

# Keysight Technologies

## RF/Microwave Switching Solutions

Solution Brochure



The core of test systems—  
RF/Microwave signal routing without  
compromise

Keysight RF/Microwave switching benefits

- Highly reliable and repeatable switching up to 5 M cycles
- Switching and signal conditioning up to 67 GHz
- Switch management features such as relay counters, switch verification, and switch sequencer
- Automated calibration
- Custom and standard, off-the-shelf solutions

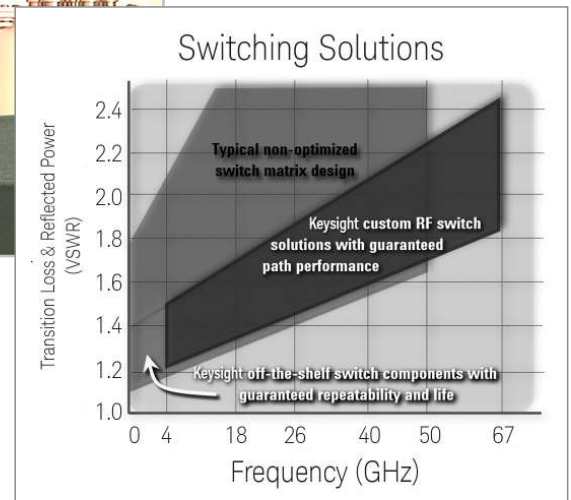
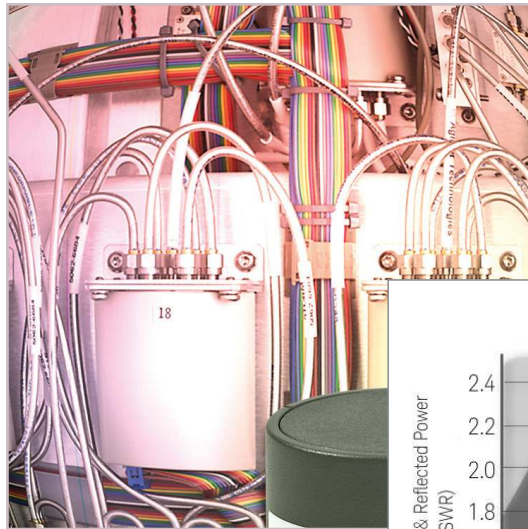
## Keysight RF/Microwave Switching Solutions

Keysight Technologies, Inc. has been providing RF/Microwave switch solutions for over 20 years. We have offerings from simple switch control to fully integrated solutions that are tested and documented. Keysight is in the unique position of supplying the highest quality RF and Microwave components, and the expertise to guarantee world-class path performance in a switching solution.

Keysight has a broad range of solutions for R&D and manufacturing engineers who develop design validation or functional test systems for a variety of applications. We offer RF/Microwave solutions with the broad range of supported switches up to 50 GHz and custom solutions to 67 GHz, future-proofing your investment for emerging commercial standards like WiMAX™, LTE and UMB. Our solutions are designed for test applications in many areas including military radios, radar communications or satellites in Aerospace/Defense or handsets, base stations, or radio components in wireless applications.

There are many issues one must consider when designing an RF switch matrix, which makes it a challenging task. Some of these issues include the:

- Electrical and mechanical constraints
- Switch control architecture
- Signal integrity and reliability
- Cost effectiveness
- Documentation and support








## RF/Microwave Switching Solutions

This brochure describes how Keysight solutions can provide just the right switching solutions to give you the confidence you need in your measurements. It provides an overview of the many RF/Microwave switching solutions as well as how to best choose among several different types of approaches to RF switching and/or switch control.



Many of Keysight's switching products come standard with these key features:

- LXI Class C with standard LAN, USB and GPIB interfaces
- Web interface for remote monitoring and control
- Relay counter to track switch closures
- Switch sequencer for faster switch setup and execution
- Switch verification to ensure closures
- SCPI code generator for ease of programming
- Software drivers for most common development environments

Product		Benefit
<p><b>Electromechanical Switches</b>                      Multiport Switches, SPDT Switches, Bypass Switches, Transfer Switches, Matrix Switches and Low Cost L-Series Switches</p>		<p>High accuracy and guaranteed repeatability for automated test and measurement – all with a wide variety in configurations to meet all your switching requirements</p>
<p><b>Custom Switch Solutions</b>                      For more information see <a href="http://www.keysight.com/find/switchmatrix">www.keysight.com/find/switchmatrix</a></p>		<p>Just the right custom switch solutions; as well as guaranteed world-class path performance solutions up to 67 GHz</p>
<p><b>Switch Platforms</b>                      L4490A/91A 2U &amp; 4U RF/Microwave Switch Platforms</p>		<p>Shorten the custom switch matrix development time and lower costs</p>
<p><b>Switch &amp; Control Units</b>                      34980A Multifunction Switch/Measure Unit,                      34970A Data Acquisition Switch Unit</p>		<p>Mixed signal system that can cost up to 40% less than VXI or PXI – Get low frequency and high frequency switching in a single box</p>
<p><b>Switch Drivers</b>                      34945A Switch/Attenuator Driver,                      L4445A Microwave Switch/Attenuator Driver,                      11713B/C Attenuator/Switch Drivers, U2121A Digital I/O for RF Switch Control</p>		<p>Easily control switches on a bench, in a test fixture or on a tray in your rack</p>

## RF/Microwave switching considerations

The choice of cables, connectors and switches can significantly impact overall system performance and reliability. The cables, connectors and switches create the signal path from the DUT to the measurement instruments. Ideally, there would be no signal degradation when routing from one point to another. For actual test systems, there is always some degradation of the signal in passing through these components. Signal degradation is directly related to signal frequency and the quality of signal routing components. To ensure good signal integrity choose cables, connectors and switches where the insertion loss, VSWR, and isolation at the desired frequencies do not compromise the measurement.

