiple test stations to connect to the ZT-20X6NB over a network and independently manage test signal traffic.



ZT-20X6NB GUI main control screen

## Touch-Screen Control

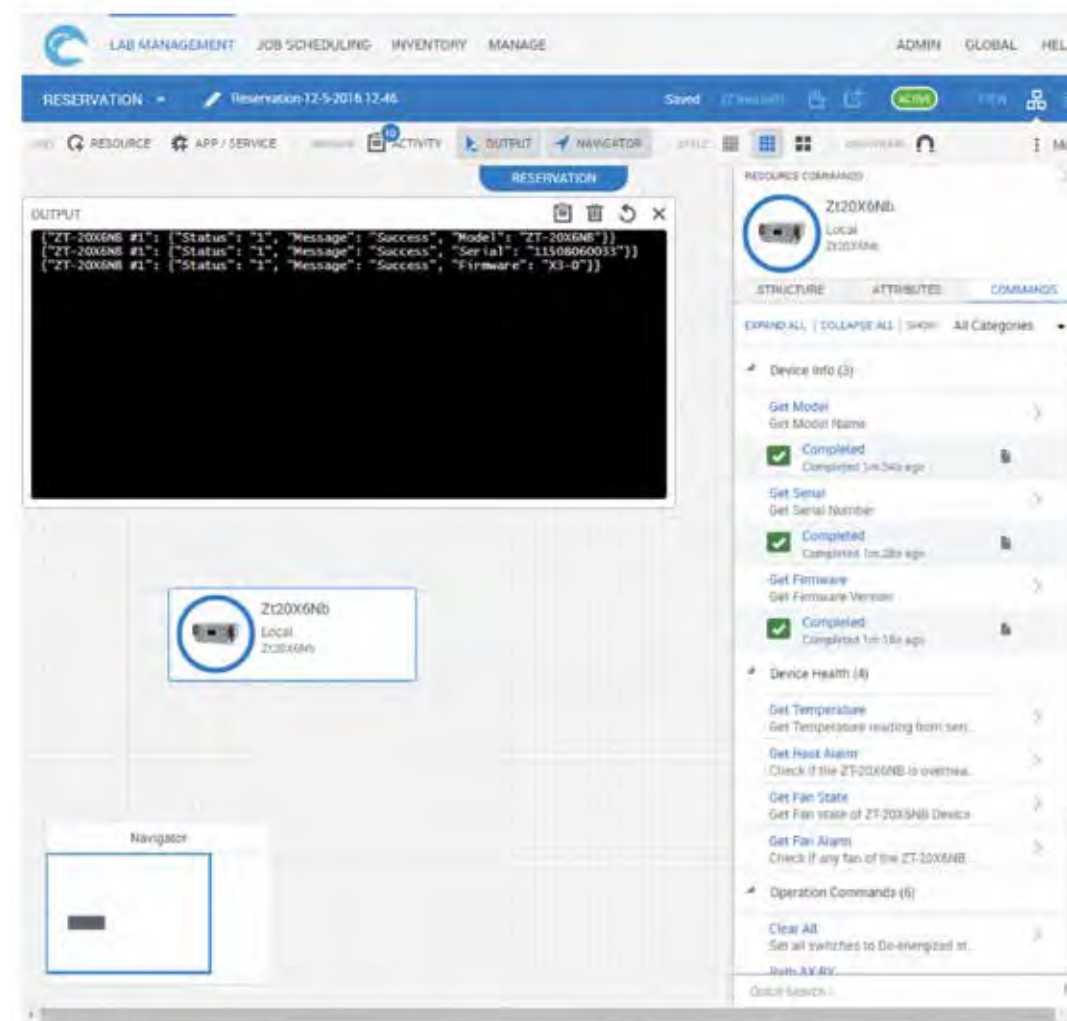
The ZT-20X6NB features touch-screen control installed on the front panel of the unit, giving you the convenience to control the system either remotely from your PC or directly from the unit itself without the need for a USB or LAN connection. The touch screen interface allows you to set any switch path, view active switch paths on a graphical display, and even configure Ethernet connection parameters.



ZT-20X6NB GUI touch screen displays

## ZT-20X6NB Cloud-Based Driver (Shell)

- CloudShell allows complex network infrastructure and automated test systems to be developed in a virtual “sand box” environment
- Mini-Circuits provides a driver / shell for easy integration of ZT-20X6NB in the CloudShell software
- ZT-20X6NB can be modelled “off line” in the sand box to speed up the development and implementation of your automated test environment
- Combined with a powerful orchestration script to direct the development workflow, a complete environment replica can be created
- The sandbox environment can be deployed via portals and APIs to be accessed by developers inside and outside your company
- The result is accelerated development times, straightforward deployment and reduced development costs



ZT-20X6NB shell





## ZTDAT-Series 1 to 6000 MHz Multi-Channel Attenuation Systems

### Functional Description

Mini-Circuits' ZTDAT series are multi-channel programmable attenuator systems suitable for a wide range of signal level control applications from 1 MHz to 6 GHz. Each independently controlled channel provides 0 to 95 dB attenuation in 0.25 dB\* steps with more than 100 dB isolation between channels. Its unique design maintains linear attenuation change per dB, even at the highest attenuation settings.

