

Operating and Service Manual

**Agilent 85331B and 85332B
Solid State Switch**



Agilent Technologies

Manufacturing Part Number: 85331-90001

Printed in Malaysia

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General Information

Solid State Switch Overview

The Agilent 85331B and 85332B are PIN diode based solid state switches which provide superior performance in terms of fast switching speed, high isolation and broad operating frequency range.



Figure 1 85332B (Left) and 85331B (Right) Solid State Switches

Table 1 shows the two models of solid state switches available.

Table 1 List of Solid State Switches

Model	Configuration	Frequency Range	Connector Type	Bias Pin
85331B	SP2T	45 MHz to 50 GHz	2.4 mm (f)	The bias connector mates with LEMO 7 pin plug #FGG.1K.307.CLAC60
85332B	SP4T	45 MHz to 50 GHz	2.4 mm (f)	

General Information

The 85331B and 85332B solid state switches offer rapid switching capability between test channels. These high-performance solid state switches have 90 dB isolation, low insertion loss and a 45 MHz to 50 GHz bandwidth. They are absorptive and provide good impedance match, which is key to achieve accurate measurements. The switches are small in size and are durable, making the switches useful for applications in antenna test, radar and other test systems that require fast switching time and high isolation.

A typical configuration with the solid state switches connected to the source antenna and AUT (Antenna under test) is illustrated in [Figure 2](#).

NOTE

The 85331B and 85332B do not contain a switch control unit. If your system is configured with an 85330A multiple channel controller, the switch control unit must be ordered separately (Agilent part number 85331-60061).

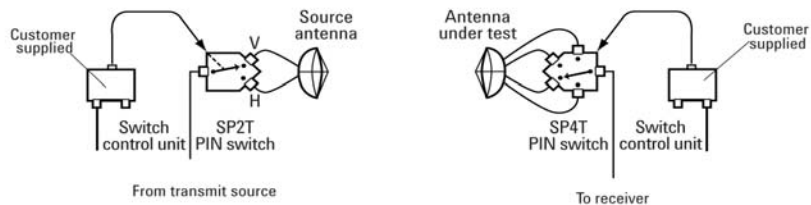


Figure 2 A typical multiple-channel, multiple-frequency system configuration

**Drive Levels /
Switch Operation
Logic**

Solid state PIN diode switches must always be connected to an active bias supply source to either ON (low insertion loss state) or OFF (high isolation state). Figure 3 illustrates the switch port match definitions during ON and OFF states. Contrary to the normal mechanical latching feature of electromechanical coaxial switches, there is no way to latch a solid state switch in the ON or OFF state with the power source removed.

A solid state switch which is not powered will exhibit neither the low insertion loss nor high isolation characteristics, but rather some intermediate value of loss through all paths.

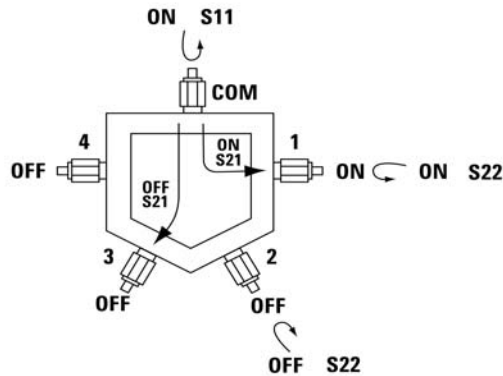


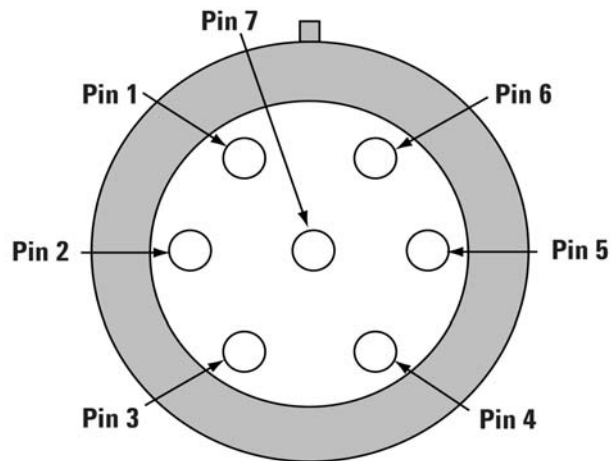
Figure 3 Switch Port Match Definitions for Switch ON/OFF States

General Information

Figure 4 shows the pin locations on the bias connector. The notch and red mark on the bias connector outer ring are used as reference. The condition to turn ON/OFF a port can be found in Table 4.

