Rack-Mounted | USB & Ethernet Control

9-Port Mesh Network ZTMN-0995A

50Ω 500-6000 MHz

Model Name	Connector Type
ZTMN-0995A-S	SMA female
ZTMN-0995A-N	N-type female
ZTMN-0995A-T	TNC female

Product Overview

Mini-Circuits' ZTMN series mesh networks are multiport test systems with independently variable attenuation on every internal path. This concept allows simulation of a "real-world" mesh communication network within 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.

ZTMN-0995A is a 9-port mesh covering the 500-6000 MHz bands, with 0 to 95 dB attenuation range on each of the 36 internal paths. The model is housed in a compact 3U height, 19-inch rack chassis with all RF connectors on the front panel. The ZTMN series also supports larger mesh network combinations, with custom attenuation and frequency ranges available on request.

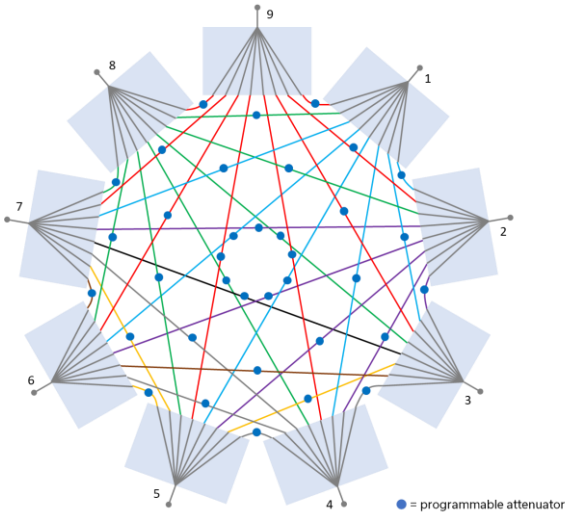
The system can be controlled via USB or Ethernet (supporting SSH, HTTP & Telnet protocols). Full software support is provided, including our user-friendly GUI application for Windows and a full API with programming instructions for Windows and Linux environments (both 32-bit and 64-bit systems).

Key Features

Feature	Advantages
Wide attenuation range	Independently controllable 0-95 dB attenuators on each path allow simulation of a wide range of test scenarios including receiver sensitivity, device / base-station hand-overs, device failures, interference effects.
Ethernet / LAN control	Remote control from any computer or device with a network connection (SSH, HTTP or Telnet protocols).
USB HID (Human Interface Device)	Local control via USB connection. Plug-and-Play, no driver required. Compatible with Windows® or Linux® operating systems using 32 and 64 bit architectures.
Full software support	The user friendly Windows GUI (graphical user interface automation) allows manual control straight out of the box. A full API (application programming interface), programming examples and manuals are provided to allow automation in most programming environments.

9-Port Mesh Network ZTMN-0995A

Block Diagram



Attenuator / Path Map

- The mesh is constructed using nine 4-channel programmable attenuator blocks, addressed 01 to 09
- Each of the 4 channels within a block controls the path loss between a pair of ports, as shown below

	Channel 1 (A)	Channel 2 (B)	Channel 3 (C)	Channel 4 (D)
Att 01	1 <> 5	2 <> 5	3 <> 5	4 <> 5
Att 02	2 <> 6	3 <> 6	4 <> 6	5 <> 6
Att 03	3 <> 7	4 <> 7	5 <> 7	6 <> 7
Att 04	4 <> 8	5 <> 8	6 <> 8	7 <> 8
Att 05	5 <> 9	6 <> 9	7 <> 9	8 <> 9
Att 06	3 <> 4	2 <> 4	1 <> 4	4 <> 9
Att 07	2 <> 3	1 <> 3	3 <> 9	3 <> 8
Att 08	1 <> 2	2 <> 9	2 <> 8	2 <> 7
Att 09	1 <> 9	1 <> 8	1 <> 7	1 <> 6