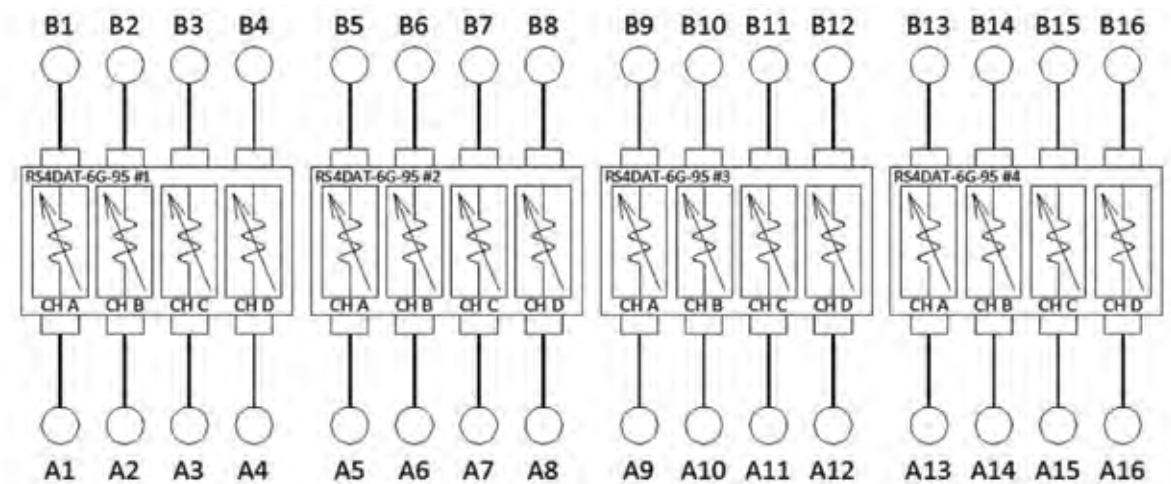
Each model is housed in a compact 19-inch rack chassis with SMA or N-type RF connectors on the front and rear panels. A series of standard model options are provided, from 8 to 24 attenuator channels, with custom configurations available on request.

The system can be controlled via USB or Ethernet (supporting both HTTP and Telnet network protocols). Full software support is provided, including our user-friendly GUI application for Windows and a full API with programming instructions for Windows and Linux environments (both 32-bit and 64-bit systems).

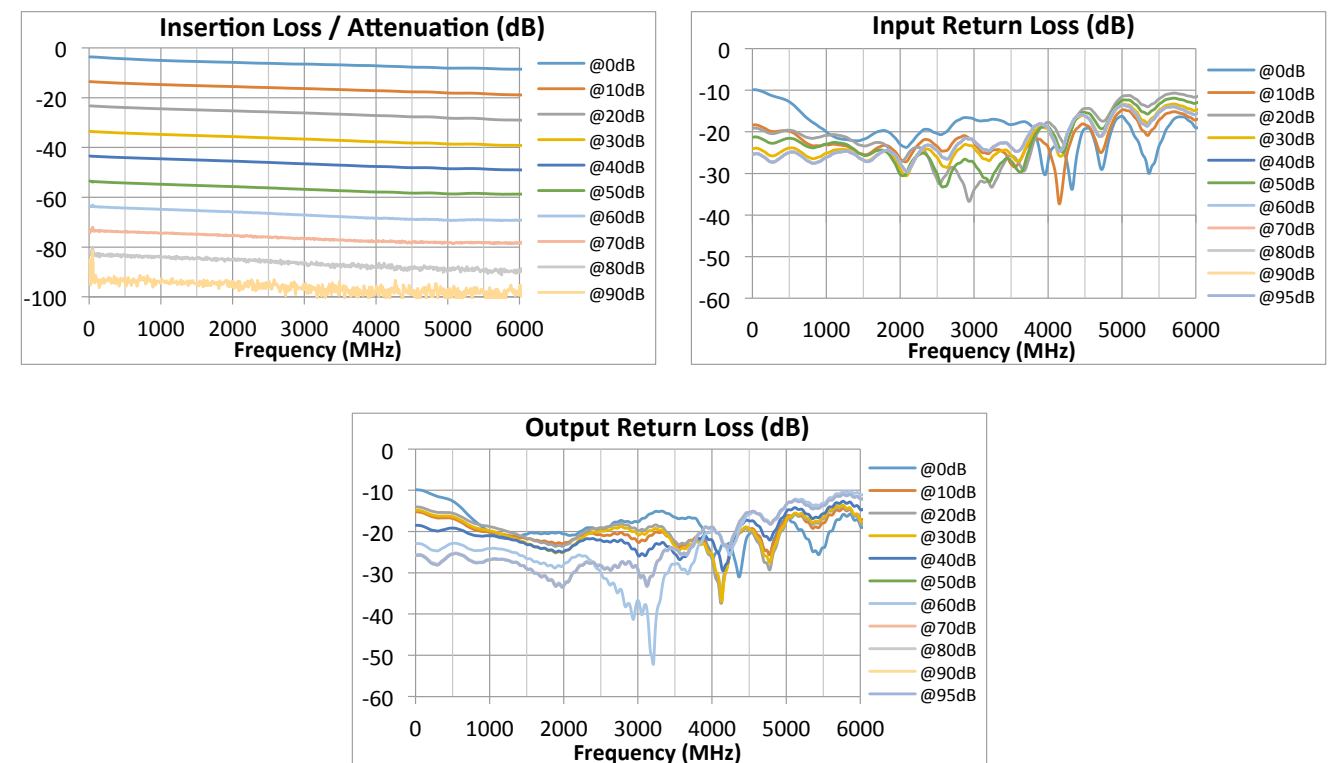
The series also includes Mini-Circuits' novel SPI daisy-chaining interface which allows multiple ZTDAT attenuator systems to be cascaded together into a Master/Slave chain. The full chain effectively becomes one system with every attenuator channel (from 8 to several hundred) controlled through the single USB or Ethernet connection and software interface of the Master unit.

