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DATA SHEET

# L4490A and L4491A

## RF Switch Platform

Shorten your switch matrix development time with a robust, reliable solution




KEYSIGHT TECHNOLOGIES

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## Introduction

The Keysight Technologies, Inc. L4490A/91A RF switch platform simplifies the task of defining and building a custom switch matrix. Engineers are often under pressure to lower cost and get to market quickly. The L4490A/91A provides the right tools to easily define and build a custom switch matrix while reducing your overall design time – all without sacrificing signal integrity. In addition, with the robust design, you can have confidence in the reliability and longevity of your system.

The RF switch platform easily integrates into your test environment with standard rack mount kits, LAN and GPIB connectivity, graphical web interface and software drivers for the most common programming environments.

This platform is ideal for R&D and manufacturing engineers creating custom switch matrices for A/D and wireless applications testing mobile radios, handsets, base stations, radio components, and other wireless devices. Also, with the broad range of supported switches up to 50 GHz, you can future-proof your investment for emerging standards like WiMAXTM, LTE and UMB.

Build custom designs from multiplexers, blocking or non-blocking matrices or a combination of both with signal conditioning to meet your unique needs.

## Key Features

- Flexible and easily configurable switch mounting system for robust and reliable signal routing
- 3D models included for quick RF cable layout and documentation
- Graphical web interface for quick setup, troubleshooting and support
- Easy connection and control of all the most popular microwave switches and attenuators
- Expandable up to 128 coil drives
- Effective switch management with switch verification, sequences and relay counter
- Software drivers for most common programming environments
- LXI compliance includes web interface and built-in Ethernet connectivity

# Hardware Platform

## Two Sizes with Ample Space to Mount Switches and Other Components

2U and 4U high versions of the switch platform are available to give you flexibility for your unique needs and expandability for future projects. Both platforms come standard with 64 coil drives integrated into the enclose with options for expansion.  The 2U version uses a bottom mounting tray with pre-drilled holes for mounting up to 8 multiport switches or a combination of devices using optional bracket kits. See Figure 1.

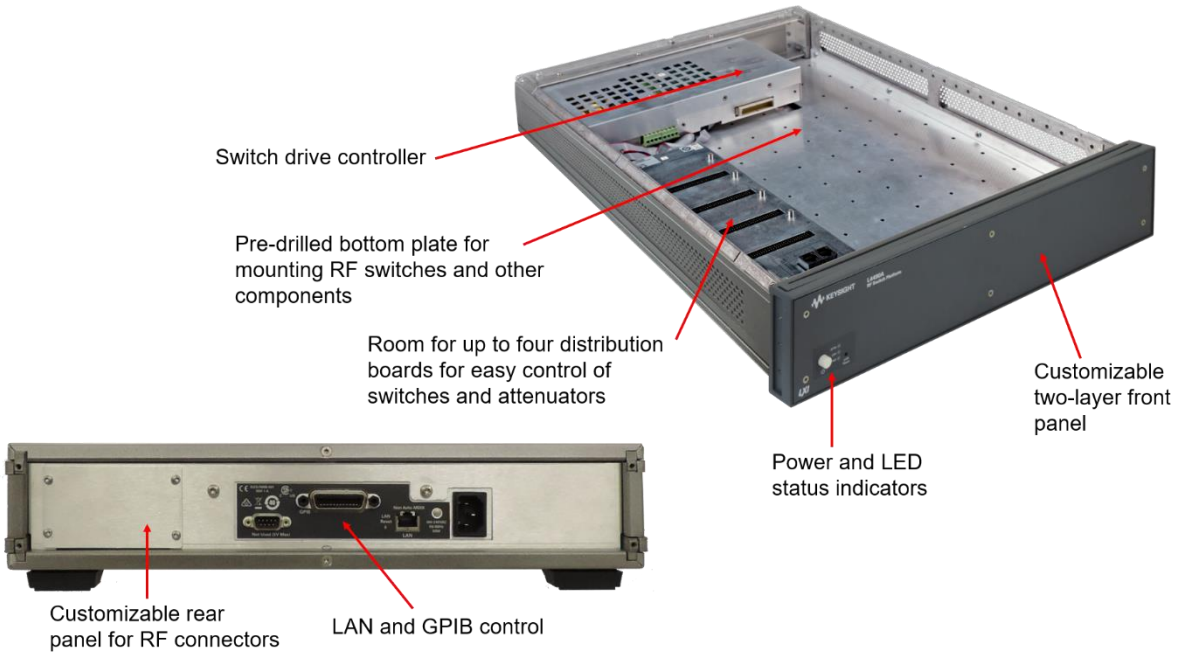



Figure 1. L4490A RF Switch Platform

The 4U version has a unique switch mounting system with a robust design ensuring that all components are securely mounted, giving you confidence in a highly accurate and repeatable RF connection. It utilizes a switch mounting system with a tray for vertically mounting switches and attenuators using optional bracket kits. All devices are securely mounted with the RF connectors on top, giving you a compact, flexible solution to meet your custom needs.

The 4U switch mounting tray has plenty of space for mounting and controlling up to 48 SPDT switches or 16 multiport switches, or a combination of these and other devices. Note that some complex switch configurations require more than the supplied 600 mA quiescent current. See quiescent current calculations in the specifications section for more information. Another mounting tray at the rear of the instrument provides space for mounting additional components. There is also an optional front panel with locations for mounting up to 8 multiport switches. The 4U unit also has a location on the rear panel to mount a user-provided fan for when cooling is required. See Figure 2.

