Agilent U2931A RF Switch Driver Board

Operating Guide

Agilent Technologies

Notices

® Agilent Technologies, Inc. , 2008

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Agilent Technologies, Inc. as governed by United States and international copyright laws.

Manual Part Number

U2931-90001

Edition

First Edition, April 10, 2008

Agilent Technologies, Inc.
3501 Stevens Creek Blvd.
Santa Clara, CA 95052 USA

Trademark Acknowledgements

Pentium is a U.S. registered trademark of Intel Corporation.

Microsoft, Visual Studio, Windows, and MS Windows are trademarks of Microsoft Corporation in the United States and/or other countries.

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, Agilent 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. Agilent 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 Agilent 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.

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.

Restricted Rights Legend

U.S. Government Restricted Rights. Software and technical data rights granted to the federal government include only those rights customarily provided to end user customers. Agilent provides this customary commercial license in Software and technical data pursuant to FAR 12.211 (Technical Data) and 12.212 (Computer Software) and, for the Department of Defense, DFARS 252.227-7015 (Technical Data - Commercial Items) and DFARS 227.7202-3 (Rights in Commercial Computer Software or Computer Software Documentation).

Safety Notices

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 on the instrument and in the documentation indicate precautions, which must be taken to maintain safe operation of the instrument.

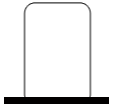|			
⎓	Direct current (DC)	▣	Equipment protected throughout by double insulation or reinforced insulation
∼	Alternating current (AC)	○	Off (supply)
∼	Both direct and alternating current		On (supply)
3∼	Three-phase alternating current	⚡	Caution, risk of electric shock
⏚	Earth (ground) terminal	⚠	Caution, risk of danger (refer to this manual for specific Warning or Caution information)
⏚	Protective conductor terminal	🔥	Caution, hot surface
⏚	Frame or chassis terminal		Out position of a bi-stable push control
⏚	Equipotentiality		In position of a bi-stable push control

General Safety Information

<table>
<tr>
<td>

WARNING

</td>
<td>

- **Do not load the output terminals above the specified current limits.**
- **Do not use the device if it appears damaged or defective.**
- **Observe all markings on the device before connecting any wiring to the device.**
- **Do no operate the device in the presence of flammable gases or fumes.**
- **Do no install substitute parts or perform any unauthorized modification to the device.**

</td>
</tr>
</table>

<table>
<tr>
<td>

CAUTION

</td>
<td>

- Applying excessive voltage or overloading the device will cause irreversible damage to the circuitry.
- Use the device with the cables provided.
- Repair or service that is not covered in this manual should only be performed by qualified personnels.
- To avoid ESD damage to the RF switch driver board, users are highly recommended to comply with the following cautions:
  - User are required to discharge themselves to any large metal object (e.g. Shelf, desk, etc.) prior to operating the RF switch driver board.
  - Operate the RF switch driver board under an ESD protected workstation, with the minimum requirements of using wrist strap (connected to ground) and ESD pad. The wrist strap can be grounded by connecting to the power supply ground and/or circuit board ground.
- Avoid human body contact or a charged material to the on-board components and circuitries. Always hold the board edges when carrying the RF switch driver board.

</td>
</tr>
</table>

Environmental Conditions

This instrument is designed for indoor use and in an area with low condensation. The table below shows the general environmental requirements for this instrument.

Environmental conditions	Requirements
Operating temperature	0 °C to 40 °C
Operating humidity	Up to 95% at 40 °C (non-condensing)
Storage temperature	–40 °C to 70 °C

CAUTION The U2931A RF switch driver board complies with the following safety and EMC requirements.

- IEC 61326-2002/EN 61326:1997+A1:1998+A2:2001+A3:2003
- Canada: ICES-001:2004
- Australia/New Zealand: AS/NZS CISPR11:2004

Regulatory Markings

C E ISM 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.	**N10149**	The C-tick mark is a registered trademark of the Spectrum Management Agency of Australia. 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. Cet appareil ISM est confomre a la norme NMB-001 du Canada.		This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste.
ESD	This symbol indicates that a device, or part of a device, may be susceptible to electrostatic discharges (ESD), which can result in damage to the product. Observe ESD precautions given on the product, or its user documentation, when handling equipment bearing this mark.		

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

This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label 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 instrument is classified as a "Monitoring and Control Instrument" product.