\* 0.25 dB steps from 0 to 90 dB; 0.5 dB steps above 90 dB

Functional Schematic



ZTDAT-Series Curves



## Cascading ZTDAT Attenuator Racks

Multiple ZTDAT attenuator racks can be combined to form much larger programmable attenuator systems by “cascading” the SPI interfaces. This allows large numbers of attenuator channels to be controlled through a single USB or Ethernet connection and software interface. All software commands are issued to the Master unit (the first unit in the chain) which will in turn control all Slave units as required. Cascading ZTDAT units is easy:

1. Connect the SPI Out port of the first ZTDAT unit to the SPI In port of the next ZTDAT unit
2. Continue connecting additional ZTDAT units in the same manner, as required
3. Connect the AC power inputs for all ZTDAT units in the chain
4. Connect the control connection (USB or Ethernet) to the first ZTDAT in the chain; this becomes the Master unit
5. Each individual attenuator channel within the cascaded chain can now be addressed as if they are part of the Master

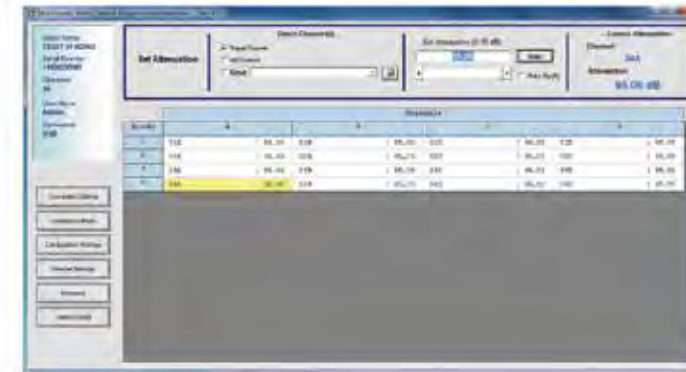


3 ZTDAT racks “daisy chained” via SPI ports

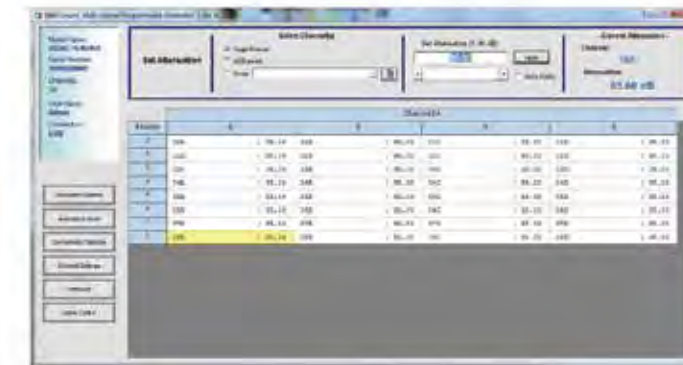
## Cascading ZTDAT Attenuator Racks

Mini-Circuits’ user-friendly control software for multi-channel attenuator systems automatically detects “slave” units cascaded to the “master” unit and displays settings for all channels in connected in the chain.

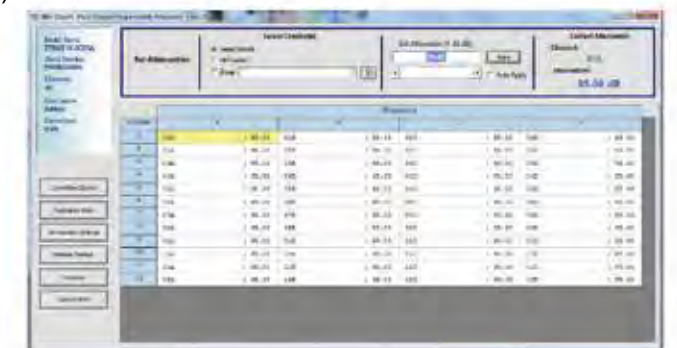
This allows you to scale your setup by adding more channels at will while managing settings from a single control interface.