Mechanical Specifications

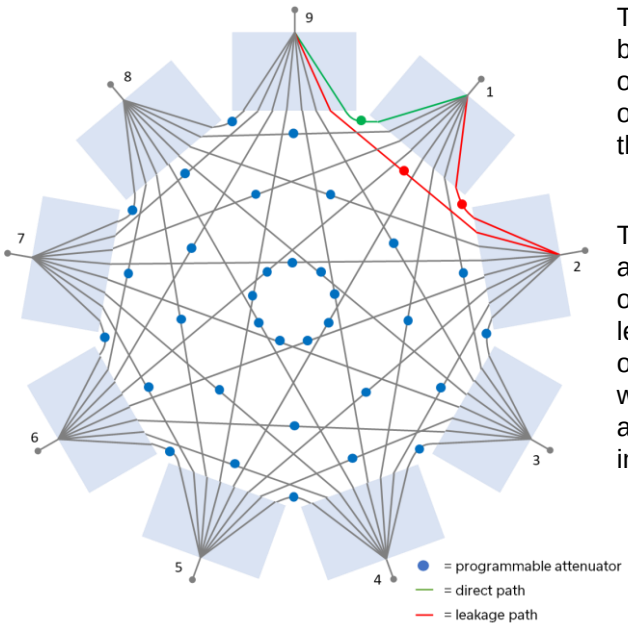
Dimensions	19” (W) x 3U (H) x 20” (D)			
Case Drawing	99-01-2786			
Case Material	Aluminum (with protective coating to prevent corrosion)			
RF Connectors	**Panel**	**Connector Options**	**Quantity**	**Port Labels**
	Front	• SMA female • N-type female • TNC female	9	1 - 9
Panel Items	**Front Panel**			**Rear Panel**
Other Connectors				• AC mains power input (IEC C14 inlet) • USB type B socket • RJ45 (LAN) socket
Other	• Power on / off switch with LED • Carry handles			
Power Supply	AC mains power input (90-260 V, 47-63 Hz)			
Fuse	2A, 250V rating			
Temperature	Operating: 0 to +50 ºC			

Electrical Specifications at 25°C

Parameter	Conditions	Min	Typical	Max	Unit
Frequency		500	-	6000	MHz
Insertion Loss[1]	500-3000 MHz	-	25	30	dB
	3000-6000 MHz	-	30	35	
Isolation	Direct path[2]		110		dB
	Leakage path[3]		65		
Input Return Loss		-	15	-	dB
Input Power		-	-	+30	dBm
Attenuation Range	Per Path	0	-	95	dB
Attenuation Steps	0 – 90dB Range	0.25	-	-	dB
	90 – 95dB Range	0.50	-	-	
Attenuation Accuracy	(Refer to RC4DAT-6G-95 datasheet)	-	± 0.50	-	dB

1. Path loss on the direct path between 2 ports when the attenuator in path is at 0 dB
2. Path loss on the direct path between 2 ports with all attenuators at 95 dB
3. Path loss on the leakage path between 2 ports with the 2 attenuators in the leakage path at 0 dB and all others at 95 dB

Mesh Isolation Characteristic



The green path in the diagram opposite is the direct path between ports 1 & 2. In an ideal mesh this would be the only route between these 2 ports. The insertion loss (IL) on the green direct path is approximately as below, when the attenuator highlighted in green is set to 0 dB:

$$IL_{DIRECT} = IL_{SPLITTER}+IL_{ATTENUATOR}+IL_{SPLITTER}$$

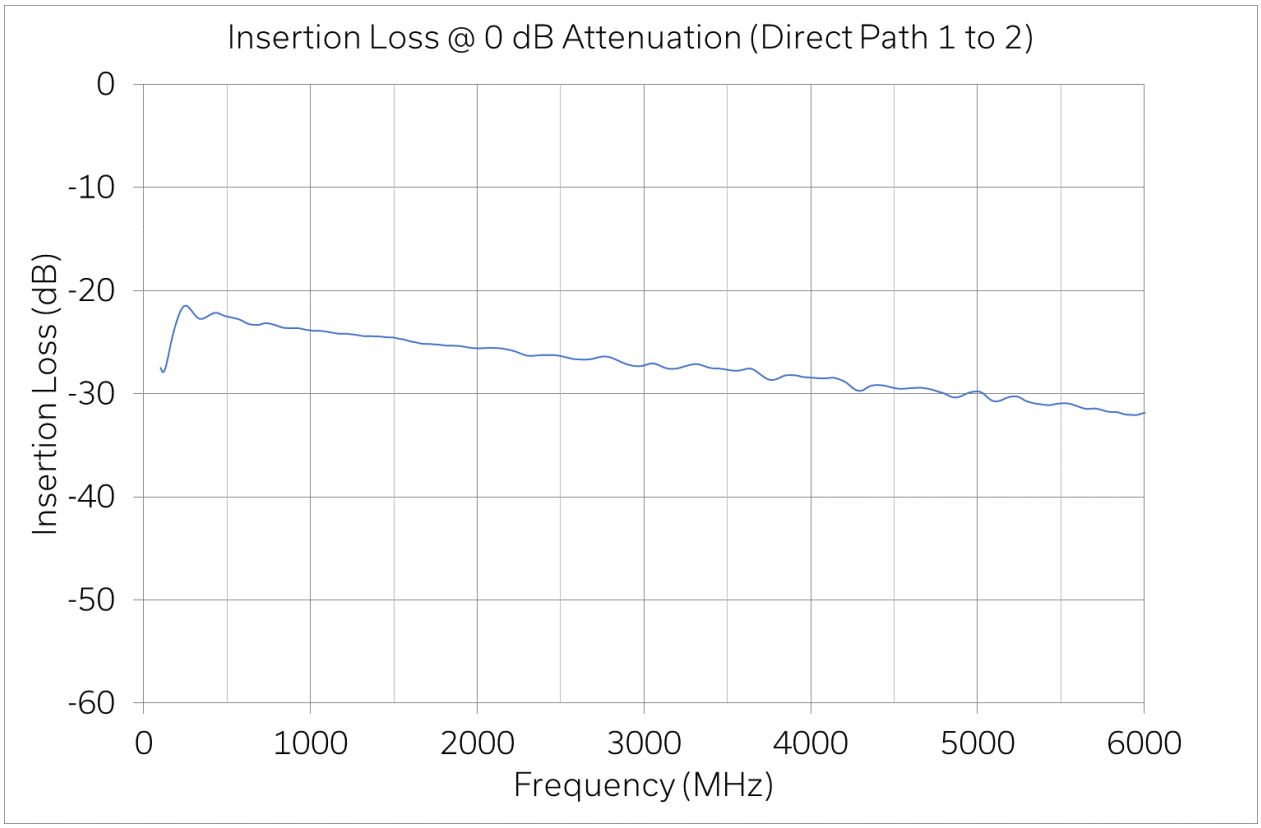
The red path highlights an indirect, leakage path which also exists between ports 1 & 2 due to the finite isolation of the splitter / combiner component. A number of similar leakage paths also exist across the output ports of the other splitter / combiner components within the mesh. The worst-case isolation (ISO) of the red leakage path is approximately as below, when the attenuators highlighted in red are set to 0 dB:

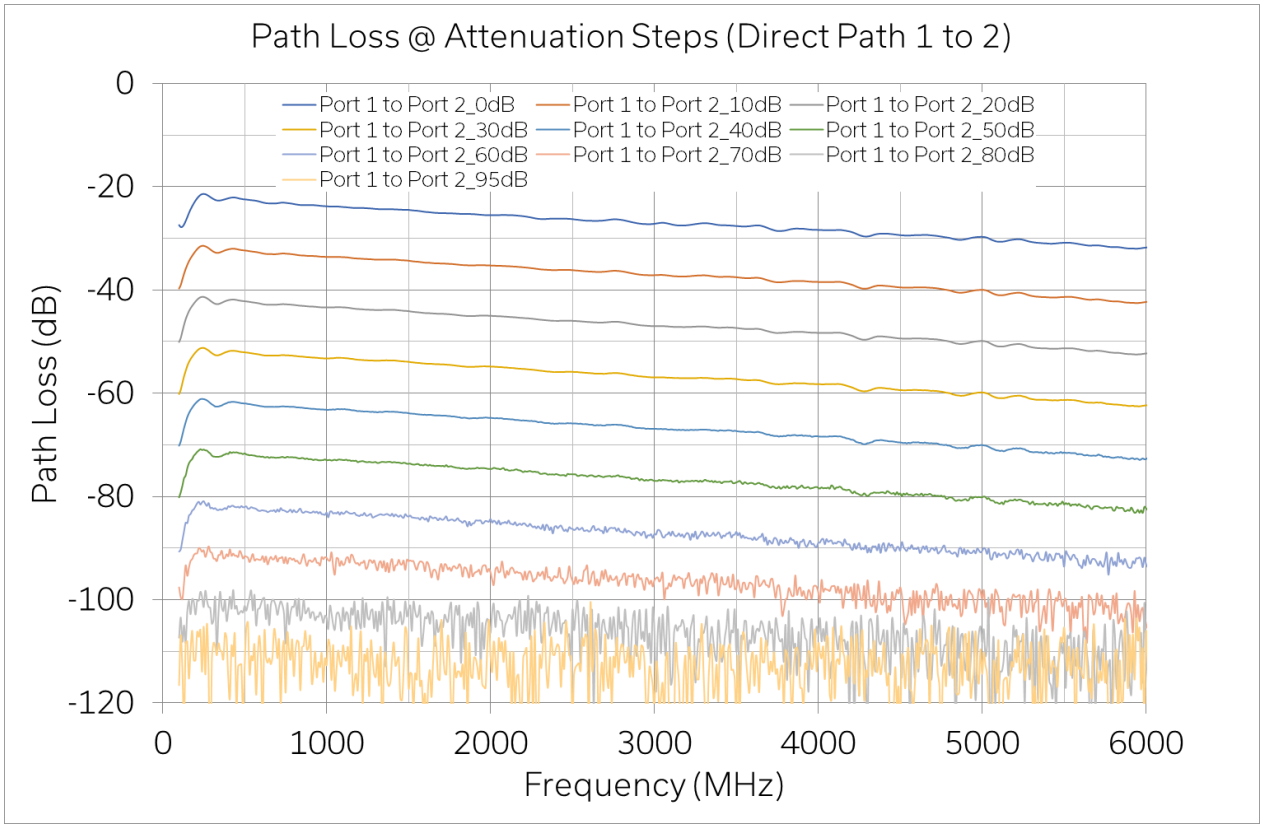
$$ISO_{LEAKAGE} = IL_{SPLITTER}+IL_{ATTENUATOR}+ISO_{SPLITTER}+IL_{ATTENUATOR}+IL_{SPLITTER}$$

Mini-Circuits minimizes the leakage paths by design; a well-designed splitter / combiner component can offer in the order of 20 dB isolation over a wide bandwidth. It is not possible to remove entirely the leakage paths but their effects can be mitigated during operation of the mesh through careful choice of the programmable attenuation values in path. Mini-Circuits' recommendations are:

1. Terminate any unused external ports around the mesh to ensure the best impedance match throughout.
2. Set all programmable attenuators to their maximum values (95 dB) initially to ensure all direct and leakage paths are isolated, then reduce the attenuation on the specific paths required by the test scenario.
3. When leakage paths are affecting measurements, consider increasing the value on all internal programmable attenuators to minimize their significance. Every 1 dB increase in insertion loss on all direct paths, leads to a 2 dB increase on all indirect paths.