The affixed product label is shown as below.

Do not dispose in domestic household waste

To return this unwanted instrument, contact your nearest Agilent Technologies, or visit:

www.agilent.com/environment/product

for more information.

Agilent Technologies	**DECLARATION OF CONFORMITY** According to EN ISO/IEC 17050-1:2004	C E

Manufacturer's Name: Agilent Technologies Microwave Products (M) Sdn. Bhd
Manufacturer's Address: Bayan Lepas Free Industrial Zone,
11900, Bayan Lepas, Penang, Malaysia

Declares under sole responsibility that the product as originally delivered

Product Name: Agilent RF Switch Board
Models Number: U2931A
Product Options: This declaration covers all options of the above product(s)

complies with the essential requirements of the following applicable European Directives, and carries the CE marking accordingly:

Low Voltage Directive (2006/95/EC)
EMC Directive (2004/108/EC)

and conforms with the following product standards:

EMC

Standard	Limit
IEC 61326:2002 / EN 61326:1997+A1:1998+A2:2001+A3:2003	
CISPR 11:1990 / EN55011:1990	Class A Group 1
IEC 61000-4-2:1995 / EN 61000-4-2:1995	4 kV CD, 8 kV AD
IEC 61000-4-3:1995 / EN 61000-4-3:1996	3 V/m, 80-1000 MHz
IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5 kV signal lines, 1 kV power lines
IEC 61000-4-5:1995 / EN 61000-4-5:1995	0.5 kV line-line, 1 kV line-ground
IEC 61000-4-6:1996 / EN 61000-4-6:1996	3 V, 0.15-80 MHz
IEC 61000-4-11:1994 / EN 61000-4-11:1994	1 cycle / 100%

Canada: ICES-001:2004
Australia/New Zealand: AS/NZS CISPR11:2004

The product was tested in a typical configuration with Agilent Technologies test systems.

Safety IEC 61010-1:2001 / EN 61010-1:2001

Additional Information:
The U2931A receives power from an AC/DC power supply model DSA-60W-20 1 24060.

This DoC applies to above-listed products placed on the EU market after:

31-March-2008
Date

Tay Eng Su

Quality Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor,
or Agilent Technologies Deutschland GmbH, Herrenberger Straße 130, 71034 Böblingen, Germany.

Template: A5971-5302-2, Rev. E   U2931A   DoC Revision 1.0

Product Regulations

EMC

	Performance Criteria
IEC 61326-1:2002 / EN 61326-1:1997+A1:1998**+**A2:2001+A3:2003	
CISPR 11:1990 / EN 55011:1990 – Group 1 Class A	
IEC 61000-4-2:1995 / EN 61000-4-2:1995 (ESD 4kV CD, 8kV AD)	A
IEC 61000-4-3:1995 / EN 61000-4-3:1996 (3V/m, 80% AM)	A
IEC 61000-4-4:1995 / EN 61000-4-4:1995 (EFT 0.5kV line-line, 1kV line-earth)	A
IEC 61000-4-5:1995 / EN 61000-4-5:1995 (Surge 0.5kV line-line, 1kV line-earth)	A
IEC 61000-4-6:1996 / EN 61000-4-6:1996 (3V, 0.15~80 MHz, 80% AM, power line)	A
IEC 61000-4-11:1994 / EN 61000-4-11:1994 (Dips 1 cycle, 100%)	A
Canada: ICES-001:2004	
Australia/New Zealand: AS/NZS CISPR11:2004	

Safety IEC 61010-1:2001 / EN 61010-1:2001

Additional Information:
The product herewith complies with the essential requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC and carries the CE Marking accordingly (European Union).

[1]Performance Criteria:
A Pass - Normal operation, no effect.
B Pass - Temporary degradation, self recoverable.
C Pass - Temporary degradation, operator intervention required.
D Fail - Not recoverable, component damage.
N/A – Not applicable

Notes:

Regulatory Information for Canada
ICES/NMB-001:2004
This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme à la norme NMB-001 du Canada.

Regulatory Information for Australia/New Zealand
This ISM device complies with Australian/New Zealand AS/NZS CISPR11:2004

⊘ N10149

Contents

Introduction

The U2931A RF switch driver is an adapter board for the Agilent U2121A digital IO device, which enables you to control various types of RF switches easily. It has enhanced driving capability and consists of different types of connectors to suit different switches.

