U7104E/F/N and U7106E/F/N Series Coaxial Multiport Switches

KEYSIGHT

OPERATING AND SERVICE MANUAL

Notices

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CE	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.		This symbol indicates 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 the product.
ISM 1-A	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).	**ICES/NMB-001**	ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.
	The RCM mark is a registered trademark of the Australian Communications and Media Authority.		
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South Korean Class A EMC Declaration

Information to the user:

This instrument has been conformity assessed for use in business environments. In a residential environment, this equipment may cause radio interference.

This EMC statement applies to the equipment only for use in business environment.

사 용 자 안 내 문
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This instrument is designed to comply with the following EMC (Electromagnetic Compatibility) requirements:

– EMC Directive 2014/30/EU

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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.

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  (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

This chapter provides you an overview of Keysight U7104E/F/N and U7106E/F/N series coaxial multiport switches.

General Information

Keysight U7104E/F/N SP4T, U7106E/F/N SP6T terminated switches provide the life and reliability required for automated test and measurement, signal monitoring and routing applications. These switches can be used in various applications as they are available in multiple frequency ranges, up to 67 GHz.

Figure 1-1 Keysight U7104E/F/N coaxial multiport switches

Figure 1-2 Keysight U7106E/F/N coaxial multiport switches

Innovative design and careful process control create switches that meet the requirements for highly repeatable switching elements in test instruments and switching interfaces. The switches are designed to operate for more than 1,000,000 cycles. The exceptional insertion loss repeatability reduces sources of random errors in the measurement path and improves measurement uncertainty.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.

Table 1-1 List of Keysight U7104E/F/N and U7106E/F/N coaxial multiport switches

Model number	Frequency range	Configuration
U7104E	DC to 50 GHz	SP4T
U7104N	DC to 54 GHz	SP4T
U7104F	DC to 67 GHz	SP4T
U7106E	DC to 50 GHz	SP6T
U7106N	DC to 54 GHz	SP6T
U7106F	DC to 67 GHz	SP6T

Key Features

- SP4T and SP6T configurations
- Magnetic latching
- Operating life of 1 million cycles, typical to ensure accurate system measurements and reduce calibration intervals
- Excellent isolation, typically >65 dB at 67 GHz
- Opto-electronic indicators and interrupts
- Terminated ports
- TTL/5 V CMOS compatible (optional)

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2 Switch Configuration

This chapter provides you information on how to drive the switches using standard drive and TTL drive. Also included is the configuration to utilize the function of the position indicator.

Driving the Switch

Each RF path can be closed by applying ground (TTL “High” for option 300 and 500) to the corresponding “drive” pin. In general, all other RF paths are simultaneously opened by internal logic.

See Figure 2-1 for drive connection diagrams.

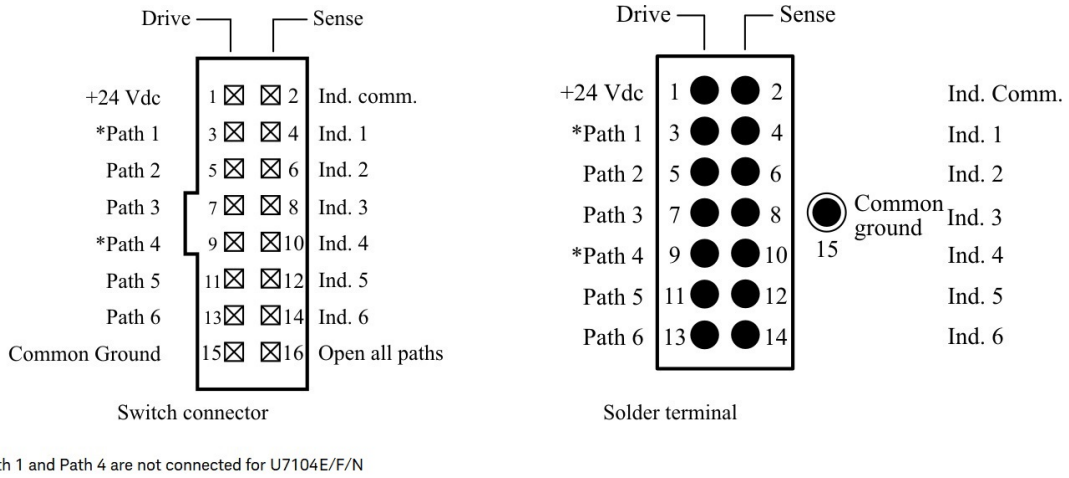


Figure 2-1 U7104E/F/N and U7106E/F/N Drive connection diagrams for Options 200, 300, 400 and 500