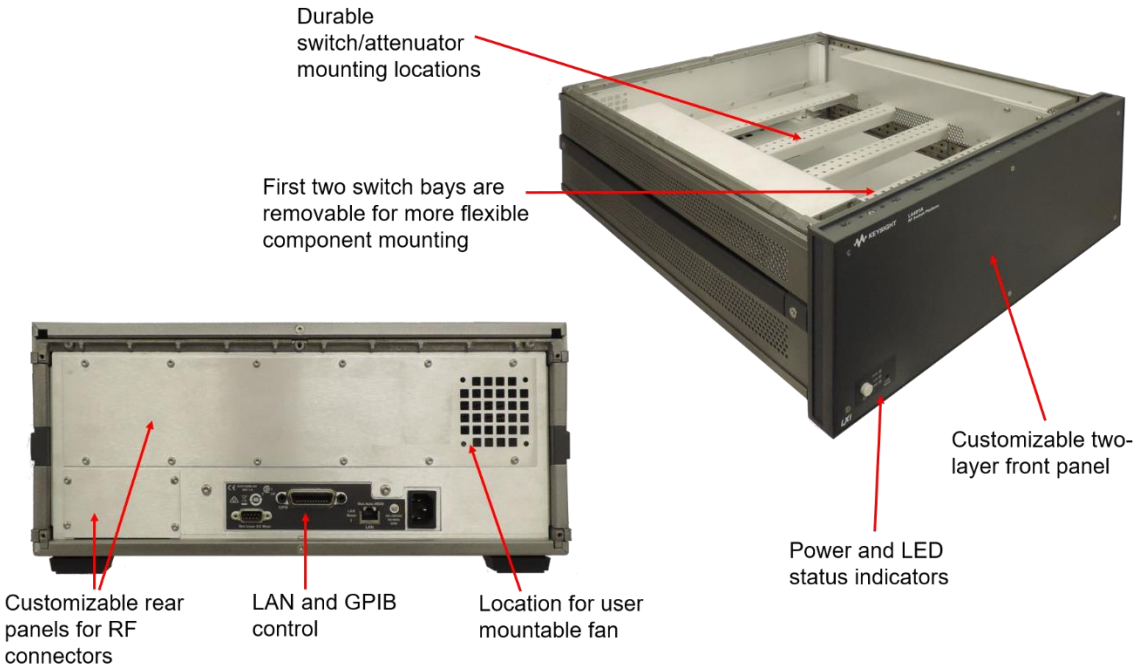



Figure 2. L4491A RF Switch Platform

The design also provides easy access for building, customizing and servicing the unit. You can easily remove the top, bottom, front and rear panels for quick access. The front and rear panels can be customized for your unique needs. You can drill or punch holes for mounting RF connectors, LEDs and other signal routing components. See Figure 3.

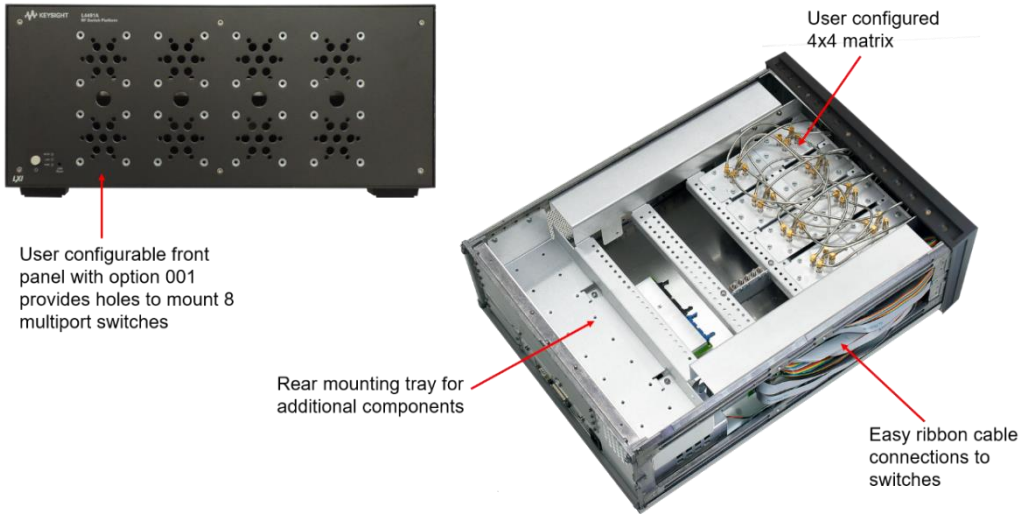



Figure 3. L4491A Customization

## Computers Models Decrease Development Time

For even more time savings 2D and 3D models of the switch mounting system, switches and brackets are provided in .dxf, .stp and .igs formats. This enables you to quickly layout cable routing and document your solution in your own modeling tools.  See Figure 4.

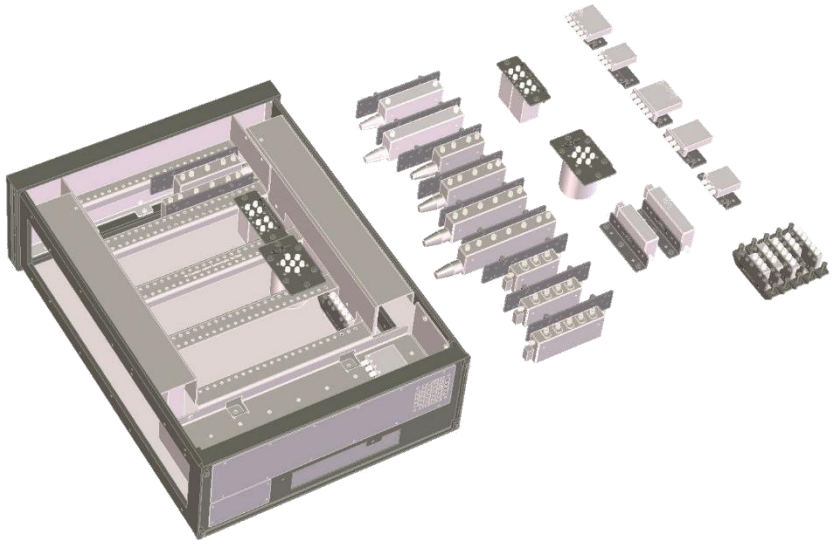


Figure 4. 3D Models

## Easy Serviceability

With the switch mounting system, switches are easily replaced through the bottom of the box without disturbing the RF cabling. See Figure 5. The Y1156A diagnostics board tests the L4490A/91A to ensure all the control signals are being delivered to the switches. This test is easily done using the switch sequences supplied through the web interface.