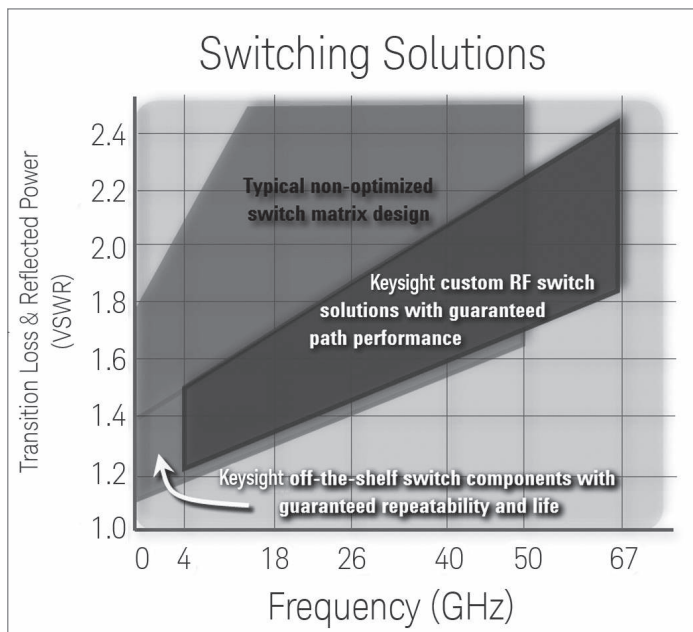


## Key factors in selecting RF/Microwave switches

When selecting RF/Microwave switches, be aware that the most common and readily available switches often present a minimum viable solution. The cost of the minimum solution may seem attractive; however, when using these products, the test system can give varying results over time and can often be difficult to troubleshoot. By adding a few switching options and features, you can significantly improve the repeatability, performance and usability of your switching solution.

Be sure to include the following features when selecting your RF/Microwave switches:

- Use high quality switches so the insertion loss, VSWR and isolation at the desired frequencies do not compromise your measurements.
- Select switches with long life and high repeatability between switch cycles to improve test system integrity.
- Use switches that provide position feedback so you can determine the actual position of the signal instead of the programmed state.
- Use switches with latching relays for less heat rise resulting in better measurement uncertainty.
- Use switches with D-sub socket connectors for ease of wiring.



## Keysight RF/Microwave Switches

Keysight switches are designed with high accuracy and repeatability for automated test and measurement, signal monitoring and routing applications. These switches provide excellent performance with a wide variety of configurations to meet all your switching requirements.

- **Bypass** switches insert or remove a test component from a signal path.
- **SPDT** switches route signals from an input to two output paths.
- **Multiport** switches allow a single input and multiple (three or more) output paths.
- **Transfer** switches can be used to switch between two inputs and two outputs, as a drop-out switch, for signal reversal, as a SPDT switch, or to bypass a test component.
- **Matrix** switches can be connected individually via internal microwave switches to form an RF path. They can be configured for blocking 1x5, 2x4, or 3x3 switching applications.

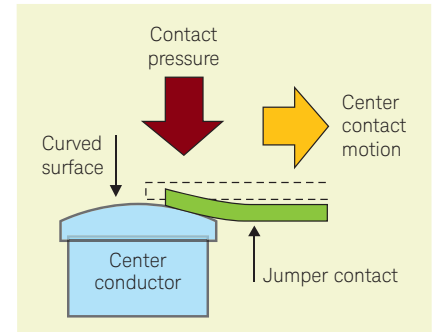
Electromechanical switches are widely used in both basic signal routing and application-specific switch matrices such as tree matrix, full access matrix, bypassing an active device, multi-source/multi-DUT switching, etc.

### Electromechanical switches

Keysight electromechanical switches are available in many different configurations with operating life up to 10 million cycles. With a guaranteed insertion loss repeatability of 0.03 dB up to 5 million cycles, these switches ensure accurate system measurements and reduce calibration intervals. Unmatched isolation, typically > 90 dB at 4 GHz, reduces sources of random errors. TTL drive option is available for most switches.

Keysight Electromechanical switches offer:

- A typical switching life that is two times the guaranteed specifications. For example, the specified switching life for 87106A is 5 million cycles, but in actuality the 87106A can typically work up to more than 10 million cycles.
- Guaranteed insertion loss repeatability of 0.03 dB up to 5 million cycles. This is made possible in Keysight switches with a unique “wiping action” mechanism in the contact area. The wiping action removes debris to ensure the insertion loss repeatability.
- Maximum input power of 100 W at 4 GHz at 25 °C under cold switching conditions, which means the RF signal is removed before switching is performed. Cold switching results in lower contact stress and longer life.