Control interface for one ZTDAT unit (16 channels)



Control interface for two ZTDAT units, one master and one slave (32 channels)



Control interface for three ZTDAT units, one master and two slaves (48 channels)



## ZTMN-SERIES

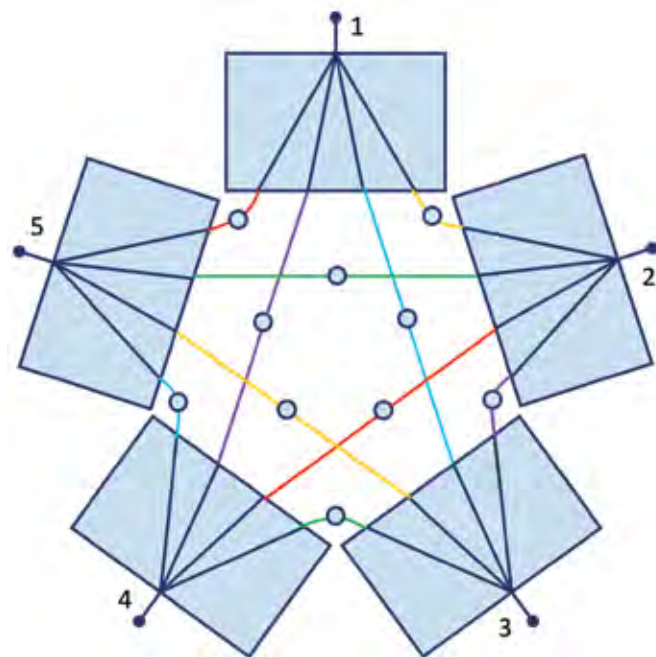
### n-Port Mesh Networks

Mesh networks allow simultaneous interconnection of 3 to n devices or test systems. Common applications include testing of Bluetooth and Zigbee devices, wireless handsets and Wi-Fi systems.

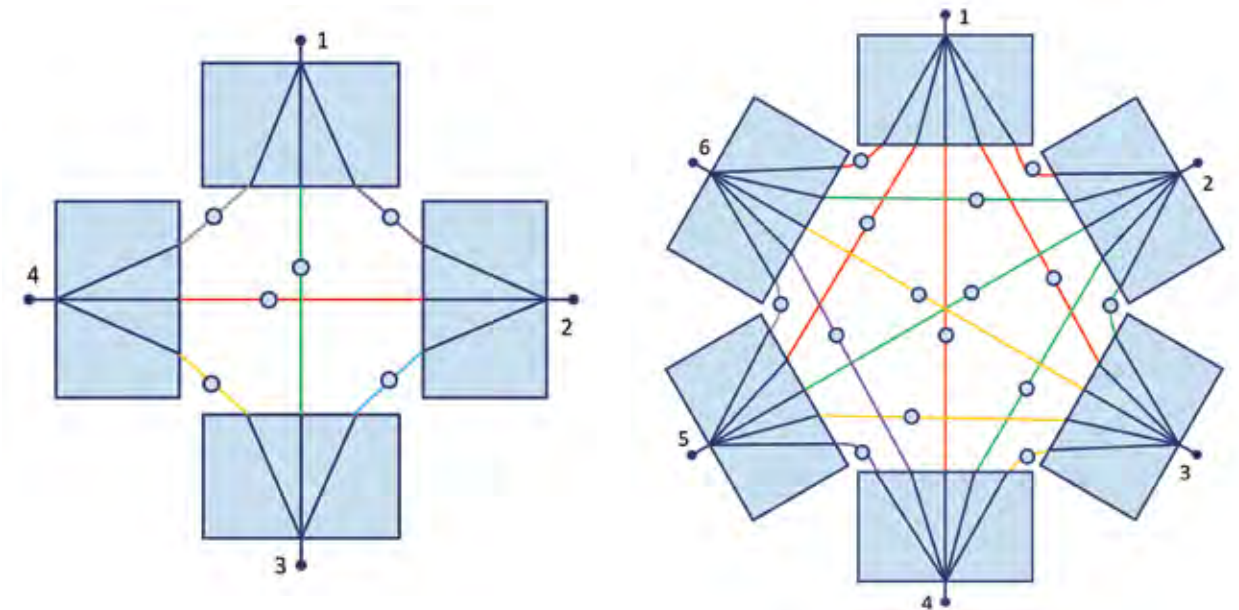
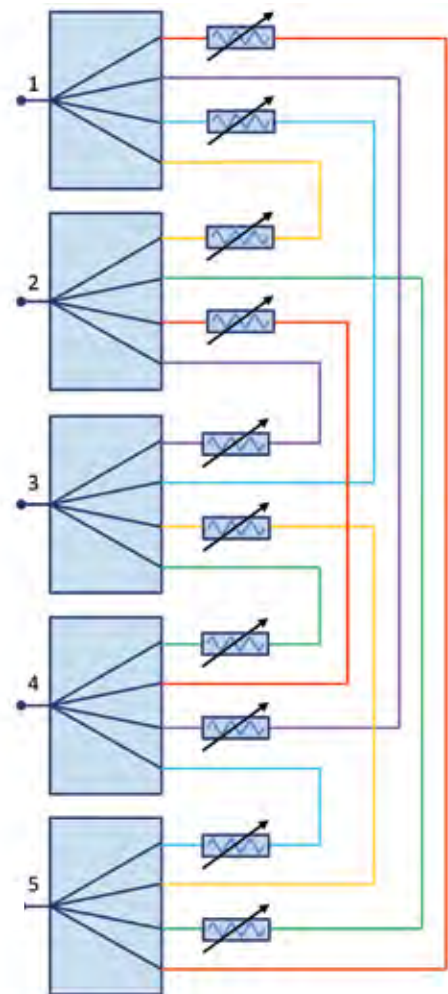
Mini-Circuits' ZTMN series are multi-port mesh networks covering all the key telecoms bands from 350 to 6000 MHz with independently variable attenuation on every path. This concept allows simulation of a "real-world" mesh communication network in the confined space of a production environment. Path loss can be varied independently between any pair of devices on the network without affecting any other combination of devices, allowing simulation of a complex range of test cases.