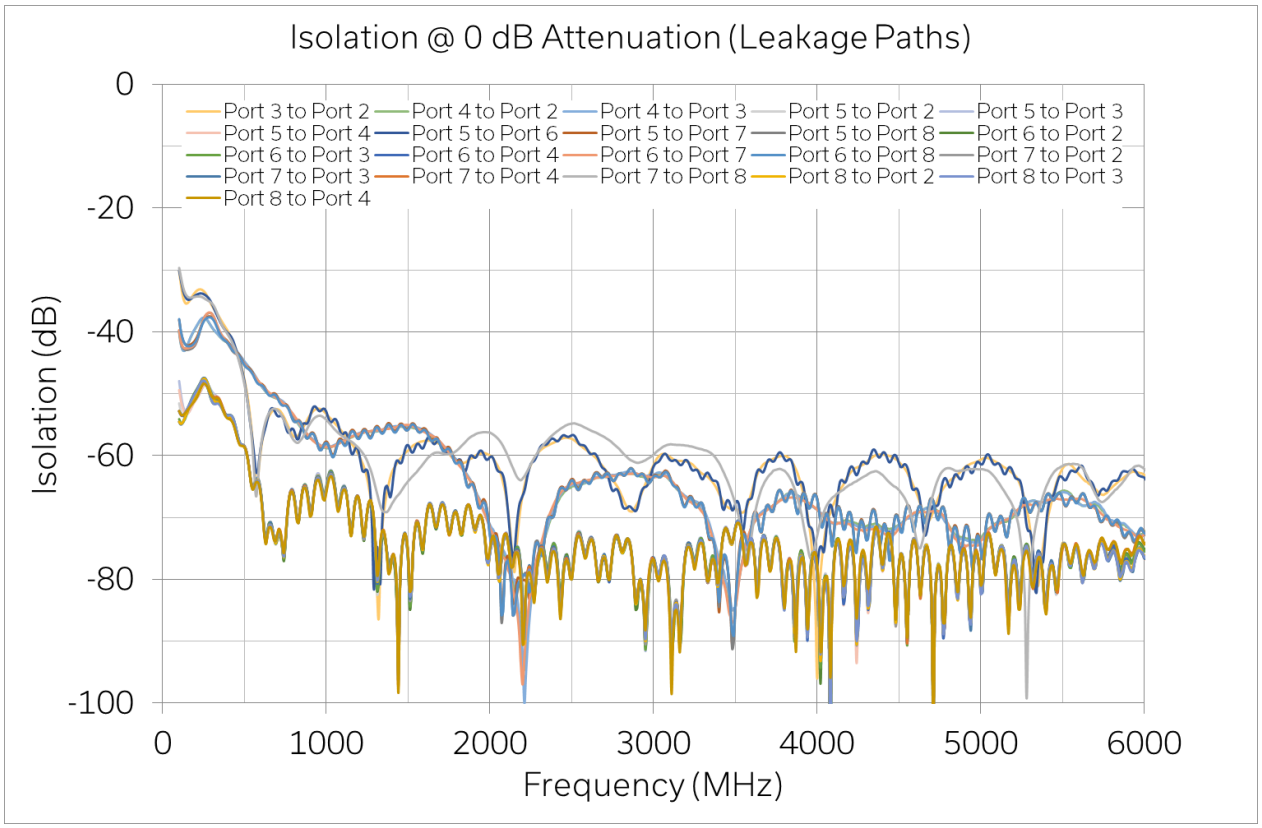
Typical Performance

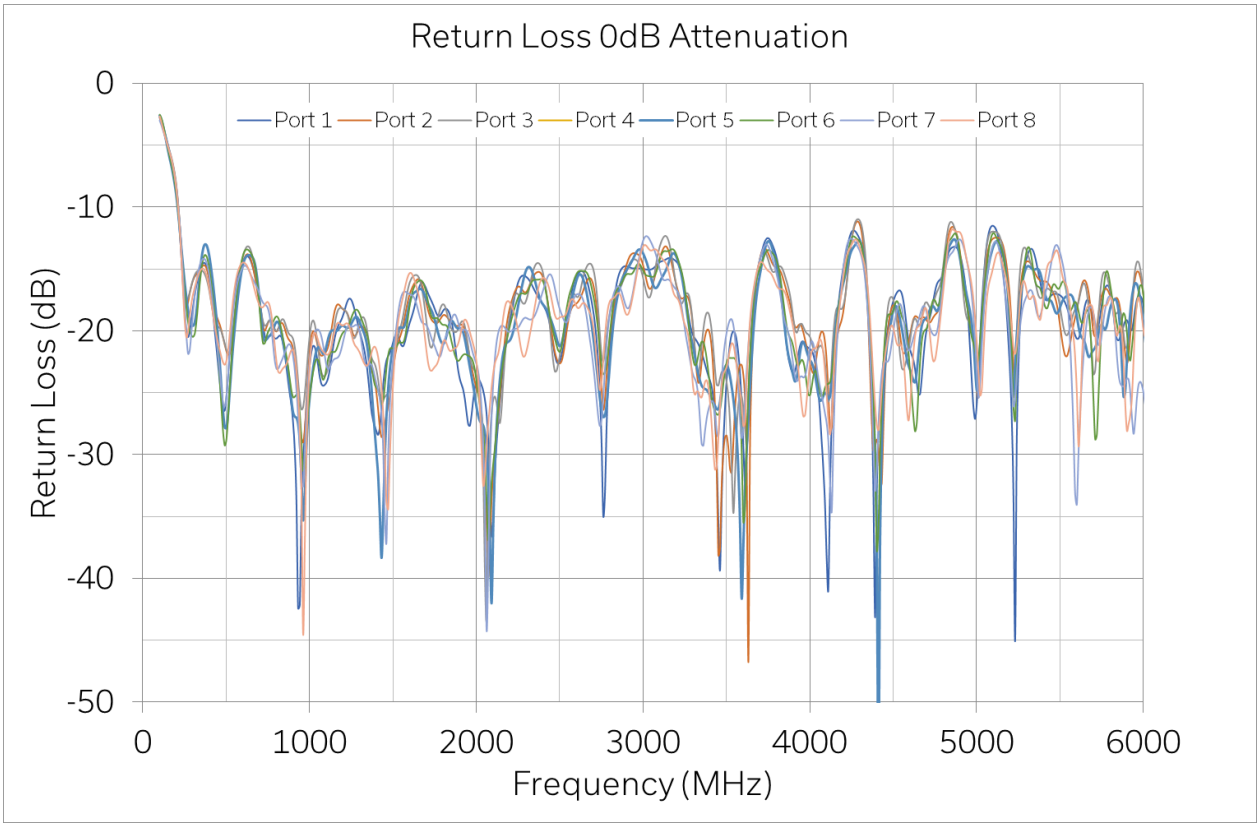




9-Port Mesh Network ZTMN-0995A

Typical Performance





Software Specifications

Software & Documentation Download:

- Mini-Circuits' full software and support package including user guide, Windows GUI, DLL files, programming manual and examples are available for download from: https://www.minicircuits.com/softwaredownload/multiatt.html
- Please contact testsolutions@minicircuits.com for support

Minimum System Requirements:

Parameter	Requirements	
Interface	USB HID & Ethernet (HTTP & Telnet)	
System Requirements	GUI	Windows 98 or later
	USB API DLL	Windows 98 or later and programming environment with ActiveX or .NET support
