

# Keysight L7222C Coaxial Transfer Switch



Operating and  
Service Manual

# Notices

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### 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.

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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](http://www.keysight.com/find/switches)  
(product-specific information and support, software and documentation updates)
- [www.keysight.com/find/assist](http://www.keysight.com/find/assist)  
(worldwide contact information for repair and service)

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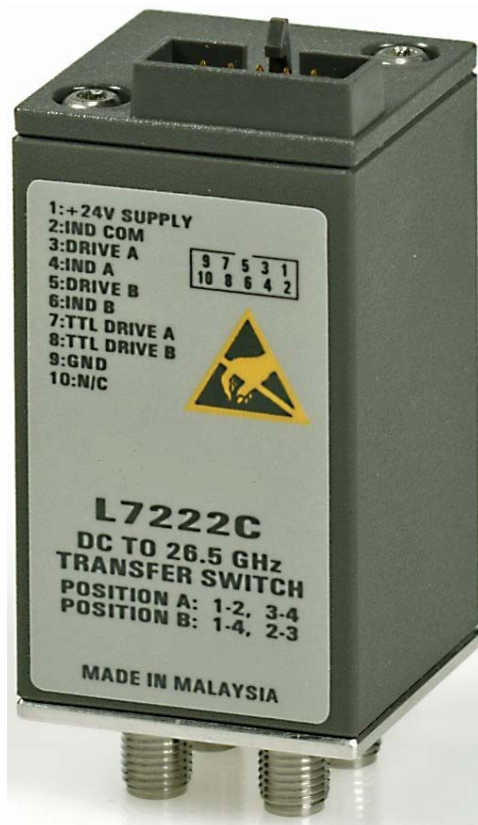
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## General Information

### L-Series coaxial transfer switch overview

Keysight L7222C coaxial transfer switch is designed for flexibility in signal routing applications and provides exceptional insertion loss repeatability of 0.03 dB, low insertion loss and high isolation > 80 dB.



**Figure 1** L-series coaxial transfer switch - L7222C

Table 1 shows general details of L7222C coaxial transfer switch.

**Table 1** General information on L7222C coaxial transfer switch

Model	Frequency range	Configuration
L7222C	DC to 26.5 GHz	DPDT

## Features

- Guaranteed 0.03 dB insertion loss repeatability for 2 million cycles
- Excellent isolation, typically > 80 dB at 26.5 GHz
- Opto-electronic indicators and interrupts
- Magnetic latching
- TTL/5V CMOS compatible (optional)

The L7222C can be used in a variety of applications such as switching two inputs and two outputs, signal reversal switching or as a drop-out switch. Innovative design and careful process control mean the L7222C meet the requirements for highly repeatable switching elements in test instruments and switching interfaces. L7222C 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 this switch increases system uptime and lowers the cost of ownership by reducing calibration cycles and switch maintenance.

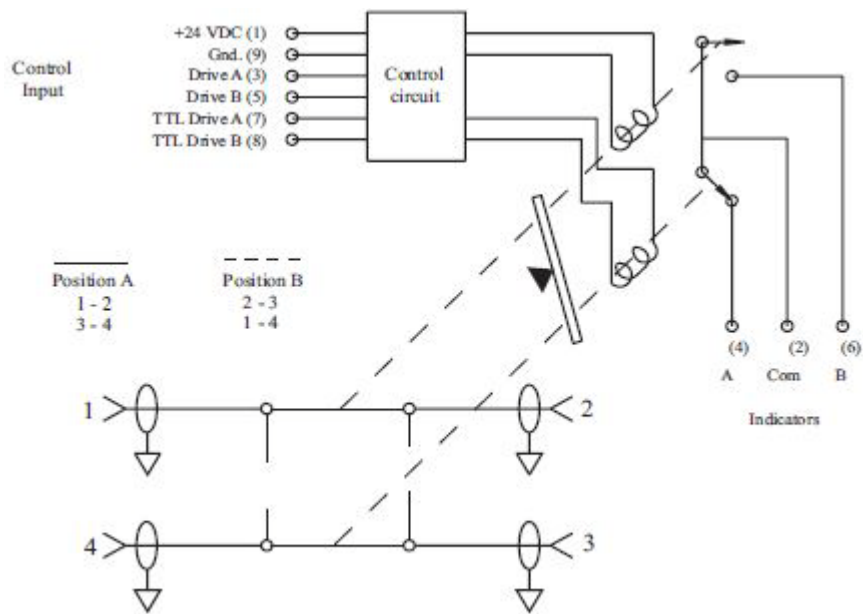
Opto-electronic interrupts and indicators improve reliability and extend the life of the switch by eliminating DC circuit contact failures characteristic of conventional electromechanical switches. The L7222C have circuits that interrupt the current to all the solenoids once switching is complete and offer 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.