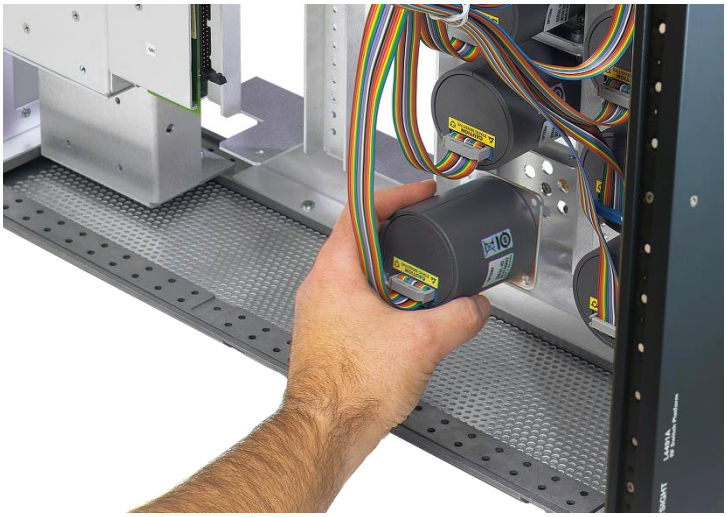


Figure 5. Easy to service the unit without disturbing the RF cabling

## Switch Drive and Readback Capabilities

The Keysight L4490A/91A integrates the power and control signals for all of the most popular RF and uW switches and attenuators. It comes standard with 64 switch coil drive lines – that's enough to control 32 standard SPDT switches or 8 multiport switches. With Option 002, it's expandable to control another 64 coils. In addition, access to the 5 V, 12 V and 24 V supplies is also available to control other devices in your RF switch matrix. If you need more control and monitoring lines, Option 004 adds 16 digital IO lines and 28 additional relay drive lines.  Both uses distribution boards for simple connections to the switches using standard ribbon cables.

The distribution boards also have digital inputs so you can read back the actual position of the switch, giving you more confidence in switch closures. Use digital outputs to drive LEDs to show the actual switch position.

# SW Control

## Graphical Web Interface

The built-in graphical web browser interface provides remote access and control of the instrument via a Java-enabled browser such as Internet Explorer. Using the web interface, you can set-up, troubleshoot and maintain your instrument from anywhere on the network. See Figure 6.

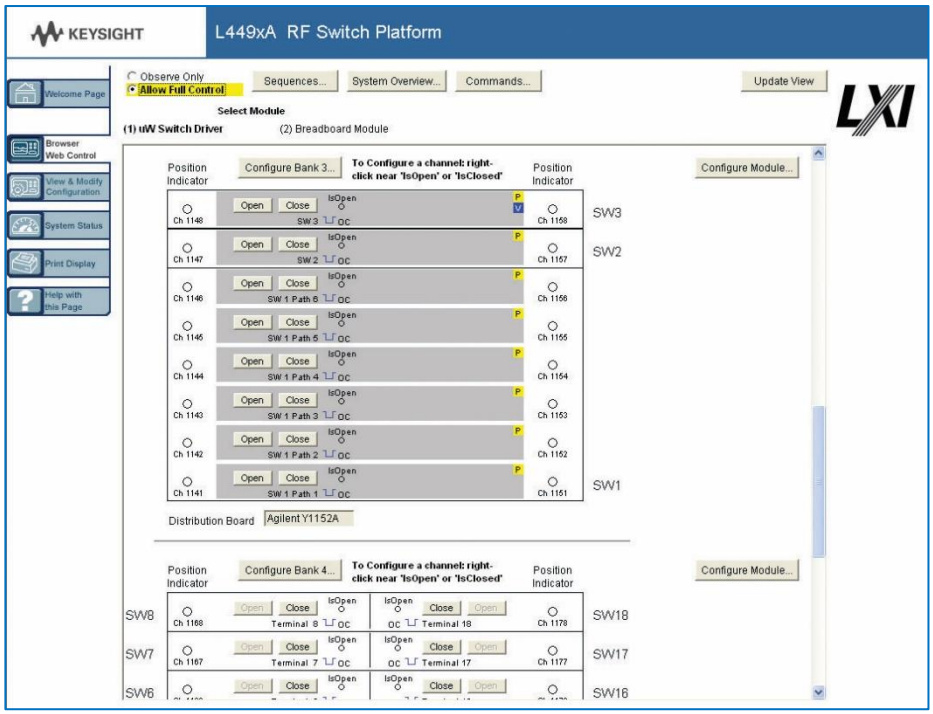



Figure 6. The web interface makes it easy to set up, troubleshoot and maintain your test remotely

The graphical web interface provides the following functions:

- View and modify instrument setup
- Configure switch/attenuator channels
- Open or close switches
- Send, receive and view SCPI commands
- Define and execute switch sequences
- View error queue
- Get status reports on relay cycle counts, firmware revisions, and more

Additionally, since the web server is built into the instrument, you can access it on any operating system that supports the web browser without having to install any special software. Password protection and LAN lockout are also provided for additional security.

## Switch Management

Switch sequences allow you to define and control complex signal paths with user assigned names. Sequences can be nested and called from your program. Up to 500 sequences can be defined and stored in non-volatile memory so when power is lost, the sequences are not. Use sequences and the break-before-make features to ensure switch closures are made in the right order and eliminate possible damage to your valuable DUTs or test equipment. See Figure 7.

Switch counts are also stored in the instrument's non-volatile memory. So you can monitor when a a switch is nearing its end-of-life. Additionally, power up/down states can be identified and stored in non-volatile memory, protecting the DUT when power is lost.

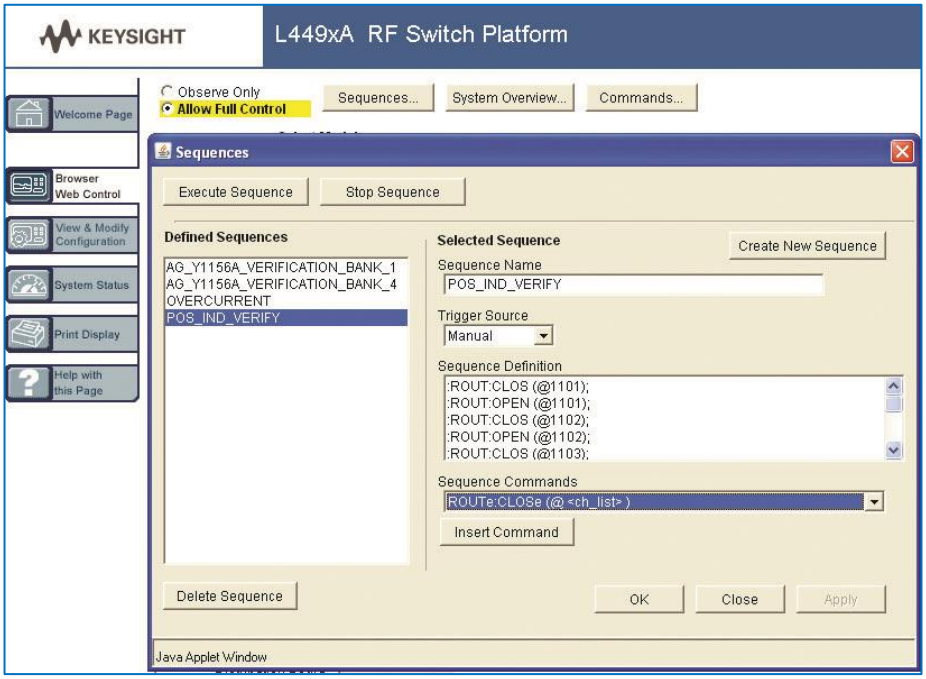



Figure 7. L4490A/91A switch sequences developed/executed from the Web interface or programming environment

