Applications

RF/microwave switches find use in a wide variety of signal routing applications for test and measurement systems. Typical applications include:

- Selection of multiple signal sources to one output
- Selection of multiple input signals to one measurement instrument
- Transfer switching to insert or remove a device in a signal path
- Matrix switching of multiple inputs and outputs

Technology

Agilent electromechanical coaxial switches feature low insertion loss, high isolation, broadband performance, long life and exceptional repeatability. Agilent coaxial switches are all designed with an "edge-line" coaxial structure. This transmission line structure provides for movement of the edge-line center conductor between two fixed, continuous ground planes. The main advantage of this innovation is that the moving contacts can be easily activated, yet maintain high isolation and low insertion loss.

The RF contact configuration is designed for controlled wiping action. Since the outer conductor is not part of the switching function, repeatability and life are enhanced. The switching action occurs typically within 15 to 30 milliseconds, after which permanent magnets latch the contacts to retain the new switch position.

The Agilent 87104/106 and 87204/206 family of switches use optoelectronic sensing to provide the coil current interrupt function. Since no mechanical contacts are involved in this function, the switch reliability is improved.

Key specifications

- Frequency range
- Input power
- Insertion loss
- Isolation
- SWR
- Repeatability
- Life

Frequency range

One of the main advantages of electromechanical switches is that they transmit signals all the way down to dc. The top frequency limits are set by the size of the coaxial structure and connectors. Various Agilent models are available up to 40 GHz. Parameters such as insertion loss, isolation and SWR behave in a predictable manner. Typically, these parameters will linearly degrade at higher frequencies.

Input power

The ability of a switch to handle power depends very much on the materials used for the signal carrying components of the switch and on the switch design. Two switching conditions should be considered: "hot" switching and "cold" switching. Hot switching occurs when RF/microwave power is present at the ports of the switch at the time of the switching function. Cold switching occurs when the signal power is removed before activating the switching function.

Hot switching causes the most stress on internal contacts, and can lead to premature failure. Cold switching results in lower contact stress and longer life, and is recommended in situations where the signal power can be removed before switching.

Insertion loss

Insertion loss for electromechanical switches is very low, ranging from 0.1 dB at low frequencies to 1.5 dB at high frequencies. This performance distinguishes them from solid-state switches which range from 0.5 dB to 6 dB. Factors that influence loss are: path length, types of material used on signal carrying surfaces, contact wear, corrosion or other contamination. Insertion loss can play an important role whether high or low power are present. In high-power systems, this additional loss may require that the source power be increased to compensate. In receiver applications, the effective sensitivity of the system is reduced by the amount of insertion loss. In other systems, additional power may not be available, due to the prohibitive cost of supplying more power.

Isolation

High isolation in switches is important to almost every measurement application, because it prevents unwanted signals from interfering with the desired signal. Isolation is the amount that the unwanted signal is attenuated before it is detected at the port of interest. Agilent switches have high isolation, with typical values >90 dB to 18 GHz and >50 dB to 26.5 GHz. High isolation can be particularly important in measurement systems where signals from sources are being routed. If too much power from an unselected source is allowed to flow through a device under test, measurement results will not be accurate.

SWR

The standing wave ratio (SWR) of a switch specifies how well the connectors and switching signal path are matched to an ideal 50-ohm transmission line. Low SWR is crucial in test set design when signal routing configurations involve multiple components in series, thereby adding to measurement uncertainty. SWRs of 1.1 to 1.5 are typical in Agilent switches.

Repeatability

Repeatability plays an important role in any test system. In test applications where accuracies of less than a few tenths of a dB are required, the system designer must consider the effects of switch repeatability in addition to test equipment capabilities. In automated test systems where switches are used for signal routing, every switch will add to the repeatability error. Such errors cannot be calibrated out of the system due to their random nature. Agilent switches are designed for high repeatability, 0.03 dB maximum over 5 million cycles.

Repeatability is a measure of the change in a specification from cycle to cycle over time. When used as a part of a measurement system, switch repeatability is critical to overall system measurement accuracy. Repeatability can be defined for any of the specifications of a switch, which includes: insertion loss, reflection, isolation and phase. Insertion loss repeatability is specified for all Agilent switches, as this tends to be the specification most sensitive to changes in switch performance.

Factors that affect insertion loss repeatability include:

- Debris
- Contact pressure
- Plating quality
- Contact shape and wiping action

Debris is generated in a switch when two surfaces come in contact during movement. The debris may find its way between contacts, causing an open circuit. Agilent has developed processes that control contamination and debris generation to minimize these effects.

Switch contacts are typically gold plated to maximize conductivity and minimize surface corrosion. Special plating materials, surface finish, contact shape and wiping pressure all combine to minimize surface effects on insertion loss repeatability.

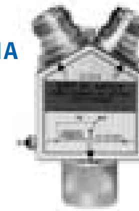
Contact resistance is inversely proportional to contact pressure. Insufficient pressure increases life but also increases contact loss. Too much pressure damages the contact surfaces, with little insertion loss improvement. Contact surface wiping provides a means for breaking through surface corrosion and moving debris away from the contacts. This allows the switch to clean the contact surfaces with each switch cycle.

Life

The life of a switch is usually specified in cycles, i.e. the number of times it switches from one position to another and back. Agilent determines life by cycling switches to the point of degradation. Typically, Agilent switches, in life cycle tests, perform to specifications for at least twice as many cycles as warranted.

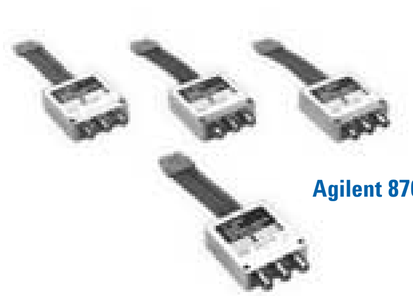
Four Agilent switch families have a specified life of 5 million cycles. This long life results in lower cost of ownership by reducing periodic maintenance, downtime and repairs.

Agilent offers a broad line of coaxial switches, covering up to 40 GHz, for use in test and measurement applications. All switches use magnetically-latched solenoids and are primarily designed with break-before-make RF contacts for test simplicity. The Selection Guide on page 145 describes the product families and their features.



Agilent 8761A

Agilent 8762/63/64 family



Agilent 8765 family

Coaxial – flexible, high performance

The Agilent N181x series of coaxial latching switches combines unmatched flexibility of configuration with excellent repeatability, long life, and reliability. Options include choice of DC connector type, coil voltage level, standard or high performance, position indictors, current interrupts, and TTL/5V CMOS compatibility. All switches have SMA (f) connectors and are offered in frequency ranges up to 26.5 GHz.

The Agilent N1810UL is a three-port single pole double throw switch. The Agilent N1810TL is a single pole double throw switch with two 50 ohm terminations, making it ideal for applications where port matching is required. The N1811TL is a four-port switch with one internal load that can terminate the device under test when in the bypass mode. (Up to 1 watt.) The N1812UL is a versatile, unterminated 5-port switch that can be used in transfer switch applications and for signal path reversal.

SPDT – configurable connectors

Agilent 8761A,B SPDT switches operate up to 18 GHz. Each port features six connector options plus 50-ohm termination for design flexibility.

SPDT – high performance

Agilent 8762A,B,C switches operate up to 26.5 GHz. They provide exceptional isolation of 90 dB to 18 GHz and switched terminations, so that all ports maintain a 50-ohm match. Internal loads are rated at 1 watt average (100 W peak, 10 µsec pulse width). Control voltage Options T15 and T24 are compatible with TTL/5V CMOS drive circuitry. Another model, Agilent 8762F, is designed for 75-ohm transmission lines, making it valuable for communication applications up to 4 GHz.

SPDT – high reliability

Agilent 8765A,B,C,D,F are SPDT switches that offer outstanding performance and a life of 5 million cycles. This switch family is available in four models up to 40 GHz, as well as a 75-ohm model to 4 GHz.Unlike the Agilent 8762 switches, they do not have internal, switched RF loads or dc current interrupts. Coil voltage options cover the complete range from 5 Vdc to 24 Vdc. Since the switches are magnetically latched, the coil voltage may be switched off after 15 ms.

The standard Agilent 8765 switch comes with ribbon cables and standard printed circuit board with a 0.025-inch connector for convenient assembly. Optional solder terminals are available.

Coaxial – high performance

Agilent 8763A,B,C switches operate up to 26.5 GHz. They are preferred for drop-in, drop-out applications because of their compact design. These switches are used to automatically insert or remove a test component from a signal path. Because of their excellent isolation, they can also be used as the intersection (crosspoint) switch in full-access matrix switching applications. One port is internally terminated. Options T15 and T24 are available for TTL/5V CMOS compatibility.

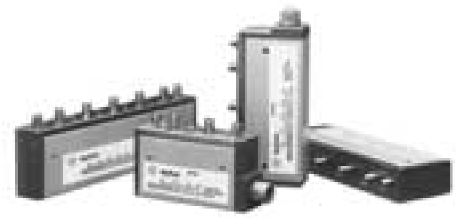
Agilent 8764A,B,C switches operate up to 26.5 GHz, similar to the Agilent 8763, but with the internal termination replaced by a fifth port. The fifth port can be utilized for signal path reversal or as a calibration port. Options T15 and T24 offer TTL/5V CMOS compatibility.

Multiport – low profile

Agilent 8766/67/68/69K series switches are modified versions of the Agilent 8494/95/96/97 series step attenuators (dc to 26.5 GHz) for applications requiring a single-pole, 3-throw, 4-throw, 5-throw or 6-throw coaxial switch. The switch ports are unterminated. These switches offer warranted repeatability of 0.03 dB maximum over 5 million switching cycles.

The switches are available with several optional cables and connectors to make them compatible with standard 14-pin DIP sockets. Isolation and insertion loss vary with frequency, and depend upon the port selected.

Switches



Agilent 87104/106 family

Agilent 8766/67/68/69 family

Agilent 87204/206 family

Multiport – high performance

Agilent 87104A,B,C and 87106A,B,C multiport switches operate up to 26.5 GHz. These switches offer warranted repeatability of 0.03 dB maximum over 5 million switching cycles.

