USB & ETHERNET

Mechanical Switch Assembly

ZTMR-2

50Ω 8 x SPDT 18 GHz | 1 x SP6T 12 GHz Rack-Mount SMA Female

THE BIG DEAL

- Mechanical Absorptive Switches
- High Reliability, Millions of Switch Cycles
- Convenient Rack-Mountable Chassis
- SSH Secure Ethernet Communication
- Software Control & Automation
- LED Switch State Indicators

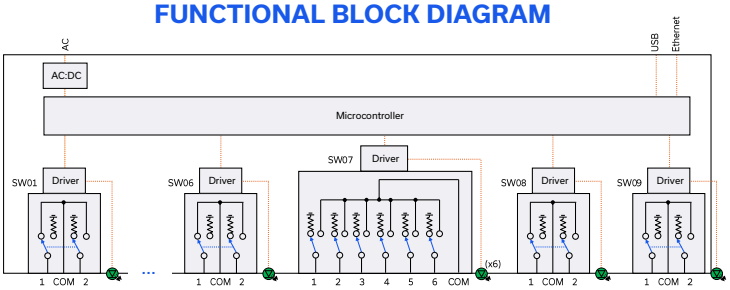


Generic photo used for illustration purposes only

APPLICATIONS

- Benchtop and Rack-Mounted Automated Test Systems
- 5G FR1 & FR3, WiFi 6E MIMO, UWB, Bluetooth
- Military Radio, Radar & Electronic Warfare
- Quantum Computing
- Switch Matrices

FUNCTIONAL BLOCK DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' ZTMR-2 houses a combination of independently controlled electro-mechanical SPDT and SP6T switches. Each switch operates over a wide bandwidth (from DC to 18 GHz for the SPDT switches and DC to 12 GHz for the SP6T) with high isolation and low insertion loss. The absorptive switches are failsafe with a break-before-make configuration and lifetime of millions of switching cycles when used within the noted specifications.

The switches are housed in a 19-inch rack chassis with all SMA (female) RF connectors on the rear along with LED switch state indicators for a visual display of all switch states. The switch assembly can be controlled via USB or Ethernet (supporting SSH, 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.

The modular design of the ZTMR series switch rack supports easy maintenance and re-configuration in the field, without the need to return the whole system to a Mini-Circuits facility. Custom switch configurations can be configured to fit any requirement.

KEY FEATURES

Feature	Advantages
Mechanical Switches	Mechanical absorptive switches provide low loss, high isolation, high reliability, repeatable performance and internal termination of input signals on the disconnected paths.
Flexible & Modular Design	Configure just the switch combination needed for your test application, with the flexibility to add or change switch modules in future as test requirements evolve.
Secure Ethernet Communication	Support for SSH (secure shell protocol) provides a means for secure communication over Ethernet networks with strict security policies. HTTP & Telnet communication via Ethernet are also supported.
Fail-Safe Design	The switches revert to a known default state when the DC supply is removed, allowing their use in systems that must continue to operate safely in the event of power failure.
Rack-Mount Chassis	Compact 3U height, 19" rack-mountable chassis suits integration in automated production test environments.
Integrated Control & Power	Easy to use on the lab bench or integrate into larger automated test systems without the need to develop custom control systems.

Mechanical Switch Assembly

ZTMR-2

50Ω 8 x SPDT 18 GHz | 1 x SP6T 12 GHz Rack-Mount SMA Female

ELECTRICAL SPECIFICATIONS AT +25°C (EACH SPDT SWITCH)

Parameter	Conditions	Min.	Typ.	Max.	Units
Frequency Range		DC		18	GHz
Insertion Loss	DC-8 GHz 8-12 GHz 12-18 GHz		0.15 0.25 0.30	0.30 0.40 0.50	dB
Isolation (Inactive Paths)[1]	DC-8 GHz 8-12 GHz 12-18 GHz	75 70 60	90 80 66		dB
Return Loss[2]	DC-8 GHz 8-12 GHz 12-18 GHz		20 20 19		dB
Switching Time			25		ms
RF Input Power (Cold Switching)	DC-18 GHz Into Internal Termination			20 1	W
Switch Lifetime	100 mW Hot Switching[3] 1 W Hot Switching		5 1		Million Cycles

1. Isolation measured between Com and any disconnected port. Example: Isolation for Com to 1 is the leakage measured at port 1 from a signal input at Com when the active switch path is set to Com to 2.
2. Return loss into all ports in all states.
3. Hot switching power above this level will degrade the switch lifetime.

