

Mechanical Switch Assembly **ZT-2SP16T-18**

50Ω DC to 18 GHz 2 x SP16T Rack-Mount SMA Female

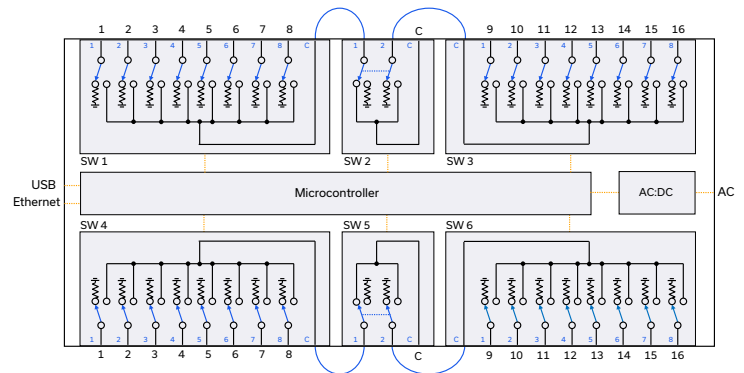
## THE BIG DEAL

- Mechanical absorptive switches
- 2 x SPDT + 4 x SP8T or configure into 2 x SP16T
- Ethernet & USB control
- Fail-safe / redundancy switching
- LED switch state indicators
- SSH secure Ethernet communication



Generic photo used for illustration purposes only

## FUNCTIONAL BLOCK DIAGRAM



## APPLICATIONS

- Benchtop and rack-mounted automated test systems
- 5G FR1, WiFi 6E, UWB, Bluetooth
- Military radio, radar & electronic warfare
- Switch matrices

## PRODUCT OVERVIEW

Mini-Circuits' ZT-2SP16T-18 houses 2 x SPDT and 4 x SP8T absorptive electro-mechanical switches. Each switch operates over an extremely wide bandwidth, from DC to 18 GHz with high isolation and low insertion loss. The switches can be conveniently interconnected on the front panel, using Mini-Circuits' 141-3SMR+ conformable cables, to form a pair of SP16T switches.

The switches are housed in a compact, 2U height, 19-inch rack chassis with all SMA (female) RF connectors on the front. LED switch state indicators on the front panel enable visual display of all switch states. The switch assembly 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.

## 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                        |
| 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                         |
| Break-before-make configuration | Prevents a momentary connection of the old and new signal paths, reducing the inconsistent transient effects that could otherwise be observed during switching                                       |
| Rack-mount chassis              | Compact 2U height, 19" rack-mountable chassis suits integration in automated production test environments.   |
| 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. |

Mechanical Switch Assembly **ZT-2SP16T-18**

50Ω DC to 18 GHz 2 x SP16T Rack-Mount SMA Female

**ELECTRICAL SPECIFICATIONS AT +25°C (EACH SP16T SWITCH)**

Interconnected using 141-3SMR+ cables

| Parameter       | Conditions  | Min. | Typ. | Max. | Units |
|-----------------|-------------|------|------|------|-------|
| Frequency Range |             | DC   |      | 18   | GHz   |
| Insertion Loss  | DC – 8 GHz  |      | 0.45 |      | dB    |
|                 | 8 – 12 GHz  |      | 0.65 |      |       |
|                 | 12 – 18 GHz |      | 0.90 |      |       |
| Isolation       | DC – 8 GHz  |      | 90   |      | dB    |
|                 | 8 – 12 GHz  |      | 85   |      |       |
|                 | 12 – 18 GHz |      | 80   |      |       |
| Return Loss     | DC – 8 GHz  |      | 20   |      | dB    |
|                 | 8 – 12 GHz  |      | 20   |      |       |
|                 | 12 – 18 GHz |      | 15   |      |       |

