

Keysight 87222R Low PIM Coaxial Transfer Switch

Operating and
Service Manual

Notices

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Waste Electrical and Electronic Equipment (WEEE) Directive

This instrument complies with the WEEE Directive marking requirement. This affixed product label indicates that you must not discard this electrical or 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 as shown below.



Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit <http://about.keysight.com/en/companyinfo/environment/takeback.shtml> for more information.

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/switches
(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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1 Introduction

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This chapter provides you an overview of the Keysight 87222R low PIM coaxial transfer switch.

General Information

The 87222R low PIM coaxial transfer switch offers the flexibility essential in signal routing applications. The switch provides exceptional repeatability, low insertion loss, high isolation, and simplification of design in signal routing and conditioning applications.

The 87222R can be used in a variety of applications, such as a drop-out switch, switching two inputs and two outputs, or signal reversal switching.



Figure 1-1 Keysight 87222R low PIM coaxial transfer switch

Innovative design and careful process control mean the 87222R meets the requirements for highly repeatable switching elements in test instruments and switching interfaces. The switch offers exceptional insertion loss repeatability, reducing sources of random errors in the measurement path and improving measurement uncertainty.

Switch life is a critical consideration in production test systems, satellite and antenna monitoring systems, and test instrumentation. The longevity of the switch increases system uptime and lowers the cost of ownership by reducing calibration cycles and switch maintenance.

Operating from DC to 26.5 GHz, the switch exhibits exceptional isolation performance required to maintain measurement integrity. Isolation between ports is typically > 100 dB to 12 GHz and > 90 dB to 26.5 GHz, reducing the influence of signals from other channels and system measurement uncertainties. Hence, the 87222R is an ideal element in large, multitiered switching systems.

The 87222R is designed to fall within most popular industry footprints. The 1¼ inch square flange provides tapped mounting holes, while the rest of the 2¼ inch long by 1¼ inch square body will easily fit into most systems. The standard 10-pin ribbon drive cable or optional solder terminal connections accommodate the need for secure and efficient control cable attachment.

Opto-electronic interrupts and indicators improve reliability and extend the life of the switch by eliminating DC circuit contact failures characteristic of conventional electromechanical switches. The 87222R has circuits that interrupt the current to all the solenoids once switching is complete and offers independent indicators that are controlled by optical interrupts. These indicators provide a closed path between the indicator common pin and the corresponding sense pin of the selected path.