ELECTRICAL SPECIFICATIONS AT +25°C (SP6T SWITCH)

Parameter	Conditions	Min.	Typ.	Max.	Units
Frequency Range		DC		12	GHz
Insertion Loss	DC-6 GHz 6-8 GHz 8-12 GHz		0.15 0.20 0.25	0.25 0.30 0.45	dB
Isolation (Inactive Paths)[4]	DC-6 GHz 6-8 GHz 8-12 GHz	80 80 80	95 90 90		dB
Return Loss[5]	DC-6 GHz 6-8 GHz 8-12 GHz		20 20 20		dB
Switching Time			25		ms
RF Input Power (Cold Switching)	Through Path Into Internal Termination			20 1	W
Switch Lifetime	100 mW Hot Switching[6] 1 W Hot Switching	10	 1		Million Cycles

4. Isolation measured between Com and any disconnected port. Example: Isolation for Com to 1 is the leakage measured at port 1 from a signal input at Com when the active switch path is set to Com to 2.
5. Return loss into Com when active or ports 1-6 in any state; Com is reflective when disconnected.
6. Hot switching power above this level will degrade the switch lifetime.

Mechanical Switch Assembly ZTMR-2

50Ω 8 x SPDT 18 GHz | 1 x SP6T 12 GHz Rack-Mount SMA Female

CONTROL INTERFACES

Ethernet Control	Supported Protocols	TCP / IP, SSH, HTTP, Telnet, DHCP, UDP (limited)
	Max Data Rate	100 Mbps (100Base-T Full Duplex)
USB Control	Supported Protocols	HID – High Speed
	Min Communication Time[7]	400 µs typ.

7. Based on the polling interval of the USB HID protocol (125 µs with 64 bytes per packet) and no other significant CPU or USB activity.

SOFTWARE & DOCUMENTATION

Mini-Circuits' full software and support package including user guide, Windows GUI, API, programming manual and examples can be downloaded free of charge (refer to the last page for the download path).

A comprehensive set of software control options is provided:

- GUI for Windows – Simple software interface for control via Ethernet and USB
- Programming / automation via Ethernet
  - Complete set of control commands which can be sent via any supported protocol – simple to implement in the majority of modern programming environments

- Programming / automation via USB
  - DLL files provide a full API for Windows with a set of intuitive functions which can be implemented in any programming environment supporting .Net Framework or ActiveX
  - Direct USB programming is possible in any other environment (not supporting .Net or ActiveX)

Please contact testsolutions@minicircuits.com for support.

MINIMUM SYSTEM REQUIREMENTS

Hardware	Intel i3 (or equivalent) or later
GUI (USB or Ethernet Control)	Windows 7 or later
USB API DLL	Windows 7 or later with support for Microsoft .Net Framework or ActiveX
USB Direct Programming	Windows 7 or later; Linux
Ethernet	Windows, Linux or macOS with Ethernet TCP / IP support

PROGRAMMING COMMANDS

The key ASCII / SCPI commands for control of the system for control via the Ethernet or USB API are summarized below (refer to the programming manual for full details):

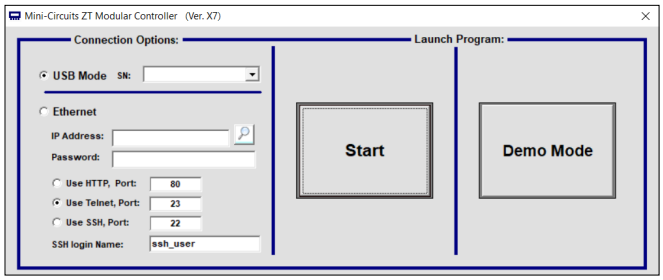
Command / Query	Description
:MN?	Read model name
:SN?	Read serial number
:FIRMWARE?	Read firmware version
:[sw_type]:[sw_label]:STATE:[port]	Set a single switch state: • [sw_type] = SPDT or SP6T • [sw_label] = Switch number (1 to 9) • [port] = The port to be connected to Com of the specified switch • Example :SPDT:1:STATE:2
:[sw_type]:[sw_label]:STATE?	Get the state of a single switch: • [sw_type] = SPDT or SP6T • [sw_label] = Switch number (1 to 9) • Example :SPDT:1:STATE?