For rigorous requirements such as matrix switching, you can rely on port-to-port isolation of better than 100 dB at 4 GHz, 70 dB at 20 GHz, and 65 dB at 26.5 GHz. When used in switching trees or in full access matrixes, isolation and insertion loss repeatability is crucial to measurement confidence.

Agilent 87104 is a single-pole-4-throw (SP4T) and the Agilent 87106 is a SP6T function. Both switches have internal solid-state logic that automatically programs the non-used ports to a matched load when any one port is programmed to "on". This relieves the user from having to provide external logic drive pulses. For user-designed circuit drivers, Option T24 is available. It provides internal circuits that are compatible with external TTL/5V CMOS digital ICs.

Internal current interrupts and position indicators are optoelectronically coupled to the electromechanical switch action. These solenoids are all magnetically latched, eliminating the need for maintaining coil current. This provides highly-reliable solenoid control along with accurate position indication to monitor circuits. Unselected RF ports are terminated in a well-matched 50-ohm load for eliminating unwanted reflections in unused signal lines.

The Agilent 87104/106 models have the capability to perform switching with a make-before-break action, by energizing the coils in the proper logic sequence. When this function is engaged, the impedance momentarily goes to 25 ohms, and then returns to the nominal 50-ohm match.

Agilent 87204A,B,C and 87206A,B,C switches are fully equivalent to models Agilent 87104/106 in their RF switching performance. However, their drive circuits are primarily designed to work with the Agilent 87130A and 70611A switch drivers. In particular, the switches are best suited for interfacing with the switch driver's monitor circuits. In automated systems, the importance of switch position monitoring and reporting is often critical to system operation. See pages 184 and 185 for more information on switch driver instruments. The standard Agilent 87204/206 provides a 16-pin drive connector while Option 100 provides solder terminals. The Agilent 87204/206 can perform make-before-break or break-before-make switching.

Transfer

The Agilent 87222C/D/E transfer switches can be used in many different applications to increase system flexibility and simplify system design. The following are five examples: switch between two inputs and two outputs, use as a drop-out switch, use for signal reversal, configure as a SPDT switch, and bypass an active device.

Matrix

The 87406B matrix switch consists of 6 ports which can be individually connected via internal microwave switches to form an RF path. The switch can can be configured for blocking 1 x 5, 2 x 4, or 3 x 3 switching applications.

GPIB compatibility

All of the Agilent switch families can be remotely and automatically controlled from switch driver instruments such as the Agilent 11713A, 3235A, 3488A, or E1700A. These drivers are all GPIB (IEEE 488) compatible as is the Agilent 87130A switch driver, a stand alone system for automated control of up to 248 switches. For systems configured in the Agilent Modular Measurement System, use the Agilent 70611A to operate up to 248 switches. Drivers are also available for Agilent VXI and Agilent VEE systems.

Switch driver cables

See page 183 for a brief listing of driver cables. For complete cable configuration information, request publication number 5963-2038E, *Agilent 70611A, Agilent 87130A and Agilent 11713A Switch and Attenuator Driver Configuration Guide*.

Agilent model	Frequency range	Features	Product category: SPDT configurable connectors	SPDT high performance	SPDT high reliability	Transfer high performance		Multiport low-profile			
						4-port	5-port	SP3T	SP4T	SP5T	SP6T
N1810UL	dc to 26.5 GHz	• 5 million cycles			X						
N1810TL	dc to 26.5 GHz	• < 0.03 dB repeatability		X							
N1811TL	dc to 26.5 GHz	• TTL/5V CMOS option				X					
N1812UL	dc to 26.5 GHz	• Current interrupts and position indicators options • High performance options					X				
8761A	dc to 18 GHz	• 1 million cycles	X								
8761B	dc to 18 GHz	• Selectable connector configuration	X								
8762A	dc to 4 GHz	• 1 million cycles		X							
8762B	dc to 18 GHz	• High repeatability		X							
8762C	dc to 26.5 GHz	• All-ports terminated		X							
8762F (75 Ω)	dc to 4 GHz	• Current interrupts and position indication capability • TTL/5V CMOS option		X							
8763A	dc to 4 GHz	• 1 million cycles				X					
8763B	dc to 18 GHz	• High repeatability				X					
8763C	dc to 26.5 GHz	• 1-port terminated • Current interrupts and position indication capability • TTL/5V CMOS option				X					
8764A	dc to 4 GHz	• 1 million cycles					X				
8764B	dc to 18 GHz	• High repeatability					X				
8764C	dc to 26.5 Ghz	• Unterminated • Current interrupts and position indication capability • TTL/5V CMOS option					X				
8765A	dc to 4 GHz	• Highest frequency range			X						
8765B	dc to 20 GHz	• 5 million cycles			X						
8765C	dc to 26.5 GHz	• High repeatability			X						
8765D	dc to 40 GHz	• Unterminated			X						
8765F (75 Ω)	dc to 4 GHz				X						
8766K	dc to 26.5 GHz	• 5 million cycles					X				
8767K	dc to 26.5 GHz	• High repeatability						X			
8768K	dc to 26.5 GHz	• Unterminated								X	
8769K	dc to 26.5 GHz	• Current interrupts and position indication capability									X

Selection Guide (continued)

Agilent model	Frequency range	Features	Product category: High performance transfer 4-port	Product category: High performance matrix SP6T
87104A	dc to 4 GHz	• 5 million cycles	X	
87104B	dc to 20 GHz	• High repeatability	X	
87104C	dc to 26.5 GHz	• All-ports terminated	X	
87106A	dc to 4 GHz	• Optoelectronic interrupts and position indicators		X
87106B	dc to 20 GHz			X
87106C	dc to 26.5 GHz	• TTL/5V CMOS option		X
87204A	dc to 4 GHz	• 5 million cycles	X	
87204B	dc to 20 GHz	• High repeatability	X	
87204C	dc to 26.5 GHz	• All-ports terminated	X	
87206A	dc to 4 GHz	• Optoelectronic interrupts and position indication capability		X
87206B	dc to 20 GHz			X
87206C	dc to 26.5 GHz			X
87222C	dc to 26.5 GHz	• 5 million cycles	X	
87222D	dc to 40 GHz	• High repeatability	X	
87222E	dc to 50 GHz	• Opto-electronic indicators and interrupts • TTL/5V CMOS compatible • Unterminated	X	
87406B	dc to 20 GHz	• 5 million cycles • High repeatability • Opto-electronic indicators and interrupts • TTL/5V CMOS option • Terminated ports		X
87606B	dc to 20 GHz	• 5 million cycles • High repeatability • Opto-electronic indicators and interrupts • Sensing capability • Terminated ports		X

N1810UL, N1810TL[1]

Standard performance specifications

Isolation (dB) = 90 - 1.13 XF, where F is specific in GHz					
	dc	4 GHz	12.4 GHz	20 GHz	26.5 GHz
	90	85	76	67	60
Insertion loss (dB) = 0.3 + 0.019 X F, where F is specified in GHz					
	dc	4 GHz	12.4 GHz	20 GHz	26.5 GHz
	0.30	0.38	0.53	0.68	0.80
SWR	dc - 2 GHz	2 - 4 GHz	4 - 12.4 GHz	12.4 - 20 GHz	20 - 26.5 GHz
	1.10	1.15	1.20	1.30	1.60

Optional high performance specifications

Isolation (dB) = 125 - 1.32 X F, where F is specified in GHz					
	dc	4 GHz	12.4 GHz	20 GHz	26.5 GHz
Opt. 301	125	120	109	99	90
Insertion loss (dB) =0.3 + 0.019 X F, where F is specified in GHz					
	dc	4 GHz	12.4 GHz	20 GHz	26.5 GHz
Opt. 302	0.15	0.23	0.38	0.53	0.65
SWR	dc - 2 GHz	2 - 4 GHz	4 - 12.4 GHz	12.4 - 20 GHz	20 - 26.5 GHz
	1.06	1.10	1.15	1.20	1.45

[1] Specifications include margins for measurement uncertainties

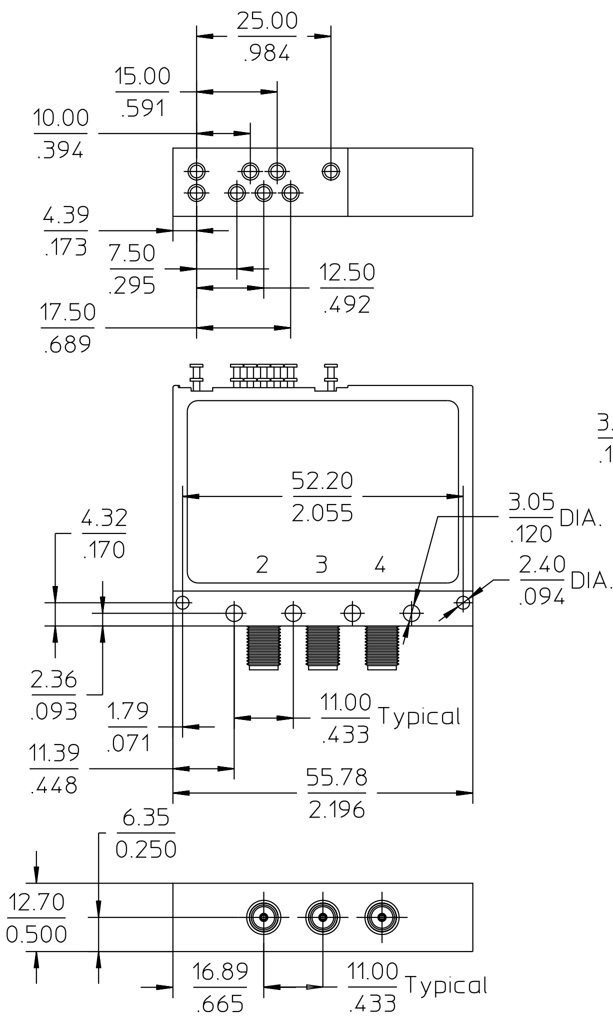
Options – N1810TL, N1810UL

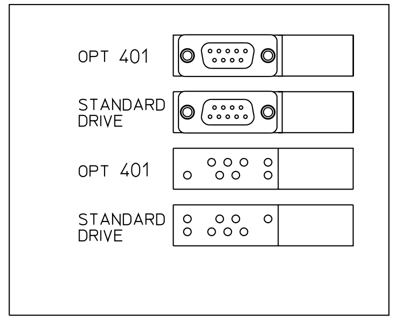
Frequency range	Coil voltage	DC connector	Performance	Drive
002 dc - 2 GHz	**105**[2] 5 volts	**201** D-submini 9 pin (f)	**301** High isolation	**401** TTL/5V CMOS compatible
004 dc - 4 GHz	**115** 15 volts	**202** Solder lugs	**302** Low SWR & insertion loss	**402** Position indicators
020 dc - 20 GHz	**124** 24 volts		**UK6** Calibration certificate with test data	**403** Current interrupts
026 dc - 26.5 GHz				

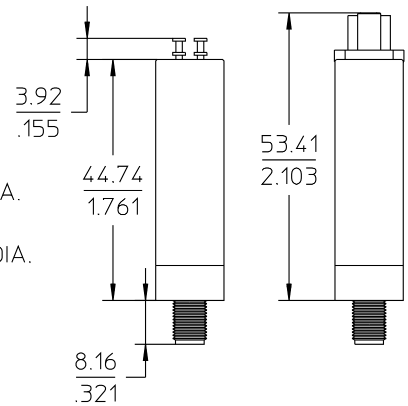
[2] Option 105 includes Option 402 and Option 403.