Keysight Patented Electromechanical switch technology with wiping action to remove debris.



### 87104/6 Series DC to 40 GHz Multiport Switches

The Keysight 87104/6 A/B/C/D latching coaxial switch combines unmatched flexibility of configuration with excellent repeatability, long life, and reliability.



### N1810 Series SPDT Coaxial Switches

The Keysight N1810TL/UL SPDT latching coaxial switch combines unmatched flexibility of configuration with excellent repeatability, long life and reliability. These SPDT switches can be used to route signals from input to two output paths.



### Bypass Switches

These bypass switches can be used to automatically insert or remove a test component from a signal path. The switches allow the user to “bypass” an active device. The Keysight N1811/2TL latching coaxial switch combines unmatched flexibility of configuration with excellent repeatability, long life, and reliability.



### 87222 Series DC to 50 GHz Coaxial Transfer Switches

Flexibility is essential in signal routing applications, and the Keysight 87222C/D/E 4-port coaxial transfer switch offers just that. It provides exceptional repeatability, low insertion loss, and high isolation. These switches provide simplification of design in signal routing and conditioning applications.



### 87404/06 Series Matrix Switches

The Keysight 87406B and 87606B matrix switches provide the life and reliability required for automated test and measurement, signal monitoring and routing applications. The switches are designed to operate for more than 10 million cycles and will meet all electrical specifications for at least 5 million cycles.



### Keysight's L-Series Electro-Mechanical Switches

Reduce measurement uncertainty for 2 million cycles with a guaranteed 0.03 dB insertion loss repeatability and unmatched isolation. These economically-priced, high-performance switches offer a full selection of switch configurations from DC up to 26.5 GHz. The L-Series switches are a lower cost alternative with many of the same specifications as previous generations but with lower life expectancy.

Electromechanical Switch Selection Table								
Keysight model number	Frequency	Terminated (T)/ Unterminated (U)	Guaranteed operating life (n million cycle)	Repeatability (dB)	Min isolation (dB)	Max insertion (dB) loss	Max SWR	RF connectors
Bypass switch (4-port)								
8763A	DC to 4 GHz	T	1	0.03	100	0.25	1.20	SMA (f)
8763B	DC to 18 GHz	T	1	0.03	90	0.50	1.30	SMA (f)
8763C	DC to 26.5 GHz	T	1	0.50	50	1.25	1.80	3.5 mm (f)
N1811TL	DC to 26.5 GHz	T	5	0.03	60	0.80	1.60	SMA (f)
Bypass switch (5-port)								
8764A	DC to 4 GHz	U	1	0.03	100	0.25	1.20	SMA (f)
8764B	DC to 18 GHz	U	1	0.03	90	0.50	1.30	SMA (f)
8764C	DC to 26.5 GHz	U	1	0.50	50	1.25	1.80	3.5 mm (f)
N1812UL	DC to 26.5 GHz	U	5	0.03	60	0.80	1.60	SMA (f)
Single-pole double-throw (SPDT) switch								
8762A	DC to 4 GHz	T	1	0.03	100	0.25	1.20	SMA (f)
8762F <sup>1</sup>	DC to 4 GHz	T	1	0.03	100	0.40	1.30	Mini SMB (m)
8765A	DC to 4 GHz	U	5	0.03	101	0.30	1.20	SMA (f)
8765F <sup>1</sup>	DC to 4 GHz	U	5	0.03	90	0.40	1.20	Mini SMB (m)
8761A	DC to 18 GHz	U	1	0.03	45	0.80	1.35	SMA (f) <sup>2</sup>
8761B	DC to 18 GHz	U	1	0.03	45	0.80	1.35	SMA (f) <sup>2</sup>
8762B	DC to 18 GHz	T	1	0.03	90	0.50	1.30	SMA (f)
8765B	DC to 20 GHz	U	5	0.03	65	0.70	1.70	SMA (f)
8762C	DC to 26.5 GHz	T	1	0.50	50	1.25	1.80	3.5 mm (f)
8765C	DC to 26.5 GHz	U	5	0.03	50	0.97	1.70	3.5 mm (f)
N1810UL	DC to 26.5 GHz	U	5	0.03	60	0.80	1.60	SMA (f)
N1810TL	DC to 26.5 GHz	T	5	0.03	60	0.80	1.60	SMA (f)
8765D	DC to 40 GHz	U	5	0.03	50	1.67	1.50	2.4 mm (f)
Single-pole triple-throw (SP3T) switch								
8766K	DC to 26.5 GHz	U	5	0.05	Isolation <sup>3</sup>	3.43	1.80	3.5 mm (f)
Single-pole four-throw (SP4T) switch								
87104A	DC to 4 GHz	T	5	0.03	100	0.36	1.20	SMA (f)
87204A	DC to 4 GHz	T	5	0.03	100	0.36	1.20	SMA (f)
L7104A	DC to 4 GHz	T	2	0.03	90	0.36	1.20	SMA (f)
L7204A	DC to 4 GHz	U	2	0.03	90	0.36	1.20	SMA (f)
87104B	DC to 20 GHz	T	5	0.03	70	0.60	1.70	SMA (f)
87204B	DC to 20 GHz	T	5	0.03	70	0.60	1.70	SMA (f)
L7104B	DC to 20 GHz	T	2	0.03	65	0.60	1.70	SMA (f)
L7204B	DC to 20 GHz	U	2	0.03	65	0.60	1.70	SMA (f)
87104C	DC to 26.5 GHz	T	5	0.03	65	0.70	1.70	SMA (f)
87204C	DC to 26.5 GHz	T	5	0.03	65	0.70	1.70	SMA (f)
L7104C	DC to 26.5 GHz	T	2	0.03	60	0.70	1.70	SMA (f)
L7204C	DC to 26.5 GHz	U	2	0.03	60	0.70	1.70	SMA (f)
8767K <sup>4</sup>	DC to 26.5 GHz	U	5	0.05	Isolation <sup>3</sup>	3.43	1.80	3.5 mm (f)
87104D	DC to 40 GHz	T	5	0.03	65	0.70	1.95	2.92 (f)
8767M <sup>4</sup>	DC to 50 GHz	U	5	0.03	45	2.60	2.30	2.4 mm (f/m)