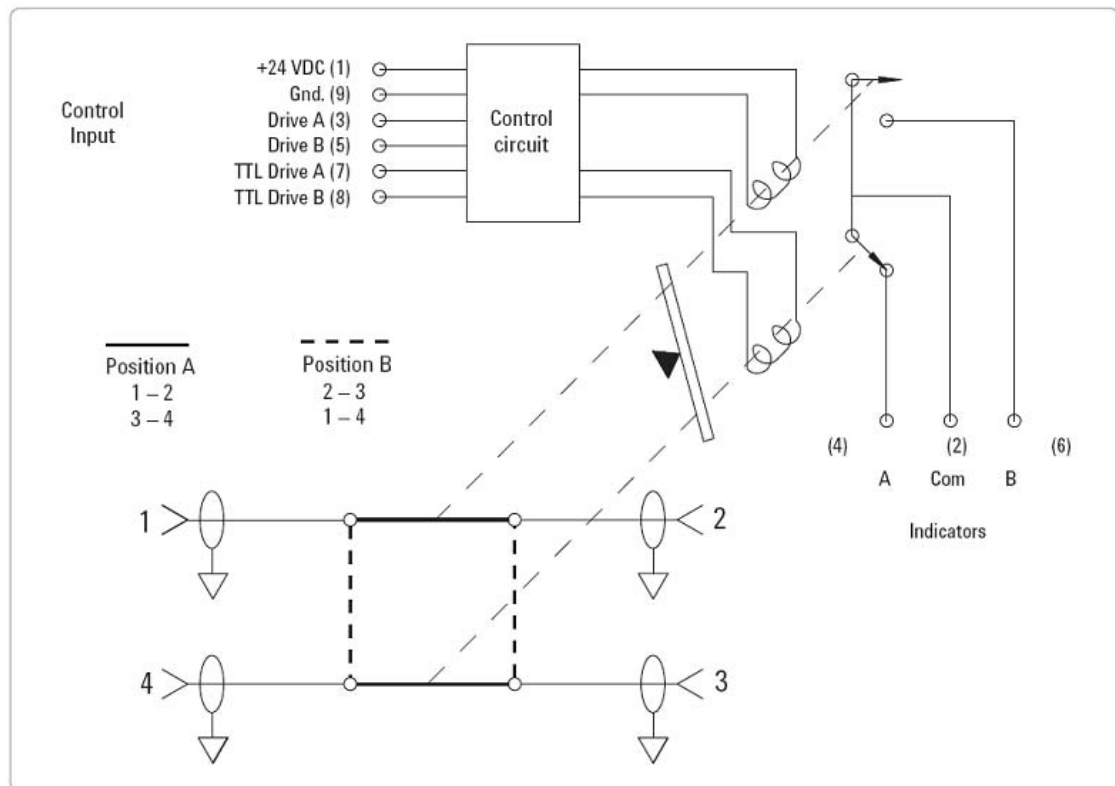


Figure 1-2 Keysight 87222R schematic

Key Features

- Excellent isolation, typically >90 dB at 26.5 GHz
- Opto-electronic indicators and interrupts
- Magnetic latching
- TTL/5 V CMOS compatible
- PIM level (typical) of -165 dBc

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2 Switch Configuration

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Electronic Position Indicators	19

This chapter provides you information on driving the switch and the configuration to utilize the function of the position indicators.

Driving the Switch

There are two positions for the 87222R switch (see [Table 2-1](#)). Position A has RF Port 1 connected to RF Port 2 and RF Port 3 connected to RF Port 4. Position B has RF Port 2 connected to RF Port 3 and RF Port 1 connected to RF Port 4. Either switch can be driven with a standard grounding drive control with or without a separate ground. Single line or dual line TTL control are also available. The switch operates in a break-before-make mode. See [Figure 2-1](#).

1 Standard drive:

See [Figure 2-2](#) for drive connection diagrams.

- Connect pin 1 to supply (+20 VDC to +32 VDC).
- Connect pin 9 to ground^[1].
- Select position A by applying ground to pin 3^[2].
- Select position B by applying ground to pin 5^[2].

2 Single line TTL drive:

See [Figure 2-2](#) for drive connection diagrams.

See [Figure 2-3](#) for TTL voltage states.

- Connect pin 1 to supply (+20 VDC to +32 VDC).
- Connect pin 9 to ground^[3] ^[4].
- Connect pin 8 to TTL “High.”
- Select position A by applying TTL “High” to pin 7^[2].
- Select position B by applying TTL “Low” to pin 7^[2].

3 Dual line TTL drive:

See [Figure 2-2](#) for drive connection diagrams.

See [Figure 2-3](#) for TTL voltage states.

- Connect pin 1 to supply (+20 VDC to +32 VDC).
- Connect pin 9 to ground^[3] ^[4].
- Select position A by applying TTL “High” to pin 7 and TTL “Low” to pin 8^[2].
- Select position B by applying TTL “Low” to pin 7 and TTL “High” to pin 8^[2].

[1] Pin 9 does not need to be grounded for the switch to operate in standard drive mode. If pin 9 is not grounded, the position indicators will only function while the appropriate drive has ground applied. Therefore, if a pulse drive is used and continuous indicator operation is required, pin 9 must be grounded.

[2] After the RF path is switched and latched, the drive current is interrupted by the electronic position-sensing circuitry. Pulsed control is not necessary, but if implemented, the pulse width must be 15 ms minimum to ensure that the switch is fully latched.

[3] For TTL drive, pin 9 must be grounded.

[4] In addition to the quiescent current supplying the electronic position sensing circuitry, the drive current flows out of pin 9 (during switching) when using TTL drive.

CAUTION

FOR USERS OF THE KEYSIGHT 11713B/C SWITCH DRIVER:

Do not drive the 87222R using the S9 or S0 outputs from either the banana plugs or from pins 3 or 4 within the Atten X and Atten Y Viking sockets located on the rear panel of the 11713B/C.

Table 2-1 Drive control alternatives

RF path	Standard drive voltage		Single line TTL/5 V CMOS drive voltage		Dual line TTL/5 V CMOS drive voltage	
	Drive A Pin 3	Drive B Pin 5	TTL Drive A Pin 7	TTL Drive B Pin 8	TTL Drive A Pin 7	TTL Drive B Pin 8
Position A 1 to 2, 3 to 4	Ground	Open	High	High	High	Low
Position B 2 to 3, 1 to 4	Open	Ground	Low	High	Low	High