Mechanical Switch Assembly ZTMR-2

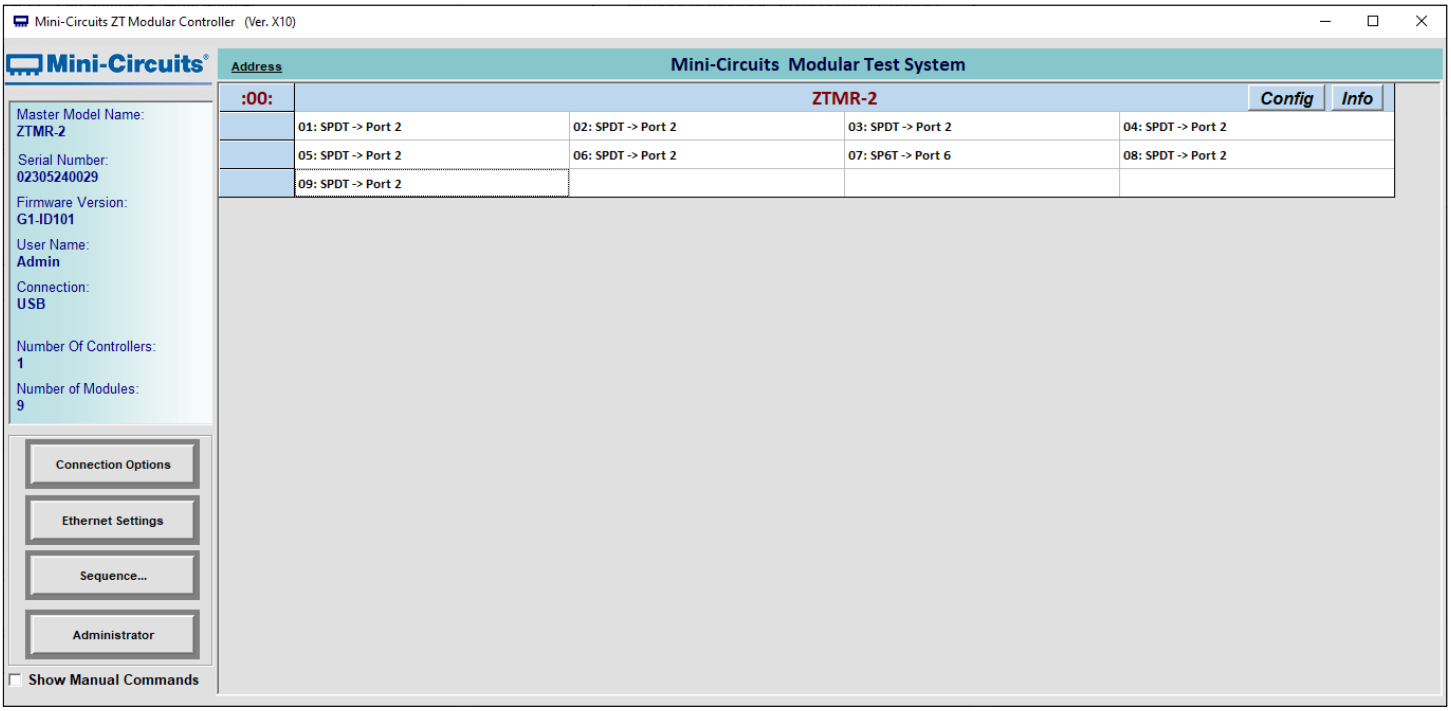
50Ω 8 x SPDT 18 GHz | 1 x SP6T 12 GHz Rack-Mount SMA Female

GRAPHICAL USER INTERFACE (GUI) FOR WINDOWS

- Connect via USB or Ethernet
- Run GUI in “demo mode” to evaluate software without a hardware connection



- View and set all switch states at the click of a button
- Configure automated switching sequences
- Define custom switch and port labels
- Set switch power-up states
- Configure Ethernet settings
- Update firmware