### Standard Ethernet connectivity with LXI

The L4490A/91A comes standard with built-in GPIB and Ethernet connectivity. The 100BaseT Ethernet interface offers highspeed connections that allow for remote access and control. You can set up a private network to filter out unwanted LAN traffic and speed up the I/O throughput or take advantage of the remote capabilities and distribute your tests worldwide. Monitor, troubleshoot or debug your application remotely.

### Software for most popular programming environments

Full support for standard programming environments ensures compatibility and efficiency. The L4490A/91A supports the SCPI language and is software compatible with the L4445A and 34945A uW switch drivers. You can use direct I/O with the or use software you already have and know, standard IVI and LabVIEW software drivers that provide compatibility with the most popular development environments including:

- Keysight VEE PRO
- National Instruments LabVIEW, Lab-Windows/CVI, TestStand, and Switch Manager
- Microsoft C/C++ and Visual Basic

## Supported Components

The following Keysight microwave switches and attenuators are directly supported with the Y1150A-Y1155A distribution boards:

- N181x/U9397x Series SPDT switches
- 8762/3/4 Series SPDT switches
- 8765x coaxial switches
- 8766x/8767x/8768x multiport switches
- 87104x/106x/L710xx/L720xx multiport switches
- 87406x Series matrix switches
- 87204x/206x Series multiport switches
- 87606x Series matrix switches
- 87222x/L7222 transfer switches
- 849x/8490x Series attenuators

Other switches and devices through individual screw terminal connections

## Keysight Custom RF Switch Solutions

Keysight also offers fully customized RF switch solutions ranging from basic RF switches arranged in standard topologies to complex RF switches and other signal routing and conditioning components arranged in highly complex and custom topologies based on your requirements. Example matrices include designs ranging from a simple 1 x 12 fanout to a full 10 x 10 non-blocking, full access matrix.

These solutions are completely assembled and offer high performance, and high reliability with Keysight RF switches or other specified components. The high-quality, semi-rigid coaxial cables ensure excellent signal integrity. These systems are also fully tested with S-parameters on every signal path and include full documentation and support. In example is shown in Figure 8. See www.keysight.com/find/switchmatrix to find out more.

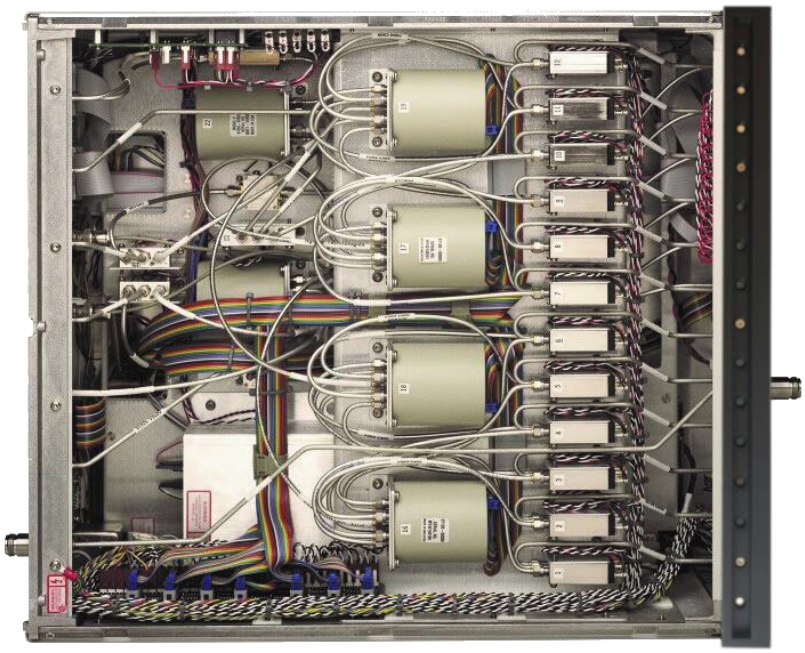


Figure 8. Keysight custom solutions are fully integrated, tested and documented

## Characteristics and Specifications

| | |
|---|---|
| **Switch Drive (64 channels)** | |
| **Low side drive mode** | |
| Driver off voltage (max) | 30 V |
| Driver off leakage current | 500 µA |
| Driver on current (max) | 600 µA |
| Driver on voltage (max) | 0.5 V at 600 mA |
| **TTL drive mode** | |
| Hi output voltage | 3 V at $I_{out}$ = 2 mA |
| Lo output voltage | 0.4 V at $I_{in}$ = 20 mA |
| Lo input current | 20 mA |
| **Position Indicator Sense Inputs** | |
| Channels | 64 |
| Lo input voltage (max) | 0.8 V |
| Hi input voltage (min) | 2.5 V |
| Input resistance | > 100 kΩ at $V_{in} \leq 5$ V<br>> 20 kΩ at $V_{in} > 5$ V |
| Maximum input voltage | 30 V |
| **Switch Drive Power Supply** | |
| Voltage | TTL or low-level AC |
| Current | 40 mV p-p |
| Quiescent Current Requirement | Most latching switches require some small amount of quiescent current to remain in their position. This current can range from 1 to 2 mA to 50 mA to 40 mA. Be sure to calculate your quiescent current needs using the 5989-2272EN Configuration Guide.<br><br>Example:<br>Twelve 87106C nominal quiescent current: 12 x 30 mA = 360 mA<br>Plus six N1810TL nominal quiescent current: 6 x 1.5 mA = 9 mA<br>Total nominal quiescent current = 369 mA |
| **External Power Connection** | |
| Voltage range | 4.75 V to 30 V |
| Current limit | 2 A |
| **LED Indicator (current mode drivers)** | |
| Channels | 64 |
| Supply voltage | 5 V nominal |
| LED current drive | 5 mA nominal (prog 1-20 mA) |
| Driver compliance voltage | 0.8 V |
| **Memory** | |
| States | 5 instrument states with user label in non-volatile memory |