The default operation of the switches is break-before-make. Make-before-break switching can be accomplished by simultaneously selecting the “drive” pins for old RF path and new RF path. Once the new RF path is closed (15 ms), de-select the old RF path “drive” pin while leaving the new RF path “drive” pin selected. The switch circuitry will automatically open the old RF path while leaving the new RF path engaged.

Standard Drive (Option 200 and Option 400)

1 Connect pin 1 to supply voltage (24 Vdc) and pin 15 to ground.

NOTE Pin 15 must always be connected to ground to enable the electronic position-indicating circuitry and drive logic circuitry.

CAUTION If pin 15 is not connected to power supply ground, catastrophic failure will occur.

2 Select (close) desired RF path by applying ground to the corresponding “drive” pin; for example ground pin 3 to close RF path 1.

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 the switch is fully latched.

3 To select another RF path, ensure that all unwanted RF path “drive” pins are disconnected from ground (to prevent multiple RF path engagement). Ground the “drive” pin which corresponds to the desired RF path.

4 To open all RF paths, ensure that all RF path “drive” pins are disconnected from ground. Then, connect pin 16 to ground.

TTL Drive (Option 300 and Option 500)

1 Connect pin 1 to supply voltage (24 Vdc) and pin 15 to ground.

NOTE Pin 15 must always be connected to ground to enable the electronic position-indicating circuitry and drive logic circuitry.

In addition to the quiescent current supplying the electronic position-sensing circuitry, the drive current flows out of pin 15 (during switching) on TTL drive switches (option 300 and option 500).

CAUTION If pin 15 is not connected to power supply ground, catastrophic failure will occur.

2 Select (close) desired RF path by applying ground to the corresponding “drive” pin; for example apply TTL “High” to pin 3 to close RF path 1.

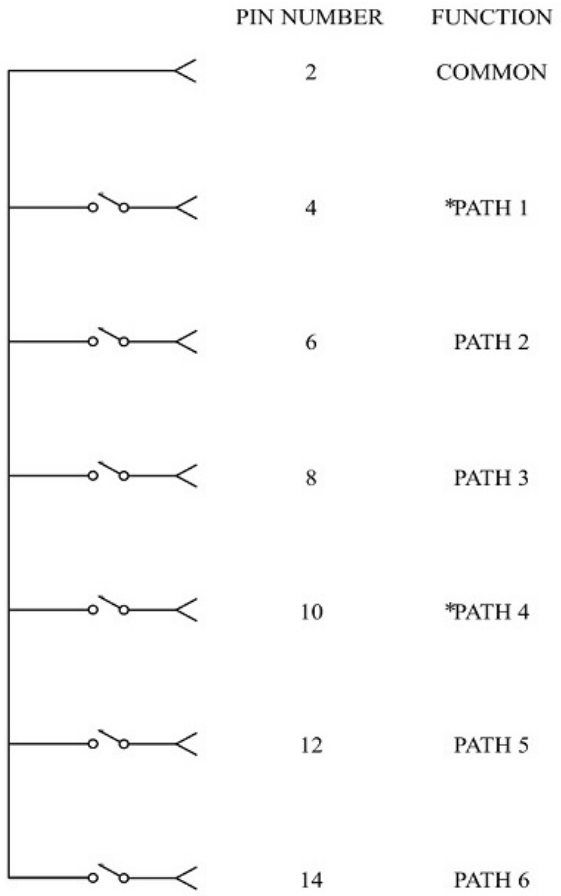
NOTE After the RF path is switched and latched, the drive current is interrupted by the electronic position-sensing circuitry. Pulsed control is not necessary, but if implemented, the pulse width must be 15 ms minimum to ensure the switch is fully latched.