Number of paths, operating frequency and path attenuation range (up to 120 dB) can be tailored to your specific test requirements.

*Schematic drawings for 5-port mesh network; conceptual diagram below and assembly diagram to the right.*



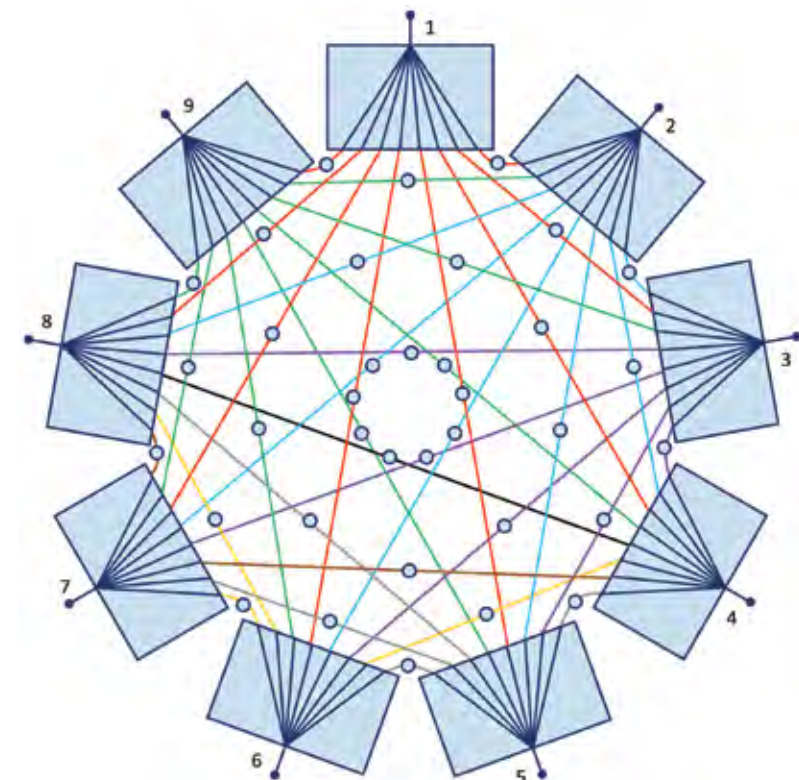
● = programmable attenuator



Common mesh network requirement, clockwise from top left: 4-port mesh; 6-port mesh; 9-port mesh

*Even larger mesh network configurations available on request!*

● = programmable attenuator





## ZTMN-0495AS 350 to 6000 MHz 4-Port Mesh Network

### Functional Description

ZTMN-0495AS is a 4-port mesh network 0 to 95 dB attenuation range on each path, in 0.25 dB\* steps. The unique attenuator design maintains linear attenuation change per dB, even at the highest attenuation settings.

The system model is housed in a compact 2U height, 19-inch rack chassis with SMA RF connectors on the front panel. The ZTMN series also supports larger mesh network combinations (up to 36 ports) with customer attenuation and frequency ranges available on request.

The system can be controlled via USB or Ethernet (supporting both HTTP and Telnet network protocols). Full software support is provided, including our user-friendly GUI application for Windows and a full API with programming instructions for Windows and Linux environments (both 32-bit and 64-bit systems).

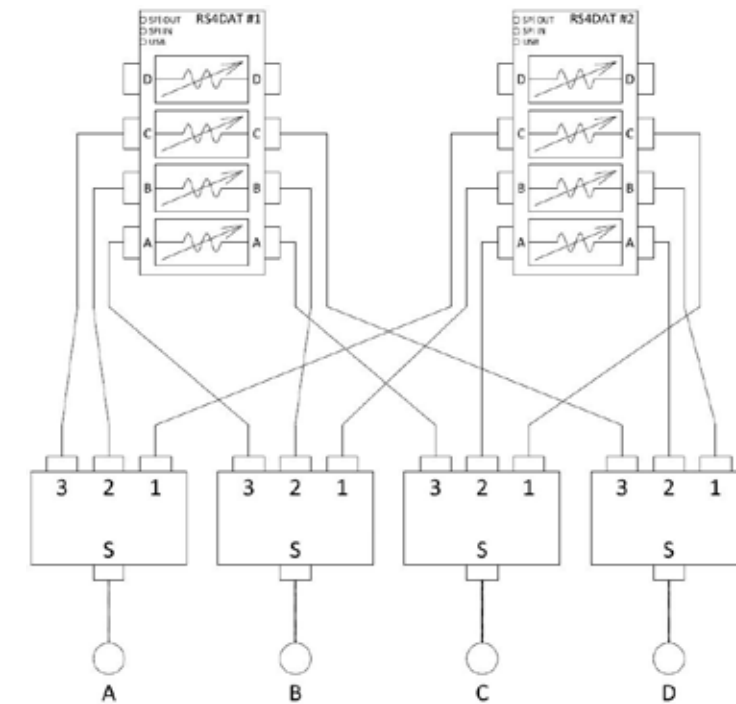
\* 0.25 dB steps from 0 to 90 dB; 0.5 dB steps above 90 dB