1. 75 ohm impedance

2. Only applicable when all ports have the same connector type. Connector options available: Type-N (m/f)/APC-7/UT-250 Coax/SMA (m/f)/50 ohm termination

3. Varies with frequency and port selected

4. Insertion loss stated is from common port to the furthest port

Electromechanical Switch Selection Table, continued								
Keysight model number	Frequency	Terminated (T)/ Unterminated (U)	Guaranteed operating life (n million cycle)	Repeatability (dB)	Min isolation (dB)	Max insertion (dB) loss	Max SWR	RF connectors
Single-pole five-throw (SP5T) switch								
8768K <sup>4</sup>	DC to 26.5 GHz	U	5	0.05	Isolation <sup>3</sup>	3.43	1.80	3.5 mm (f)
8768M <sup>4</sup>	DC to 50 GHz	U	5	0.05	45	2.60	2.30	2.4 mm (f/m)
Single-pole six-throw (SP6T) switch								
87106A	DC to 4 GHz	T	5	0.03	100	0.36	1.20	SMA (f)
87206A	DC to 4 GHz	T	5	0.03	100	0.36	1.20	SMA (f)
L7106A	DC to 4 GHz	T	2	0.03	90	0.36	1.20	SMA (f)
L7206A	DC to 4 GHz	U	2	0.03	90	0.36	1.20	SMA (f)
87106B	DC to 20 GHz	T	5	0.03	70	0.60	1.70	SMA (f)
87206B	DC to 20 GHz	T	5	0.03	70	0.60	1.70	SMA (f)
L7106B	DC to 20 GHz	T	2	0.03	65	0.60	1.70	SMA (f)
L7206B	DC to 20 GHz	U	2	0.03	65	0.60	1.70	SMA (f)
87106C	DC to 26.5 GHz	T	5	0.03	65	0.70	1.70	SMA (f)
87206C	DC to 26.5 GHz	T	5	0.03	65	0.70	1.70	SMA (f)
L7106C	DC to 26.5 GHz	T	2	0.03	60	0.70	1.70	SMA (f)
L7206C	DC to 26.5 GHz	U	2	0.03	60	0.70	1.70	SMA (f)
8769K <sup>4</sup>	DC to 26.5 GHz	U	5	0.05	Isolation <sup>3</sup>	3.43	2.05	3.5 mm (f)
87106D	DC to 40 GHz	T	5	0.03	65	0.70	1.95	2.92 (f)
8769M <sup>4</sup>	DC to 50 GHz	U	5	0.03	45	2.60	2.30	2.4 mm (f/m)
Double-pole double-throw (transfer) switch								
87222C	DC to 26.5 GHz	U	5	0.03	67	0.86	1.65	SMA (f)
L7222C	DC to 26.5 GHz	U	2	0.03	57	0.86	1.65	SMA (f)
87222D	DC to 40 GHz	U	5	0.03	60	1.20	1.70	2.92 mm (f)
87222E	DC to 50 GHz	U	5	0.05	60	1.15	1.70	2.4 mm (f)
Matrix switch (3x3, 2x4 & 1x5)								
87406B	DC to 20 GHz	T	5	0.03	70	1.00	1.90	SMA (f)
87606B	DC to 20 GHz	T	5	0.03	70	1.00	1.90	SMA (f)

- 75 ohm impedance
- Only applicable when all ports have the same connector type. Connector options available: Type-N (m/f)/APC-7/UT-250 Coax/SMA (m/f)/50 ohm termination
- Varies with frequency and port selected
- Insertion loss stated is from common port to the furthest port