	USB Direct Programming	Linux; Windows 98 or later
	Ethernet	Windows, Linux or Mac computer with a network port and Ethernet TCP / IP support
Hardware	Pentium II or later with 256 MB RAM	

Application Programming Interface (API)

Ethernet Support:
- Simple ASCII / SCPI command set for attenuator control
- Communication via HTTP or Telnet
- Supported by most common programming environments

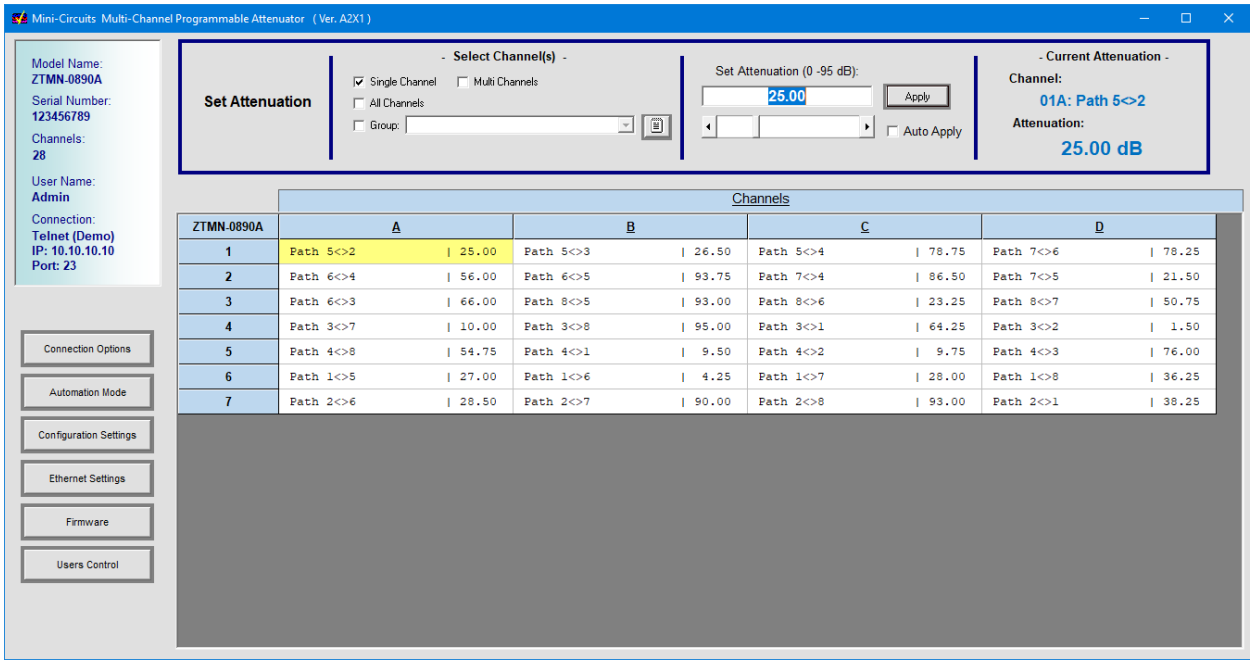
USB Support (Windows):
- ActiveX COM DLL file for creation of 32-bit programs
- .NET library DLL file for creation of 32 / 64-bit programs
- Supported by most common programming environments (refer to application note AN-49-001 for summary of supported environments)