## Features

SP4T and SP6T configuration with magnetic latching

- Warranted 0.03 dB insertion loss repeatability for 2 million cycles
- Excellent isolation, typically > 85 dB at 26.5 GHz
- Opto-electronic indicators and interrupts
- TTL/5V CMOS compatible (optional)
- Terminated and unterminated ports

Innovative design and careful process control creates switches that meet the requirements for highly repeatable switching elements in test instruments and switching interfaces. The exceptional 0.03 dB insertion loss repeatability is warranted for 2 million cycles at 25°C. This reduces sources of random errors in the measurement path and improves measurement uncertainties. Switch life is a critical consideration in production test systems, satellite and antenna monitoring systems, and test instrumentation. The longevity of these switches increases system uptime, and lowers the cost of ownership by reducing calibration cycles and switch maintenance.



**Figure 2** Keysight L7222C coaxial transfer switch schematic

## Driving the switch

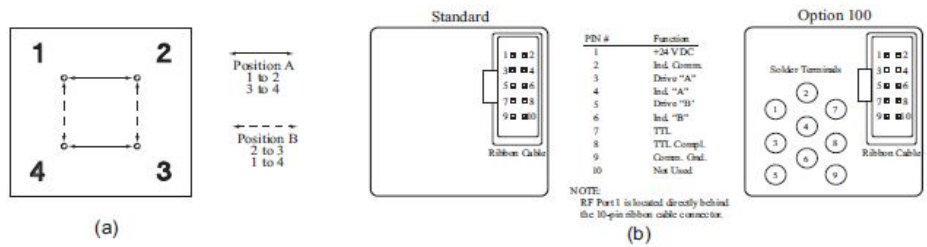
There are two positions for the L7222C coaxial transfer switch. See [Figure 3](#). Position A has RF Port 1 connected to RF Port 2 and RF Port 3 connected to RF Port 4. Position B has RF Port 2 connected to RF Port 3 and RF Port 1 connected to RF Port 4. Either switch can be driven with a standard grounding 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.

**Table 2** Standard drive control

RF path	Standard drive voltage	
	Drive A Pin 3	Drive B Pin 5
Position A	Ground	Open
Position B	Open	Ground

**Table 3** TTL drive control

RF path	Single line TTL/5V CMOS drive voltage		Dual line TTL/5V CMOS drive voltage	
	TTL Drive A Pin 7	TTL Drive B Pin 8	TTL Drive C Pin 7	TTL Drive D Pin 8
Position A	High	High	High	Low
Position B	Low	High	Low	High



**Figure 3** (a) RF port connections and (b) drive connections

### Standard drive

- Connect pin 1 to supply voltage (+20 Vdc to +32 Vdc) and pin 9 to ground. See [Figure 3](#) for connection diagram and [Table 2](#) for standard drive control.

### NOTE

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.

- Select position A by applying ground to pin 3.
- Select position B by applying ground to pin 5.

**NOTE**

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.

---

### Single line TTL drive

- Connect pin 1 to supply voltage (+20 Vdc to +32 Vdc) and pin 9 to ground. See [Figure 3](#) for connection diagram and [Table 3](#) for TTL drive control.

**NOTE**

For TTL drive, pin 9 must be grounded.

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.

---

- Select position A by applying TTL “High” to pin 7 and TTL “High” to pin 8.
- Select position B by applying TTL “Low” to pin 7 and TTL “High” to pin 8.

**NOTE**

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.

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### Dual line TTL drive

- Connect pin 1 to supply voltage (+20 Vdc to +32 Vdc) and pin 9 to ground. See [Figure 3](#) for connection diagram and [Table 3](#) for TTL drive control.

**NOTE**

For TTL drive, pin 9 must be grounded.

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.