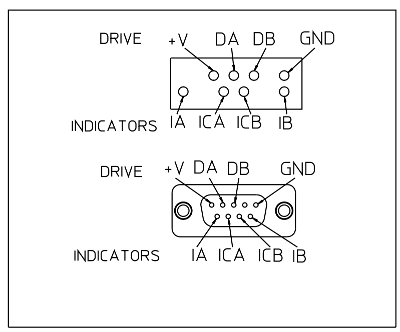
Product outlines

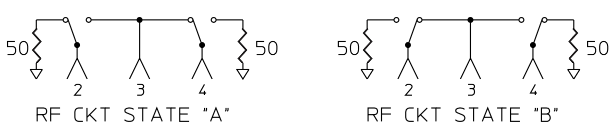
Agilent N1810UL





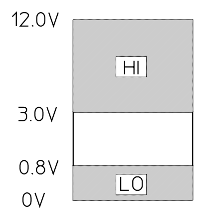






Driving Logic Table

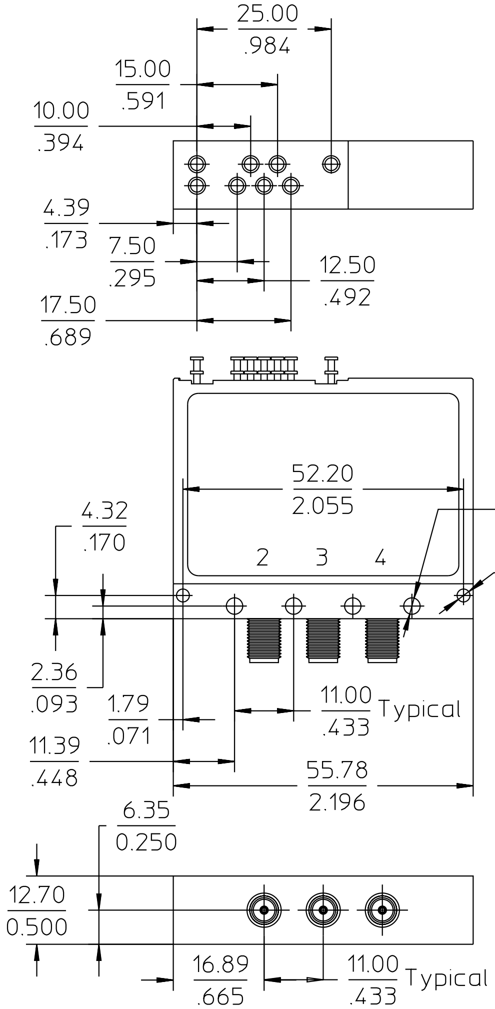
State	Standard DA	Standard DB	Option 401 DA	Option 401 DB	GND	Indicator CKTs ICA-IA	Indicator CKTs ICB-IB
"A"	GND	OPEN	HI	LO	GND	CLOSED	OPEN
"B"	OPEN	GND	LO	HI	GND	OPEN	CLOSED

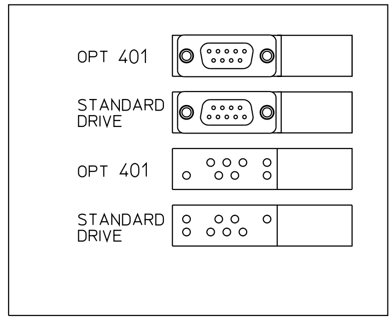


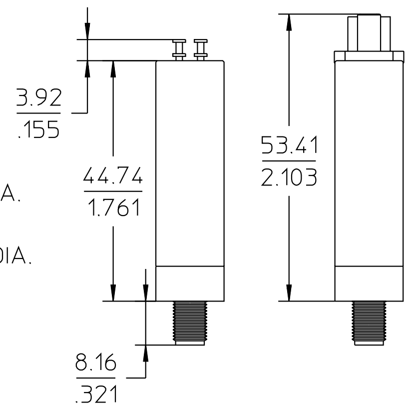
TTL Control Voltage States

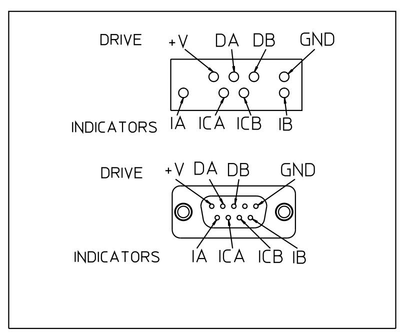
Product outlines

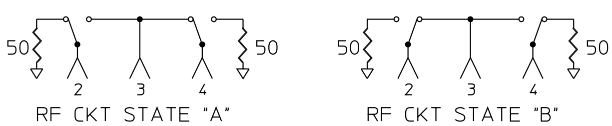
Agilent N1810TL





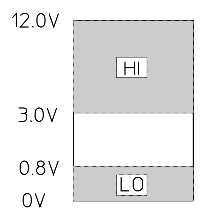






Driving Logic Table

State	Standard DA	DB	Option 401 DA	DB	GND	Indicator CKTs ICA-IA	ICB-IB
"A"	GND	OPEN	HI	LO	GND	CLOSED	OPEN
"B"	OPEN	GND	LO	HI	GND	OPEN	CLOSED



TTL Control Voltage States

SPDT

Specifications

Agilent model	8761A, 8761B	8762A, 8762B	8762C	8762F	8765A, 8765B, 8765C	8765D	8765F
Features	Unterminated Break-before-make Selectable connector configuration	← Terminated Break-before-make Current interrupts Position indication capability[1] →			← Unterminated Break-before-make →		
Impedance	50 Ω	50 Ω	50 Ω	75 Ω	50 Ω	50 Ω	75 Ω
Frequency range	dc to 18 GHz	**A:** dc to 4 GHz **B:** dc to 18 GHz	dc to 26.5 GHz	dc to 4 GHz	**A:** dc to 4 GHz **B:** dc to 20 GHz **C:** dc to 26.5 GHz	dc to 40 GHz	dc to 4 GHz
Insertion loss (dB)	<0.5 to 12.4 GHz <0.8 to 18 GHz	**A:** <0.20 to 2 GHz <0.25 to 4 GHz **B:** <0.25 to 2 GHz <0.50 to 18 GHz	<0.25 to 2 GHz <0.50 to 18 GHz <1.25 to 26.5 GHz	<0.4	**A & B:** **$0.2 + 0.025f^2$** max **C:** **$0.25 + 0.027f^2$** max 0.2 @ 4 GHz typ. 0.5 @ 20 GHz typ. 0.7 @ 26.5 GHz typ.	**$0.2 + 0.023f^2$** max 0.2 typ. @ 4 GHz 0.5 typ. @ 20 GHz 0.7 typ. @ 26.5 GHz **$0.75 + 0.023\Delta f^3$** max ($26.5 \le f \le 40$) 1.0 typ. @ 40 GHz	<0.18 to 1 GHz <0.24 to 2 GHz <0.4 to 4 GHz
SWR (through line)	See connector code Option data on page 93	**A:** <1.2 to 4 GHz **B:** <1.1 to 2 GHz <1.2 to 12.4 GHz <1.3 to 18 GHz	<1.15 to 2 GHz <1.25 to 12.4 GHz <1.40 to 18 GHz <1.8 to 26.5 GHz	<1.30	**A & B:** <1.2 to 4 GHz <1.35 to 12.4 GHz <1.45 to 18 GHz <1.7 to 20 GHz **C:** <1.25 to 4 GHz <1.45 to 18 GHz <1.7 to 26.5 GHz	<1.25 to 4 GHz <1.45 to 18 GHz <1.7 to 40 GHz	<1.15 to 1 GHz <1.20 to 4 GHz
SWR (into termination) Option 7:	Add 0.05 to SWR (Through Line) of connector selected	**A:** <1.1 to 2 GHz <1.2 to 4 GHz **B:** <1.15 to 2 GHz <1.20 to 12.4 GHz <1.30 to 18 GHz	<1.15 to 2 GHz <1.25 to 12.4 GHz <1.40 to 18 GHz <1.8 to 26.5 GHz	<1.30	← N/A →		
Isolation (dB)	>50 to 12.4 GHz >45 to 18 GHz	>100 to 4 GHz >90 to 18 GHz	>90 to 18 GHz >50 to 26.5 GHz	>100	**$110 - 2.25f^2$** min 120 typ. @ 4 GHz 90 typ. @ 20 GHz 60 typ. @ 26.5 GHz	**$110 - 2.25f^2$** min 120 typ. @ 4 GHz 90 typ. @ 20 GHz 60 typ. @ 26.5 GHz 55 typ. @ 40 GHz >50 (26.5 to 40 GHz)	>100 to 1 GHz >90 to 4 GHz

[1] Provides position sensing when used with Agilent 87130A/70611A or customer supplied external circuitry.
[2] f is frequency in GHz.
[3] $\Delta f = f\ (GHz) - 26.5$.