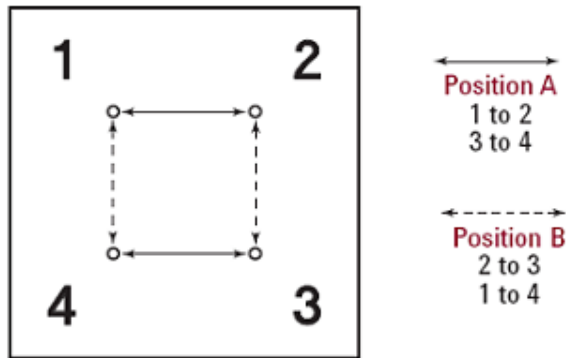


Figure 2-1 RF port connections

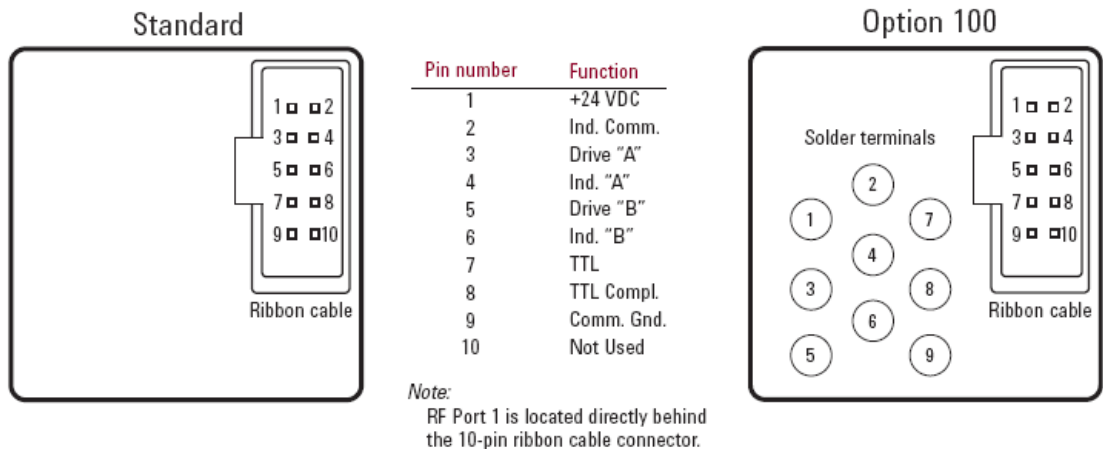


Figure 2-2 Drive connections

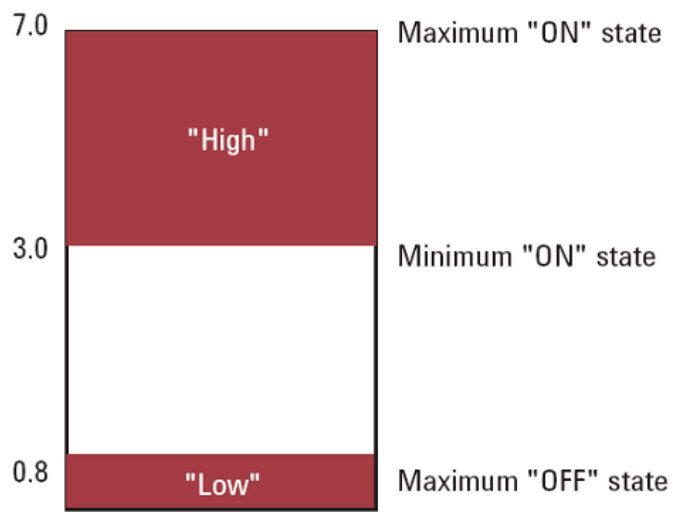


Figure 2-3 TTL control voltage states

Electronic Position Indicators

The independent electronic position indicators consist of optically isolated, solid-state relays, which are driven by photo-electric sensors coupled to the mechanical position of the RF path's moving elements. See [Figure 2-4](#). The circuitry consists of a common which can be connected to an output corresponding to either position A or position B. The solid state relays are configured for AC and/or DC operation. The electronic position indicators require that the supply (+20 VDC to +32 VDC) be connected to pin 1 but require that pin 9 be grounded if pulse drive is used and continuous indicators operation is desired. If pin 9 is not grounded, the position indicators will function while the appropriate drive has ground applied.

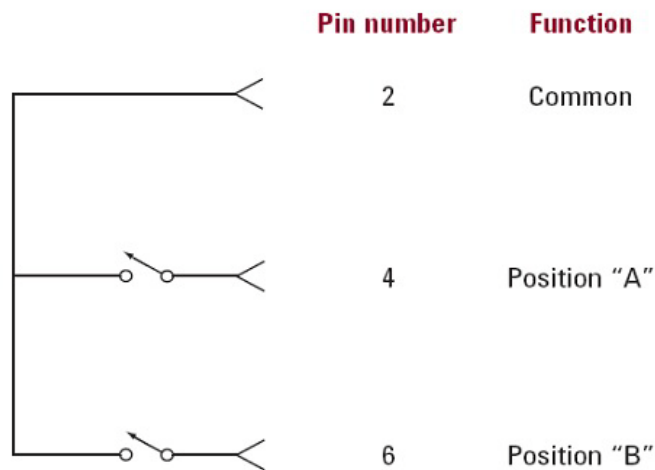


Figure 2-4 Indicator function diagram

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3 Specifications

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Characteristics and Specifications