| General Specifications | | |
|---|---|---|
| Power supply and line frequency | 100 V to 240 V ±10% (50-60 Hz ±10% auto sensed) | |
| Power consumption | 100/200 VA | |
| Operating environment | Full accuracy for 0ºC to 55ºC<br>Full accuracy to 80% R.H. at 40ºC | |
| Storage environment | -40ºC to 70ºC | |
| Safety conforms to | CSA, UL/IEC/EN 61010-1 | |
| EMC conforms to | IEC/EN 61326-1, CISPR 11 | |
| **Mechanical Characteristics** | **L4490A** | **L4491A** |
| Dimensions (H x W x L) | 88.1 x 425.6 x 574.0 mm<br>(3.47 x 17.76 x 22.60 in) | 177.0 x 425.6 x 574.0 mm<br>(6.97 x 17.76 x 22.60 in) |
| Weight | 7.7 kg (17 lbs) | 9.1 kg (20 lbs) |
| **Additional Power** | | |
| ±5 V | 1 A | |
| +12 V | 3 A (3 A fused) | |
| +24 V | 0.6 A | |
| Total max power[1] | 35 W at 40ºC derated linearly to 10W at 55ºC (L4490A)<br>40 W at 40ºC derated linearly to 10 W at 55ºC (L4491A) | |
| **Digital IO Option 004** | | |
| Max module power dissipation | 16 digital IO lines plus 28 relay drive lines | |
| Power available | 6W | |
| 12 V regulation no load to full | 10% | |
| 5 V regulation no load to full load | 5% | |
| Max power from 12 V | 6 W | |
| Max power from 5 V | 1 W | |
| 28 relay drives | sink up to 100 mA | |
| GPIO ports chan 1 and chan 2 | 8 configure bits as input or output | |
| Chan 3 | 3 output bits | |

## Software Specifications

| Supported Software Components | |
|---|---|
| Operating systems | Microsoft Windows 7 and 10 |
| Standard compliant drivers | IVI-C (32-bit/64-bit), IVI-COM (32-bit/64-bit) |
| IVI class support | IviDriver 1.0, IviSwtch 4.0 |
| Application development environments (ADE) | Microsoft Visual Basic, Microsoft Visual C++, Microsoft .NET, Visual Basic, Agilent VEE Pro, National Instruments LabVIEW |
| Keysight IO Libraries Suite | Version 2018 or greater |

[1] If additional power is required to drive relays, use an external power supply.

# Ordering and Configuration Information

## Table 1. L449xA Product Options

| Model | Description | Comments |
|---|---|---|
| L4490A | 2U RF switch platform | Includes switch driver and space to mount RF components. Comes standard with LAN and GPIB interface. User's guide is included on CD |
| L4490A-004 | Add 16-bit digital IO and 28 bits of relay drive lines | Recommended for DIO control |
| L4491A | 4U RF switch platform | Includes switch driver and space to mount RF components. Comes standard with LAN and GPIB interface. User's guide is included on CD |
| L4491A-001 | Front panel with holes to mount up to 8 Keysight | Replaces STD blank front panel with a front panel |
| L4491A-002 | Add 64 additional switch drive lines with additional 34945EXT | Required if you have more than 4 distribution boards |
| L4491A-004 | Add 16-bit digital IO and 28 bits of relay drive lines | Recommended for DIO control |
| L4491A-005 | Standard 4U unit with center tray for mounting switches | Recommended for RF switch mounting configurations |
| L4491A-006 | 4U unit with bottom mounting tray (pre-drilled bottom for mounting switches and no center switch | Replaces center tray mounting option 005 with no center tray and mounting holes on bottom of the unit |
| L449xA-AXA | Standard rackmount flange kit | |
| L449xA-AXB | Standard rackmount kit with handles | |

## Table 2. Distribution Boards

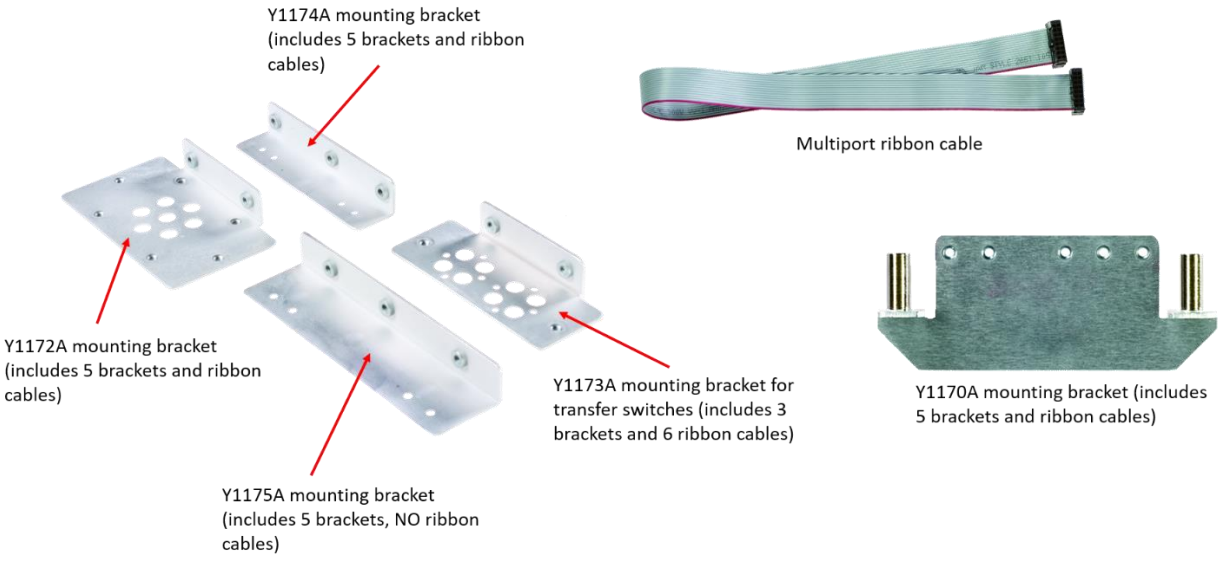
Distribution boards are required for control of external switches. See Table 5 to determine correct distribution boards needed.