## Custom Switch Solutions

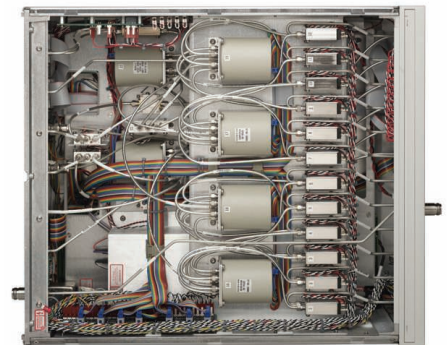
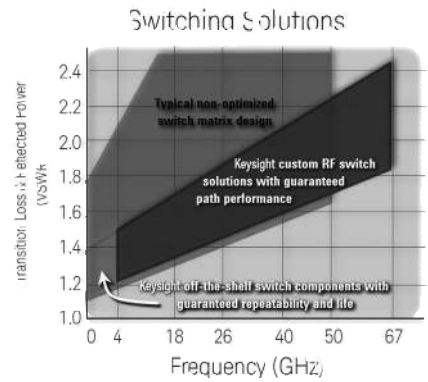
Keysight Technologies provides integrated, high performance RF test systems and system components to the aerospace/defense and wireless industries. We deliver significant numbers of systems per year and a custom system purchased from Keysight brings confidence in a highly accurate and repeatable solution. The system team also designs and provides system components for our customers. The heart of an RF test system is the switch matrix. Keysight has been providing exceptional switch matrices for many years and continues to do so as part of our system business.

To complete custom switching and signal conditioning units, our switch matrix designs range from a simple 1 x 12 fanout to a 10 x 10 non-blocking full access matrix, to complete custom switching and signal conditioning units. The keys to Keysight's exceptional switch matrix performance are our unmatched design experience, our no-compromise manufacturing processes for switches and semi-rigid cables, and our well-established methods for matrix assembly and testing.

The Customs team uses Keysight's standard commercial manufacturing process, except for one difference, you are involved in the design phase. Then after your matrix is built, we will measure the S-parameters of every signal path with a Keysight Performance Series Network Analyzer to make sure that your specifications are met. The test data is included in the documentation you receive with the matrix.

### Recommended Electronic Calibration (ECal) modules

The software supports the use of Keysight Electronic Calibration (ECal) modules for reducing calibration time and increasing ease-of-use. Various frequency span and connector type options are available. For more information on custom solutions, go to: [www.keysight.com/find/switchmatrix](http://www.keysight.com/find/switchmatrix)



## RF/Microwave Switch Platforms

The Keysight L4490A and L4491A RF Switch Platforms are designed for the test engineer designing his own RF switch solution. These platforms provide the tools to shorten RF switch development time and lower costs. Both platforms include power, switch drive control and space to mount all the most popular switches and attenuators and other signal conditioning components.

- The L4490A 2U high unit features a bottom plate with pre-drilled holes for mounting switches, attenuators and other signal conditioning components.
- The L4491A 4U high version features a unique system to mount switches and attenuators vertically in the enclosure for a compact, reliable solution to meet your custom needs.

Both platforms come standard with 64 coil drives integrated into the enclosure, with several options offered for expansion. Time-saving features include:

- Flexible and easily configurable switch mounting system for robust and reliable signal routing
- 3D models for quick layout and documentation of RF switches and cables
- Graphical Web interface for quick setup, troubleshooting and support
- Easy connection and control of all the most popular microwave switches and attenuators
- Effective switch management with user defined switch sequences, relay counter, exclude lists and switch closure verification
- Software drivers for all the most common programming environments

The front panels come blank so they can easily be customized to your unique requirements. An optional front panel is also available with holes for mounting switches directly onto the front panel.

The RF Switch Platforms were designed with serviceability in mind. Easily identify and access switch failures without having to disturb your RF cabling.

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.

For more information on either the L4490A or L4491A, go to [www.keysight.com/find/L4490A](http://www.keysight.com/find/L4490A) or [www.keysight.com/find/L4491A](http://www.keysight.com/find/L4491A)



Customer configured solutions

<b>L449xA Switch Platforms &amp; Accessories</b>		
<b>Product</b>	<b>Description</b>	<b>Comments</b>
<b>L4490A</b>	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.
<b>OPT 004</b>	Add 16 bit digital IO and 28 bits of relay drive lines	Recommended for DIO control
<b>L4491A</b>	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.
<b>OPT 001</b>	Front panel with holes to mount up to 8 Keysight 87xxx or L7xxx style multiport switches	
<b>OPT 002</b>	Add 64 additional switch drive lines with additional 34945EXT	
<b>OPT 004</b>	Add 16 bit digital IO and 28 bits of relay drive lines	Recommended for DIO control
<b>OPT 006</b>	4U unit with bottom mounting tray (pre-drilled bottom for mounting switches and no center switch tray)	
<b>Accessories</b>	Distribution boards - Required for control of external switches.	
<b>Y1150A</b>	Distribution board for 8 N181x/U9397x SPDT switches	
<b>Y1151A</b>	Distribution board for two 87104x/106x/L7x0xx multiport or 87406B matrix switches	
<b>Y1152A</b>	Distribution board for one 87204x/206x or 87606B switch and two N181x switches	
<b>Y1153A</b>	Distribution board for two 84904/5/6/7/8 or 8494/5/6 step attenuators	
<b>Y1154A</b>	Distribution board for two 87222/L7222C transfer switches and six N181x SPDT switches	
<b>Y1155A</b>	Distribution board w/ generic screw terminals for driving 16 switch coils	
<b>Y1156A</b>	Diagnostics board to verify switch control signals	Recommended for troubleshooting purposes
	Mounting brackets with ribbon cables	
<b>Y1170A</b>	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 switches in switch tray). Ribbon cables only support N1810 series switches.
<b>Y1171A</b>	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.
<b>Y1172A</b>	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 (up to 16 multiport switches in the switch tray)
<b>Y1173A</b>	Mounting brackets and ribbon cables for mounting qty 6 87222 series transfer switches in the L4490A/91A (3 brackets and 6 cables)	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 switch bay (up to 16 per switch tray)
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 switch bay (up to 16 per switch tray)

## Low Frequency and RF/Microwave Switch and Control Units – 34980A, 34970A

Keysight has several standard switching systems that offer either RF/Microwave switching on a card or RF/Microwave switch drivers.

These modules can be used in high frequency systems or in mixed systems that require both high and low frequency switching in a single box.



	<b>34970A Data Acquisition Switch Unit</b>	<b>34980A Multifunction Switch/Measure Unit</b>
Number of available slots	3	8
Number of available modules	8	21
Front panel	Yes	Yes
<b>Available module functionality</b>		
Integrated DMM	6½ digit	6½ digit
Max scan speed	250 ch/s	1000 ch/s
Max 2-wire Mux channels	60	560
Max voltage	300 V	300 V
Max frequency	2 GHz	26.5 GHz
Max matrix cross points	96	4,096
IO interfaces	GPiB, RS-232	LAN, USB 2.0, GPiB
Microwave switch driver	No	Yes

## Low Frequency and RF/Microwave Switch and Control Units – 34980A, 34970A

### 34980A Multifunction Switch/Measurement Unit

The Keysight 34980A is an eight-slot mainframe that includes an optional built-in 6½ digit DMM. Choose from more than 20 optional plug-in modules that offer a broad range of functionality which includes DC to 26.5 GHz switching, counter/totimizer, digital I/O with pattern capabilities, and D/A converters – in one compact, high-performance modular platform. The 34980A is easily integrated into automated test or data acquisition applications with a graphical Web interface, standard connectors, standard I/O to the computer, and standard software drivers.

- Front panel or software controlled
- Graphical Web interface for quick setup and troubleshooting
- Easy connections with standard D-sub cables or screw terminal blocks
- Use RF/Microwave Switches on a card or control switches external to the mainframe with switch driver
- Define and execute up to 500 switch sequences stored in non-volatile memory
- Relay cycle counter to predict end of switch life
- LXI Class C compliant with standard LAN, USB and GPIB interfaces

For more information on the Keysight 34980A, go to:  
[www.keysight.com/find/34980A](http://www.keysight.com/find/34980A)

### 34970A Data Acquisition Switch Unit

The Keysight 34970A consists of a three-slot mainframe with a built-in 6½ digit digital multimeter. Each channel can be configured independently to measure one of 11 different functions without the added cost or hassles of signal-conditioning accessories. Choose from eight optional plug-in modules to create a compact data logger, full-featured data acquisition system or low-cost switching unit. The 34970A is ideal for small automated test equipment (ATE) systems that require some low frequency switching with RF switching, or it also has the ability to control switches external using the digital IO module.

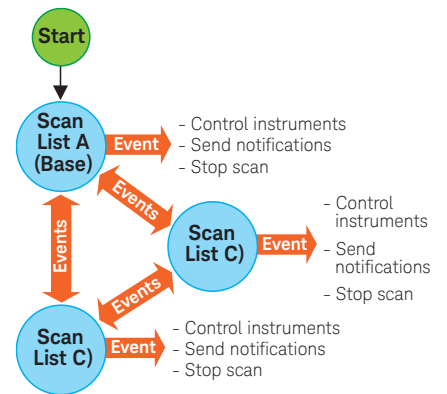
- Front panel or software controlled
- Easy connections
- RF Switching to 2 GHz
- Relay cycle counter to predict end of switch life

For more information on the Keysight 34970A, go to:  
[www.keysight.com/find/34970A](http://www.keysight.com/find/34970A)



### BenchLink Data Logger for 34970A and 34980A

The 34970A and 34980A also include FREE BenchLink Data Logger software for a convenient way to collect and analyze your data. The New BenchLink Data Logger Pro adds real-time limit checking, decision making and conditional branching with no programming required. For more information go to [www.keysight.com/find/3483xA](http://www.keysight.com/find/3483xA)



34980A Multifunction Switch/Measure Mainframe and Modules							
Low frequency modules							
Module	Description	Max volts	Switch/ carry current	BW (MHz)	Scan ch/sec	Thermal offset	Comments
Multiplexers							
<b>34921A</b>	40-channel armature multiplexer w/ low thermal offset	±300 V	1 A / 2 A	45 MHz	100	< 3 µV	· Temp reference · 4 current channels · Config as 2- or 4-wire
<b>34922A</b>	70-channel armature multiplexer	±300 V	1 A / 2 A	25 MHz	100	< 3 µV	Config as 2- or 4-wire
<b>34923A</b>	40/80-channel reed multiplexer	±150 V peak	0.5 A / 1.5 A	45 MHz	500	< 50 µV	Config as 1-, 2- or 4-wire
<b>34924A</b>	70-channel reed multiplexer	±150 V peak	0.5 A / 1.5 A	25 MHz	500	< 50 µV	Config as 2- or 4-wire
<b>34925A</b>	40/80-channel optically isolated FET multiplexer	±80 V	0.02 A / 0.02 A	1 MHz	1000	< 3 µV	Config as 1-, 2- or 4-wire
Matrices							
<b>34931A</b>	Dual 4x8 armature matrix	±300 V	1 A / 2 A	30 MHz	100	< 3 µV	Backplane expandable
<b>34932A</b>	Dual 4x16 armature matrix	±300 V	1 A / 2 A	30 MHz	100	< 3 µV	Backplane expandable
<b>34933A</b>	Dual/quad 4x8 reed matrix	±150 V peak	0.5 A / 1.5 A	30 MHz	500	< 50 µV	Backplane expandable Config as 1- or 2-wire
<b>34934A</b>	Quad 4x32 reed matrix	±100 V	0.5 A / 0.5 A	20 MHz	500	< 50 µV	
General purpose							
<b>34937A</b>	28-channel Form C and 4-channel Form A	300 V 30 VDC/250 VAC	1 A / 2 A 5 A / 8 A	10 MHz	N/A	3 µV	
<b>34938A</b>	20-channel 5-amp Form A	30 VDC/250 VAC	5 A / 8 A	1 MHz	N/A	3 µV	
<b>34939A</b>	64-channel Form A	±100 V	1 A / 2 A	10 MHz	N/A	3 µV	
RF and microwave modules							
Module	Description	Insertion loss	Isolation	Frequency range	VSWR	Input im- pedence	Comments
<b>34941A</b>	Quad 1x4 50 ohm 3 GHz RF multiplexer	< 0.6 dB	> 58 dB	3 GHz	< 1.25	50 ohm	Specs @ 1 GHz
<b>34942A</b>	Quad 1x4 75 ohm 1.5 GHz RF multiplexer	< 0.6 dB	> 60 dB	1.5 GHz	< 1.35	75 ohm	Specs @ 1 GHz
<b>34945A</b>	Microwave switch/attenuator driver						
<b>34946A</b>	Dual 1x2 SPDT terminated microwave switch	< 0.42 dB < 0.69 dB < 0.8 dB	> 85 dB > 67 dB < 60 dB	4 GHz or 20 GHz 26.5 GHz	< 1.15 < 1.30 < 1.6	50 ohm	@ 4 GHz @ 20 GHz @ 26.5 GHz
<b>34947A</b>	Triple 1x2 SPDT unterminated microwave switch	< 0.42 dB < 0.69 dB < 0.8 dB	> 85 dB > 67 dB < 60 dB	4 GHz or 20 GHz 26.5 GHz	< 1.15 < 1.30 < 1.6	50 ohm	@ 4 GHz @ 20 GHz @ 26.5 GHz
System control modules							
Module	Description	Comments					
<b>34950A</b>	64-bit digital I/O with memory and counter	Eight 8-bit digital I/O channels with programmable polarity, thresholds up to 5 V, 7 handshaking protocols and pattern memory. Two 10 MHz frequency counter/totalizers.					
<b>34951A</b>	4-channel isolated D/A converter with waveform memory	Output DC voltage up to ±16 V or DC current up to ±20 Output waveforms with a 200 kHz update rate and 16 bits of resolution. Use on-board memory to create waveforms with more than 500,000 points.					
<b>34952A</b>	Multifunction module with 32-bit DIO, 2-ch D/A and totalizer	Four 8-bit digital I/O channels, two ±12 V analog outputs, and a 100 kHz gated totalizer.					
<b>34959A</b>	Breadboard module	Create your own custom designs with access to the +12 V and +5 V supplies, 16 GPIO ports and 32 drive lines.					

<b>34970A Data Acquisition Control Mainframe and Modules</b>					
<b>Product comparison – 34970A Data acquisition control unit module</b>					
Product	Description	Speed (Ch/sec)	Max voltage	Max current	Comments
<b>34901A</b>	20-ch. multiplexer (2/4-wire)	60	300 V	1 A	2 current channels (22 ch. total); built-in cold junction reference; connects to internal DMM
<b>34902A</b>	16-ch. multiplexer (2/4-wire)	250	300 V	50 mA	Built-in cold junction reference; reed relays multiplex inputs to internal DMM
<b>34903A</b>	20-ch. actuator/GP switch	120	300 V	1 A	Form C (SPDT) switches; no connection to internal DMM
<b>34904A</b>	4x8 matrix	120	300 V	1 A	2-wire, full crosspoint; no connection to internal DMM
<b>34905A</b>	2-GHz dual 1:4 RF mux, 50 ohm	60	42 V	0.7 A	1-GHz through provided BNC-to-SMB adapter cables; no connection to internal DMM
<b>34906A</b>	2-GHz dual 1:4 RF mux, 75 ohm	60	42 V	0.7 A	1-GHz through provided BNC-to-SMB adapter cables; no connection to internal DMM
<b>34907A</b>	Two 8-bit digital I/O ports	N/A	42 V	400 mA	Open Drain
	26-bit, 100 kHz event counter	N/A	42 V		Gated, selectable input threshold
	Two 16-bit analog outputs	N/A	±12 V	10 mA	Earth referenced, calibrated No connection to internal DMM
<b>34908A</b>	40-ch. single-ended multiplexer	60	300 V	1 A	Common low, no 4-wire meas. Built-in cold junction reference; connects to internal DMM

## RF/Microwave Switch Drivers

Switch drivers are good for controlling RF/Microwave switches and attenuators anywhere in a test system. They can control switches on a bench, in a test fixture or on a tray in your rack.

	<b>34945A</b>	<b>L4445A</b>	<b>11713B/C</b>	<b>U2121A</b>
Number of Control Lines	64 to 512	64 to 512	10 to 20	16
Front Panel	Yes	No	Yes	No
IO Interfaces	LAN, USB, GPIB	LAN, GPIB	GPIB, USB, LAN	USB



### 34980A Switch/Measurement Unit with the 34945A Switch Driver

The Keysight 34980A switch/measure mainframe with the 34945A switch driver is an ideal solution for systems requiring both low and high frequency switching. This offers a low cost solution for mixed signal switching applications.

- Control of most popular microwave switches and attenuators
- Expandable with 34945EXT Remote Module
- Distribution boards for ease of wiring
- Switch readback capabilities
- External power option for simultaneous switching
- Create and execute up to 500 switching sequences from nonvolatile memory



The Keysight 34945A switch/attenuator driver module for the 34980A Multifunction Switch/Measure Unit allows you to control switches and attenuators external to the 34980A Mainframe. This module provides power and control signals for many of the most popular microwave switches and attenuators. Distribution boards offer ease of wiring to the external switches. One 34945A and 34945EXT can drive up to 64 switch coils, that is 32 SPDT switches. Extend up to 8 additional 34945EXT's to drive up to 512 switch coils.

### L4445A uW/Attenuator Switch Driver

The Keysight L4445A is a 1U high, ½ rack-wide standalone instrument that controls external switches and attenuators. With its small size and Ethernet connectivity, the switch/attenuator driver can be placed wherever your application needs it. The Keysight L4445A provides the right power and control signals to control switches, attenuators and other devices. The digital outputs can be used to drive LEDs to indicate the switch position. Digital inputs can be used to read back the actual position of the switch or attenuator.

The L4445A offers RF/Microwave control of switches and attenuators in a test fixture with expandability up to 512 control lines.

For more information on the Keysight L4445A, go to [www.keysight.com/find/L4445A](http://www.keysight.com/find/L4445A)





## RF/Microwave Switch Drivers (continued)

### 11713B/11713C Attenuator/Switch Driver

The Keysight 11713B and 11713C attenuator/ switch drivers provide remote or front-panel drive control for two or four programmable attenuators and two or four SPDT switches. The Keysight 11713B or 11713C can also be used to independently control from 10 to 20 switches. Designed with both benchtop and ATE environments in mind, this flexible, stand-alone driver provides an intuitive user interface, a variety of switching options, software programmability and remote control features for quick, easy design validation and automated testing.

- User friendly interface provides quick set up, switching and remote control of small-scale ATE
- Multiple connectivity options of GPIB, USB, LAN (LXI Class C) for easy remote integration
- An integrated, tri-voltage power supply of 5, 15 and 24 V saves rack space (11713C only)

An integrated power supply eliminates the need for an external power source. Each Keysight 11713B or 11713C is offered with nine optional plug-in drive cables to provide point-to-point connection to Keysight programmable attenuators and switches. The driver response time is less than 10 microseconds.

Front panel push-buttons and an easy-to-read LCD display simplify the setup of functions such as voltage, TTL functions, IP address, etc. Powerful software programming and a choice of GPIB, USB or LAN connectivity and software instrument drivers provide instrument and programming compatibility.

For more information on the Keysight 11713, go to [www.keysight.com/find/switchdrivers](http://www.keysight.com/find/switchdrivers)

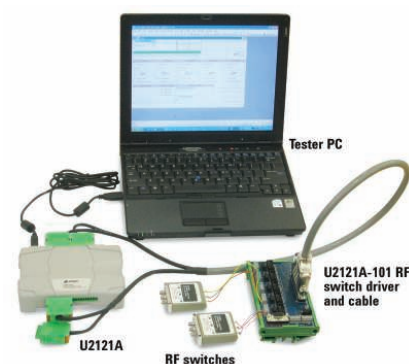


### U2121A USB Digital I/O for RF Switch Control

With the optional RF switch integration kit, the Keysight U2121A digital input/output (DIO) module becomes a convenient, cost-effective way to implement RF switching in small test systems for a variety of applications. The simplified installation and operation of the DIO card and the breakout module allows straightforward control of small RF switching systems. This helps you quickly create simple yet cost-effective RF switch systems.

- Control and monitor up to five RF switches
- Quick and easy setup with bundled RF switch driver software and cable
- Hassle-free setup eliminates complex DC connections, enabling more focus on RF signal routing
- Programmable DIO power-up states allow storage of pre-defined RF switch states
- Watchdog timer provides failsafe capability to preserve known states
- Supports failsafe and latching-relay switches for maximum flexibility

For more information on the Keysight U2121A-based RF Switch Driver, go to [www.keysight.com/find/DIOSolution](http://www.keysight.com/find/DIOSolution)



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