Electrical Specifications (5°C to 45°C)					
Parameter	Conditions	Min	Typ	Max	Units
Frequency Range		350		6000	MHz
Attenuation Range	0.25 dB steps	0		90	dB
	0.5 dB steps	90		95	
Insertion Loss	1-2000 MHz		16.5		dB
	2000-4000 MHz		18.5		
	4000-6000 MHz		21.0		
Input Operating Power <sup>1</sup>	1 MHz			+12	dBm
Return Loss			12		dB
Attenuation Transition Time <sup>2</sup>			650		ns

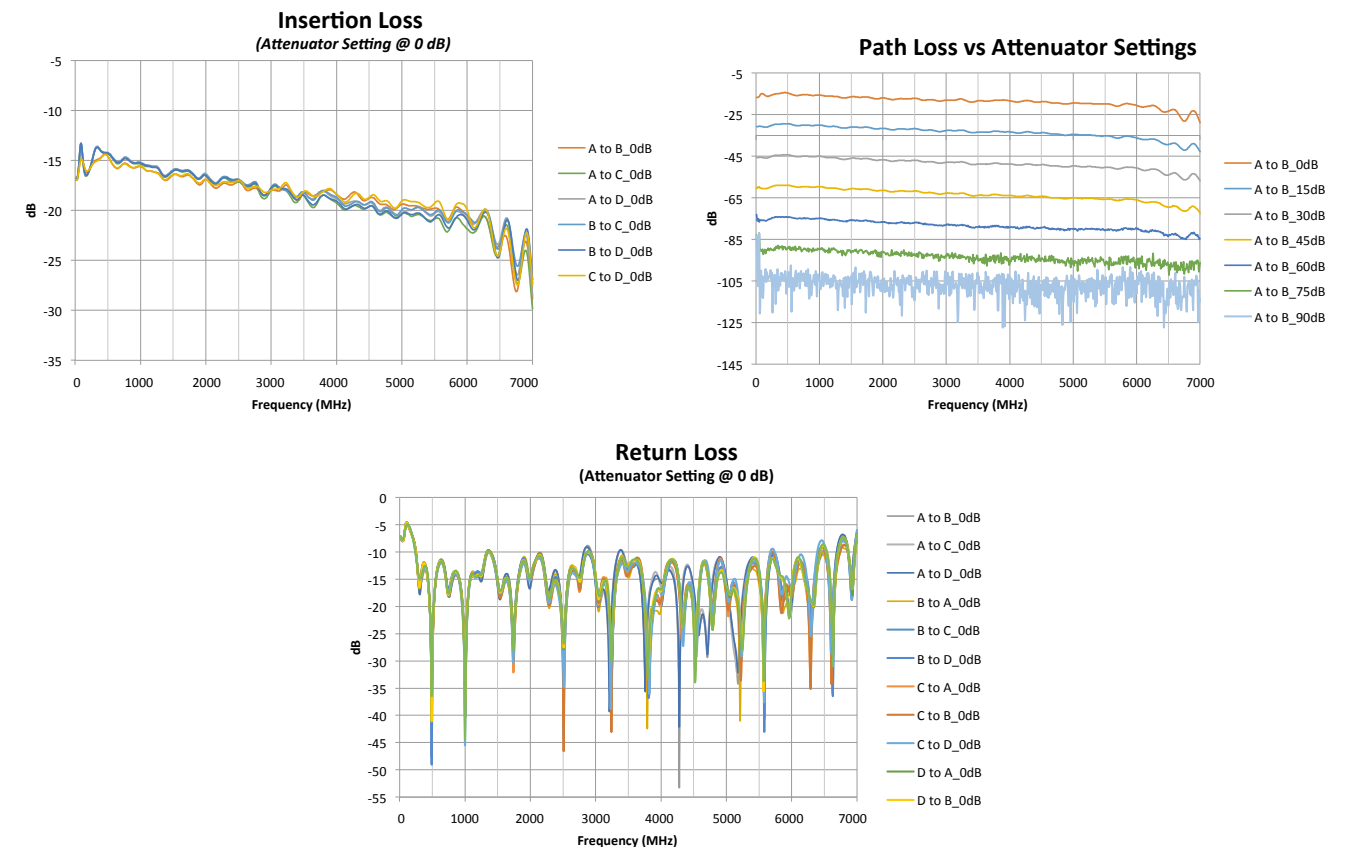
<sup>1</sup> Total input power at A and B ports of any channel (channels are bidirectional)

<sup>2</sup> Defined as the time between the attenuator starting to change state and settling on the final value. Communication delays (in the order of 1-10 ms via USB or Ethernet) and microcontroller delays must also be considered.