The U2931A RF switch driver consists of a driver interface module, an interface cable (equipped with a 37-pin D-sub connector on one end and four 10-way terminal block connectors on the other end), a 10-pin to D-sub adapter, and a 24 VDC, 2.5 A power adapter. This module is connected to the U2121A using the provided interface cable.

This module is distributed into five RF switch driver channels and one general IO terminal. Each channel is pre-programmed to drive three different types of Agilent RF switches. Only one type of RF switch can be connected to a single channel during operation.

| CAUTION | **DO NOT** connect different types of RF switches to the same channel during operating time. |

The U2931A module is designed to handle 24 VDC switches.

Power supply

The switches on this module are powered by the provided power adapter. There is only one power supply voltage available for this module, which is 24 VDC, 2.5 A.

Power consumption

The U2931A can drive up to 1500 mA continuously using the provided power supply. For each channel, it is able to drive up to 300 mA load per switch. Precaution must be taken to ensure that the total current consumption on all channels is not more than 1500 mA, which is the maximum driving capability of the module.

Standard Purchase Items Checklist
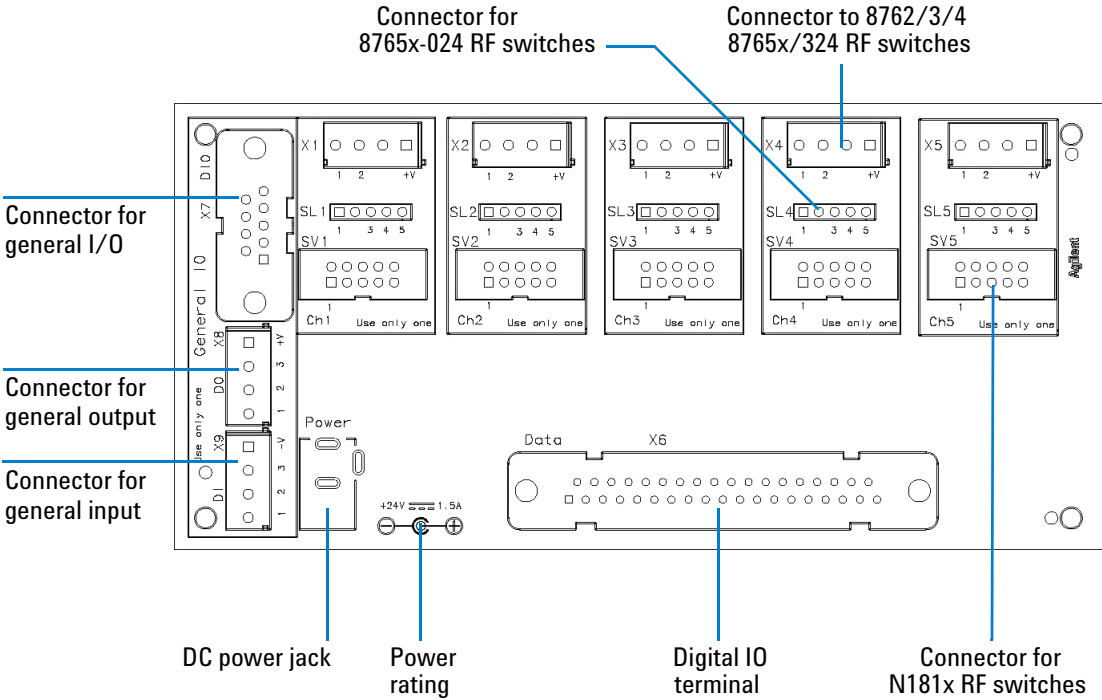
Verify that you have received the following items with the U2931A-101 RF switch driver board purchase. If anything is missing or damaged, please contact the nearest Agilent Sales Office.