| Model | Description |
|---|---|
| Y1150A | Distribution board for 8 N181x/U9397x SPDT switches |
| Y1151A | Distribution board for two 87104x/106x/L7x0xx multiport or 87406B matrix switches |
| Y1152A | Distribution board for one 87204x/206x or 87606B switch and two N181x switches |
| Y1153A | Distribution board for two 84904/5/6/7/8 or 8494/5/6 step attenuators |
| Y1154A | Distribution board for two 87222/L7222C transfer switches and six N181x SPDT switches |
| Y1155A | Distribution board with generic screw terminals for driving 16 switch coils |
| Y1156A | Diagnostics board to verify switch control signals (Recommended for troubleshooting purposes) |

## Table 3. Mounting Kits

Includes brackets, screws, and ribbon cables where appropriate

| Model | Description | Comments |
|---|---|---|
| Y1170A | Mounting brackets and ribbon cables for mounting qty 5 N181x or 8762/3/4 Series switches in the L4491A | Can mount 12 SPDT switches per bay (up to 48 SPDT witches in switch tray). Ribbon cables only support N1810 series switches |
| Y1171A | Mounting brackets and ribbon cables for mounting qty 5 N181x or 8762/3/4 Series switches in the L4490A | Can mount up to 8 SPDT switches. Ribbon cables only support N1810 series switches |
| Y1172A | Mounting brackets and ribbon cables for mounting qty 5 87xxx or L7xxx multiport/matrix switches in the L4490A/91A | Can mount 4 multiport/matrix switches per bay in the L4491A (up to 16 total) and up to 8 multiports in the L4490A |
| Y1173A | Mounting brackets and ribbon cables for mounting qty 6 87222 series transfer switches in the L4490A/91A (3 brackets and 6 cables) | Can mount up to 12 transfer switches per bay in the L4491A. Recommend right angle RF cable when used in the L4490A due to height restrictions |
| Y1174A | Mounting brackets and ribbon cables for mounting qty 5 849xx Series step attenuators in the L4490A/91A | Can mount up to 4 attenuators per bay in the L4491A |
| Y1175A | Mounting brackets for mounting qty 5 849x series attenuators or 876x Series switches in the L4490/91A | Can mount up to 4 attenuators per bay in the L4491A. NO ribbon cables included. |



## Table 4. Mechanical Replacement Parts

| Part Number | Description | Comments |
|---|---|---|
| L4490-06101 | Extra bottom/top mounting tray with pre-drilled mounting holes for mounting switches | Same tray as used in L4490A and L4491A Option 006 |
| L4490-80000 | Extra L4490A dual layer front panel | Same front panel as L4491A standard front panel |
| L4490-80001 | Extra L4491A dual layer front panel | Same front panel as L4491A standard front panel |
| L4490-80002 | Extra L4491A dual layer front panel with holes to mount up to 8 Keysight 87xxx or L7xxx style multiport switches | Same front panel as L4491A Option 001 |
| L4490-06213 | Extra L4491A rear filler panel<br>Includes fan holes for 60 mm fan (50 mm mounting hole to hole spacing) | Same rear filler panel as on the standard L4991A |
| L4490-06120 | Extra L4490A/L4491A small rear panel | Filler panel |

## Table 5. Accessory Selection

Use the following table to select distribution boards, mounting brackets and switch options.

| Switch Model | Description | Frequency Range | Reference Document Number[2] | Coil Voltage Option | Position Indicator Option | DC Connector Option | Distribution board [No. of switches/ board] | Bracket Kit[3] |
|---|---|---|---|---|---|---|---|---|
| N1810UL<br>N1810TL<br>N1811TL<br>N1812UL | Un-terminated latching 3-port (SPDT)<br>Terminated latching 3-port (SPDT)<br>Un-terminated latching 5-port<br>Terminated latching 4-port (bypass) | DC – 2, 4,20, or 26.5 GHz | 5968-9653E | 124 | 402/403[4] | 201: DB9F | Y1150A [8]<br>Y1152A [2]<br>Y1154A [6] | Y1170A (L4491A)<br>Y1171A (L4490A) |

[2] Product and technical overviews for the switches and attenuators listed can be obtained by document number from the Keysight RF & Microwave Test Accessories website. Go to http://www.keysight.com/find/accessories, select 'RF & Microwave Test Accessories,' and search for the document number. Additional information can also be found in the 'RF and Microwave Test Accessories Catalog' accessible from this site. If viewing this document on-line, click on the reference document link.

[3] Bracket kits apply to the L4490A and L4491A. These kits include pre-assembled control cables and hardware for mounting switches/attenuators to the brackets and the bracket assemblies to the L4490A and L4491A RF Switch Platforms.

[4] Drive Option 403 adds current interrupts which allow continuous drive mode to be used within the 34945A/L4445A/L4490A/L4491A.

## Table 5. Accessory Selection, cont.

| Switch Model | Description | Frequency Range | Reference Document Number[5] | Coil Voltage Option | Position Indicator Option | DC Connector Option | Distribution board [No. of switches/ board] | Bracket Kit[6] |
|---|---|---|---|---|---|---|---|---|
| N1810U<br>N1810T<br>N1811T<br>N1812U | Low PIM Switch, SPDT unterminated latching<br>Low PIM Switch, SPDT terminated latching<br>Low PIM Switch, 4 port terminated latching<br>Low PIM Switch, 5 port unterminated latching | DC – 4,20, or 26.5 GHz | N1810-80002 | 105: 5 VDC1<br>115: 15 VDC<br>124: 24 VDC<br>401: TTL/5 V (CMOS compatible) | 402 | 201: DB9F<br>202: Solder lug | | |
| 87104A<br>87104B<br>87104C | SP4T 4-port latching, terminated<br>SP4T 4-port latching, terminated<br>SP4T 4-port latching, terminated | DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz | 87104-80017 | 024 | Included | 161: 16-pin DIP | Y1152A [2] | Y1172A |
| 87104P<br>87104Q<br>87104R | Low PIM Switch SP4T, terminated<br>Low PIM Switch SP4T, terminated<br>Low PIM Switch SP4T, terminated | DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz | 87104-80017 | 024: 24 VDC<br>T24: TTL/5 V CMOS compatible | Included | 161: 16 pin DIP<br>100: Solder terminals | | |
| 87106A<br>87106B<br>87106C | SP6T 6-port latching, terminated<br>SP6T 6-port latching, terminated<br>SP6T 6-port latching, terminated | DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz | 87104-80017 | 024 | Included | 161: 16-pin DIP | Y1152A [2] | Y1172A |
| 87106P<br>87106Q<br>87106R | Low PIM Switch SP6T, terminated<br>Low PIM Switch SP6T, terminated<br>Low PIM Switch SP6T, terminated | DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz | 87104-80017 | 024: 24 VDC<br>T24: TTL/5 V CMOS compatible | Included | 161: 16 pin DIP<br>100: Solder terminals | | |
| 87406B | 6-port matrix, terminated | DC – 20 GHz | 5965-7841E | 024 | included | 161: 16-pin DIP | Y1151A [2] | Y1172A |
| 87406Q | Low PIM Switch, matrix, terminated | DC – 20 GHz | 87406-80005 | 024: 24 VDC<br>T24: TTL/5 V CMOS compatible | Included | 161: 16 pin DIP<br>100: Solder terminals | | |