NOTE

Only one port can be turn ON at a time, or all ports can be OFF. The total current is approximately 480 mA for 85332B and 240 mA for 85331B with all ports OFF.



Pin 1 = Port 1 on/off bias
Pin 2 = Port 2 on/off bias
Pin 3 = Port 3 on/off bias (not connected for 85331B)
Pin 4 = Port 4 on/off bias (not connected for 85331B)
Pin 5 = Common/ground (0VDC)
Pins 6, 7 = Not connected

Figure 4 Bias Connector Pin Locations

Specifications

Specifications refer to the performance standards or limits against which the solid state switches are tested.

Typical characteristics are included for additional information only and they are not specifications. These are denoted as “typical”, “nominal” or “approximate” and are printed in italics.

Table 2 RF Specifications for 85331B Solid State Switch

Agilent Model Number	85331B				
Frequency Range	0.045 to 0.5	0.5 to 18	18 to 26.5	26.5 to 40	40 to 50
Insertion Loss(dB)	-2.0	-4.5	-6.0	-10.0	-15.5
Isolation (dB)	-85	-90	-90	-85	-75
Return Loss - OFF port (dB)	-19.0	-19.0	-12.5	-10.0	-6.0
Return Loss - ON port (dB)	-10.0	-10.0	-6.0	-6.0	-4.5
Return Loss - COM port(dB)	-10.0	-10.0	-5.5	-4.5	-4.0
<i>Switching Speed</i>	<i>< 1 us typical (from 1 port to another port)</i>				

Specifications

Table 3 RF Specifications for 85332B Solid State Switch

Agilent Model Number	85332B				
Frequency Range	0.045 to 0.5	0.5 to 18	18 to 26.5	26.5 to 40	40 to 50
Insertion Loss(dB)	-2.0	-4.5	-7.0	-12.0	-21.5 ¹ / _{-15.5} ²
Isolation (dB)	-85	-90	-90	-85	-75
Return Loss - OFF port (dB)	-19.0	-19.0	-12.5	-10.0	-6.0
Return Loss - ON port (dB)	-9.0	-9.0	-5.0	-4.5	-4.5
Return Loss - COM port(dB)	-10.0	-10.0	-5.5	-4.0	-4.0
Switching Speed	< 1 us typical (from 1 port to another port)				

1. COM port to port 1 and 4.
2. COM port to port 2 and 3.

Table 4 Absolute Maximum Rating¹ for 85331B and 85332B Solid State Switches

	Min	Nominal	Max	Unit
RF Input Power (Average)			+27	dBm
Vdc Bias to Turn ON Port	-6.65	-7.00	-7.35	V
Current Drawn for ON Port		40		mA
Vdc Bias to Turn OFF Port	5.98	6.30	6.62	V
Current Drawn for OFF Port		120		mA

1. Operation in excess of any one of these may result in permanent damage to the products.

Environmental Specifications

The 85331B and 85332B solid state switches are designed to fully comply with Agilent Technologies' product operating environmental specifications as shown in [Table 5](#).

Table 5 *85331B and 85332B Solid State Switches Environmental Specifications*

Temperature:	
Operating	-20°C to +55°C
Storage	-40°C to +70°C
Cycling	-40°C to +70°C, 10 cycles @ 20°C per minute, 20 minutes dwell time per MIL-STD-833F, Method 1010.8, Condition C modified)
Humidity:	
Operating	5% to 95% relative at 40°C or less (non-condensing)
Storage	5% to 95% relative at 40°C or less (non-condensing)
Shock:	
Half-sine, smoothed	100 G @ 6.0 ms, 3 shock pulses per orientation
Vibration:	
Broadband random	50 to 2000 Hz, 7.0 G rms, 15 minutes, per MIL-STD-833F, Method 2026-1 (modified)
Altitude:	
Operating	<4,600 meters (15,000 feet)
Storage	<15,300 meters (50,000 feet)
ESD Immunity:	
Contact Discharge	15 kV (to outer conductor) per IEC 61000-4-2
Air Discharge	6kV (to center pin) per IEC 61000-4-2

Physical Specifications

Table 6 and Figure 5 and Figure 6 illustrate the physical specifications of 85331B and 85332B solid state switches.