✔ U2931-60013 10 ways IDC to 9-pins D-Sub adapter

✔ U2931-60012 power adapter

✔ Agilent U2931A RF Switch Driver Board Operating Guide

✔ Agilent U2931A RF Switch Driver Product Reference CD-ROM

Product at a Glance

Product outlook

Top view (without casing)

Connector for
8765x-024 RF switches

Connector to 8762/3/4
8765x/324 RF switches

Connector for
general I/O

Connector for
general output

Connector for
general input

DC power jack

Power
rating

Digital IO
terminal

Connector for
N181x RF switches

Product dimensions

Top view (without casing)

72.00 mm

150.00 mm
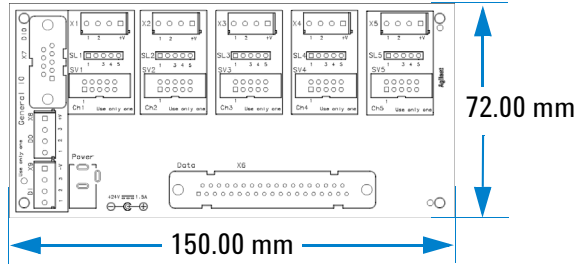
Top view (with casing)

85.00 mm

153.00 mm
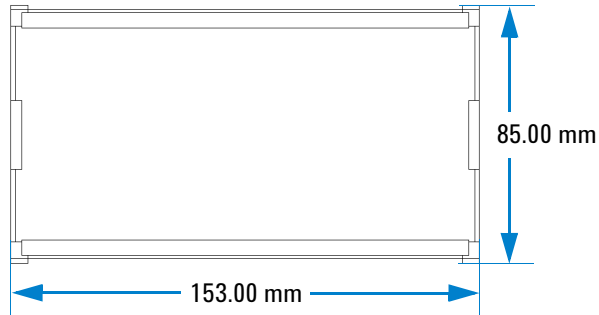
Front view (with casing)
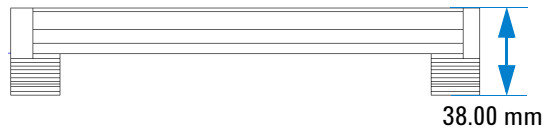
Side view (with casing)

38.00 mm

85.00 mm
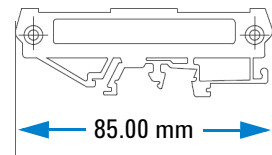
Connector Pins Configuration

Pin out configuration for all terminals

Table 1   8762/2/3 and 8765x-324 Series switches (X1 to X5)

Pin	Function
1	Position #1
2	Position #2
3	N.C.
4	+24 V

Table 2   8765x-024 Series switches (SL1 to SL5)

Pin	Function
1	Position #2
2	N.C.
3	+24 V
4	+24 V
5	Position #1

Table 3   N181X Series switches (SV1 to SV5)

Pin	Function	Pin	Function
1	GND	2	+5 V
3	N.C.	4	Indicator B
5	Position B	6	+5 V
7	Position A	8	Indicator A
9	+24 V	10	N.C.

IO mapping

There are three main control bits used in the U2931A as shown in tables below. These control bits also refers to the U2121A control bit status.

Table 4   Output enable/disable control

Control Stage	Control Bit, DO14	Description
Output disabled	OFF (0)	To disable all outputs in U2931A
Output enabled	ON (0)	To enable all outputs in U2931A

Table 5   Position information read back control

RF Switches	Control Bit		Description
	D16	D15	
8765x and 8762/3/4	OFF (0)	ON (1)	Read position information from 8765x and 8762/3/4 series switches
N181x	ON (1)	OFF (0)	Read position information from N181x series switches

WARNING   **DO NOT set both D15 and D16 control bits to ON stage!**

Each of the five RF switch channels uses two digital output pins and two digital input pins during the operation.

Table 6a IO mapping for 8762/3/4, 8765x-324 and N181x Series RF switches

Channel	Control Bit		Position Bit	
	State A	State B	State A	State B
1	O1	O2	I1	I2
2	O3	O4	I3	I4
3	O5	O6	I5	I6
4	O7	O8	I7	I8
5	O9	O10	I9	I10
General IO	O11, O12 & O13		I11, I12 & I13	

Table 6b IO mapping for 8765x-024 Series RF switches

Channel	Control Bit		Position Bit	
	State A	State B	State A	State B
1	O2	O1	I2	I1
2	O4	O3	I4	I3
3	O6	O5	I6	I5
4	O8	O7	I8	I7
5	O10	O9	I10	I9
General IO	O11, O12 & O13		I11, I12 & I13	

Table 7 Position indicator stage definition

RF Switches Model	Activated	Deactivated
8732/3/4 Series and 875x Series	OFF (0)	ON (1)
N181x Series	ON (1)	OFF (0)

Hardware Installation

1 Connect the U2931A board digital IO terminal to the U2121A terminal block using the interface cable.

2 Connect the power adapter to the RF switch driver board's DC power jack.

3 Connect the RF switches as below:

    i For 8762/3/4 and 8765x-324 RF switches, connect to any SL1[1] to SL5[1] slot.

    ii For 8765x-024 RF switches, connect to any X1[2] to X5[2] slot.

    iii For N181x RF switches, connect to any SV1[3] to SV5[3] slot.