[5] Product and technical overviews for the switches and attenuators listed can be obtained by document number from the Keysight RF & Microwave Test Accessories website. Go to http://www.keysight.com/find/accessories, select 'RF & Microwave Test Accessories,' and search for the document number. Additional information can also be found in the 'RF and Microwave Test Accessories Catalog' accessible from this site. If viewing this document on-line, click on the reference document link.

[6] Bracket kits apply to the L4490A and L4491A. These kits include pre-assembled control cables and hardware for mounting switches/attenuators to the brackets and the bracket assemblies to the L4490A and L4491A RF Switch Platforms.

## Table 5. Accessory Selection, cont.

| Switch Model | Description | Frequency Range | Reference Document Number[7] | Coil Voltage Option | Position Indicator Option | DC Connector Option | Distribution board [No. of switches/ | Bracket Kit[8] |
|---|---|---|---|---|---|---|---|---|
| 87204A<br>87204B<br>87204C<br>87206A<br>87206B<br>87206C<br>87606B | SP4T 4-port latching, terminated<br>SP4T 4-port latching, terminated<br>SP4T 4-port latching, terminated<br>SP6T 6-port latching, terminated<br>SP6T 6-port latching, terminated<br>SP6T 6-port latching, terminated<br>6-port matrix, terminated | DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz<br>DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz<br>DC – 20 GHz | 5965-3309E<br>5965-7842E | Included | Included | 161: 16-pin DIP | Y1152A [1] | Y1172A |
| 87606Q | Low PIM Switch, matrix, terminated | DC – 20 GHz | 87606-80005 | 024: 24 VDC | N/A | 161: 16 pin DIP<br>100: Solder terminals | | |
| 87222C<br>87222D<br>87222E | 4-port transfer<br>4-port transfer<br>4-port transfer | DC – 26.5 GHz<br>DC – 40 GHz<br>DC – 50 GHz | 5968-2216E | Included | Included | 161: 16 pin DIP | Y1154A [2] | Y1173A |
| 87222R | Low PIM Switch, transfer | DC – 26.5 GHz | 87222-80007 | 24 VDC | Included | 161: 16 pin DIP<br>100: Solder terminals | | |
| L7104A<br>L7104B<br>L7104C<br>L7106A<br>L7106B<br>L7106C | SP4T 4-port latching, terminated<br>SP4T 4-port latching, terminated<br>SP4T 4-port latching, terminated<br>SP6T 6-port latching, terminated<br>SP6T 6-port latching, terminated<br>SP6T 6-port latching, terminated | DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz<br>DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz<br>DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz | 5989-6030EN | 024 | Included | 161: 16 pin DIP | Y1151A [2] | Y1172A |

[7] Product and technical overviews for the switches and attenuators listed can be obtained by document number from the Keysight RF & Microwave Test Accessories website. Go to http://www.keysight.com/find/accessories, select 'RF & Microwave Test Accessories,' and search for the document number. Additional information can also be found in the 'RF and Microwave Test Accessories Catalog' accessible from this site. If viewing this document on-line, click on the reference document link.

[8] Bracket kits apply to the L4490A and L4491A. These kits include pre-assembled control cables and hardware for mounting switches/attenuators to the brackets and the bracket assemblies to the L4490A and L4491A RF Switch Platforms.

## Table 5. Accessory Selection, cont.

| Switch Model | Description | Frequency Range | Reference Document Number[9] | Coil Voltage Option | Position Indicator Option | DC Connector Option | Distribution board [No. of switches/ | Bracket Kit[10] |
|---|---|---|---|---|---|---|---|---|
| 8762A<br>8762B<br>8762C<br>8763A<br>8763B<br>8763C<br>8764A<br>8764B<br>8764C<br>8762F | Terminated latching 3-port (SPDT)<br>Terminated latching 3-port (SPDT)<br>Terminated latching 3-port (SPDT)<br>Terminated latching 4-port (transfer)<br>Terminated latching 4-port (transfer)<br>Terminated latching 4-port (transfer)<br>Terminated latching 5-port<br>Terminated latching 5-port<br>Terminated latching 5-port<br>75 ohms Terminated (SPDT) | DC – 4 GHz<br>DC – 18 GHz<br>DC – 26.5 GHz<br>DC – 4 GHz<br>DC – 18 GHz<br>DC – 26.5 GHz<br>DC – 4 GHz<br>DC – 18 GHz<br>DC – 26.5 GHz<br>DC – 4 GHz | 5952-1873E | 024 | N/A | Solder terminals (standard) | Y1155A [8] | Y1170A (L4491A) Y1171A; L4490A |
| L7222C | 4-port transfer latching, terminated | DC – 26.5 GHz | 5989-6084EN | Included | Included | 161: 16 pin DIP | Y1151A [2] | Y1173A |
| 9765A<br>8765B<br>8765C<br>8765D<br>8765F | Coaxial (SPDT), SMA<br>Coaxial (SPDT), SMA<br>Coaxial (SPDT), 3.5 mm<br>Coaxial (SPDT), 2.4 mm<br>Coaxial (SPDT), 75 ohm, SMB | DC – 4 GHz<br>DC – 20 GHz<br>DC – 26.5 GHz<br>DC – 40 GHz<br>DC – 4 GHz | 5962-2231E<br><br><br><br>5091-2679E | 324 | N/A | Solder terminals (with 324) | Y155A [8] | Y1170A (L4491A) Y1171A (L4490A) |
| 8766K<br>8767K<br>8768K<br>8769K | Coaxial (SP3T)<br>Coaxial (SP4T)<br>Coaxial (SP5T)<br>Coaxial (SP6T) | DC – 26.5 GHz<br>DC – 26.5 GHz<br>DC – 26.5 GHz<br>DC – 26.5 GHz | 5959-7831 | 024 | N/A | 060 (12-pin Viking) | Y155A [2] Y1155 [1] | Y1175A |
| 8767M<br>8768M<br>8769M | Coaxial (SP4T)<br>Coaxial (SP5T)<br>Coaxial (SP6T) | DC – 50 GHz<br>DC – 50 GHz<br>DC – 50 GHz | 5988-2477EN | 024 | N/A | 10-pin DIP | Y1153A [2] | Y1175A |
| U9397A<br>U9397C | 8 GHz Solid State<br>18 GHz Solid State | 300 kHz- 8 GHz<br>300 kHz- 18 GHz | 5989-6080EN | Included | N/A | Solder terminals | Y1155A [8] | Y1170A (L4491A) Y1171A (L4490A) |