Table 6 85331B and 85332B Solid State Switches Physical Specifications

Dimensions	Per Figure 5 and Figure 6
Net weight, kg (lb)	0.36 (0.79)

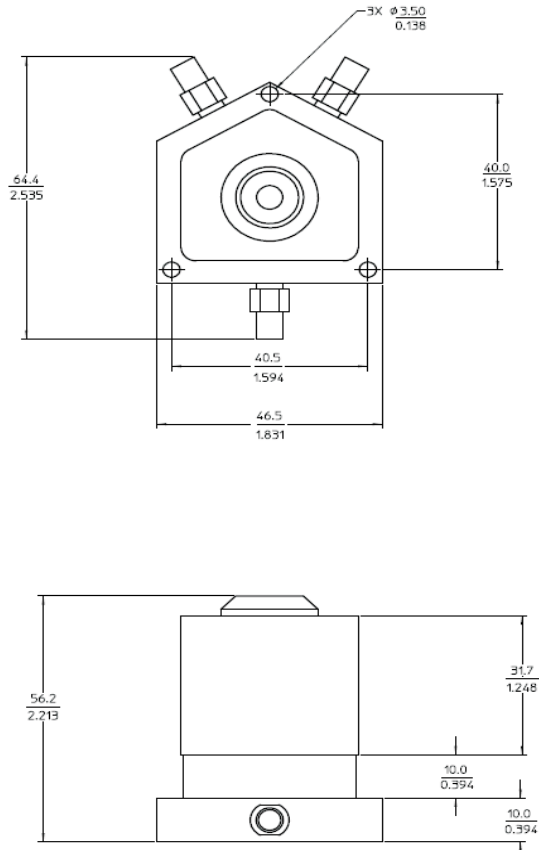


Figure 5 Dimensions of 85331B Solid State Switch

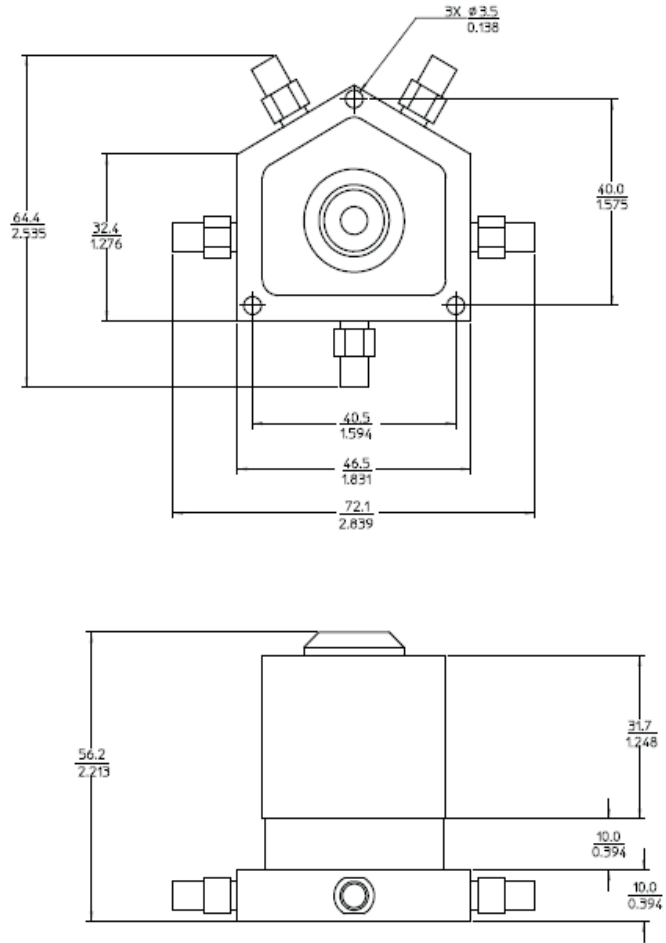


Figure 6 Dimensions of 85332B Solid State Switch

Installation

- Initial Inspection**
1. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked both mechanically and electrically.
 - Check for mechanical damage such as scratches or dents.
 - Procedures for checking electrical performance are given under “Operator’s Check” or “Performance Tests”.
 2. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, contact the nearest Agilent Technologies Sales and Service office. Refer to the Service and Support information in the front matter of this manual. Agilent Technologies will arrange for repair or replacement of the damaged or defective equipment. Keep the shipping materials for the carrier’s inspection.
 3. If you are returning the instrument under warranty or for service, repackaging the instrument requires original shipping containers and materials or their equivalents. Agilent Technologies can provide packaging materials identical to the original materials. Refer to Service and Support information in the front matter of this manual for the Agilent Technologies nearest you. Attach a tag indicating the type of service required, return address, model number, and serial number. Mark the container **FRAGILE** to insure careful handling. In any correspondence, refer to the instrument by model number and serial number.