> **NOTE** Connect only one type of the RF switch to one channel. Do not use multiple switches simultaneously on one channel.

4 Connect other types of load to general IO, X7[4] or X8[5] and X9[6] if required. The load voltage is 24 VDC. The maximum load should not exceed 300 mA per output channel and 3 mA per input channel.

> **WARNING** The total allowable current is 1500 mA. Please ensure that the total current consumption is not more than 1500 mA.

[1] SL1 to SL5 refers to the 8762/3/4 and 8765x-324 RF switch connectors for Ch1 to Ch5.

[2] X1 to X5 refers to the 8765x-024 RF switch connectors for Ch1 to Ch5.

[3] SV1 to SV5 refers to the N181x RF switch connectors for Ch1 to Ch5.

[4] X7 refers to the connector for general I/O on the switch driver board.

[5] X8 refers to the connector for general output on the switch driver board.

[6] X9 refers to the connector for general input on the switch driver board.

Software Operation

1 Click **Start > All Programs > Agilent RF Switch Driver > Agilent RF Switch Driver Application Software** to run the U2121A & U2931A RF Switch Driver Application Software.

2 To start the application, click on the **Start** button.

3 The **Select USB Device** dialog box will appear displaying the connected U2121A devices. Select a U2121A device and click on it to establish the connection.

4 Select the switch type corresponding to the connected switch on each channel.

5 Use the toggle paddle for each channel in the program to select respective switch position.

6 Use the checkbox and the **Send Output** button in the General Output section to control the output devices connected to the RF switches.

7 To view the General Input Status, click the **Refresh Input Status Bits** button in the General Input section.

8 Click **Exit** to leave the program, all switches will be disabled upon exiting the program.

| NOTE | Refer to the *Agilent RF Switch Driver Application Software Help File* for more information. |

Supported Switches

The U2931A supports three types of Agilent RF switches as shown in Table 9. User can choose to drive the same switches in all five channels or a mixture of three switches for five channels. However, only one type of switch can be used in a channel at a time. Do not use multiple types of switches in the same channel.
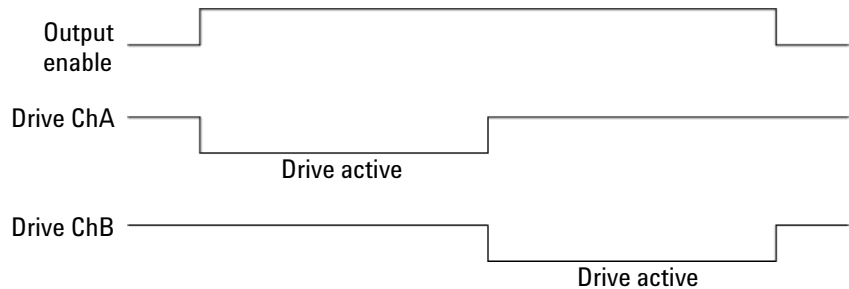
Drive modes

The RF switch driver board drives the switches using the open collector drive method. It provides a current path to the ground when asserted.
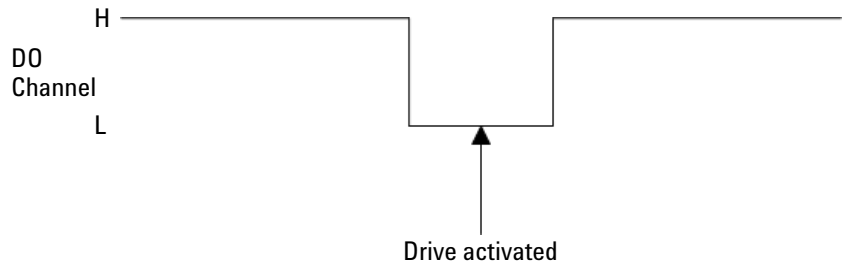

Continuous Drive

Continuous drive method controls the switches by activating the control bit and holds it until it is disabled. This mode will have a consistent current draw when the switch is activated.