3 To select another RF path, ensure that all unwanted RF path “drive” pins are at TTL “Low” (to prevent multiple RF path engagement). Apply TTL “High” to the “drive” pin which corresponds to the desired RF path.

4 To open all RF paths, ensure that all RF path drive” pins are at TTL “Low”. Then, apply TTL “High” to pin.

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 2-2). The circuitry consists of a common which can be connected to an output corresponding to each RF path. If multiple RF paths are engaged, the position indicator corresponding to each closed RF path will be connected to common. The solid state relays are configured for AC and/or DC operation. The electronic position indicators require that the supply (24 Vdc) be connected to pin 1 and ground connected to pin 15.



***Paths 1 and 4 are not connected for U7104E/F/N**

Figure 2-2 U7104E/F/N and U7106E/F/N Pin configuration for indicator function

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3 Specifications

This chapter provides you the environmental specifications of Keysight U7104E/F/N and U7106E/F/N series coaxial multiport switches.

Environmental Specifications

Keysight U7104E/F/N and U7106E/F/N series coaxial multiport switches are designed to fully comply with Keysight Technologies' product operating environmental specifications as shown in the table below.

Table 3-1 U7104E/F/N and U7106E/F/N environmental specifications

Temperature	
– Operating	-25°C to +75°C
– Storage	–55 °C to +85°C
– Cycling	–55 °C to +85°C, 10 Cycles per MIL-STD-202F
Humidity	
– Operating	95% RH at 40°C
– Resistance	95% RH at 65°C, 10 Days per MIL-STD-202F, Method 106E
Shock	
– End-user handling	Delta-V: 3m/s ±5%, Duration <3ms at 6 faces
– Mechanical Survival	Half Sine: 500g, 0.5ms at 6 faces
– Transportation	50g , delta-V: 8m/s ±10% at 6 faces
Vibration	
– Operating (Random)	0.3 Grms, 5-500Hz
– Survival (Random)	7 Grms, 50-2000Hz
Altitude	
– Operating	4,600 meters (15,092 feet)
– Non-operating	15,300 meters (50,197 feet)

Physical Specifications

The table below lists the weight of the Keysight U7104E/F/N and U7106E/F/N series coaxial multiport switches.

Model number	Weight
U7104E/F/N	231 gm (0.509 lbs)
U7106E/F/N	235 gm (0.518 lbs)

Figure 3-1 and Figure 3-2 show the dimensions of the Keysight U7104E/F/N and U7106E/F/N series coaxial multiport switches respectively.