Specifications (continued)

Agilent model	8761A,B	8762A,B	8762C	8762F	8765A,B,C	8765D	8765F	N1810x
Input power average peak [1]	10 W 5 kW [2]	1 W ← 100 W → (10 µs max)			2 W ← 100 W → (10 µs max)			1 W 50 W (15 µs max)
Switching time (max)	50 ms	← 30 ms →			← 15 ms →			15 ms
Repeatability (max) [3]	0.03 dB	0.03 dB	0.03 dB to 18 GHz 0.5 dB to 26.5 GHz	0.03 dB	← 0.03 dB →			0.03 dB
Life (min)	1,000,000 cycles	← 1,000,000 cycles →			← 5,000,000 cycles →			
RF connectors	See connector options in ordering example	SMA (f)	3.5 mm (f)	Mini SMB (m) [4] (75 Ω)	A & B: SMA (f) C: 3.5 mm (f)	2.4 mm (f) See options	Mini SMB (m) [4] (75 Ω)	SMA (f)
DC connectors	Solder terminals	← Solder terminals →			← Ribbon cable →			D-subminі 9 pin or solder terminals

[1] Not to exceed average power (non-switching).
[2] Option 7: 2 W average, 100 W peak (10 µs max).
[3] Measured at 25 °C.
[4] 75 Ω Mini SMB does not mate with 75 Ω SMB. See data sheet for more information.

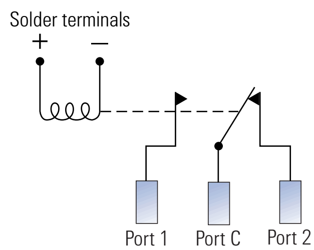
Options

Agilent model	8761A	8761B	8762A,B,C,F			8765A,B,C,D,F			
Supply voltage, current and impedance [5]			Std. / Opt. T24	Opt. 011	Opt. 015/Opt. T15	Opt. 005	Opt. 010	Opt. 015	Opt. 024
Supply voltage Range	12 to 15 Vdc	24 to 30 Vdc	20 to 32 Vdc	4.5 to 7 Vdc	12 to 20 Vdc	4.5 to 7 Vdc	7 to 12 Vdc	12 to 20 Vdc	20 to 32 Vdc
Supply voltage (nom)	12 Vdc	24 Vdc	24 Vdc	5 Vdc	15 Vdc	5 Vdc	10 Vdc	15 Vdc	24 Vdc
Current (nom)	80 mA	65 mA	120 mA	400 mA	182 mA	385 mA	300 mA	200 mA	120 mA
Impedance (nom)	150 Ω, 90 mH	400 Ω, 300 mH	200 Ω, 127 mH	13 Ω, 8 mH	82 Ω, 57 mH	13 Ω, 8 mH	33 Ω, 25 mH	75 Ω, 55 mH	200 Ω, 135 mH
Control logic	← N/A →		**Opt. T15:** TTL/5V CMOS compatible logic with 15 Vdc supply [6] **Opt. T24:** TTL/5V CMOS compatible logic with 24 Vdc supply [6]			← N/A →			
RF connector	See ordering information		← N/A →			**D (Opt. 292):** 2.92 mm (f)			
DC connectors	← N/A →					**Opt. 100:** Solder terminals **Opt. 108:** 8-inch ribbon cable extension **Opt. 116:** 16-inch ribbon cable extension			
Calibration documentation	← See ordering information →								

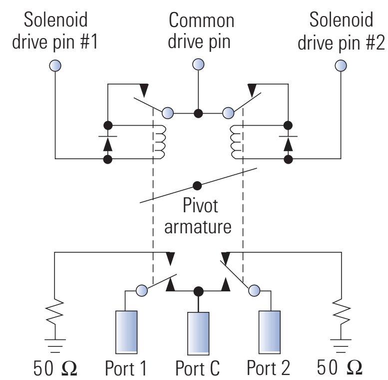
[5] Must specify option for Agilent 8765 series products.
[6] Not available with Agilent 8762F.

Schematics

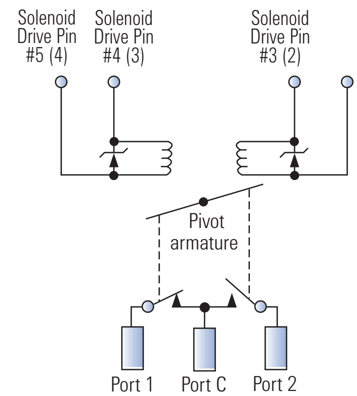
Agilent 8761 series



Agilent 8762 series



Agilent 8765 series[1]



[1] Opt. 100 Solder terminal numbers in parenthesis

Signal path control data

The tables shown here can be used to better understand how to select a signal path for each switch. For example, the Agilent 8762 switch has two drive control alternatives i.e. a standard drive scheme and a TTL/5V CMOS drive scheme. For TTL/5V CMOS drive, it is required that the supply voltage be applied to pin C and that pin 1 is grounded. To close the path from port 1 to port C, apply a TTL "low" to pin 2. Additional information related to signal path control can be found in the product data sheet.

Agilent 8761 series

RF path	DC drive control voltage	
	Pin "+"	Pin "–"
1 to C	Negative	Positive
2 to C	Positive	Negative

Agilent 8762 series

RF path	Drive control alternatives			
	Standard drive voltage[2]		TTL/5V CMOS drive voltage[2,3]	
	Pin 1	Pin 2	Pin 1	Pin 2
1 to C	Ground	Open	Ground	"High"
2 to C	Open	Ground	Ground	"Low"

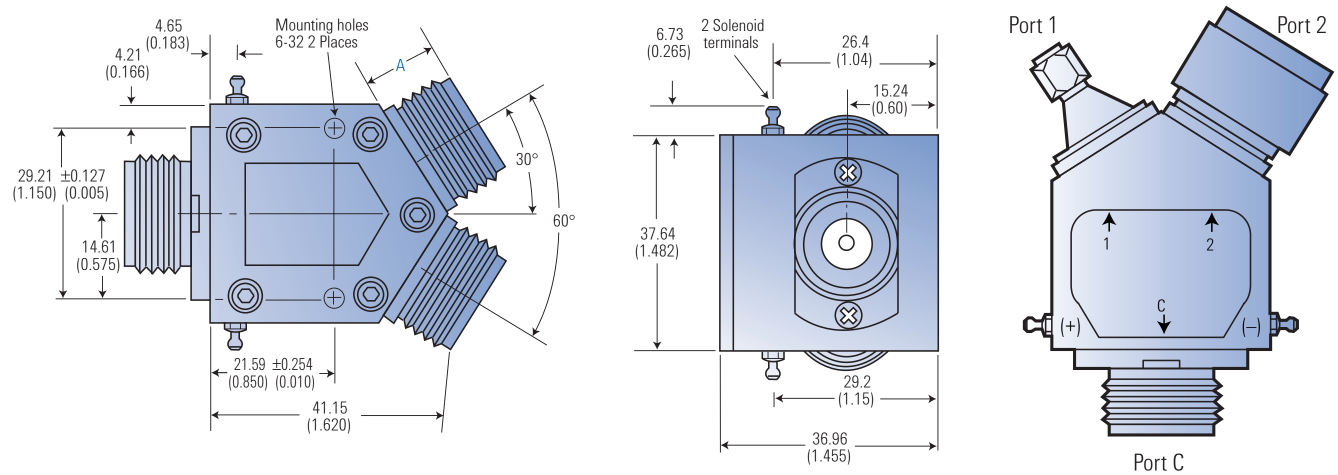
[2] Drive pin C is supply voltage.
[3] Not available on Agilent 8762F.

Agilent 8765 series

RF path	Drive control alternatives[4]									
		Common positive drive voltage			Common negative drive voltage			Polarity reversal drive voltage		
	Std. (Opt. 100)	Pin 1 (1)	Pin 3/4 (2/3)	Pin 5 (4)	Pin 3 (2)	Pin 1/5 (1/4)	Pin 4 (3)	Pin 1 (1)	Pin 3/4 (2/3)	Pin 5 (4)
1 to C		Open	Supply voltage	Ground	Open	Ground	Supply voltage	Ground	Connected	Supply voltage
2 to C		Ground	Supply voltage	Open	Supply voltage	Ground	Open	Supply voltage	Connected	Ground

[4] See data sheet for additional information on these drive control alternatives.

Agilent 8761 series



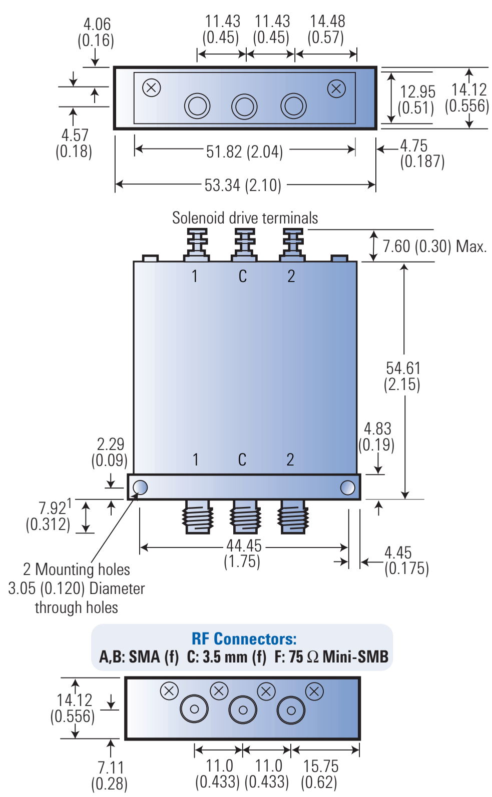
See ordering example for Agilent 8761 options on page 155.