USB Support (Linux):
- Direct USB programming using a series of USB interrupt codes

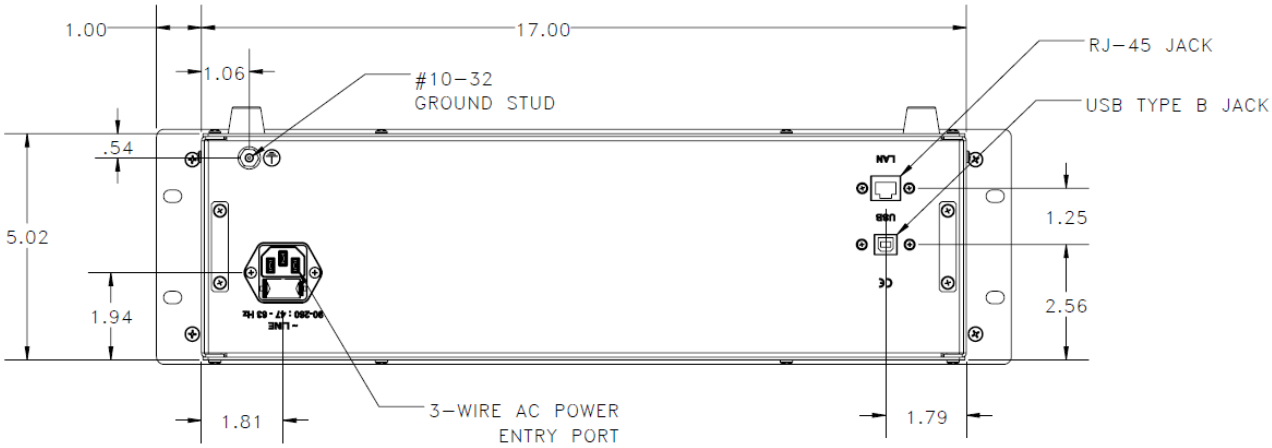
Full programming instructions and examples available for a wide range of programming environments / languages.