NOTE

For the characteristics and specifications of the 87222R Low PIM Coaxial Transfer Switch, refer to the datasheet at <https://literature.cdn.keysight.com/litweb/pdf/5991-3195EN.pdf>

4 Installation and Verification

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This chapter provides you installation information and simple verification steps of the 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**” on page 25 or “**Performance test**” on page 26.
- 2** If the contents are incomplete, there is mechanical damage or defect, or the instrument does not pass the electrical performance test, contact the nearest Keysight Sales and Service office (refer to “**Sales and Technical Support**” on page 3). Keysight 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. Keysight can provide packaging materials identical to the original materials. Refer to “**Sales and Technical Support**” on page 3 for the Keysight office nearest to 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 its model number and serial number.

Operating and Service Instructions

Operator's check

The operator's check is supplied to allow the operator to make a quick check on the switch prior to use or if a failure is suspected.

CAUTION

ESD exceeding the level specified in Environmental Specifications or RF power applied is greater than the maximum specified as in the Data Sheet (<https://literature.cdn.keysight.com/litweb/pdf/5991-3195EN.pdf>) may cause permanent damage to the device.

Description

The coaxial transfer 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 switch to be verified. The S-parameter measurement is the best way to determine if the switch is working properly.

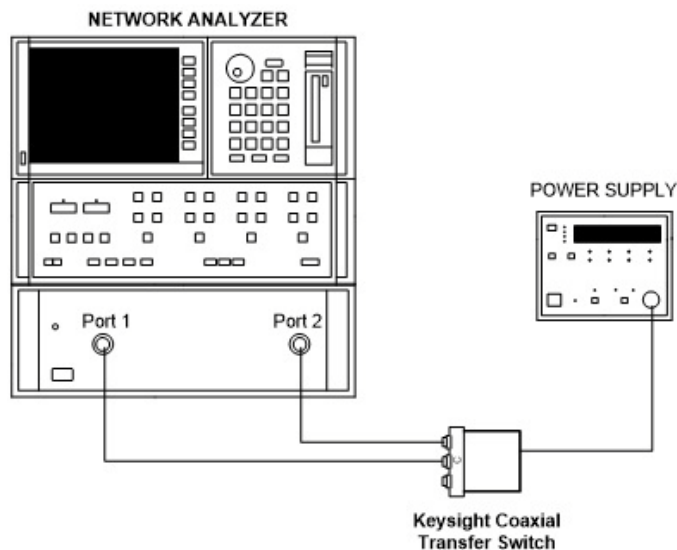


Figure 4-1 Connection to perform quick check

Quick check procedure

- 1 Connect the common port of the switch to Port 1 of the network analyzer and one of the outer RF ports to Port 2 of the network analyzer as illustrated in [Figure 4-1](#).
- 2 For standard drive, apply ground to the corresponding “drive” pin to close the selected path. Refer to [“Driving the Switch”](#) on page 16.
- 3 For TTL drive (option T24), apply “High” to the corresponding “drive” pin to close the selected path. Refer to [“Driving the Switch”](#) on page 16.
- 4 Perform the S-parameter measurement and verify against Supplemental Characteristics in the Data Sheet (<https://literature.cdn.keysight.com/litweb/pdf/5991-3195EN.pdf>).
- 5 Repeat steps 1 to 4 until all paths are measured and verified.

Performance test

The coaxial transfer switch 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 and repair

Keysight 87222R low PIM coaxial transfer switch does not require internal adjustments and is not recommended for repair.

NOTE

If any of the low PIM coaxial transfer switch fails within the warranty period, a new unit will be replaced. Refer to [Replacement units](#) for more details.

Maintenance

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

Replacement units

Table 4-1 Replacement units

Replacement unit	Part number
Low PIM switch, transfer, DC - 26.5 GHz with Option 100	87222-60037
Low PIM switch, transfer, DC - 26.5 GHz with Option 161	87222-60038
Low PIM switch, transfer, DC - 26.5 GHz with Option 161, 201	87222-60039
Low PIM switch, transfer, DC - 26.5 GHz with Option 100, 201	87222-60040

NOTE

The above list of replacement units is not applicable as customer-orderable units. The list only applies for any low PIM coaxial switch which fails within the warranty period.



This information is subject to change without notice. Always refer to the Keysight website for the latest revision.

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