User Guide

Microwave Switch/Driver Modules 34946A-34947A

KEYSIGHT TECHNOLOGIES

Notices

Manual Part Number

34980-90046

Edition

Third Edition, December 2015

Printed in

Malaysia

Published by

Keysight Technologies, Inc.
900 S. Taft Ave.
Loveland, CO 80537 USA

Trademarks

PICMG®, Compact PCI® are registered trademarks of the PCI Industrial Computer Manufacturers Group.

AdvancedTCA® and ATCA are registered trademarks of the PCI Industrial Computer Manufacturers Group.

PCI-SIG®, PCI Express®, and PCIe® are registered trademarks of PCI-SIG.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Declaration of Conformity

Declarations of Conformity for this product and for other Keysight products may be downloaded from the Web. Go to http://keysight.com/go/conformity. You can then search by product number to find the latest Declaration of Conformity.

U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at http://www.keysight.com/find/sweula. The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED "AS IS," AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR OF ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT SHALL CONTROL.

Keysight Technologies does not warrant third-party system-level (combination of chassis, controllers, modules, etc.) performance, safety, or regulatory compliance unless specifically stated.

Safety Information

CAUTION

A CAUTION denotes a hazard. It calls attention to an operating procedure or practice 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 denotes a hazard. It calls attention to an operating procedure or practice, 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 Information

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 operating instructions in the product manuals violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product must not be impaired if it is used in a manner specified in the operation instructions.

Before Applying Power

Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the external markings described under "Safety Symbols".

Ground the Instrument

Keysight chassis' are provided with a grounding-type power plug. The instrument chassis and cover must be connected to an electrical ground to minimize shock hazard. The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

Do not operate the module/chassis in the presence of flammable gases or fumes.

Do Not Operate Near Flammable Liquids

Do not operate the module/chassis in the presence of flammable liquids or near containers of such liquids.

Cleaning

Clean the outside of the Keysight module/chassis with a soft, lint-free, slightly dampened cloth. Do not use detergent or chemical solvents.

Do Not Remove Instrument Cover

Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

Keep away from live circuits

Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers and shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

DO NOT operate damaged equipment

Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to a Keysight Technologies Sales and Service Office for service and repair to ensure the safety features are maintained.

DO NOT block the primary disconnect

The primary disconnect device is the appliance connector/power cord when a chassis used by itself, but when installed into a rack or system the disconnect may be impaired and must be considered part of the installation.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to a Keysight Sales and Service Office to ensure that safety features are maintained.

In Case of Damage

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel

CAUTION

Do NOT block vents and fan exhaust: To ensure adequate cooling and ventilation, leave a gap of at least 50mm (2") around vent holes on both sides of the chassis.

Do NOT operate with empty slots: To ensure proper cooling and avoid damaging equipment, fill each empty slot with an AXIe filler panel module.

Do NOT stack free-standing chassis: Stacked chassis should be rack-mounted.

All modules are grounded through the chassis: During installation, tighten each module's retaining screws to secure the module to the chassis and to make the ground connection.

WARNING

Operator is responsible to maintain safe operating conditions. To ensure safe operating conditions, modules should not be operated beyond the full temperature range specified in the Environmental and physical specification. Exceeding safe operating conditions can result in shorter lifespan, improper module performance and user safety issues. When the modules are in use and operation within the specified full temperature range is not maintained, module surface temperatures may exceed safe handling conditions which can cause discomfort or burns if touched. In the event of a module exceeding the full temperature range, always allow the module to cool before touching or removing modules from the chassis.

Safety Symbols

CAUTION

A CAUTION denotes a hazard. It calls attention to an operating procedure or practice, 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 denotes a hazard. It calls attention to an operating procedure or practice, 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.

Products display the following symbols:

Warning, risk of electric shock

Refer to manual for additional safety information.

Earth Ground.

Chassis Ground.

Alternating Current (AC).

Standby Power. Unit is not completely disconnected from AC mains when switch is in standby.

Antistatic precautions should be taken.

CAT I
CAT II
CAT III
CAT IV

IEC Measurement Category I, II, III, or IV

For localized Safety Warnings, Refer to Keysight Safety document (p/n 9320-6792).

The CSA mark is a registered trademark of the Canadian Standards Association and indicates compliance to the standards laid out by them. Refer to the product Declaration of Conformity for details.

Notice for European Community: This product complies with the relevant European legal Directives: EMC Directive (2004/108/EC) and Low Voltage Directive (2006/95/EC).

The Regulatory Compliance Mark (RCM) mark is a registered trademark. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.

ICES/NMB-001

ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001.

This symbol represents 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 this product.

South Korean Class A EMC Declaration. this equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용 (A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으 로 합니다.

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

This product complies with the WEEE Directive (2002/96/EC) marking requirement. The affixed product label (see below) indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a “Monitoring and Control instrumentation” product.

Do not dispose in domestic household waste.

To return unwanted products, contact your local Keysight office for more information.

Content

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 internal/ 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
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

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 18.

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.

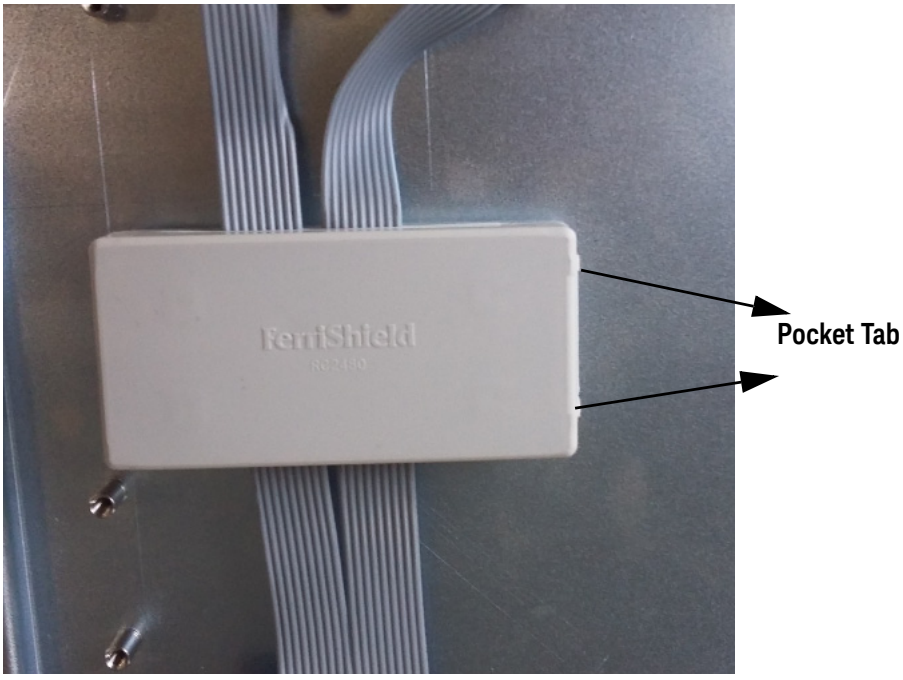
Ferrite Supressor

Ferrite suppressor is installed to prevent DMM failures that may be caused due to the external ribbon cable. If you mount the switches internally, you would not need the ferrite suppressor. You can remove it.

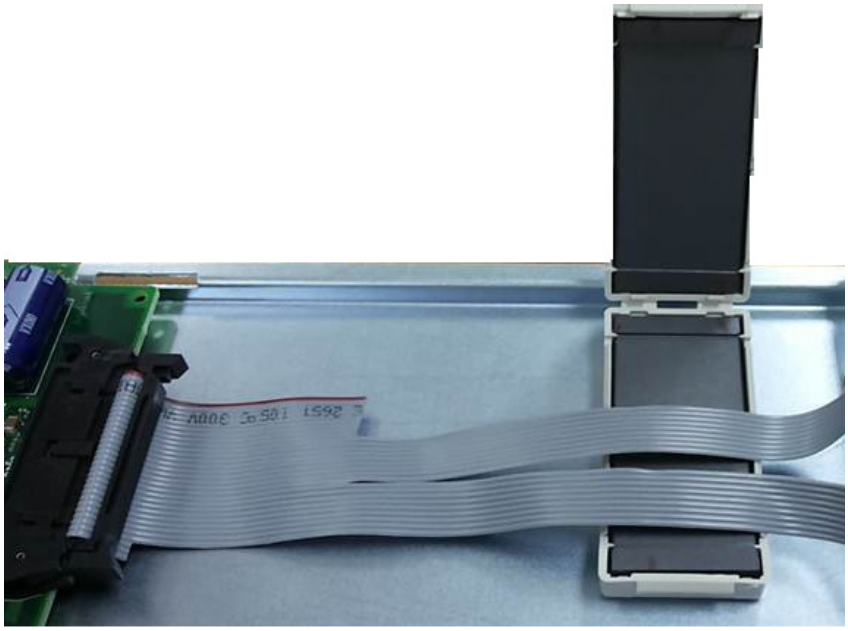
Removing the ferrite supressor

If you mount the switches internally, you would not need the ferrite suppressor.You can remove it. To remove the ferrite supressor:

1 Press the pocket tabs.



2 Rotate top half onto bottom clipping both sides in one smooth motion.



3 Remove the ferrite suppressor.

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 internal/ external to the instrument chassis. See the following sections for instructions on connecting the switches internally and externally.

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.

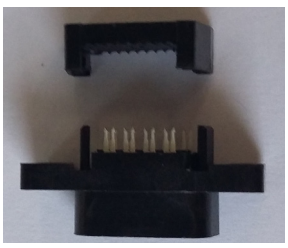
Fastening of 9-pin D-sub connector to the ribbon cable

Before installing the switches to the 34946A/ 34947A modules, fasten the 25 strand ribbon to 9-pin D-Sub connector. If you are mounting the switches externally, route the center and left 9-pin strands through the corresponding slots of the instrument face plate. For more instructions, see Installing Switches Externally to the Module section on page 13.

To fasten the 9-pin D-sub connector to the ribbon strand:

1. Cut a length of 25 strand ribbon cable long enough for the cable you wish to make.
2. Take out the connector(34946-80001) from its packaging as shown in the figure below:

3. Detach the 2 halves of the connector as shown below:

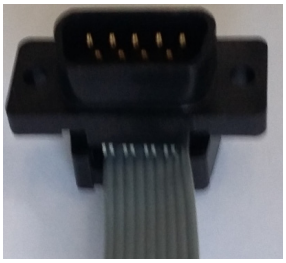


4 Feed the ribbon cable up from the bottom. Ensure the cable is centered and straight (90 degrees to the edge of the connector), then gentle squeeze the connector to slightly pinch the cable and prevent it from moving.

If you do this step wrong, your cable will be useless, so STOP and make sure you understand this step. You need to have the connectors oriented correctly on the cable. Ensure the cable is in straight.

5 Put the upper half of the connector on top of the lower half.

6 Press it all the way down until the ribbon cable is clamped tightly in between the two halves.



Inspect your completed cable. The ribbons should be snuggly clamped, and extend straight out from the connectors.

Installing Switches Externally to the Module

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).

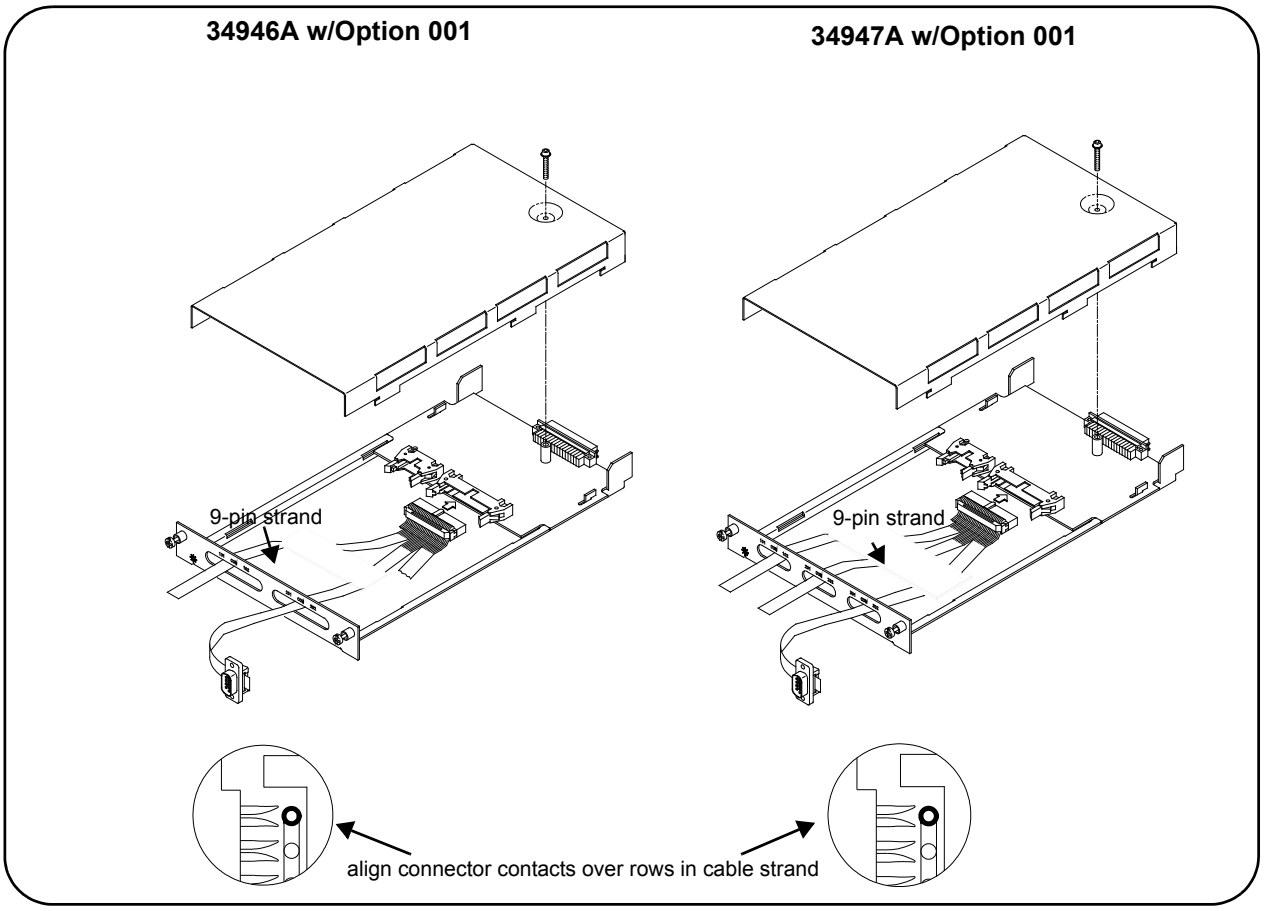


Figure 1 34946A and 34947A Option 001 Installation

NOTE Be careful when handling the 34946A or 34947A chassis with the cover removed as components within the chassis are susceptible to damage from ESD.

2 **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 9-pin 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.Do not attach the D-Sub connector (Step 4) until the strands have been routed through the face plate slots.

4 Insert the ribbon cable strand into the 9-pin D-Sub connector. For the instructions on how to insert the ribbon cable strand to the 9-pin D-sub connector, see Fastening of 9-pin D-sub connector to the ribbon cable section on page 11.

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.

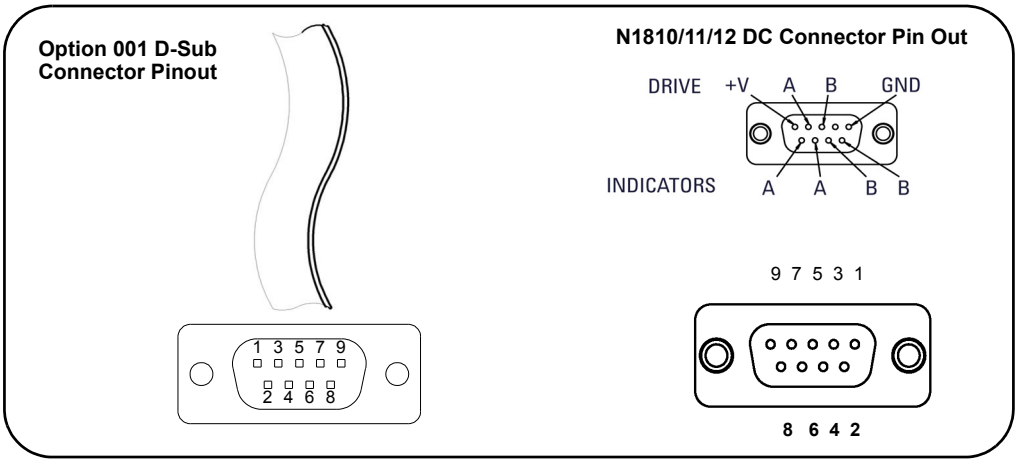


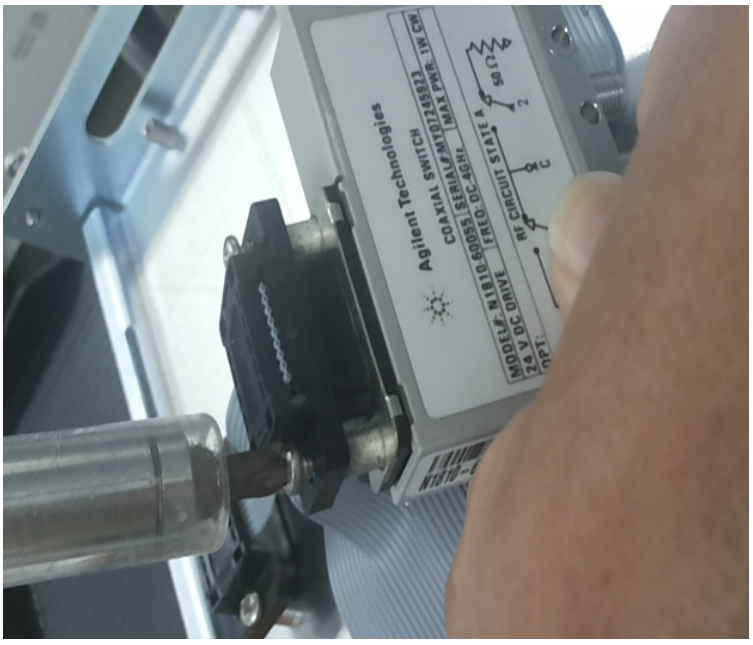
Figure 2 N1810/11/12 Switch and D-Sub Connector Pinouts

Installing Switches Internally to the Module

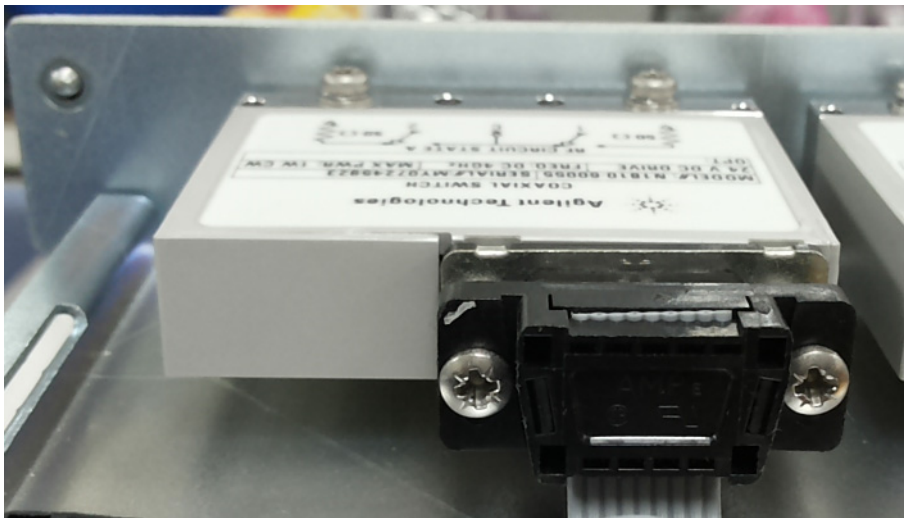
Typically the switches are mounted externally. You can also mount the switches internally to the module. Keysight supports switches being mounted internally with 34946/34947 Option 001 also.Mounting screws are included in the 34946/34947 Option 001 module package.

To install the switches internally, first fasten the connector to each ribbon cable. See the Fastening of 9-pin D-sub connector to the ribbon cable section on page 11 for instructions. Then, secure the connector to the switch using a Pozidrive(PZ1) screwdriver.

1 Use Pozidrive(PZ1) screwdriver to fasten the two screws to secure the connector to the internally mounted customer-provided-switch.

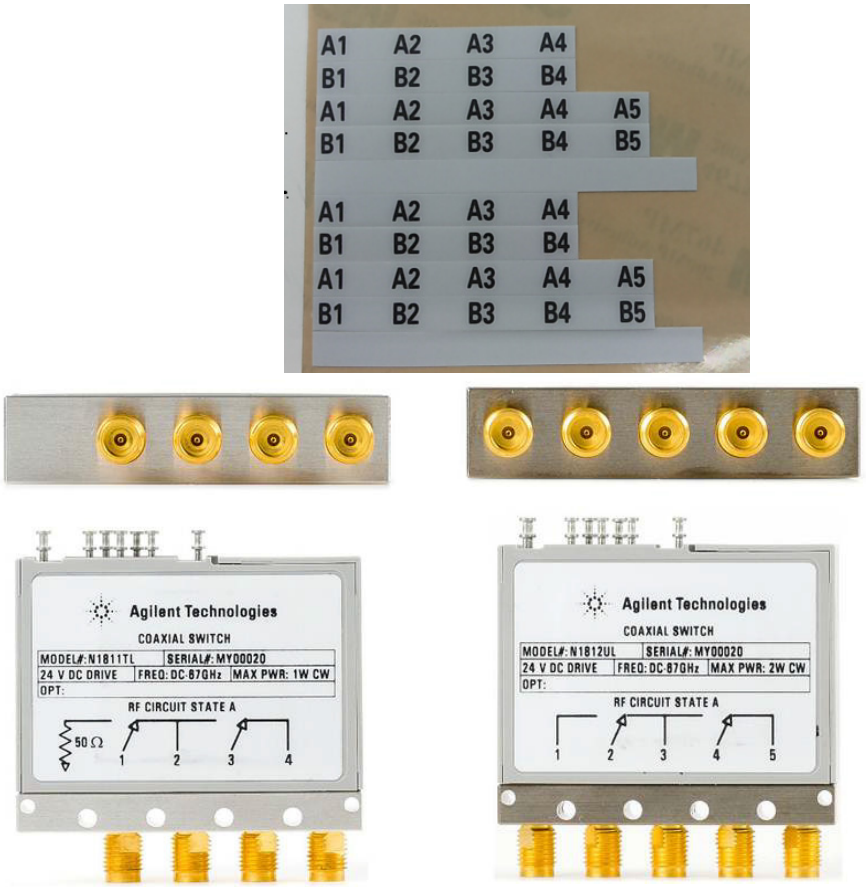


2 Fasten the two screws (0515-1410) provided in the kit using 9 in-lbs torque with T10 torx bit to secure the switch to the chassis.



Mounting 4-port/5-port switches

Typically 34946A and 34947A are standardized to control the 3-port switches (N1810UL and N1810TL). However, Option 001 can be used to control even the N1811TL (4-port) and N1812UL (5-port). Option 001 comes with stick-on Labels (34946-84302) that will be in the kit to support more than the default 3 port switches; i.e. 4 port and 5 port.



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 contained on the 34980A Product Reference CD. For example programs, also refer to the 34980A Product Reference CD.

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.

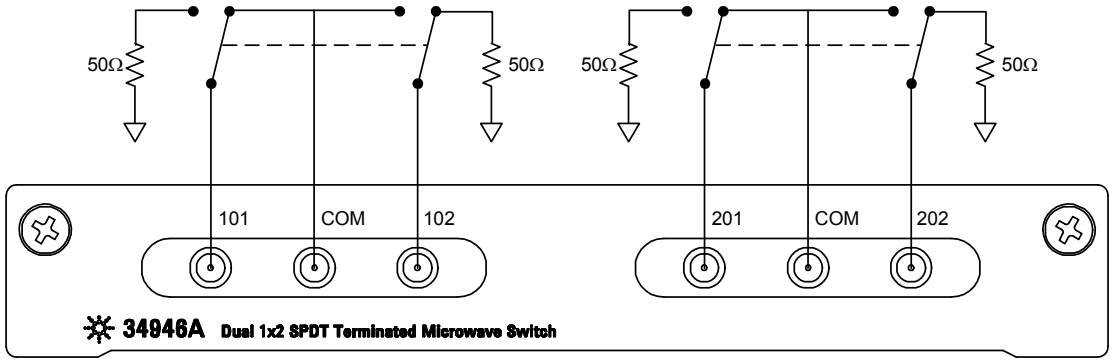


Figure 3 34946A Simplified Schematic

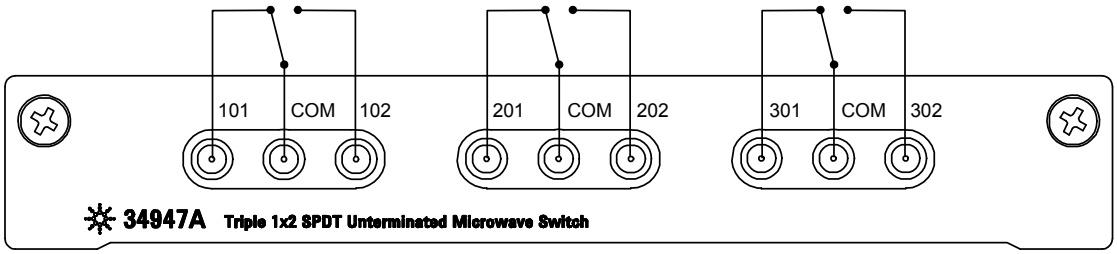


Figure 4 34947A Simplified Schematic

Index

Edition 3 December 2015
Published in USA

34980-90046
www.keysight.com