### ZTMN-0495AS Functional Schematic



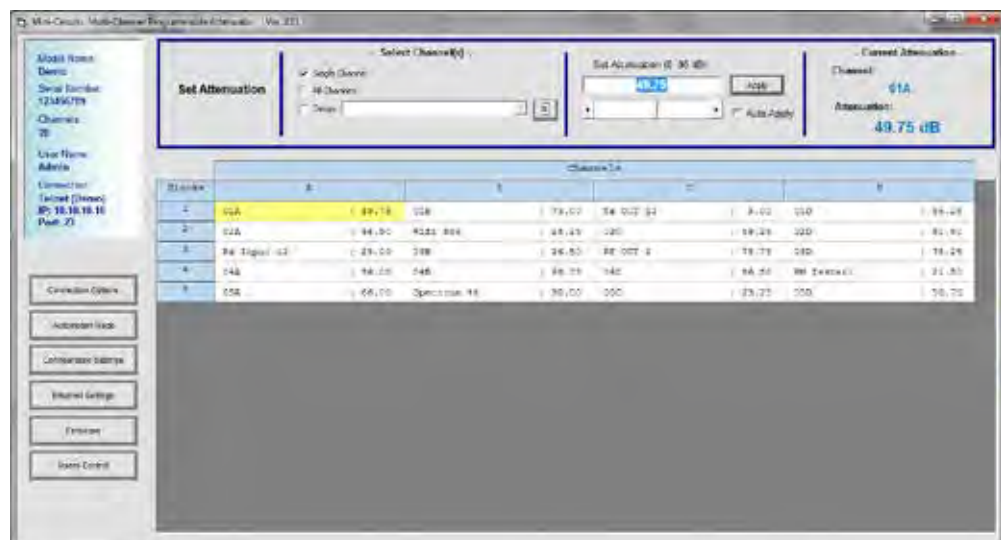
### ZTMN-0495AS Curves





## User-Friendly Control Software for Multi-Channel Programmable Attenuator Systems

Mini-Circuits' ZTDAT series multi-channel programmable attenuator systems and ZTMN-series mesh network systems come supplied with Mini-Circuits' user-friendly control software, allowing independent or simultaneous level control for many channels from a single interface.



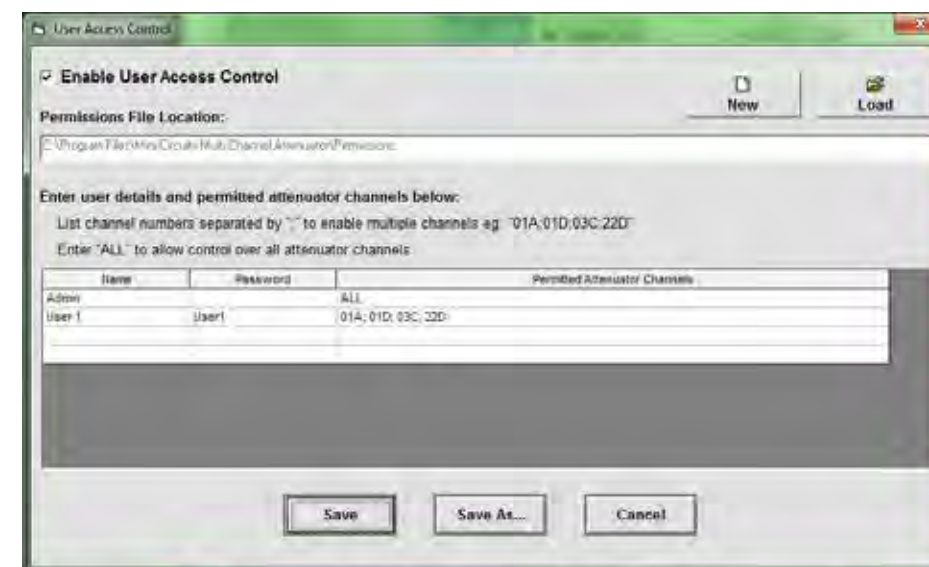
**Multi-channel attenuator system GUI main control. 20 channels shown.**

The GUI program features intuitive controls that allow you to set attenuation to fixed values as well as automate sweeping and hopping patterns. You can assign custom labels for each port for easy integration into your test setup, and define groups of channels to set levels simultaneously.



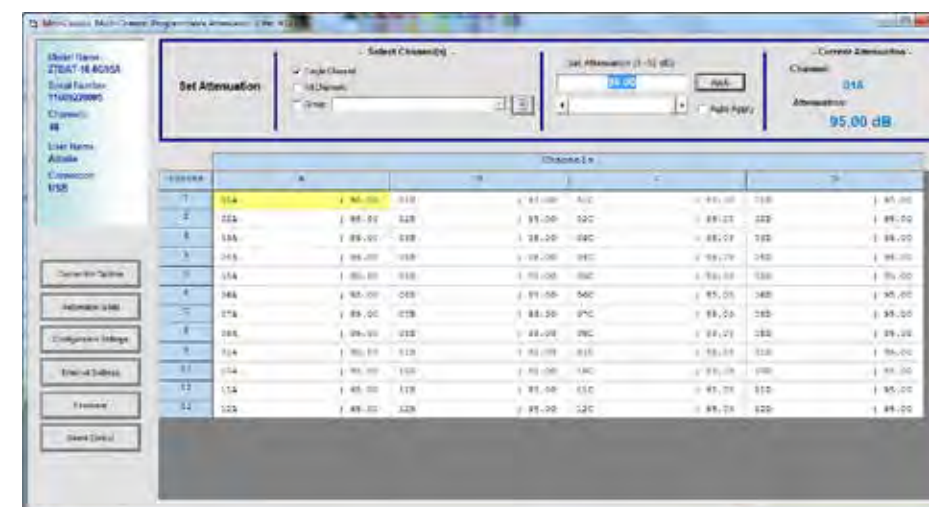
**Automation controls for sweeping and hopping attenuation patterns.**

To support test environments with multiple test stations and multiple operators, Mini-Circuits systems allow you to set up multiple, password protected profiles, and assign permission or restrict use of different attenuators in the system. This way, multiple users may connect to a unit and work independently with controlled access to different ports in the system.