Pulse drive

Pulse drive method controls the switches using a ~30 ms pulse. As shown in the figure below, the control signal is applied to one of the control bit and held for the preset time.
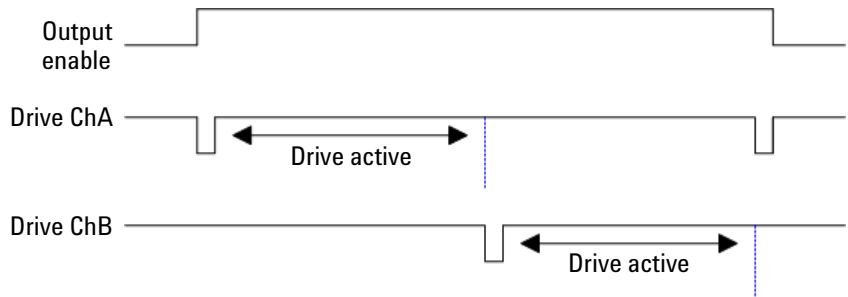
General IO

There are three digital outputs and three digital inputs available in the U2931A as an auxiliary port. These three output pins are capable to drive up to 300 mA of load. The digital input pin has a direct connection to the U2121A.

Output circuit   **Input circuit**
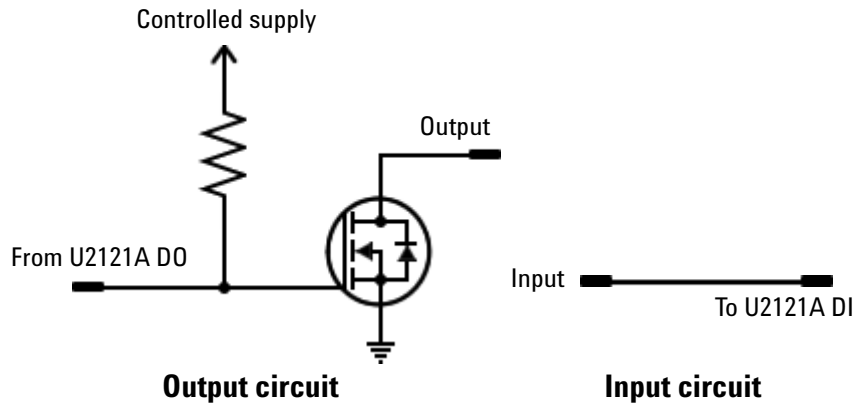
Product Specifications

Table 8 COM driver minimum system requirements

Minimum System Requirements	
PC hardware	450 MHz Pentium II or higher, 128 MB RAM, 40 GB hard disk space, CD-ROM drive.
Operating system	Windows® XP Professional or Home Edition, Service Pack 1 or later, Windows® 2000 Professional, Service Pack 4 or later.
Software driver	IVI-COM
Compatible with programming environments	• Agilent VEE • Microsoft® Visual Studio.NET, C/C++ • Microsoft® Visual Basic 6/7 • LabVIEW

Table 9 Type of switches supported by U2931A RF switch driver board

Switch/Attenuator	Coil Voltage	Connection Type	Drive Options
N1810UL/TL N1811TL N1812TL	Option 124 24 VDC	Option 201 D-Sub 9-pin female	Option 402 Position Indicators
8762A/B/C/F 8763A/B/C 8764A/B/C	Option 024 24 VDC	Solder Lugs	STD Direct coil for open drain
8765A/B/C/D	Option 324 24VDC	Solder Terminals	STD Direct coil for open drain
8765A/B/C/D	Option 024 24 VDC	Ribbon cable terminated with single in-line	STD Direct coil for open drain

Table 10 General characteristics of the U2931A RF switch driver board

| General Characteristics	
Power supply	100 VAC to 240 VAC, 50/60 Hz
Power consumption	• +24 VDC, 2 A • Isolated ELV supply source
Operating environment	0 °C to 40 °C
Storage temperature	–40 °C to 70 °C
Operating relative humidity	Up to 95% at 40 °C (non-condensing)
EMC	• IEC 61326:2002 • EN61326:1997+A1:1998+A2:2001+A3:2003
Driving current per channel	300 mA (max)
Total current	1500 mA (max)
IO channels for RF switch	5 channels
Generic IO	3 digital inputs and 3 digital outputs
Board dimension (W x D)	150 mm x 72 mm
Casing dimension (W x D x H)	153 mm x 85 mm x 38 mm
Weight	• With casing: 146 g • Without casing: 86 g
Warranty	One year