Agilent 8761 series connector dimensions

Connector code option	Connector type	Dimension "A" mm	(inch)	SWR (through line)
0	Type-N (f)	13.72	(0.540)	<1.25 to 18 GHz
1	Type-N (m)	19.79	(0.775)	<1.25 to 18 GHz
2	APC-7 threaded sleeve	9.27	(0.365)	<1.2 to 18 GHz
3	APC-7 coupling nut	11.94	(0.470)	<1.2 to 18 GHz
4	UT-250 coax	9.27	(0.365)	<1.25 to 18 GHz
5	SMA (f)	16.13	(0.635)	<1.35 to 18 GHz
6	SMA (m)	17.15	(0.675)	<1.35 to 18 GHz
7	50 Ω termination	30.5	(1.20)	

Dimensions are in millimeters (inches) nominal, unless otherwise specified.

Agilent 8762 Series

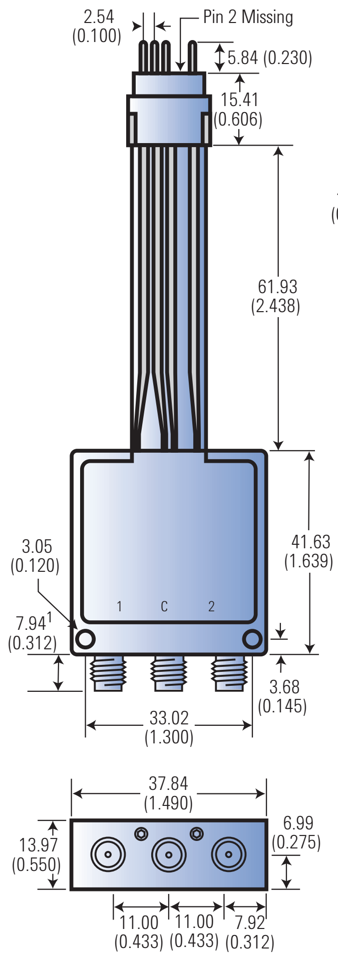


[1] 10.0 (0.393) for F version

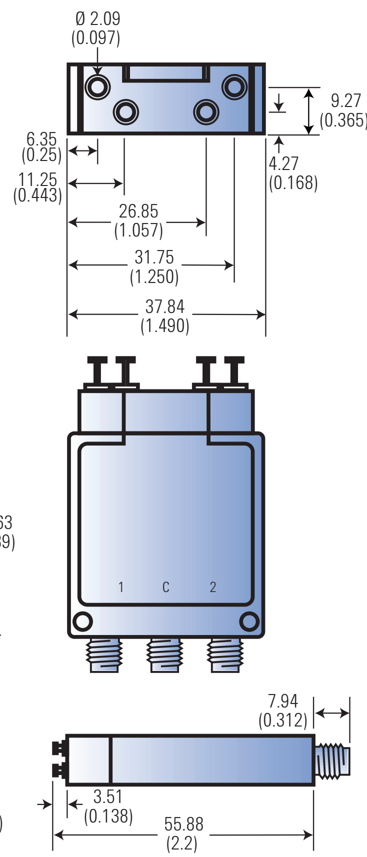
SPDT

Agilent 8765A,B,C,D

Standard



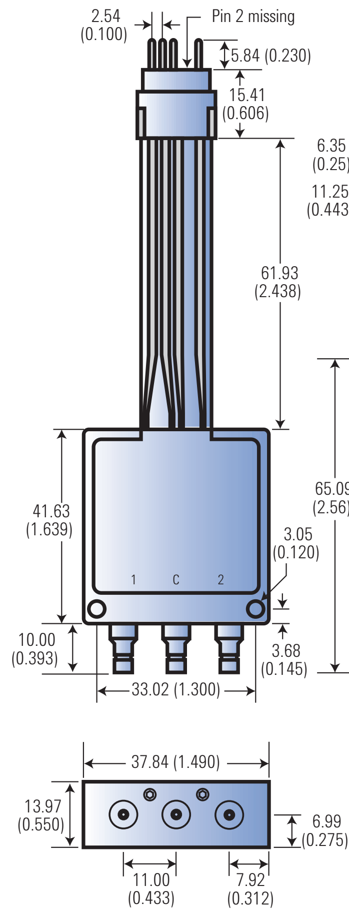
Option 100



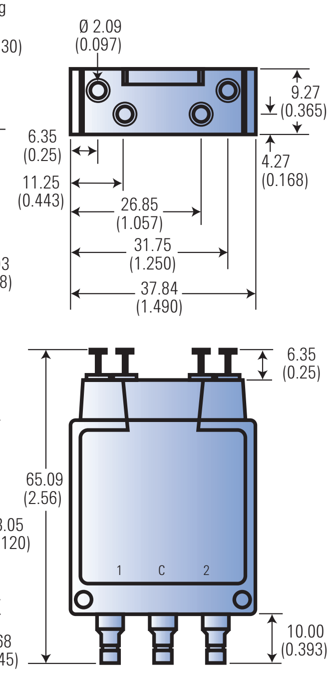
RF Connectors:
A, B: SMA (f)
C: 3.5 mm (f)
D: 2.4 mm (f)

Agilent 8765F

Standard



Option 100



RF Connectors:
75 Ω Mini-SMB (m)[2]

[1] 8.46 (0.333) for D versions.
[2] 75 Ω Mini-SMB (m) does not mate with 75 Ω SMB connectors. See data sheet for details.

Dimensions are in millimeters (inches) nominal, unless otherwise specified.

Ordering Information

Agilent 8761 series ordering example

Agilent 8761 A Option 612 (Port 1, Port 2, Port C)

Option 612 shown on Page 153 in upper right diagram.

Solenoid voltage

A: 12 to 15 Vdc
B: 24 to 30 Vdc

Connector code [1]

0: N (f)
1: N (m)
2: APC-7 threaded sleeve
3: APC-7 coupling nut
4: 7 mm for UT-250 coax
5: SMA (f)
6: SMA (m)
7: 50-ohm termination [2]

Agilent 8762 series ordering example

Agilent 8762 B Option T15 Option UK6

Frequency range

A: 4 GHz
B: 18 GHz
C: 26.5 GHz
F: 4 GHz (75 ohm)

Supply voltage/control logic

Std: 24 Vdc
011: 5 Vdc
015: 15 Vdc
T15: TTL/5V CMOS compatible with 15 Vdc supply [3]
T24: TTL/5V CMOS compatible with 24 Vdc supply [3]

Calibration documentation [4]

UK6: Commercial calibration test data with certificate

UKS: Commercial calibration certificate

Agilent 8765 series ordering example

Agilent 8765 B Option 005 Option 292 Option 108 Option UK6

Frequency range

A: 4 GHz
B: 20 GHz
C: 26.5 GHz
D: 40 GHz
F: 4 GHz (75 ohm)

Supply voltage [1]

005: 5 Vdc
010: 10 Vdc
015: 15 Vdc
024: 24 Vdc

RF connector

292: 2.92 mm (f) [5]

DC connector

Std: 3-inch ribbon cable
100: Solder terminals
108: 8-inch ribbon cable extension
116: 16-inch ribbon cable extension

Calibration documentation [4]

UK6: Commercial calibration test data with certificate

UKS: Commercial calibration certificate

[1] This option must be specified when ordering this product.
[2] Port 1 or port 2 only.
[3] Not available with Agilent 8762F.
[4] Not available for Agilent 8762F, 8765D Opt. 292, or 8765F.
[5] Available with Agilent 8765 only.

Bypass

Specifications

	8763A	8763B	8763C	8764A	8764B	8764C
Configuration	← 4-Port →			← 5-Port →		
Features	Terminated			Unterminated		
	← Break-before-make, Current interrupts, Position indication capability[1] →					
Impedance	← 50 Ω →					
Frequency range	dc to 4 GHz	dc to 18 GHz	dc to 26.5 GHz	dc to 4 GHz	dc to 18 GHz	dc to 26.5 GHz
Insertion loss (dB)	<0.20 to 2 GHz <0.25 to 4 GHz	<0.20 to 2 GHz <0.50 to 18 GHz	<0.25 to 2 GHz <0.50 to 18 GHz <1.25 to 26.5 GHz	<0.20 to 2 GHz <0.25 to 4 GHz	<0.20 to 2 GHz <0.50 to 18 GHz	<0.25 to 2 GHz <0.50 to 18 GHz <1.25 to 26.5 GHz
SWR (through line)	<1.1 to 2 GHz <1.2 to 4 GHz	<1.1 to 2 GHz <1.2 to 12.4 GHz <1.3 to 18 GHz	<1.15 to 2 GHz <1.25 to 12.4 GHz <1.40 to 18 GHz <1.8 to 26.5 GHz	<1.1 to 2 GHz <1.2 to 4 GHz	<1.1 to 2 GHz <1.2 to 12.4 GHz <1.3 to 18 GHz	<1.15 to 2 GHz <1.25 to 12.4 GHz <1.40 to 18 GHz <1.8 to 26.5 GHz
SWR (into termination)	<1.1 to 2 GHz <1.2 to 4 GHz	<1.15 to 4 GHz <1.2 to 4 GHz <1.3 to 18 GHz	<1.15 to 2 GHz <1.25 to 12.4 GHz <1.40 to 18 GHz <1.8 to 26.5 GHz	N/A	N/A	N/A
Isolation (dB)	>100 to 4 GHz	>90 to 18 GHz	>90 to 18 GHz >50 to 26.5 GHz	>100 to 4 GHz	>90 to 18 GHz	>90 to 18 GHz >50 to 26.5 GHz
Input Power Average	← 1 W →					
Peak[2]	← 100 W (10 µs max) →					
Switching Time (max)	← 30 ms →					
Repeatability (max)[3]	0.03 dB	0.03 dB	0.03 dB to 18 GHz 0.5 dB to 26.5 GHz	0.03 dB	0.03 dB	0.03 dB to 18 GHz 0.5 dB to 26.5 GHz
Life (min)	← 1,000,000 cycles →					
RF connectors	SMA (f)	SMA (f)	3.5 mm (f)	SMA (f)	SMA (f)	3.5 mm (f)
DC connectors	← Solder terminals →					

[1] Provides position sensing when used with Agilent 87130A/70611A switch driver or customer supplied external circuitry.
[2] Not to exceed 1 W average (non-switching).
[3] Measured at 25 °C.