**User access control menu**

Units featuring SPI ports may be cascaded in daisy-chain configuration to add more channels to a given system. The GUI software is set up to support scalability as your test setup evolves and your needs grow. The software automatically detects when "slave" units are connected to the "master" unit and displays controls for corresponding channels. This allows the user to manage settings for many channels in multiple, interconnected units through a single, simple control interface



**Main control screen for three sixteen-channel programmable attenuator systems cascaded via SPI connection, allowing control of forty-eight channels from a single interface.**



**RCM 100 Series**  
Multi-Channel Programmable Attenuator Systems

**RCM 200 Series**  
Multi-Function Switching Systems

## RCM Series

### Compact Modular Test Systems

#### Save Space and Reduce Cost!

Mini-Circuits' RCM series compact modular test systems offer the same flexibility and fast turnaround of our ZTM-series modular test racks for setups requiring smaller size. The design consists of a small, light-weight chassis with three open hardware slots, each of which may be outfitted with your choice of programmable attenuators with 0 – 30, 60, 90, 110 and 120 dB attenuation range (RCM-100 series) and any combination of SPDT, SP4T, SP6T and transfer switches (RCM-200 series).

All models come with USB and Ethernet-TCP/IP (HTTP and Telnet protocols) control options, allowing setup flexibility and easy remote test management. The units may be controlled with our easy-to-install, easy-to-use GUI or through your native test software using the supplied API objects for Windows® environments. The hardware is supplied with a complete set of DLLs for 32- and 64-bit Windows operating systems, programming instructions for both Windows® and Linux® operating systems, and all the accessories you need for immediate use right out of the box!

#### Features:

- Compact Chassis, Ideal for Benchtop Use
- Customizable Hardware Layout
- Light Weight
- USB & Ethernet Control
- GUI and DLLs Included
- Low-Cost

### RCM 100 Series Programmable Attenuator Module

#### 4 Programmable Attenuator Channels

Model Name	Channels	Performance per Channel		
		Frequency	Attenuation	Step
RCM-30	4	1- 6000 MHz	0 - 30 dB	0.25 dB
RCM-60	4	1- 6000 MHz	0 - 60 dB	0.25 dB
RCM-100	4	1- 6000 MHz	0 - 90 dB	0.25 dB
RCM-110	4	1- 6000 MHz	0 - 110 dB	0.25 dB
RCM-120	4	1- 6000 MHz	0 - 120 dB	0.25 dB

#### 6 Programmable Attenuator Channels

Model Name	Channels	Performance per Channel		
		Frequency	Attenuation	Step Size
RCM-30-6	6	1- 6000 MHz	0 - 30 dB	0.25 dB
RCM-60-6	6	1- 6000 MHz	0 - 60 dB	0.25 dB
RCM-100-6	6	1- 6000 MHz	0 - 90 dB	0.25 dB
RCM-110-6	6	1- 6000 MHz	0 - 110 dB	0.25 dB
RCM-120-6	6	1- 6000 MHz	0 - 120 dB	0.25 dB

*8 GHz systems available upon request*

### RCM 200 Series Multi-Function Switching Systems

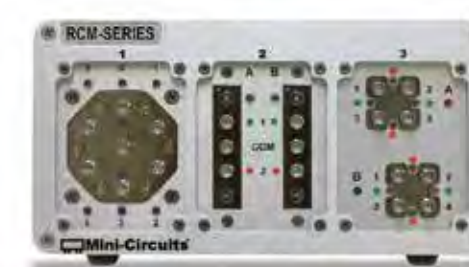
Choose any combination of SP6T, SP4T, SPDT and transfer switches – hundreds of possibilities!

#### RCM 200 Series Example Configurations

Model Name	Window1	Window 2	Window 3
RCM-200	SP4T	1-MTS	Blank
RCM-202	SP4T	1-SPDT	SP4T
RCM-203	SP6T	SP4T	Blank
RCM-3SP4T-18	SP4T	SP4T	SP4T
RCM-6SPDT-18	2-SPDT	2-SPDT	2-SPDT



6 Programmable Attenuators, 0-110 dB



1 SP6T, 2 SPDT, 2 Transfer (DPDT)



2017

# TEST SOLUTIONS



**... Serving Customers Worldwide!**

## WORLD CLASS SERVICE

- ▶ On-site integration support
- ▶ Calibration
- ▶ Software and programming support
- ▶ Service and warranty contracts available
- ▶ Tech support through equipment lifetime

## TECHNICAL SUPPORT

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