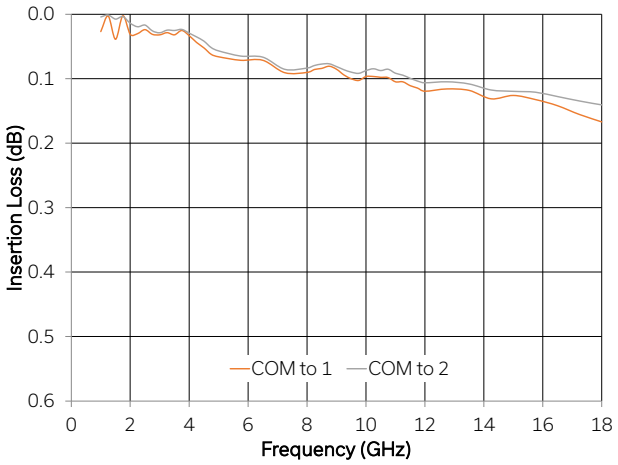


Mechanical Switch Assembly ZTMR-2

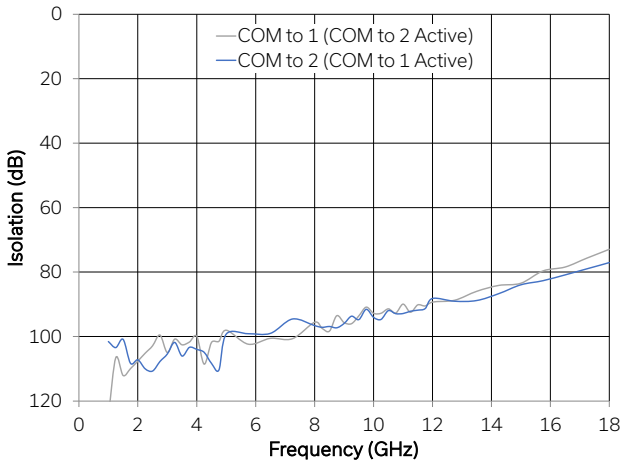
50Ω 8 x SPDT 18 GHz | 1 x SP6T 12 GHz Rack-Mount SMA Female

TYPICAL PERFORMANCE GRAPHS

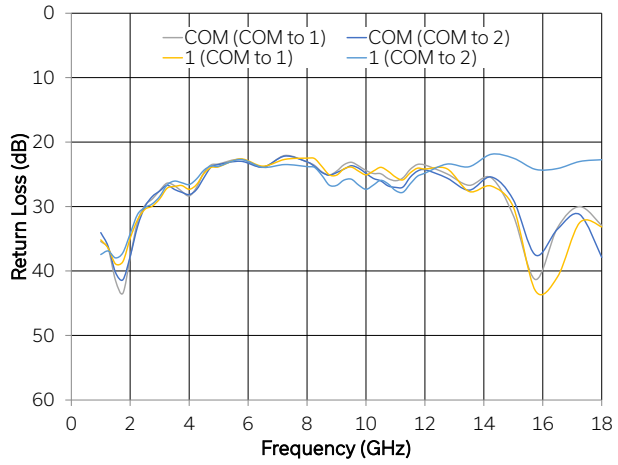
SPDT - Insertion Loss



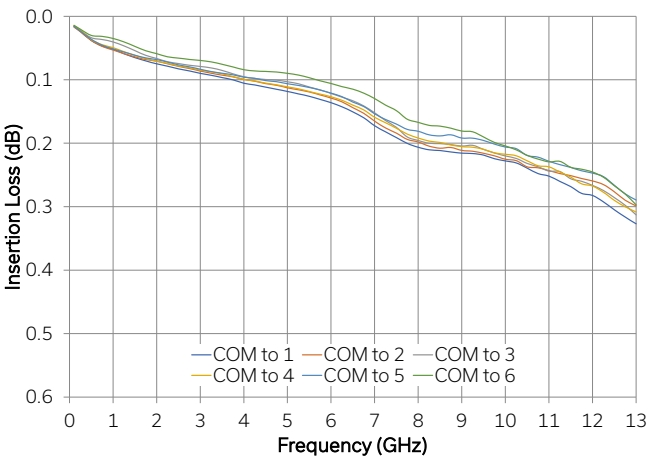
SPDT - Isolation (Inactive Paths)