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

| Parameter                          | Conditions  | Min. | Typ. | Max.    | Units          |
|------------------------------------|---|------|------|---------|----------------|
| Insertion Loss                     | DC – 8 GHz  |      | 0.15 | 0.30    | dB             |
|                                    | 8 – 12 GHz  |      | 0.25 | 0.40    |                |
|                                    | 12 – 18 GHz   |      | 0.30 | 0.50    |                |
| Isolation                          | DC – 8 GHz  | 75   | 90   |         | dB             |
|                                    | 8 – 12 GHz  | 70   | 80   |         |                |
|                                    | 12 – 18 GHz   | 60   | 66   |         |                |
| Return Loss                        | DC – 8 GHz  |      | 20   |         | dB             |
|                                    | 8 – 12 GHz  |      | 20   |         |                |
|                                    | 12 – 18 GHz   |      | 19   |         |                |
| Switching Time                     | -   |      | 25   |         | ms             |
| RF Input Power<br>(Cold switching) | DC-18 GHz<br>Into internal termination <sup>1</sup> |      |      | 20<br>1 | W              |
| Switch Lifetime                    | 100 mW hot switching <sup>2</sup>                   |      | 5    |         | million cycles |
|                                    | 1W hot switching                                    |      | 1    |         |                |

**ELECTRICAL SPECIFICATIONS AT +25°C (EACH SP8T SWITCH)**

| Parameter                          | Conditions                             | Min. | Typ. | Max. | Units          |
|------------------------------------|--|------|------|------|----------------|
| Insertion Loss                     | DC – 8 GHz                             |      | 0.15 | 0.30 | dB             |
|                                    | 8 – 18 GHz                             |      | 0.35 | 0.60 |                |
| Isolation                          | DC – 8 GHz                             | 70   | 80   |      | dB             |
|                                    | 8 – 18 GHz                             | 60   | 75   |      |                |
| Return Loss                        | DC – 8 GHz                             |      | 20   |      | dB             |
|                                    | 8 – 18 GHz                             |      | 16   |      |                |
| Switching Time                     | -                                      |      | 25   |      | ms             |
| RF Input Power<br>(Cold switching) | DC – 8 GHz                             |      |      | 20   | W              |
|                                    | 8 – 18 GHz                             |      |      | 10   |                |
|                                    | Into internal termination <sup>1</sup> |      |      | 1    |                |
| Switch Lifetime                    | 100 mW hot switching <sup>2</sup>      | 2    |      |      | million cycles |
|                                    | 1W hot switching                       |      | 1    |      |                |

<sup>1</sup> Maximum power into any internal termination is 1W per port, 3W total per switch<sup>2</sup> Hot switching power above this level will degrade the switch lifetime

Mechanical Switch Assembly **ZT-2SP16T-18**

50Ω DC to 18 GHz 2 x SP16T Rack-Mount SMA Female

## CONTROL INTERFACES

|                  |                                     |  |
|------------------|-------------------------------------|--|
| Ethernet Control | Supported Protocols                 | TCP / IP, SSH, HTTP, Telnet, DHCP, UDP (limited) |
|                  | Max Data Rate                       | 100 Mbps (100 Base-T Full Duplex)                |
| USB Control      | Supported Protocols                 | HID – High Speed                                 |
|                  | Min Communication Time <sup>3</sup> | 400 μs typ                                       |

3. Based on the polling interval of the USB HID protocol ((125 us with 1024 bytes per packet) and no other significant CPU or USB activity)

## SOFTWARE &amp; 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](mailto: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):

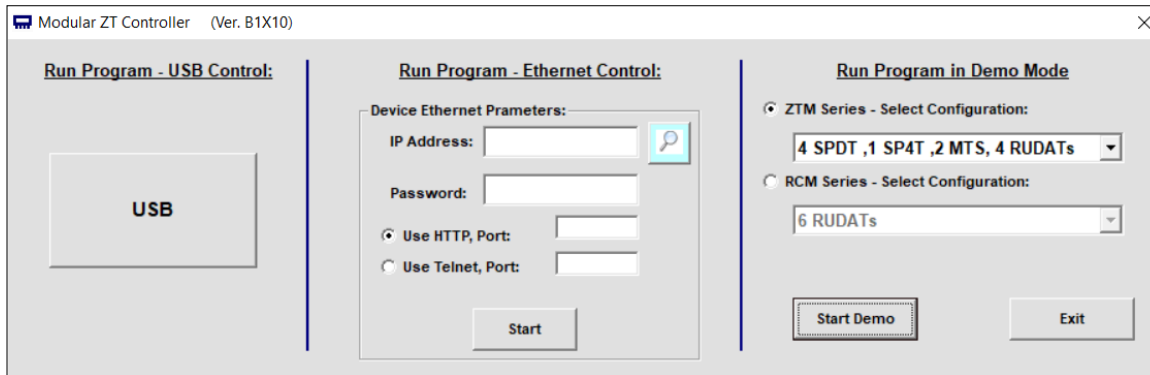
| Command / Query                            | Description   |
|--|---|
| :MN?                                       | Read model name   |
| :SN?                                       | Read serial number  |
| :FIRMWARE?                                 | Read firmware version   |
| : <b>[sw_type]:[sw_label]:STATE:[port]</b> | Set a single switch state:<br>[sw_type] = SPDT or SP8T<br>[sw_label] = 1 to 6<br>[port] = For SPDT switches: 1 (Com to 1) or 2 (Com to 2)<br>= For SP8T switches: 0 (all ports disconnected) to 8 (Com to 8)<br>Example :SP8T:3:STATE:8 (set switch SP8T switch 3 to state 8) |
| : <b>[sw_type]:[sw_label]:STATE?</b>       | Get a single switch state:<br>[sw_type] = SPDT or SP8T<br>[sw_label] = 1 to 6<br>Example :SP8T:3:STATE:8 (set switch SP8T switch 3 to state 8)  |