Options

Control logic	**Opt. T15:** TTL/5V CMOS compatible logic with 15 Vdc supply **Opt. T24:** TTL/5V CMOS compatible logic with 24 Vdc supply		
Supply voltage, current and impedance	**Std/Opt. T24**	**Opt. 011**	**Opt. 015/Opt. T15**
Supply voltage range	20 to 32 Vdc	4.5 to 7 Vdc	12 to 20 Vdc
Supply voltage (nom)	24 Vdc	5 Vdc	15 Vdc
Current (nom)	120 mA	400 mA	182 mA
Impedance (nom)	200 Ω, 127 mH	13 Ω, 8 mH	82 Ω, 57 mH
Calibration documentation	See ordering information		

N1811TL, N1812UL[1]

Standard performance specifications

Isolation (dB) = 90 - 1.13 XF, where F is specific in GHz					
	dc	4 GHz	12.4 GHz	20 GHz	26.5 GHz
	90	85	76	67	60
Insertion loss (dB) = 0.3 + 0.019 X F, where F is specified in GHz					
	dc	4 GHz	12.4 GHz	20 GHz	26.5 GHz
	0.30	0.38	0.53	0.68	0.80
SWR	dc - 2 GHz	2 - 4 GHz	4 - 12.4 GHz	12.4 - 20 GHz	20 - 26.5 GHz
	1.10	1.15	1.20	1.30	1.60

Optional high performance specifications

Isolation (dB) = 125 - 1.32 X F, where F is specified in GHz					
	dc	4 GHz	12.4 GHz	20 GHz	26.5 GHz
Opt. 301	125	120	109	99	90
Insertion loss (dB) =0.3 + 0.019 X F, where F is specified in GHz					
	dc	4 GHz	12.4 GHz	20 GHz	26.5 GHz
Opt. 302	0.15	0.23	0.38	0.53	0.65
SWR	dc - 2 GHz	2 - 4 GHz	4 - 12.4 GHz	12.4 - 20 GHz	20 - 26.5 GHz
	1.06	1.10	1.15	1.20	1.45

General operating characteristics

Switch Speed	Repeatability	Life	Impedance
< 15 ms	< .03 dB typical	> 5 mil cycles	50 ohms

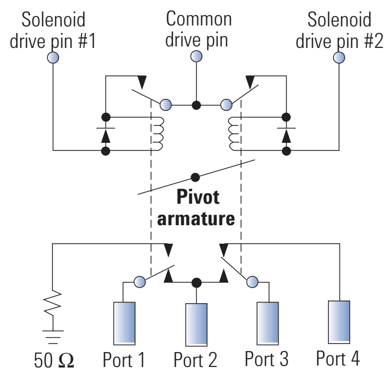
Options – N1811TL, N1812UL

Frequency range	Coil voltage	DC connector	Performance	Drive
002 dc - 2 GHz **004** dc - 4 GHz **020** dc - 20 GHz **026** dc - 26.5 GHz	**105**[2] 5 volts **115** 15 volts **124** 24 volts	**201** D-subminі 9 pin (f) **202** Solder lugs	**301** High isolation **302** Low SWR & insertion loss **UK6** Calibration certificate with test data	**401** TTL/5V CMOS compatible **402** Position indicators **403** Current interrupts

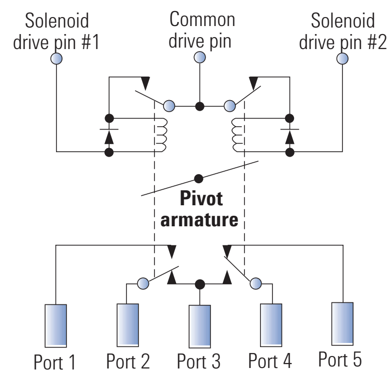
[1] Specifications include margins for measurement uncertainties
[2] Opt. 105 includes Opt. 402 and Opt. 403

Schematics

Agilent 8763 Series



Agilent 8764 Series



Signal path control data

The table at right can be used to better understand how to select a signal path for each switch. For example, the Agilent 8763 switch has two drive control alternatives i.e. a standard drive scheme and a TTL/5V CMOS drive scheme. For standard drive, it is required that the supply voltage be applied to pin C. The path from port 1 to port 2 and port 3 to port 4 can be closed by grounding pin 1 and opening pin 2. Additional information related to signal path control can be found in the product data sheet for each of the products shown here.

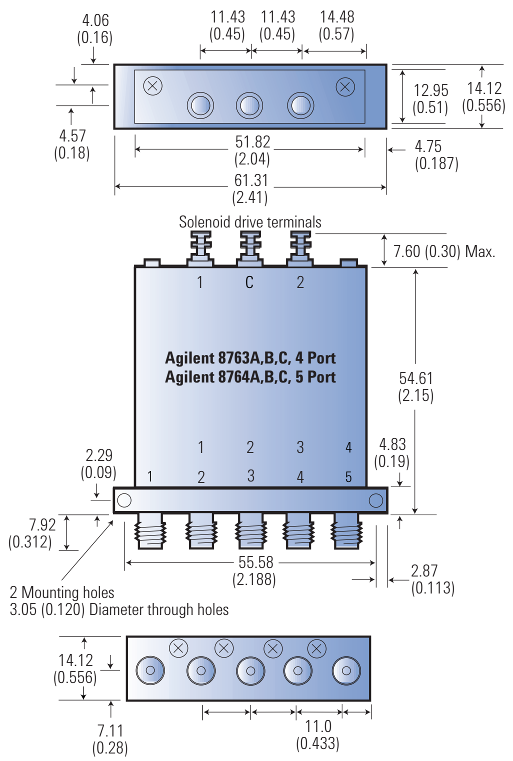
Agilent 8763/64 Series

Agilent Model	RF Path	Drive Control Alternatives: Standard Drive Voltage[1] Pin 1	Standard Drive Voltage[1] Pin 2	TTL/5V CMOS Drive Voltage[1] Pin 1	TTL/5V CMOS Drive Voltage[1] Pin 2
8763A,B,C	1 to 2 3 to 4	Ground	Open	Ground	"Low"
	2 to 3 1 terminated 4 open	Open	Ground	Ground	"High"
8764A,B,C	2 to 3 4 to 5 1 open	Ground	Open	Ground	"Low"
	1 to 2 3 to 4 5 open	Open	Ground	Ground	"High"

[1] Drive Pin C is supply voltage.

Outline drawing

Agilent 8763/64 series



RF connectors: **A, B: SMA (f)** **C: 3.5 mm (f)**

Dimensions are in millimeters (inches) nominal, unless otherwise specified.

Ordering information

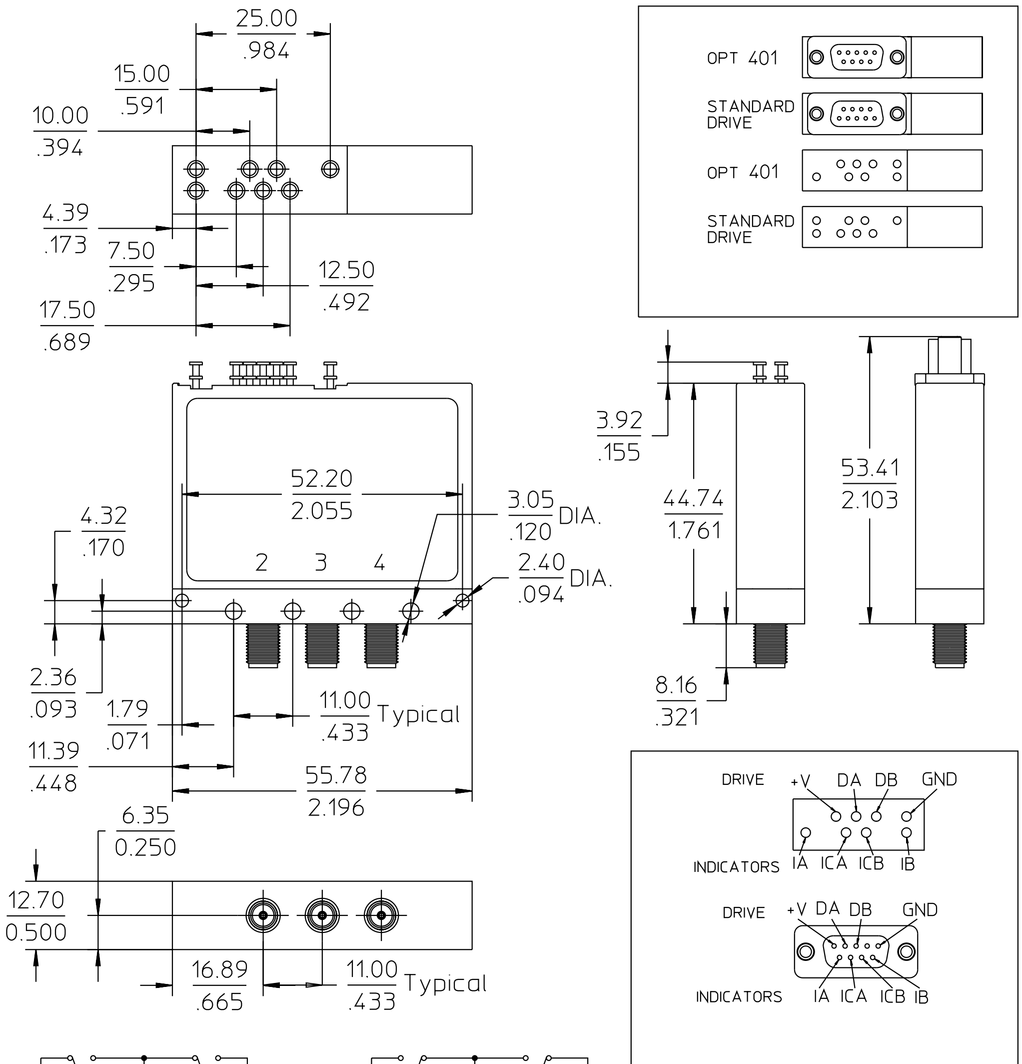
Agilent 8763/64 series ordering example

Agilent 876 3 B Option 015 Option UKS

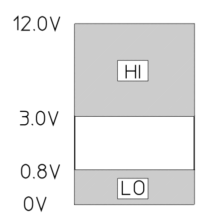
Type	Frequency range	Supply voltage/control logic	Calibration Documentation
3: 4 port 4: 5 port	A: 4 GHz B: 18 GHz C: 26.5 GHz 015: 15 Vdc	Std: 24 Vdc 011: 5 Vdc T15: TTL/5V CMOS compatible logic with 15 Vdc supply T24: TTL/5V CMOS compatible logic with 24 Vdc supply	UK6: Commercial calibration test data with certificate UKS: Commercial calibration certificate