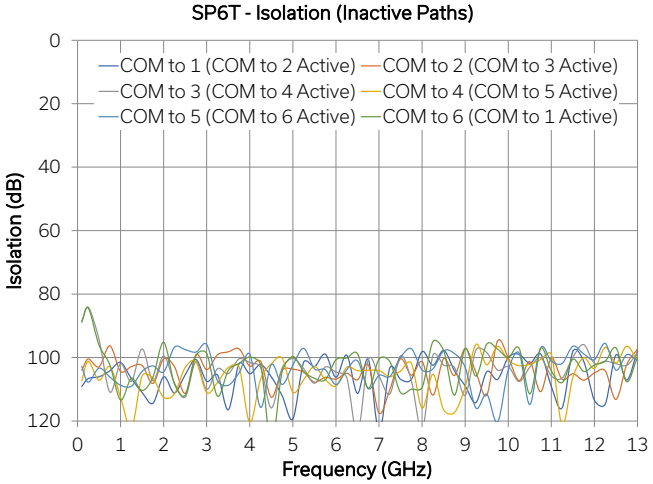
SPDT - Return Loss



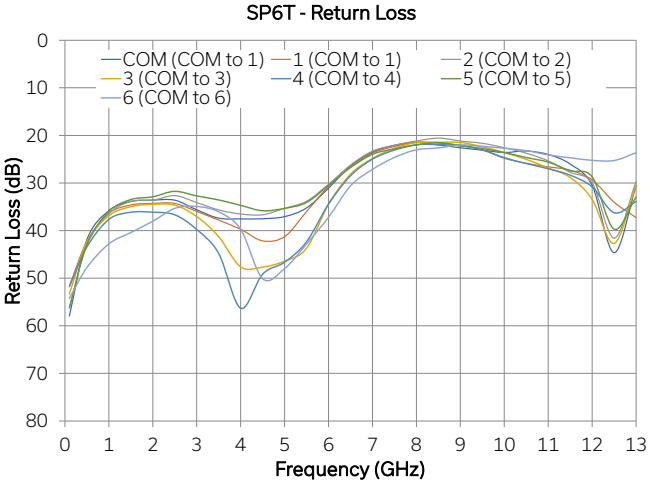
SP6T - Insertion Loss



SP6T - Isolation (Inactive Paths)



SP6T - Return Loss



Mechanical Switch Assembly

ZTMR-2

50Ω 8 x SPDT 18 GHz | 1 x SP6T 12 GHz Rack-Mount SMA Female

ABSOLUTE MAXIMUM RATINGS[8]

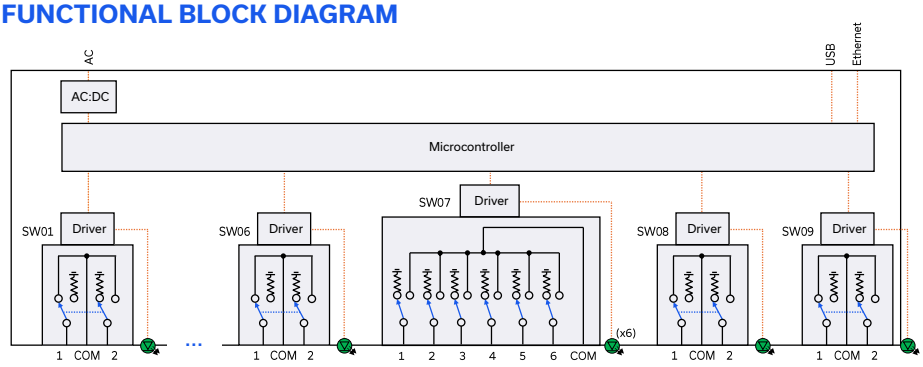
Parameter	Conditions	Limits	Units
Temperature	Operating	0 to +50	°C
	Storage	-20 to +60	
Input Power (No Damage)	Cold Switching	20	W
	Hot Switching	1	
	Into Internal Termination	1	

8. Permanent damage may occur if any of these limits are exceeded. Operating in the range between operating power limits and absolute maximum ratings for extended periods of time may result in reduced life and reliability.