Mechanical Switch Assembly **ZT-2SP16T-18**

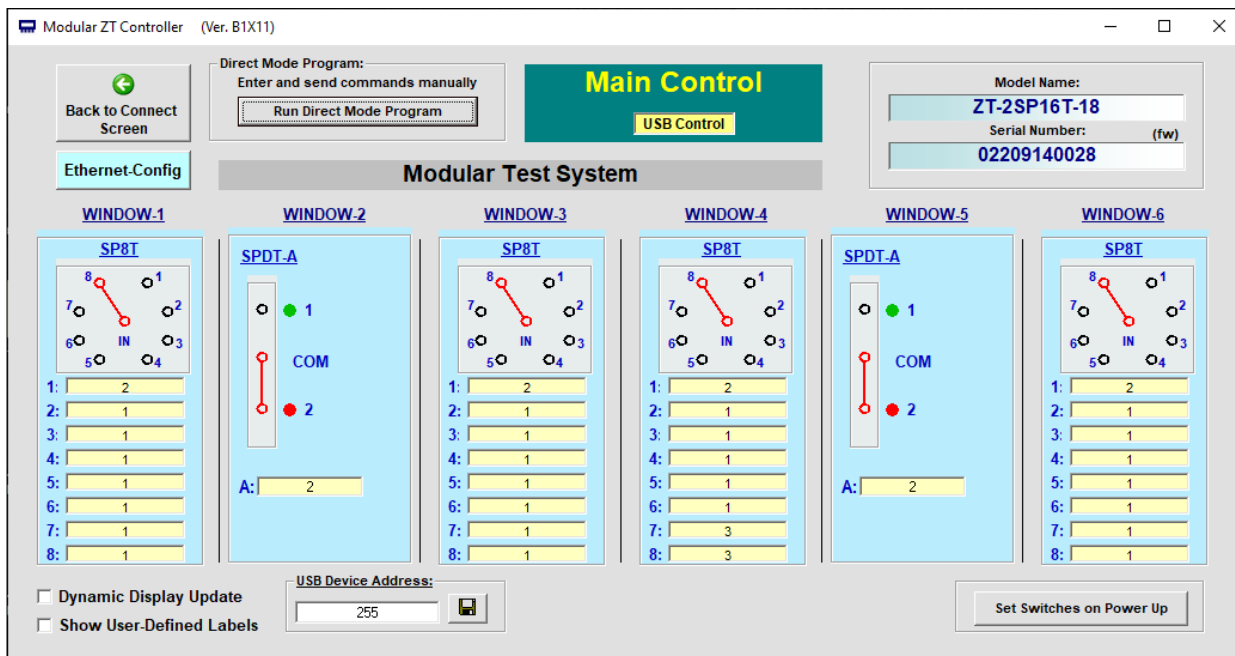
50Ω DC to 18 GHz 2 x SP16T Rack-Mount SMA Female

**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
- Set switch power-up states
- Configure Ethernet settings
- Update firmware