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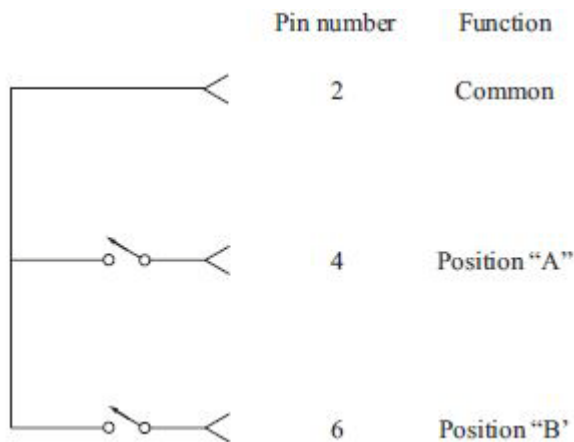
- Select position A by applying TTL “High” to pin 7 and TTL “Low” to pin 8.
- Select position B by applying TTL “Low” to pin 7 and TTL “High” to pin 8.

**NOTE**

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.

## Electronic Position Indicators

The 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 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 to +32 VDC) be connected to pin 1 but requires 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 4** Pin function diagram for indicator

# 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 Keysight Technologies Sales and Service office. Refer to the [Sales and Technical Support](#) in the front matter of this manual. Keysight 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. Keysight Technologies can provide packaging materials identical to the original materials. Refer to [Sales and Technical Support](#) in the front matter of this manual for the Keysight 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

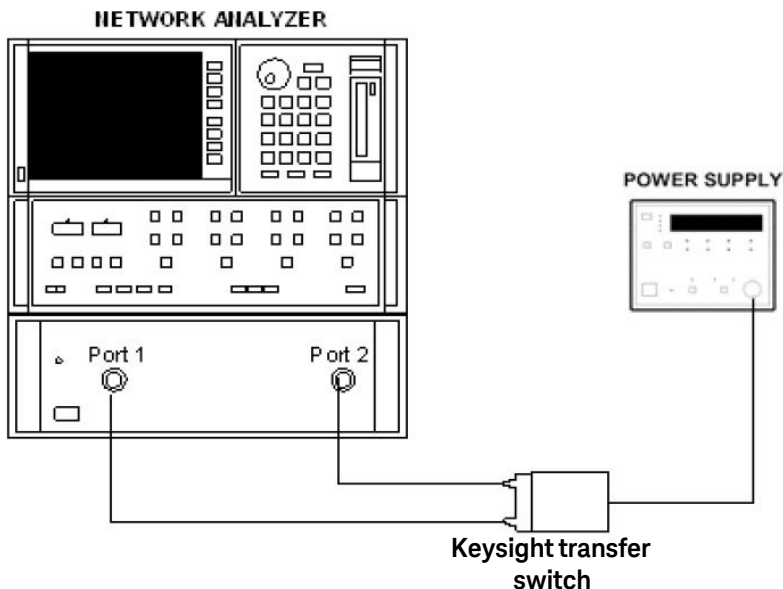
The operator's check is supplied to allow the operator to make a quick check on the coaxial transfer switch prior to use or if a failure is suspected.

### CAUTION

ESD exceeding the level specified or RF power applied is greater than the maximum specified 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-parameters measurement is the best way to determine if the switch is working properly.



**Figure 5** Connection to perform quick check

### Quick-check procedure

- 1** Connect Port 1 and Port 2 of the network analyzer to switch's Port 1 and Port 2 respectively.
- 2** Referring to [Table 2](#) (standard drive) or [Table 3](#) (TTL drive), apply appropriate drive voltage to ensure switch is in position A (path 1 connected to path 2, path 3 connected to path 4). Measure S11, S21 and S22 and verify against specifications.
- 3** Now, still in position A, disconnect switch's Port 1 and Port 2 from network analyzer. Then, connect network analyzer's Port 1 and Port 2 to Port 3 and Port 4 of the switch. Measure S11, S21 and S22 and verify against specifications.
- 4** Disconnect Port 3 and Port 4 from network analyzer. Connect Port 1 and Port 2 of the network analyzer to switch's Port 1 and Port 4 respectively.
- 5** Referring to [Table 2](#) (standard drive) or [Table 3](#) (TTL drive), apply appropriate drive voltage to ensure switch is in position B (path 1 connected to path 4, path 2 connected to path 3). Measure S11, S21 and S22 and verify against specifications.
- 6** Now, still in position B, disconnect switch's Port 1 and Port 2 from network analyzer. Then, connect network analyzer's Port 1 and Port 2 to Port 2 and Port 3 of the switch. Measure S11, S21 and S22 and verify against specifications.

## Performance Tests

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

The coaxial transfer switch does not have internal adjustments and should not be opened.

## Repair

The L7222C coaxial transfer switch is 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).



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

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