[9] Product and technical overviews for the switches and attenuators listed can be obtained by document number from the Keysight RF & Microwave Test Accessories website. Go to http://www.keysight.com/find/accessories, select 'RF & Microwave Test Accessories,' and search for the document number. Additional information can also be found in the 'RF and Microwave Test Accessories Catalog' accessible from this site. If viewing this document on-line, click on the reference document link.

[10] Bracket kits apply to the L4490A and L4491A. These kits include pre-assembled control cables and hardware for mounting switches/attenuators to the brackets and the bracket assemblies to the L4490A and L4491A RF Switch Platforms.

## Table 5. Accessory Selection, cont.

| Switch Model | Description | Frequency Range | Reference Document Number[11] | Coil Voltage Option | Position Indicator Option | DC Connector Option | Distribution board [No. of switches/ | Bracket Kit[12] |
|---|---|---|---|---|---|---|---|---|
| 84904K<br>84904L<br>84906K<br>84906L<br>84907K<br>84907L | 11 dB max, 1 dB steps, 4 sections<br>90 dB max, 10 dB steps, 4 sections<br>70 dB max, 10 dB steps, 3 sections | DC – 26.5 GHz<br>DC – 40 GHz<br>DC – 26.5 GHz<br>DC – 40 GHz<br>DC – 26.5 GHz<br>DC – 40 GHz | 5963-6944 | 24 V (standard) | Included | 10-pin DIP (standard) | Y1153A [2] | Y1174A |
| 84904M<br><br>84805M<br><br>84908M | 11 dB max, 1 dB steps, 4 sections<br>60 dB max, 10 dB steps, 3 sections<br>65 dB max, 5 dB steps, 4 sections | DC – 50 GHz | 5988-2475EN | 024 | Included | 10-pin DIP (standard) | Y1153A [2] | Y1174A |
| 8494G<br>8494H<br>8495G<br>8495H<br>8496G<br>8496H<br>8495K<br><br>8495K | 11 dB max, 1 dB steps, 4 sections<br>70 dB max, 10 dB steps, 3 sections<br>110 dB max, 10 dB steps, 4 sections<br>70 dB max, 10 dB steps, 3 sections<br>90 dB max, 10 dB steps, 4 sections | DC – 4 GHz<br>DC – 18 GHz<br>DC – 4 GHz<br>DC – 18 GHz<br>DC – 4 GHz<br>DC – 18 GHz<br>DC – 26.5 GHz<br><br>DC – 26.5 GHz | See footnote 13 below | 24 V (standard) | Included | 12-pin DIP (standard) | Y1153A [2] | Y1175A |

[11] Product and technical overviews for the switches and attenuators listed can be obtained by document number from the Keysight RF & Microwave Test Accessories website. Go to http://www.keysight.com/find/accessories, select 'RF & Microwave Test Accessories,' and search for the document number. Additional information can also be found in the 'RF and Microwave Test Accessories Catalog' accessible from this site. If viewing this document on-line, click on the reference document link.

[12] Bracket kits apply to the L4490A and L4491A. These kits include pre-assembled control cables and hardware for mounting switches/attenuators to the brackets and the bracket assemblies to the L4490A and L4491A RF Switch Platforms.

[13] Information on these attenuators plus additional information on other attenuators can be found in the latest version of the 'RF and Microwave Test Accessories Catalog.'

## Example Configuration

A test system is being built that requires the following microwave switching:

- (Qty 6) Keysight 87206B SP6T switches
- (Qty 8) Keysight N1810UL SPDT switches

Step 1. Select the required quantity of distribution boards for the required switches using Table 2:

- (Qty 6) Y1152A distribution boards to control
- (Qty 6) 87206B switches
- (Qty 1) Y1150A distribution board to control
- (Qty 8) N1810UL switches

Step 2. Select switch mounting kits from Table 3 based on switches selected:

- (Qty 2) Y1172A mounting kits to mount
- (Qty 6) 87206B switches
- (Qty 2) Y1170A mounting kits to mount
- (Qty 8) N1810UL switches

Step 3. Select the RF Platform and options. For 14 switches, the L4491A is recommended. If more than 4 distribution boards are needed, then you need to add Option 002.

Here is the final recommended configuration:

- (Qty 6) 87206B DC-20GHz SP6T switches with option 161
- (Qty 6) Y1152A distribution boards
- (Qty 2) Y1172A mounting brackets plus ribbon cables
- (Qty 8) N1810UL DC-20 GHz SPDT switches with options 124, 402, 201
- (Qty 1) Y1150A distribution board
- (Qty 2) Y1170A mounting brackets plus ribbon cables
- L4491A w/option 002 for an additional 64 control lines

See the Keysight 34945A, L4445A & L4490A/L4491A Configuration Guide (5989-2272EN) for additional configuration details.

## Related Keysight Literature

- 34945A, L4445A & L4490A/L4491A Configuration Guide 5989-2272EN
- RF and Microwave Test Accessories Catalog 5968-4314EN
- Rack Enclosures Solutions Catalog 5980-0450E

## Conclusion

Designing a custom RF switch matrix can be a challenging and time-consuming task. The Keysight Technologies, Inc. L4490A/91A RF switch platform simplifies this task allowing you to finish your test system design on-time. The switch platform provides the right tools to easily define and build a custom switch matrix while reducing your overall design time – all without sacrificing signal integrity. In addition, with the robust design, you can have confidence in the reliability and longevity of your system.

Keysight can also design and build you a complete RF switch matrix should you lack the expertise or resources to do it yourself.

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