Product outlines

Agilent N1812TL



RF CKT STATE "A"　　RF CKT STATE "B"



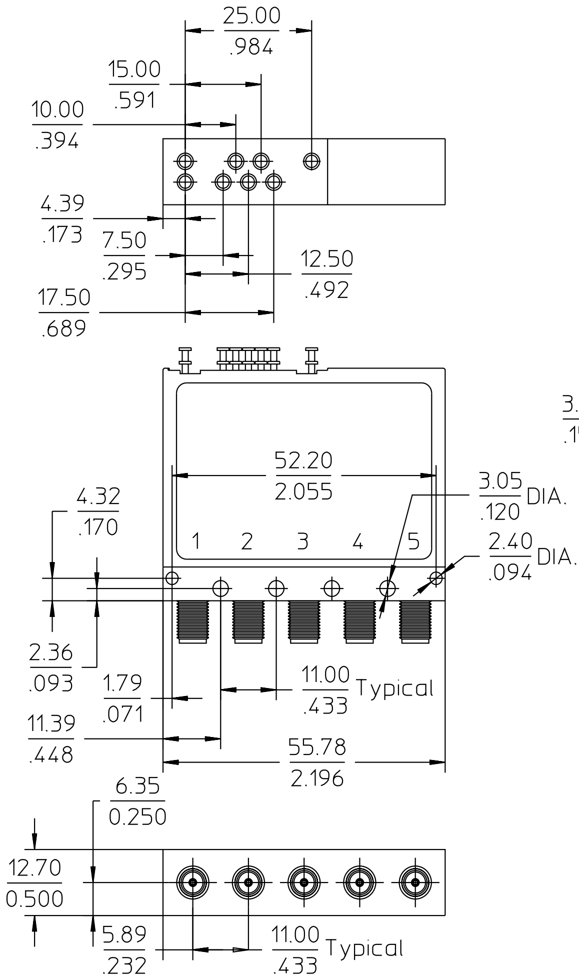
TTL Control Voltage States

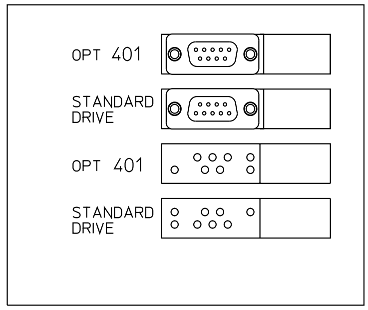
Driving Logic Table

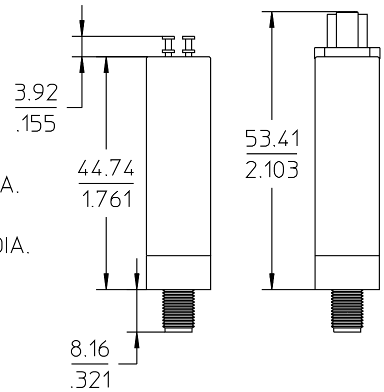
State	Standard DA	Standard DB	Option 401 DA	Option 401 DB		Indicator CKTs ICA-IA	Indicator CKTs ICB-IB
"A"	GND	OPEN	HI	LO	GND	CLOSED	OPEN
"B"	OPEN	GND	LO	HI	GND	OPEN	CLOSED

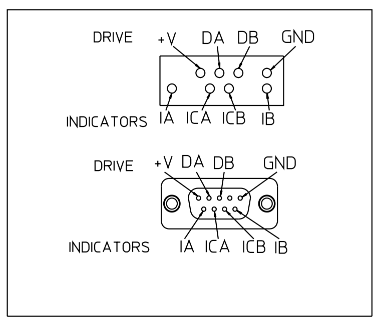
Product outlines

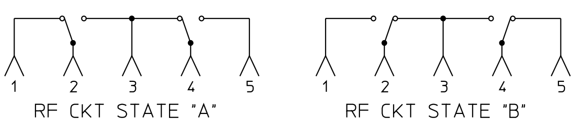
Agilent N1811UL





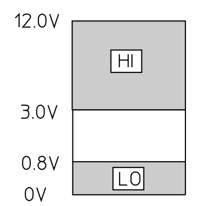






Driving Logic Table

State	Standard DA	DB	Option 401 DA	DB	GND	Indicator CKTs ICA-IA	ICB-IB
"A"	GND	OPEN	HI	LO	GND	CLOSED	OPEN
"B"	OPEN	GND	LO	HI	GND	OPEN	CLOSED



TTL Control
Voltage States

Low Profile Multiport

Specifications

Agilent model	8766K	8767K	8768K	8769K
Configuration	SP3T	SP4T	SP5T	SP6T
Features	← Unterminated Break-before-make Current interrupts Position indication capability [1] →			
Impedance	← 50 Ω →			
Frequency range	← dc to 26.5 GHz →			
Insertion loss (dB)	← **Signal path** Common to Port 1: 0.2 dB + 0.05 dB x f (GHz) Common to Port 2: 0.2 dB + 0.06 dB x f (GHz) Common to Port 3: 0.2 dB + 0.08 dB x f (GHz) Common to Port 4: 0.25 dB + 0.095 dB x f (GHz) Common to Port 5: 0.25 dB + 0.108 dB x f (GHz) Common to Port 6: 0.25 dB + 0.12 dB x f (GHz) →			
SWR (through line)	← <1.3 to 8 GHz <1.5 to 12.4 GHz <1.6 to 18 GHz <1.8 to 26.5 GHz →			<1.3 to 8 GHz <1.55 to 12.4 GHz <1.8 to 18 GHz <2.05 to 26.5 GHz
Isolation (dB)	← See chart on page 165 →			
Input power Average Peak [2]	← 1 W 100 W (10 μs max) →			
Switching time (max)	← 30 ms →			
Repeatability (max) [3]	← 0.01 dB to 18 GHz 0.05 dB to 26.5 GHz →			
Life (min)	← 5,000,000 cycles →			
RF connectors	← 3.5 mm (f) →			
DC connectors	← Viking cable connector →			

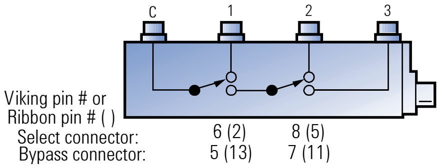
Options

Supply voltage, current, and impedance	Std.	Opt. 011	Opt. 015
Supply voltage range	20 to 30 Vdc	4.5 to 7 Vdc	13 to 22 Vdc
Supply voltage (nom)	24 Vdc	5 Vdc	15 Vdc
Current (nom)	130 mA	332 mA	187 mA
Impedance (nom)	185 Ω, 65 mH	17 Ω, 5.5 mH	80 Ω, 30 mH
RF connectors	**Opt. 002:** SMA (f) [4]		
DC connectors	**Opt. 008:** 8-inch ribbon cable		
	Opt. 016: 16-inch ribbon cable		
Calibration documentation	See ordering information		

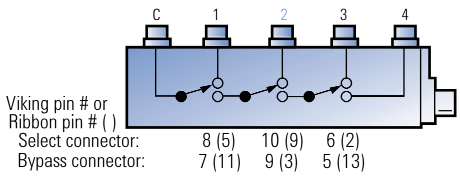
[1] Provides position sensing when used with Agilent 87130A/70611A switch driver or customer supplied external circuitry.
[2] Not to exceed 1 W average (non-switching).
[3] Measured at 25 °C.
[4] Use to 18 GHz only.

Simplified schematics

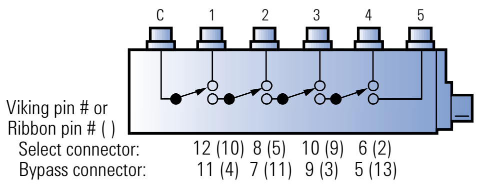
Agilent 8766K



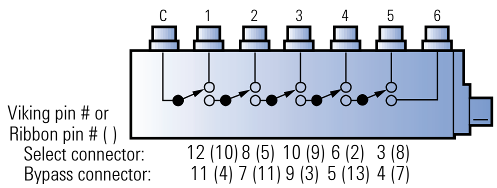
Agilent 8767K



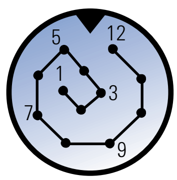
Agilent 8768K



Agilent 8769K

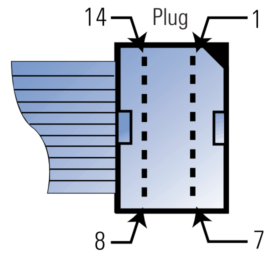


Viking plug detail [1, 2]



STD

DIP plug [3]



Option 008, 016
Pin side up

[1] DC drive interface cable has color coded tinned leads at opposite end.

[2] Supply voltage is Pin 1 (red wire).

[3] Supply voltage is Pin 6.

Dimensions are in millimeters (inches) nominal, unless otherwise specified.

Signal path control data

The tables below can be used to better understand how to select a signal path for each switch. The standard drive connector for each switch is a Viking connector with a 5 ft. cable. Alternately, a flat ribbon cable with a 14-pin DIP plug is available as an option. As an example, to connect the path from port C to port 2 of the standard 8767K, it is required that the supply voltage be applied to pin 1 (red lead) and that pin 10 (blue lead) and pin 7 (black lead) are grounded. This will "bypass" port 1 and "select" port 2. Note that section 3 can be selected or bypassed; however, isolation performance will be affected (see next page for further information). Additional information related to signal path control can be found in the product data sheet.