POWER SUPPLY

Power Supply	AC mains input: +100 V to +240 V, 50 / 60 Hz
Fuse	2 A, +250 V rating
Power Consumption	300 W maximum

FUNCTIONAL BLOCK DIAGRAM



CONNECTIONS

Port	Connector
COM & 1-2 (Each SPDT)	SMA Female
COM & 1-6 (SP6T)	SMA Female
USB	USB Type B
Ethernet / LAN	RJ45
AC Input	IEC C14 Inlet

COM = Common port
1-6 = input / output ports

SWITCH STATE TABLE (EACH SPDT SWITCH)

Switch Command	Switch x State	Switch x LED State
:SPDT:[x]:STATE:1	COM to 1	Green
:SPDT:[x]:STATE:2	COM to 2	Orange

x = switch label

SWITCH STATE TABLE (SP6T SWITCH)

Switch Command	Switch x State	Switch x LED State					
		LED1	LED2	LED3	LED4	LED5	LED6
:SP6T:7:STATE:0	All ports disconnected (COM open; 1-6 terminated)	Off	Off	Off	Off	Off	Off
:SP6T:7:STATE:1	C to 1	On	Off	Off	Off	Off	Off
:SP6T:7:STATE:2	C to 2	Off	On	Off	Off	Off	Off
:SP6T:7:STATE:3	C to 3	Off	Off	On	Off	Off	Off
:SP6T:7:STATE:4	C to 4	Off	Off	Off	On	Off	Off
:SP6T:7:STATE:5	C to 5	Off	Off	Off	Off	On	Off
:SP6T:7:STATE:6	C to 6	Off	Off	Off	Off	Off	On

POWER-UP OPTIONS

Mode	Initial Switch Paths
Default	All switches power up in the default state: SPDT: COM to 1 SP6T: All ports disconnected
Last States	All switches resume the previous state from the point of last power supply disconnection

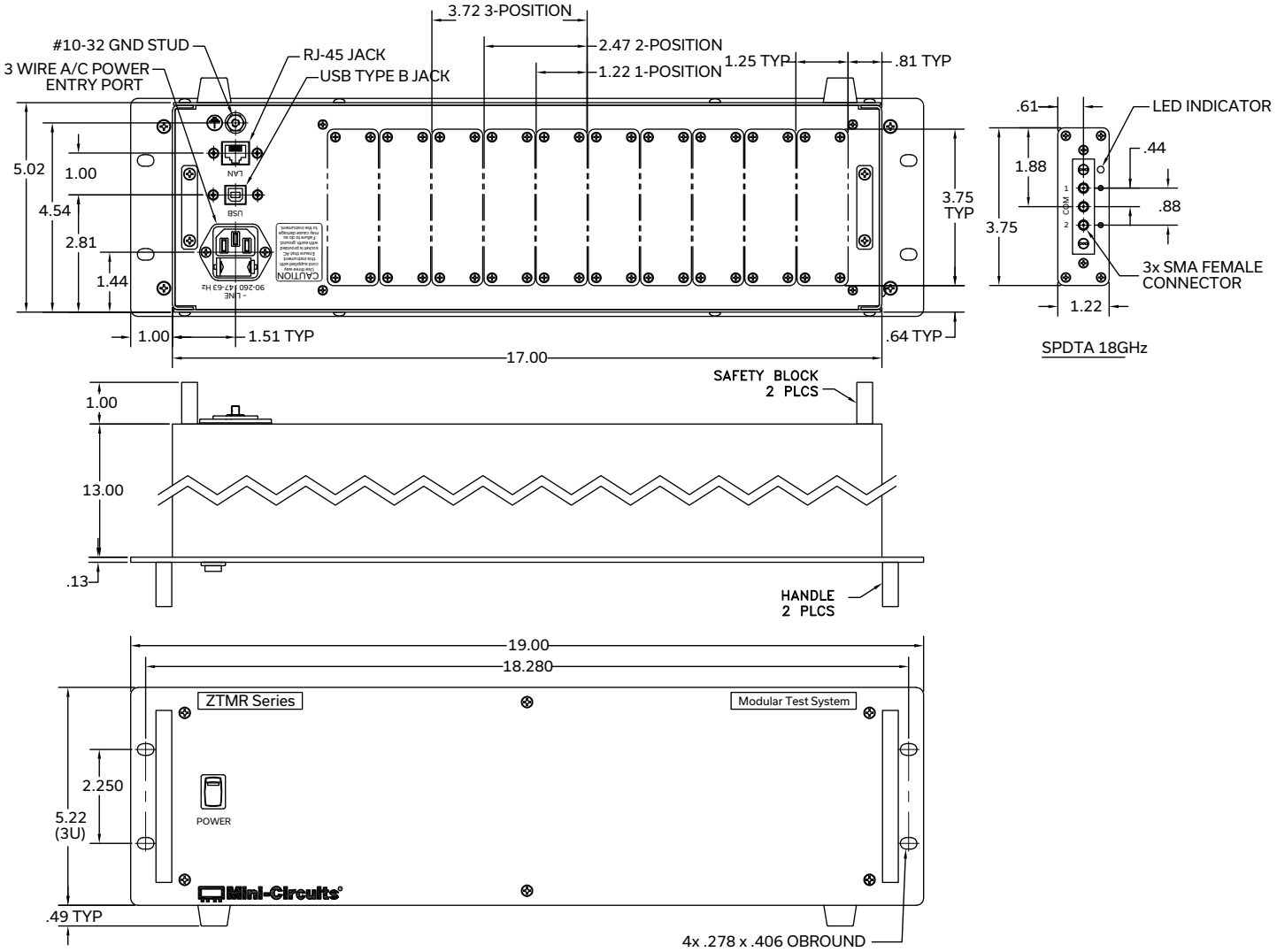
All switches revert to the default state when the power supply is turned off or disconnected