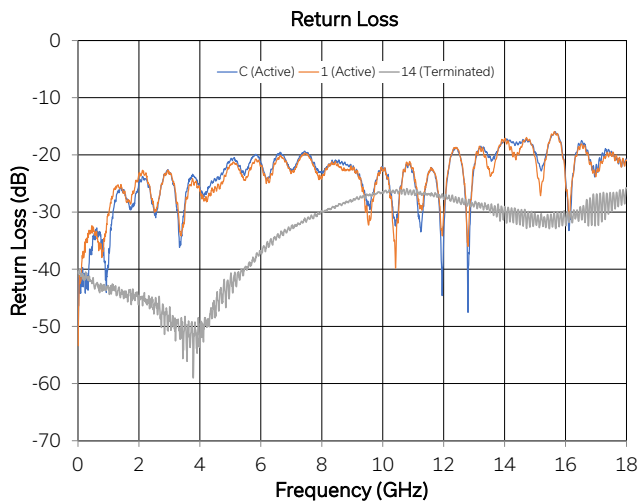
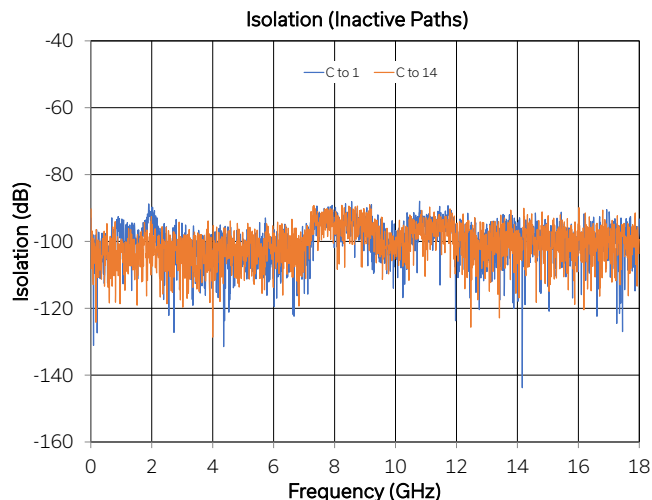
# Mechanical Switch Assembly **ZT-2SP16T-18**

50Ω DC to 18 GHz 2 x SP16T Rack-Mount SMA Female

## TYPICAL PERFORMANCE CURVES EACH SP16T SWITCH

Isolation measured between Com and any disconnected port.

Example: "C to 1" is the leakage measured at port 1 when the active switch path is C to 2.



Mechanical Switch Assembly **ZT-2SP16T-18**

50Ω DC to 18 GHz 2 x SP16T Rack-Mount SMA Female

## ABSOLUTE MAXIMUM RATINGS

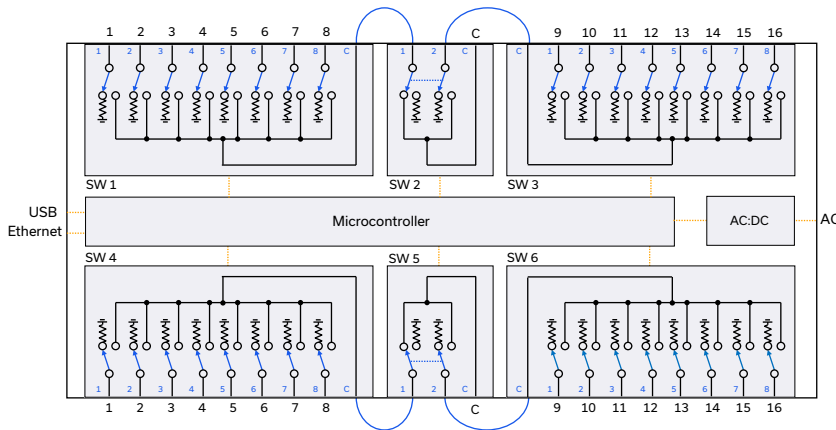
| Parameter                  | Conditions                | Limits     | Units |
|----------------------------|---------------------------|------------|-------|
| Temperature                | Operating                 | 0 to +50   | °C    |
|                            | Storage                   | -20 to +60 |       |
| Input Power<br>(No Damage) | Cold switching            |            | W     |
|                            | Each SPDT (DC-18 GHz)     | 20         |       |
|                            | Each SP8T (DC-8 GHz)      | 20         |       |
|                            | Each SP8T (8-18 GHz)      | 10         |       |
|                            | Hot switching             | 1          |       |
|                            | Into internal termination | 1          |       |

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:<br>100-240 V, 50 / 60 Hz |
| Fuse              | 2A, 250V rating                          |
| Power Consumption | 150W maximum                             |

## FUNCTIONAL BLOCK DIAGRAM



Shown with 4 external cable connections to create 2 x SP16T configuration

## CONNECTIONS

| Port                | Connector     |
|---------------------|---------------|
| C & 1-2 (each SPDT) | SMA female    |
| C & 1-8 (each SP8T) | SMA female    |
| USB                 | USB type B    |
| Ethernet / LAN      | RJ45          |
| AC Input            | IEC C14 inlet |