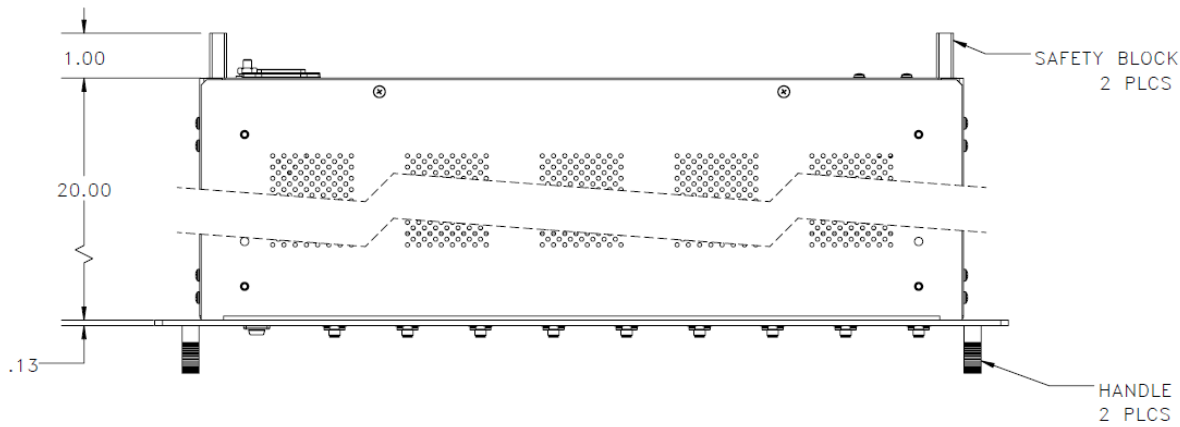
Graphical User Interface (GUI) for Windows - Key Features

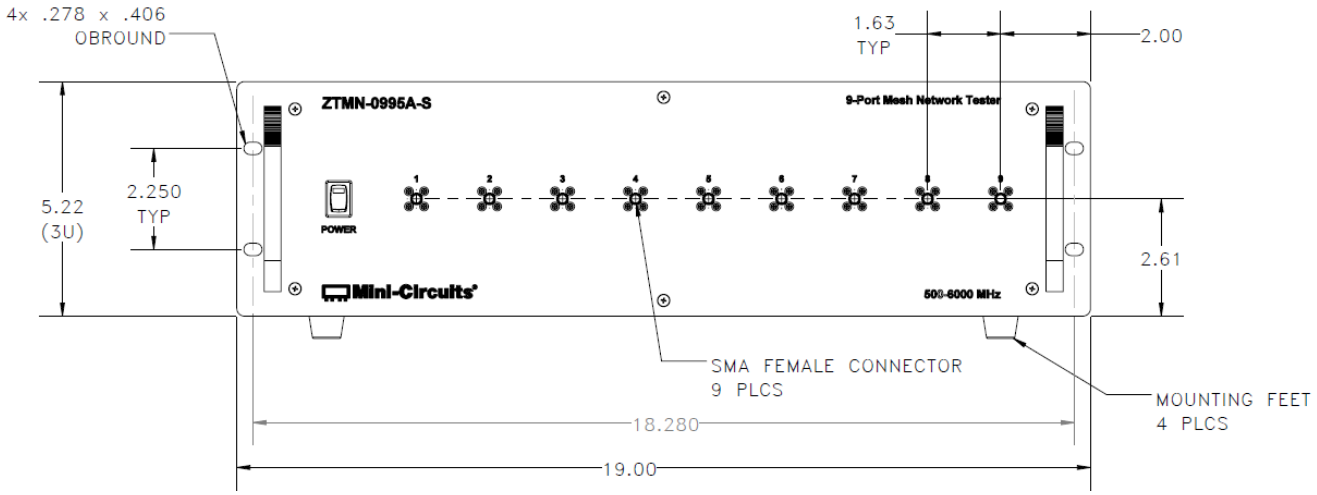
- Connect via USB or Ethernet
- Run GUI in “demo mode” to evaluate software without a hardware connection
- View and set all attenuation channels independently or in groups
- Configure automated attenuation sweep or hop sequences for groups of channels
- Configure Ethernet settings
- Upgrade firmware



Outline Drawing







Ordering Information

Please contact Mini-Circuits' Test Solutions department for price and availability:
testsolutions@minicircuits.com

Included Accessories

Model Name	Quantity	Description
CBL-3W-xx*	1	AC power cord (IEC C13 connector to local plug)
USB-CBL-AB-7+	1	USB cable (6.8 ft)
CBL-RJ45-MM-5+	1	Ethernet cable (5 ft)
HT-4-SMA	1	SMA Cable Wrench (4 in)

*Please specify one option on the purchase order, at no charge

Cable Model	Region
CBL-3W-US	USA
CBL-3W-EU	Europe
CBL-3W-IL	Israel
CBL-3W-UK	UK
CBL-3W-AU	Australia / China

Additional Notes

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.

C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp