Keysight 34946A–34947A Microwave Switch/Driver Modules

KEYSIGHT TECHNOLOGIES

User's Guide

Notices

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Safety Information

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Safety Symbols

The following symbols or markings that may be on or with the instrument and in the documentation indicate precautions which must be taken to maintain safe operation of the instrument.

	Alternating current (AC)		Caution, risk of electric shock
	Frame or chassis (ground) terminal		Caution, risk of danger (refer to this manual for specific Warning or Caution information)
	Standby supply. Unit is not completely disconnected from ac mains when switch is off		Direct current (DC)
	Off (mains supply)		On (mains supply)
	Three phase alternating current		Presence of a laser device
	Protective earth (ground) terminal		Equipment protected throughout by double insulation or reinforced insulation
	Caution, hot surface		Product is sensitive to electrostatic discharge

Additional Safety Notices

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or instructions elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability of the customer's failure to comply with the requirements.

WARNING Refer to the 34980A User's Guide before using the equipment. The 34980A User's Guide contains additional important information about the modules.

WARNING

GENERAL

If this product is not used as specified in the operating instructions, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only. Any external connections must be made prior to applying power.

WARNING

DO NOT REMOVE THE INSTRUMENT COVER

No operator serviceable parts inside. Do not install substitute parts or perform any unauthorized modifications to the instrument. Return the instrument to Keysight for service and repair to ensure the safety features are maintained in operational condition. Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired.

WARNING

GROUND THE INSTRUMENT

This is a Safety Protection Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited. The mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Inadequate earth grounding can damage the instrument. Always use the three-prong AC power cord supplied with the instrument.

Connect the AC power cord as follow:

- Ensure that the power cord is not damaged.
- Install the signal generator so that one of the following items is readily identifiable and easily reached by the operator: AC power cord, alternative switch or circuit breaker.
- Insert the mains plug into a socket outlet provided with a protective earth grounding.

WARNING

IN CASE OF DAMAGE

Do not use the instrument if it is damaged. Before you use the instrument inspect all connections. Pay particular attention to the insulation surrounding connectors and / or cable assembly insulation. NEVER use a cable showing any signs of damage. Faulty cables can cause electrical shock and /or fire hazards and could lead to personal injury or death.

WARNING

Refer to the User Guides of the 34980A and relevant modules before using the equipment.

WARNING The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device). The instrument power cord does not disconnect or de-energize external circuits connected to the analog bus, terminal blocks or modules.

WARNING Safety of any system incorporating the equipment is the responsibility of the assembler of the system.

WARNING Keysight Customers utilizing the Open Platform Test Systems are classified as follows and require the user to have the appropriate skillset:

Operator: Interacts with the test system in a production environment, selection of test sequences, defining variables, running tests (test results, test statistics, control of marking devices)

Supervisor: Includes access to maintenance functions and utility sequences (control of hardline system functions, access to test area

Developer: Full access

WARNING Dangerous voltage levels capable of causing death, may be present on a channel. Use extreme caution when handling and testing and adjusting this instrument. Any voltages greater than 30 Vrms, 42.4 Vpeak and 60 Vdc are considered hazardous (IEC 61010-1).

WARNING Removal of the instrument's cover is to be conducted by qualified personnel only. Only qualified, trained personnel who are aware of the hazards involved should remove instrument covers. Prevent operators from accessing any external circuits, test fixtures, cables or wherever hazardous voltages may be present. Failure to recognize and observe normal safety precautions could result in personal injury or death.

WARNING ENVIRONMENTAL HEALTH & SAFETY: When any channel is connected to a hazardous voltage source, the instrument and the device under test should be supervised, following local EHS practices to restrict access.

Environmental Conditions

Keysight 34980A is designed for indoor use in an installation category II and low condensation environment. Table below shows the general environmental conditions for this instrument. Refer to the product data sheet at https://literature.cdn.keysight.com/litweb/pdf/5989-1437EN.pdf for more information on the instrument general specifications.

General specifications	Requirement
Temperature	Operating condition: 0°C to 55°C Storage condition: -40°C to 70°C
Humidity	Maximum Relative Humidity (non-condensing): 80% RH up to 40°C, decreases linearly to 37% RH at 55°C[a]
Altitude	Up to 2,000 m
Pollution degree	1 or 2

[a] From 40°C to 55°C, the maximum % Relative Humidity follows the line of constant dew point.

Regulatory Markings

CE	The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives.	C SA US	The CSA mark is a registered trademark of the Canadian Standards Association.
UK CA	The UK conformity mark is a UK government owned mark. Products showing this mark comply with all applicable UK regulations.	ccr.keysight@keysight.com	The Keysight email address is required by EU directives applicable to our product.
CE CAN ICES/NMB-001(A) ISM GRP 1-A	This indicates that this ISM device complies with the Canadian ICES-001. Interference-Causing Equipment Standard for industrial, scientific and medical (ISM) equipment. Matériel industriel, scientifique et médical (ISM)	ISM 1-A	This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPR 11, Clause 5)
CE CAN ICES/NMB-001(A) ISM GRP 1-A	The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives. ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada. ISM GRP.1 Class A indicates that this is an Industrial Scientific and Medical Group 1 Class A product.	CAN ICES/NMB-001(A) ISM GRP 1-A	This is a combined marking to indicate product compliance with the Industry Canadian Interference-Causing Equipment Standard (ICES/NMB-001). This is also a symbol of an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 5).
KC	This symbol is a South Korean Class A EMC Declaration. This is a Class A instrument suitable for professional use and in electromagnetic environment outside of the home.	RCM	The RCM mark is a registered trademark of the Australian Communications and Media Authority.

	This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.		This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.
	Universal recycling symbol.	IP x y	This mark indicates product has been designed to meet the requirements of "IP x y", where "x" is the solid particle protection and "y" is the liquid ingress protection.

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation.

Please refer to keysight.com/go/takeback to understand your Trade in options with Keysight in addition to product takeback instructions.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- www.keysight.com/find/34980a
  (product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
  (worldwide contact information for repair and service)

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34946A and 34947A Dual/Triple Microwave Switch Modules

The 34946A and 34947A modules provide single-pole, double-throw switches in 4 GHz, 20 GHz, and 26 GHz options. The 34946A and 34947A modules are also available with no switches installed - but include cable kits that allow you to connect switches external to the module chassis. The configuration options of the modules are summarized below:

34946A Dual 1x2 SPDT Terminated Microwave Switch	34947A Triple 1x2 SPDT Unterminated Microwave Switch
Option 001: No switches installed Option 004: 4 GHz switches installed Option 020: 20 GHz switches installed Option 026: 26 GHz switches installed	Option 001: No switches installed Option 004: 4 GHz switches installed Option 020: 20 GHz switches installed Option 026: 26 GHz switches installed
Supported Switches: Keysight N1810UL Unterminated 3-port SPDT Keysight N1810TL Terminated 3-port SPDT Keysight N1811TL Terminated 4-port transfer Keysight N1812UL Unterminated 5-port transfer	Supported Switches: Keysight N1810UL Unterminated 3-port SPDT
Required N1810 options: Opt. 124 -- 24 Volt coil voltage Opt. 201 -- “D” subminiature 9-pin female connector Opt. 402 Position indicators	Required N1810 options: Opt. 124 -- 24 Volt coil voltage Opt. 201 -- “D” subminiature 9-pin female connector Opt. 402 Position indicators
Switch reference document number: 5968-9653E	Switch reference document number: 5968-9653E
34946A Option 001 contains cables and connectors to support two of the supported switches listed above.	
34947A Option 001 contains cables and connectors to support three Keysight N1810UL switches.	

The 34946A and 34947A modules do not connect to the analog buses. Instead, all connections are made through the visible SMA connectors via external cables. Each connector on the modules is labeled with a three-digit number that represents a channel you can control programmatically from the front panel or from the Web UI.

NOTE There are several suppliers of RF cables and connectors used with Keysight switches. Three suppliers are listed below:

Pasternack Enterprises, Inc.	http://www.pasternack.com
Micro-Coax®	http://www.micro-coax.com
S. M. Electronics L.L.C.	http://www.smelectronics.us

CAUTION The 34946A and 34947A support only 24 VDC coil options for the N1810 switches. If the proper voltage option (Opt. 124) is not used, the switches could be damaged.

The 34946A module (Options 004, 020, 026) has two independent Keysight N1810TL switches. These terminated 3-port 50-ohm switches are designed to maintain impedance matching. The 34947A module (Options 004, 020, 026) contains three independent Keysight N1810UL switches. These higher density 3-port switches are unterminated. For channel configuration on each module, refer to the simplified schematics on page 22.

The 34946A and 34947A modules implement a *verification* (position indication) feature, which senses the actual hardware state of the specified channels following a `ROUTe:CLOSe` or `ROUTe:OPEN` operation. If a switch operation appears to have failed, an error will be generated at the time the `ROUTe:CLOSe` or `ROUTe:OPEN` command is executed. An error will be generated for each channel operation that did not properly verify. The verification process will slow overall switching performance on the module.

34946A and 34947A Option 001 Installation

Option 001 to the 34946A and 34947A is a 30-pin ribbon connector to 9-pin D-Sub connector cable kit. The option allows you to connect two (34946A) or three (34947A) switches external to the instrument chassis.

NOTE **34946A Option 001 and 34947A Option 001as purchased meet all safety and EMC regulatory requirements. Any modifications or additions to the options and their conformance to local regulatory requirements are the responsibility of the user.**

The steps for installing the cable assembly and 9-pin D-Sub connectors are as follows:

1 Remove the 34946A or 34947A cover by removing the screw (T-10 torx) on the top of the instrument (Figure 1).

CAUTION **Use care when handling the 34946A or 34947A chassis with the cover removed as components within the chassis are susceptible to damage from ESD.**

2 Insert the ribbon cable into the connector on the printed circuit board as shown (Figure 1).

3 **34946A** - Route the center and left 9-pin strands through the corresponding slots of the instrument face plate (Figure 1). Cut the cable strands to the desired length, or if necessary, the full length of the strands can be used.

Do not attach the D-Sub connector (Step 4) until the strands have been routed through the face plate slots.

3 **34947A** - Route the right, center, and left 9-pin strands through the corresponding slots of the face plate as shown (Figure 1).

Cut the cable strands to the desired length, or if necessary, the full length of the strands can be used.

Do not attach the D-Sub connector (Step 4) until the strands have been routed through the face plate slots.

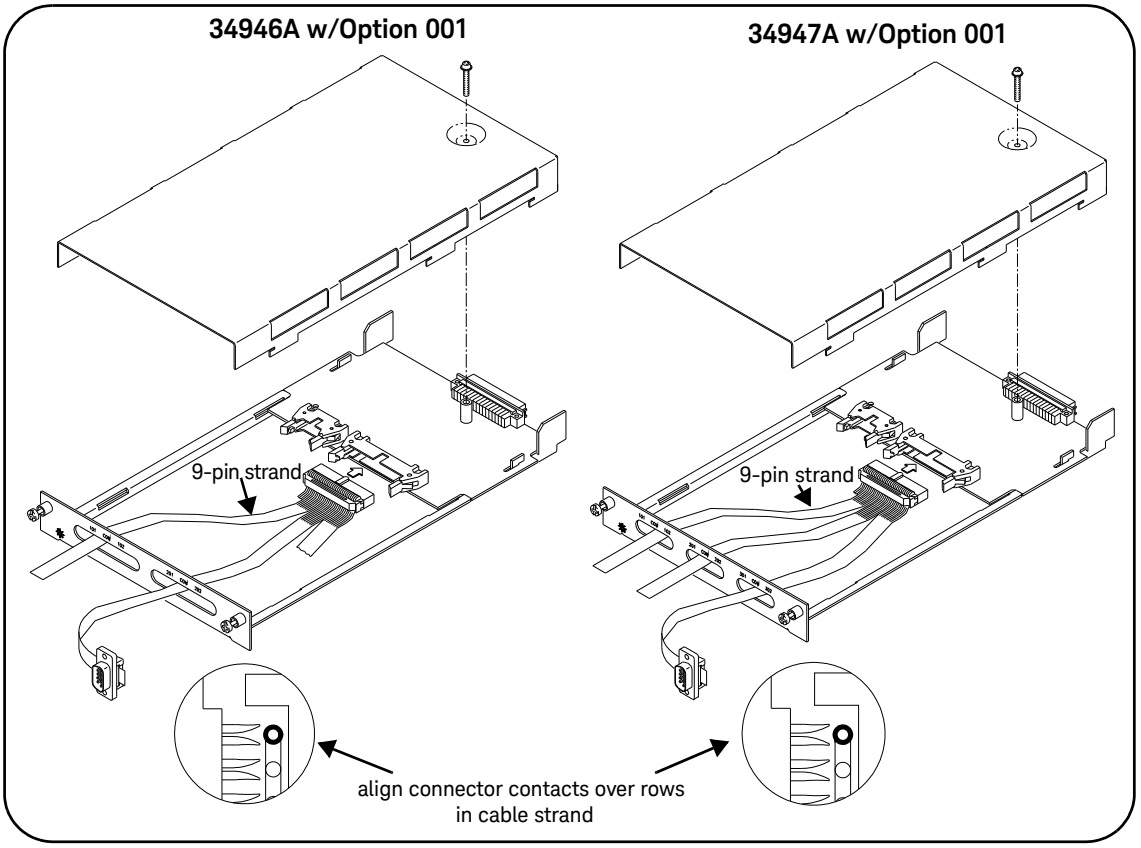

Figure 1-1 34946A and 34947A Option 001 Installation.

4 Insert the ribbon cable strand into the D-Sub connector as shown. Align the metal contacts of the connector over the pins. Press the connector onto the strand using a vise or clamp to press the contacts evenly through the cable insulation. Continue to press the connector until the metal contacts are no longer visible. Remove any excess part of the strand protruding through the connector.

5 Fold the excess ribbon cable length back into the chassis body behind the faceplate. Re-attach the instrument cover and tighten the torx screw to secure the cover in place.

The pinouts of the N1810/11/12 switches and of the D-Sub connector are shown in Figure 2. Note that the pin numbers of the switch are defined as shown, not as printed on the connector.

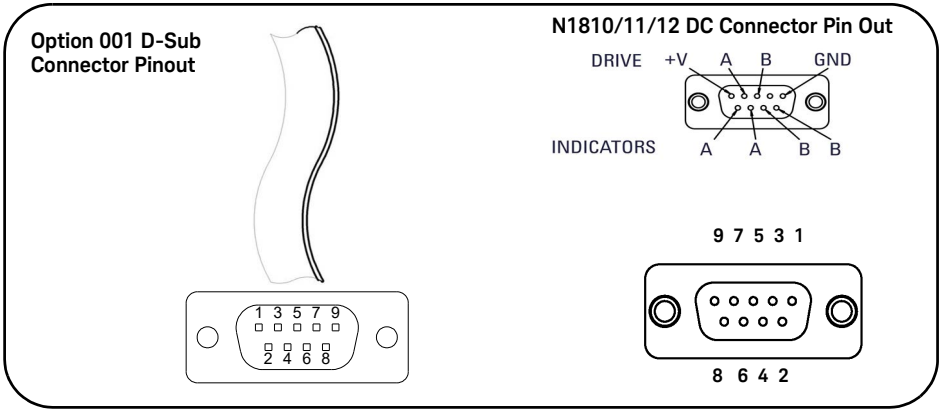

Figure 1-2 N1810/11/12 Switch and D-Sub Connector Pinouts.

34946A and 34947A SCPI Programming Examples

The programming examples below provide you with SCPI command examples to use for actions specific to the microwave switch modules.

The slot and channel addressing scheme used in these examples follow the form sccc where s is the mainframe slot number (1 through 8) and ccc is the three-digit channel number. For information on specific configurations, refer to the simplified schematics in this chapter.

For complete information on the SCPI commands used to program the 34980A, refer to the Keysight 34980A Programmer's Reference which can be downloaded from www.keysight.com/find/34980A.

Example: Closing channels You can use the `ROUTe:CLOSe` to close channels on the microwave switch modules, but these modules do not support the `ROUTe:OPEN` command. You can open channels by closing other channels. With this "one-step" operation, the relays switch in the proper order that avoids momentary connection of the wrong input to the switch output. The following statement closes channel 201 of a microwave switch module installed in slot 5.

```
ROUTe:CLOSe (@5201)
```

Example: Querying channels for open or close state The following command returns the open (1) or close (0) state of channel 202 for a module in slot 3.

```
ROUTe:CLOSe? (@3202)
```

Example: Querying the system for module identify The following command returns the identify of the module installed in slot 7.

```
SYSTem:CTYPe? 7
```

Example: Reading the cycle count for a relay The following command reads back the number of completed cycles for the channel 201 relay of a module installed in slot 6.

```
DIAGnostic:RELay:CYCLes? (@6201)
```

Example: Clearing the cycle count for a relay The following command resets the cycle count on channels 201 and 202 for a module in slot 1.

```
DIAGnostic:RELay:CYCLes:CLEar (@1201,1202)
```

Example: Resetting Module(s) to Power-On State The following command resets a module in slot 4 to its power-on state.

```
SYSTem:CPON 4
```

Example: Enabling Verification The following command enables verification on channels 201 and 202 for a module in slot 1. When verification is enabled, the actual hardware state of each relay is sensed for the correct state.

```
ROUTe:CHANnel:VERify:ENABle ON,(@1201,1202)
```

Installing SMA Connectors

When installing SMA connectors, it is recommend that you tighten them to 0.8 - 1.1 Nm (7-10 in-lbs) of torque.

34946A and 34947A Simplified Schematics

Figures 3 and 4 show the channel configurations for the 34946A and 34947A modules, respectively.

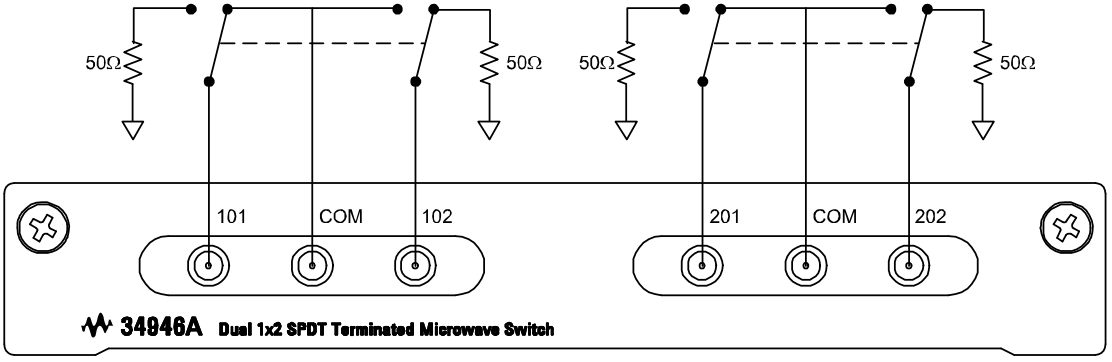

Figure 1-3 34946A Simplified Schematic.

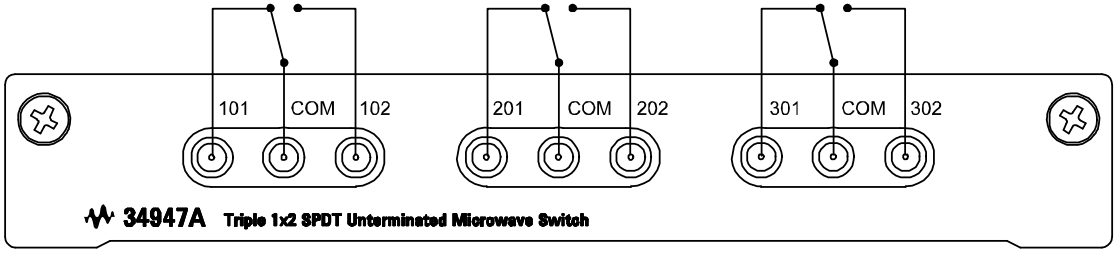

Figure 1-4 34947A Simplified Schematic.

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Numerics

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