C = Com port  
1-8 = input / output ports

## SWITCH STATE TABLES

Each SP8T Switch:

| Switch Command    | Switch State   | Switch x LED State |      |      |      |      |      |      |      |
|-------------------|--|--------------------|------|------|------|------|------|------|------|
|                   |  | LED1               | LED2 | LED3 | LED4 | LED5 | LED6 | LED7 | LED8 |
| :SP8T:[x]:STATE:0 | All ports disconnected<br>(C open; ports 1-8 terminated) | Off                | Off  | Off  | Off  | Off  | Off  | Off  | Off  |
| :SP8T:[x]:STATE:1 | C to 1   | On                 | Off  | Off  | Off  | Off  | Off  | Off  | Off  |
| :SP8T:[x]:STATE:2 | C to 2   | Off                | On   | Off  | Off  | Off  | Off  | Off  | Off  |
| :SP8T:[x]:STATE:3 | C to 3   | Off                | Off  | On   | Off  | Off  | Off  | Off  | Off  |
| :SP8T:[x]:STATE:4 | C to 4   | Off                | Off  | Off  | On   | Off  | Off  | Off  | Off  |
| :SP8T:[x]:STATE:5 | C to 5   | Off                | Off  | Off  | Off  | On   | Off  | Off  | Off  |
| :SP8T:[x]:STATE:6 | C to 6   | Off                | Off  | Off  | Off  | Off  | On   | Off  | Off  |
| :SP8T:[x]:STATE:7 | C to 7   | Off                | Off  | Off  | Off  | Off  | Off  | On   | Off  |
| :SP8T:[x]:STATE:8 | C to 8   | Off                | Off  | Off  | Off  | Off  | Off  | Off  | On   |

Each SPDT switch:

| Switch Command    | Switch x State | Switch x LED State |
|-------------------|----------------|--------------------|
| :SPDT:[x]:STATE:1 | C to 1         | Green              |
| :SPDT:[x]:STATE:2 | C to 2         | Orange             |

x = switch number

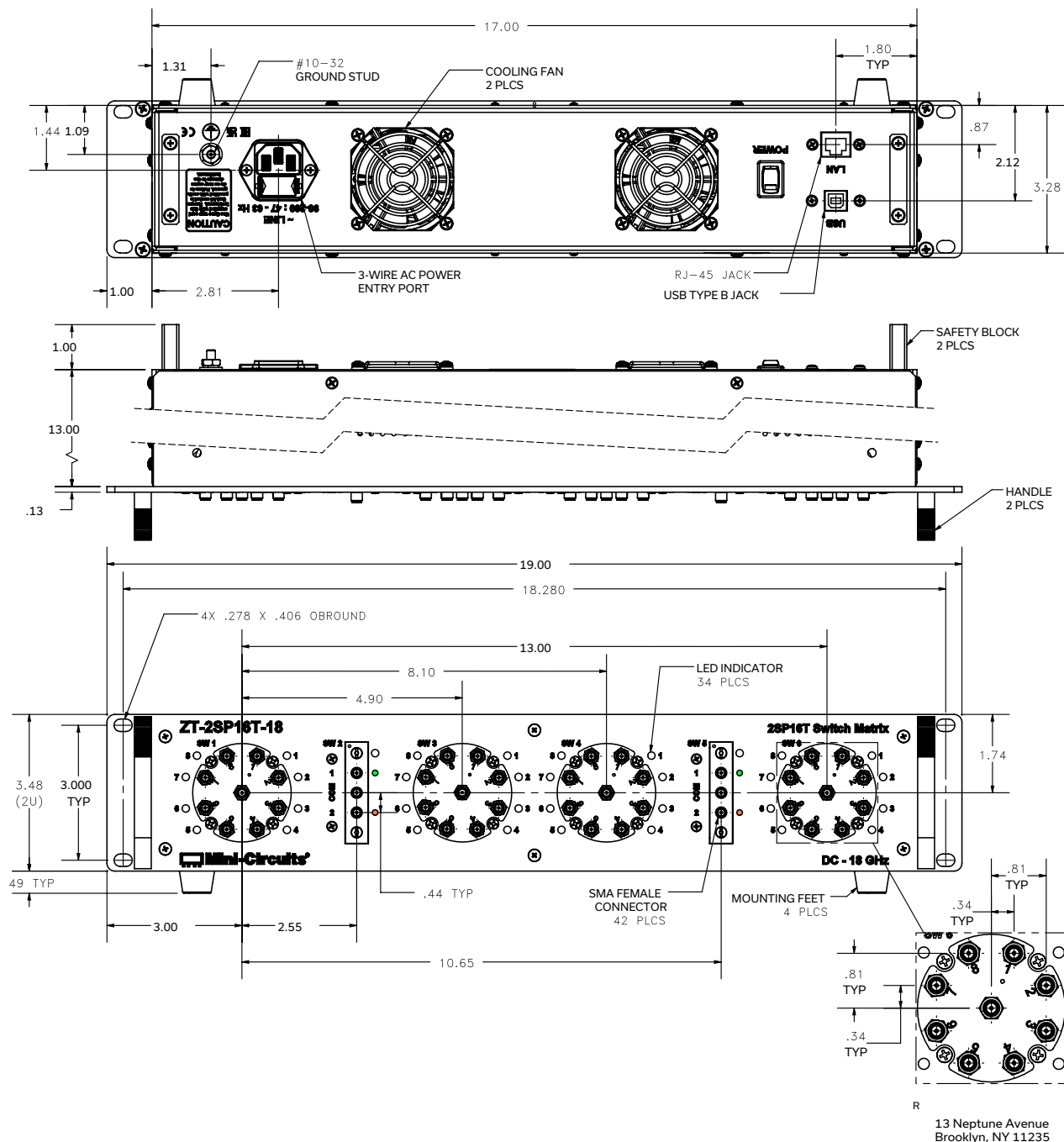


USB & ETHERNET

# Mechanical Switch Assembly ZT-2SP16T-18

50Ω DC to 18 GHz 2 x SP16T Rack-Mount SMA Female

## CASE STYLE DRAWING



## PRODUCT MARKING\*

Product Marking: ZT-2SP16T-18

Product Description: 2SP16T Switch Matrix

Product Frequency: DC-18 GHz

Unit ID Label: Serial number and other identification marks

\*Marking may contain other features or characters for internal lot control





## USB & ETHERNET





# Mechanical Switch Assembly **ZT-2SP16T-18**






50Ω DC to 18 GHz 2 x SP16T Rack-Mount SMA Female

DETAILED MODEL INFORMATION IS AVAILABLE ON OUR WEBSITE [CLICK HERE](#)

|   |  |
|---|--|
| Case Style                                | 99-01-3313   |
| Software, User Guide & Programming Manual | <a href="https://www.minicircuits.com/softwaredownload/ztm_ztm2.html">https://www.minicircuits.com/softwaredownload/ztm_ztm2.html</a>  |
| Environmental Rating                      | ENV56  |
| Regulatory Compliance                     | <p>Refer to our website for compliance methodologies and qualifications</p>  <a href="http://www.minicircuits.com/quality/environmental_introduction.html">www.minicircuits.com/quality/environmental_introduction.html</a> |

Contact Us: [testsolutions@minicircuits.com](mailto:testsolutions@minicircuits.com)

| Included Accessories  | Part Number    | Description  |
|---|----------------|--|
|   | CBL-3W-xx      | AC power cord (IEC C13 connector to local plug) Select one option from the list below. Please contact <a href="mailto:testsolutions@minicircuits.com">testsolutions@minicircuits.com</a> if your region is not listed. |
|   | 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)   |
|  | 141-3SMR+ (x4) | Hand-flex conformable interconnect cable (3" length, SMA male right-angle connectors)  |

| AC Power Cord Options   | Part Number | Description   |
|---|-------------|---|
|  | CBL-3W-US   | USA<br>NEMA 5-15 plug (type B) to IEC C13 connector                 |
|  | CBL-3W-EU   | Europe<br>CEE 7/7 plug (type E/F) to IEC C13 connector              |
|  | CBL-3W-UK   | UK<br>BS-1363 plug (type G) to IEC C13 connector                    |
|  | CBL-3W-AU   | Australia & China<br>AS/NZS 3112 plug (type I) to IEC C13 connector |
|  | CBL-3W-IL   | Israel<br>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/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)







## Environmental Specifications ENV56

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 40° C<br>Ambient Environment  | Individual Model Data Sheet |
| Storage Temperature            | -15° to 85° C<br>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      |