Operating Instruction

Operator's Check

The operator's check is supplied to allow the operator to make a quick check of the solid state switches prior to use or if a failure is suspected.

CAUTION

The RF port center conductors connect directly to the GaAs MMIC and are thus sensitive to electrostatic discharge (ESD). ESD exceeding the level specified in [Table 5](#) or RF power applied is greater than the maximum specified as in [Table 4](#) may cause permanent damage to the device.

Description

The solid state switch is connected to a network analyzer configured for the s-parameter measurement. The network analyzer may be set to sweep over the whole or selected frequency range of the solid state switch to be verified. The S_{21} (insertion loss) measurement is the best way to determine if the switch is faulty by applying the appropriate bias voltage to the bias connector.

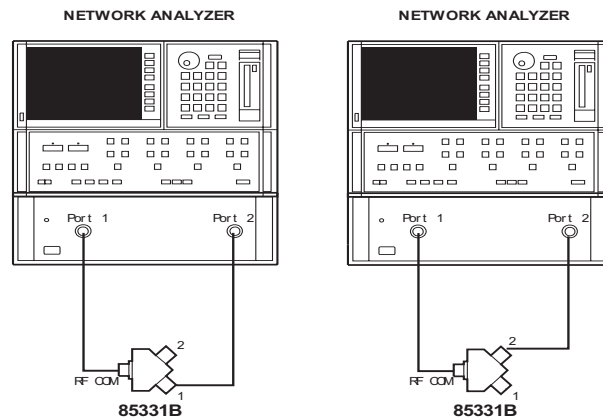


Figure 7 Connection to Perform Quick Check

Operating Instruction

Quick-Check Procedure

1. Connect RFCOM to Port 1 of the network analyzer and either RF1 or RF2 to Port 2 as illustrated in [Figure 7](#).
2. If RF1 is connected to Port 2, apply -7 Vdc to Pin 1 of bias connector (Refer to [Figure 4](#)) and +6.3 Vdc to Pin 2. This should yield low loss from RF COM to RF1. S_{21} should not exceed specification in [Table 2](#) for 85331B or [Table 3](#) for 85332B.
3. If RF2 is connected to Port 2, apply -7 Vdc to Pin 2 of bias connector (Refer to [Figure 4](#)) and +6.3 Vdc to Pin 1. S_{21} should not exceed specification in [Table 2](#) for 85331B or [Table 3](#) for 85332B.

NOTE

For 85332B, repeat the above steps until all four ports are tested.

Performance Tests

The solid state switches can be tested to the accuracy of the specifications with a network analyzer or equivalent equipment of suitable accuracy. If a network analyzer is available, test the instrument using the procedure in the analyzer's operating manual.

Service Instructions

Adjustment

The solid state switches do not have internal adjustments and should not be opened.

Repair

The 85331B and 85332B solid state switches are not recommended for repair as most components are not easily removed.

Maintenance

The connectors, particularly the connector faces, must be kept clean. For instruction on connecting and care of your connectors, refer to the Microwave Connector Care Quick Reference Card (08510-90360).

Replacement Parts

Replacement Parts

Table 7 lists the replacement parts for Agilent 85331B and 85332B solid state switches.

Table 7 *Replacement Parts for 85331B and 85332B Solid State Switches*

Description	Agilent Part Number	Qty
Replacement item for 85331B	85331-60071	1
Replacement item for 85332B	85332-60071	1

Optional Accessories

Table 8 lists the optional accessories for Agilent 85331B and 85332B solid state switches.

Table 8 *Optional Accessories for 85331B and 85332B Solid State Switches*

Description	Agilent Part Number
Switch control cable - 1 meter	85331-60025
Switch control cable - 2 meter	85331-60026
Switch control cable - 5 meter	85331-60021
Switch control cable - 10 meter	85331-60022
Switch control cable - 15 meter	85331-60067