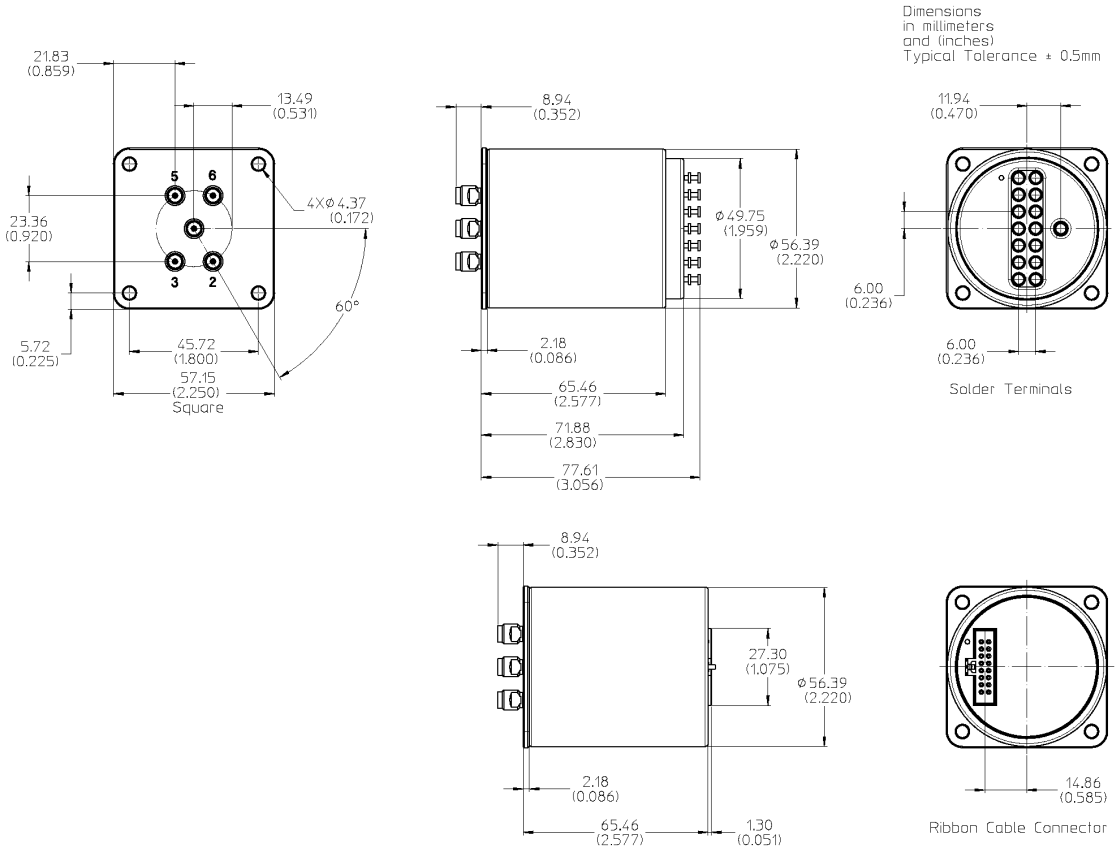

Figure 3-1 U7104E/F/N product outline

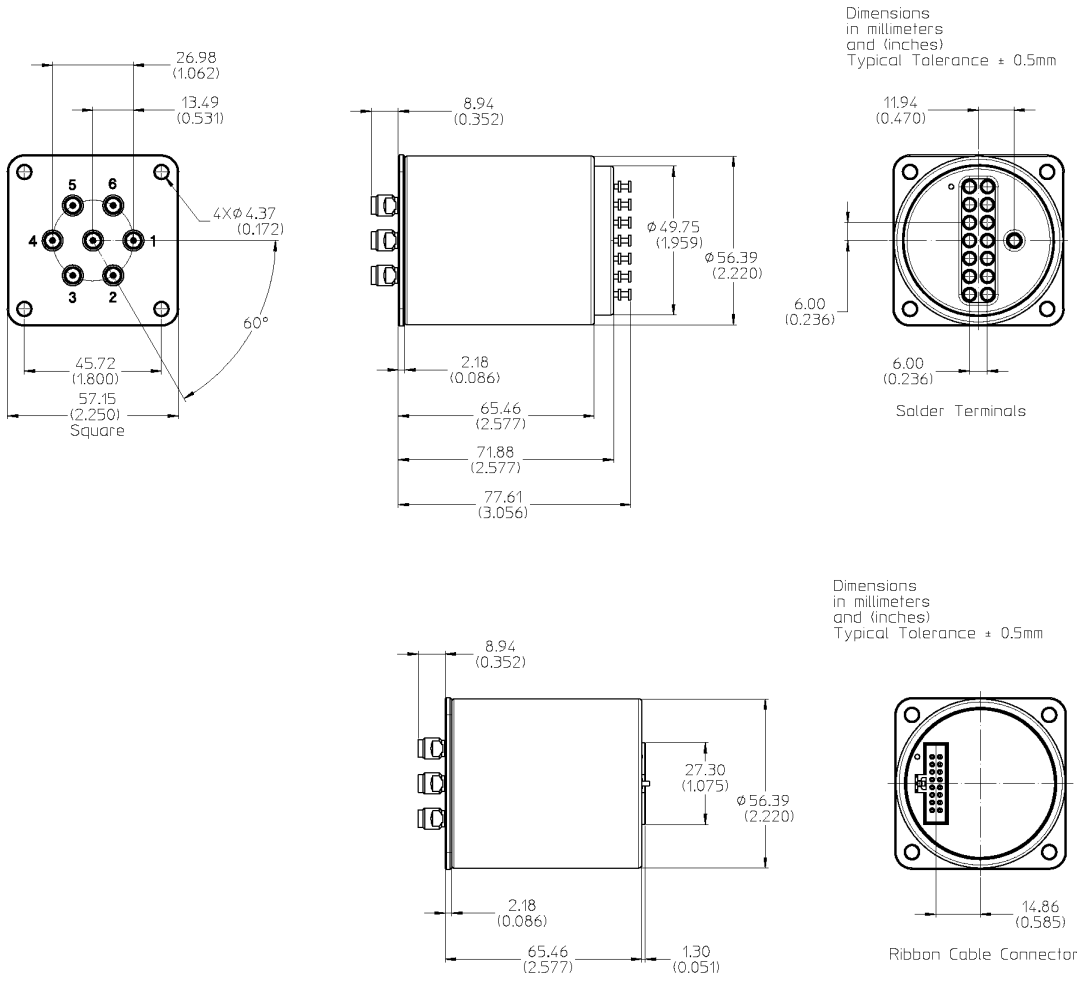

Figure 3-2 U7106E/F/N product outline

4 Installation and Verification

This chapter provides you installation information and simple verification steps of the switches.

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 29 or "Performance test" on page 30.
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 5). 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 5 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 coaxial multiport switches prior to use or if a failure is suspected.

Description

The coaxial multiport 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.

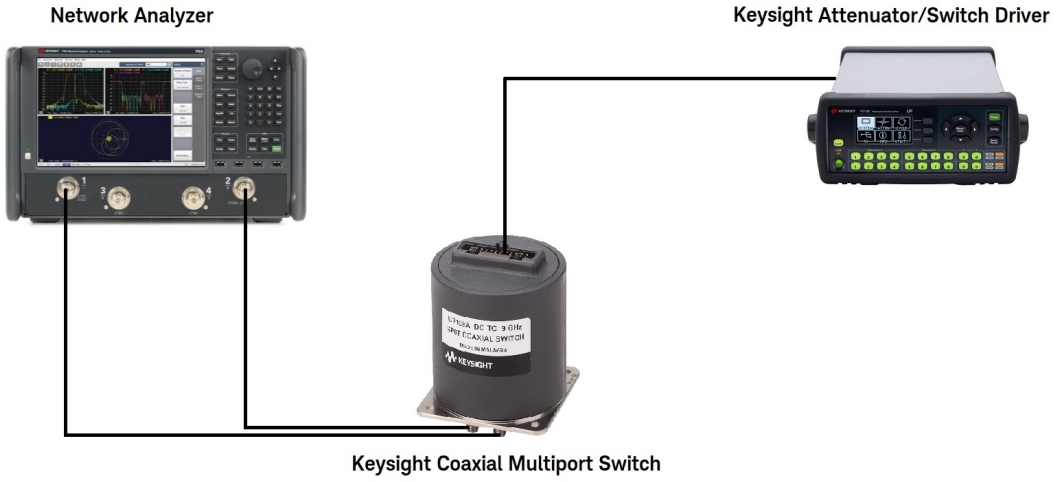

Figure 4-1 Connection to perform quick check

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 (option 200 and option 400), apply ground to the corresponding “drive” pin to close the selected path. Refer to “Standard Drive (Option 200 and Option 400)” on page 19.
3. For TTL drive (option 300 and option 500), apply “High” to the corresponding “drive” pin to close the selected path. Refer to “TTL Drive (Option 300 and Option 500)” on page 20.
4. Perform the S-parameter measurement and verify against supplemental specifications (cold switching).
5. Repeat steps 1 to 4 until all paths are measured and verified.

Performance test

The coaxial multiport 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 and repair

Keysight U7104E/F/N and U7106E/F/N series coaxial multiport switches do not require internal adjustments and are not recommended for repair.

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).

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