Mechanical Switch Assembly

ZTMR-2

50Ω 8 x SPDT 18 GHz | 1 x SP6T 12 GHz Rack-Mount SMA Female

CASE STYLE DRAWING



PRODUCT MARKING*

Product Marking: ZTMR-2
Product Description: Modular Test System
Unit ID Label: Serial number and other identification marks
*Marking may contain other features or characters for internal lot control.

Mechanical Switch Assembly

ZTMR-2

50Ω 8 x SPDT 18 GHz | 1 x SP6T 12 GHz Rack-Mount SMA Female

DETAILED MODEL INFORMATION IS AVAILABLE ON OUR WEBSITE CLICK HERE

Case Style	99-01-3597
Software, User Guide & Programming Manual	https://www.minicircuits.com/softwaredownload/ztm_ztm2.html
Environmental Rating	ENV55
Regulatory Compliance	Refer to our website for compliance methodologies and qualifications CE UKCA www.minicircuits.com/quality/environmental_introduction.html

Contact Us: testsolutions@minicircuits.com

Included Accessories	Part Number	Description
	USB-CBL-AB-7+	USB cable (6.8ft) type A to type B
	CBL-RJ45-MM-5+	Ethernet cable (5 ft)
	HT-4-SMA	SMA connector wrench (4" length)
	CBL-3W-xx	AC power cord (IEC C13 connector to local plug) Select one option from the list below. Please contact testsolutions@minicircuits.com if your regions is not listed.

AC Power Cord Options	Part Number	Description
	CBL-3W-US	USA NEMA 5-15 plug (type B) to IEC C13 connector
	CBL-3W-EU	Europe CEE 7/7 plug (type E/F) to IEC C13 connector
	CBL-3W-UK	UK BS-1363 plug (type G) to IEC C13 connector
	CBL-3W-AU	Australia & China AS/NZS 3112 plug (type I) to IEC C13 connector
	CBL-3W-IL	Israel SI-32 plug (type H) to IEC C13 connector

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/terms/viewterm.html

Mini-Circuits

Environmental Specifications **ENV55**

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-0° to 50° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-20° to 60° C Ambient Environment	Individual Model Data Sheet
Operating and Storage Humidity	5% to 85% RH (non-condensing)	Ambient
Bench Handling Test	Bench Top Tip 45° & Drop	MIL-PRF-28800F
Transit Drop Test	Free Fall Drop, 20 cm (7.9 inches)	MIL-PRF-28800F Class 3

This document and its contents are the property of Mini-Circuits