Maintenance

1 Power off your device, unplug the DC power jack and remove the RF switch driver board cable from your device.

2 Remove your device from the plastic casing.

3 Shake out any dirt that may have accumulated on the RF switch driver board.

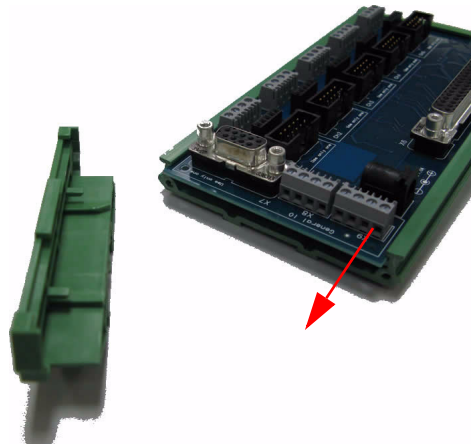**4** Wipe your RF switch driver board with a dry cloth and install the plastic casing back in place.

Disassemble Procedure

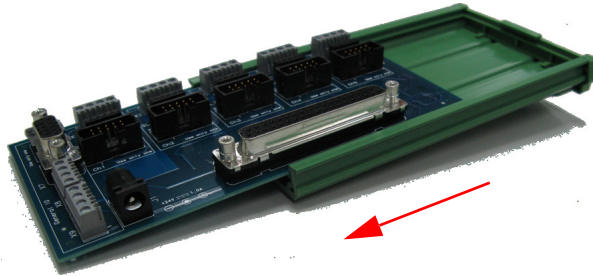The following steps shows the disassemble procedure of the RF switch driver board from its casing.

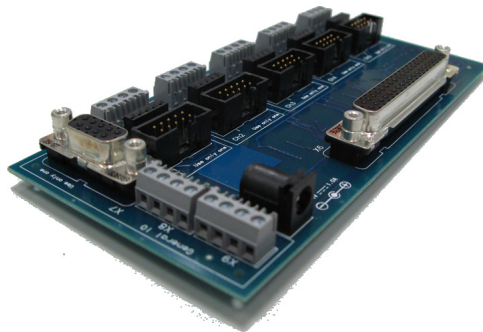**1** Remove the two screws on either side of the board.
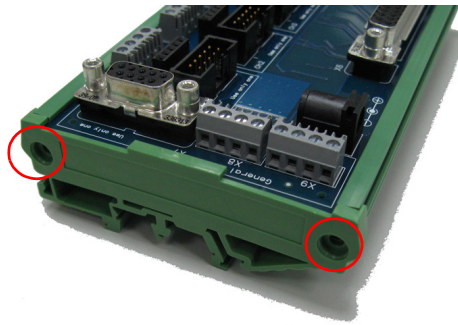
2 Remove the side panel from the casing.

3 Remove the PCA from the casing.

4 The disassembled RF switch driver board is shown below.

Ordering Info

Table 11 U2931A RF switch driver board ordering options

	Ordering Options	Description
1	U2931A-101	U2931A RF switch driver board
2	U2931A-102	U2931A RF switch driver board cable

Appendix A: Control Instructions

Please adhere to the following instructions strictly to create the COM driver.

To read digital input information.

1 When reading digital input, set the desired channel to **ON** (1) and then read the target bit. Set the channel back to **OFF** (0) when the information has been read.

2 Do not activate both Ch15 and Ch16 at the same time because this will cause an excessive current flow; which will result in a sudden temperature increase in the buffer IC and regulator IC.

NOTE	Prolonged exposure to increased temperature will cause overheating in your buffer IC and regulator IC.

To set digital output.

1 To enable digital output control, set Ch14 to **ON** (1).

2 For channel 1 to channel 5, only activated one bit at a time. Do not activate both bits together because this will damage your RF switches.

3 Some RF switches will need pulse current control instead of continuous current control. Please refer to the respective RF switches' datasheets for more information. The wrong control method will lead to RF switch damage.

NOTE	• Prolonged exposure to a continuous supplied current will cause overheating in your RF switch. Please ensure your devices temperatures are constantly monitored when supplying continuous current. • Refer to the *Agilent RF Switch Driver COM Object Help File* for more information.

www.agilent.com

Agilent Technologies