Agilent 8766K SP3T switch

Switching Section	1		2	
Section state	Select	Bypass	Select	Bypass
Std. Viking pin	6	5	8	7
Std. Viking wire color	Yellow	Violet	Green	Black
Opt. 008/016 Dual inline Pin connector	2	13	5	11
Common to Port 1	X			
Common to Port 2		X	X	
Common to Port 3		X		X

Agilent 8767K SP4T switch

Switching section	1		2		3	
Section state	Select	Bypass	Select	Bypass	Select	Bypass
Std. Viking pin	8	7	10	9	6	5
Std. Viking wire color	Green	Black	Blue	Orange	Yellow	Violet
Opt. 008/016 Dual inline Pin connector	5	11	9	3	2	13
Common to Port 1	X					
Common to Port 2		X	X			
Common to Port 3		X		X	X	
Common to Port 4		X		X		X

Agilent 8768K SP5T switch

Switching section	1		2		3		4	
Section state	Select	Bypass	Select	Bypass	Select	Bypass	Select	Bypass
Std. Viking pin	12	11	8	7	10	9	6	5
Std. Viking wire color	White	Brown	Green	Black	Blue	Orange	Yellow	Violet
Opt. 008/016 Dual inline Pin connector	10	4	5	11	9	3	2	13
Common to Port 1	X							
Common to Port 2		X	X					
Common to Port 3		X		X	X			
Common to Port 4		X		X		X	X	
Common to Port 5		X		X		X		X

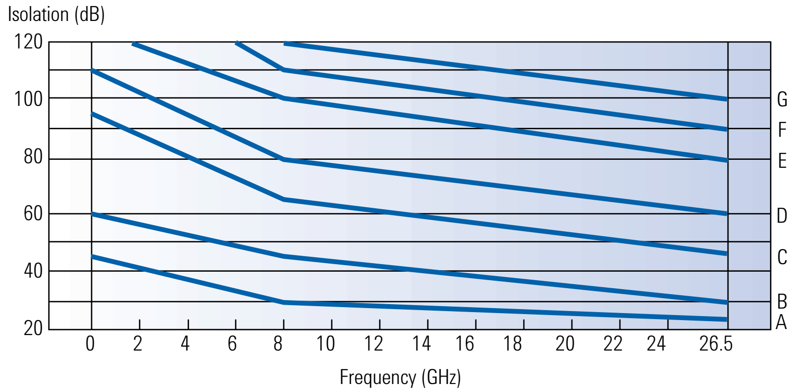
Agilent 8769K SP6T switch

Switching section	1		2		3		4		5	
Section state	Select	Bypass	Select	Bypass	Select	Bypass	Select	Bypass	Select	Bypass
Std. Viking pin	12	11	8	7	10	9	6	5	3	4
Std. Viking wire color	White	Brown	Green	Black	Blue	Orange	Yellow	Violet	Gray	White/Red
Opt. 008/016 Dual inline Pin connector	10	4	5	11	9	3	2	13	8	7
Common to Port 1	X									
Common to Port 2		X	X							
Common to Port 3		X		X	X					
Common to Port 4		X		X		X	X			
Common to Port 5		X		X		X		X	X	
Common to Port 6		X		X		X		X		X

Sections identified by this cross-hatch symbol can be selected or bypassed; however, isolation performance will be affected (see next page for further information).

Isolation calculation characteristics

Isolation and insertion loss vary with frequency and depend on the port selected as shown in the chart and tables below. The input connector "C" is always defined as the connector at the end of the switch opposite the dc drive cable. The output ports are numbered sequentially from the input connector. For example, if an Agilent 8768K is being used, use the Agilent 8768K table to determine the isolation to each port. If port three (the third connector from the input) is selected, the isolation to ports 1and 2 will follow curve A. Isolation to port 4 will follow curve B and isolation to port 5 will follow curve C. At 8 GHz, the worst case isolation to ports 1 and 2 will be 30 dB; to port 4, 45 dB, and to port 5, 65 dB. Note: in selecting ports 1 or 2, isolation to disconnected ports can be varied by choosing the position of each section to "bypass" or "select". Depending on the user's application, port assignments can be critical for optimizing performance at higher frequencies.



Agilent 8766K SP3T switch

Section	Section status 1	Section status 2	Isolation curve for Port ( ) 1	2	3
Common to Port 1	Select	Select	-	B	D
Common to Port 1	Select	Bypass	-	C	B
Common to Port 2	Bypass	Select	A	-	B
Common to Port 3	Bypass	Bypass	A	A	-

Agilent 8767K SP4T switch

Section	Section status 1	2	3	Isolation curve for Port ( ) 1	2	3	4
Common to Port 1	Select	Select	Select	-	B	D	E
Common to Port 1	Select	Select	Bypass	-	B	E	D
Common to Port 1	Select	Bypass	Select	-	C	B	D
Common to Port 1	Select	Bypass	Bypass	-	C	C	B
Common to Port 2	Bypass	Select	Select	A	-	B	C
Common to Port 2	Bypass	Select	Bypass	A	-	C	B
Common to Port 3	Bypass	Bypass	Select	A	A	-	A
Common to Port 4	Bypass	Bypass	Bypass	A	A	A	-

Low Profile Multiport

Isolation calculation characteristics

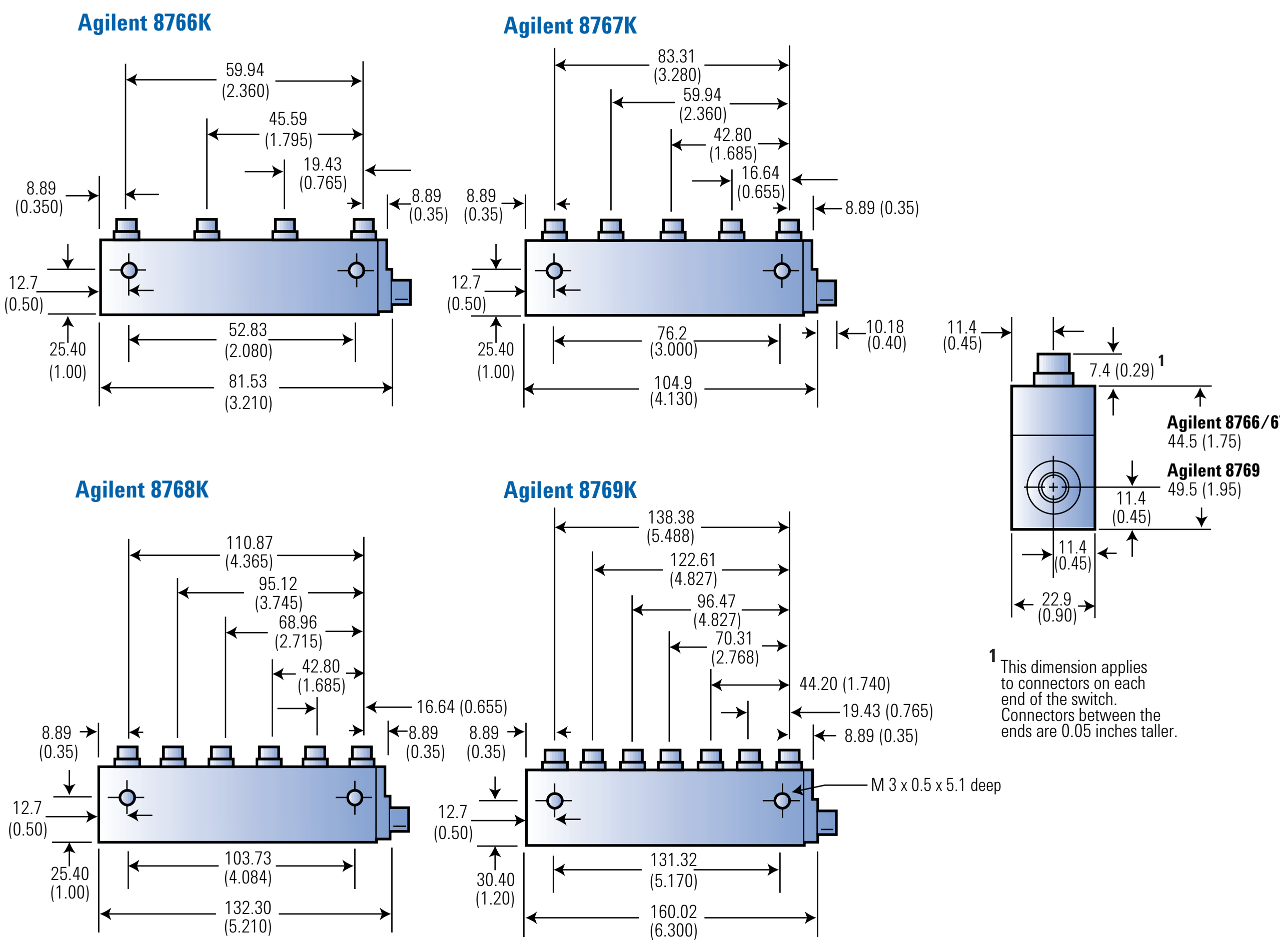
Agilent 8768K SP5T switch

Section	Section status				Isolation curve for Port ( )				
	1	2	3	4	1	2	3	4	5
Common to Port 1	Select	Select	Select	Select	–	B	D	E	F
Common to Port 1	Select	Select	Bypass	Select	–	B	E	D	E
Common to Port 1	Select	Bypass	Select	Select	–	C	B	D	E
Common to Port 1	Select	Bypass	Bypass	Select	–	C	C	B	C
Common to Port 2	Bypass	Select	Select	Select	A	–	B	D	E
Common to Port 2	Bypass	Select	Bypass	Select	A	–	C	B	C
Common to Port 3	Bypass	Bypass	Select	Select	A	A	–	B	C
Common to Port 4	Bypass	Bypass	Bypass	Select	A	A	A	–	A
Common to Port 5	Bypass	Bypass	Bypass	Bypass	A	A	A	A	–

Agilent 8769K SP6T switch

Section	Section status					Isolation curve for Port ( )					
	1	2	3	4	5	1	2	3	4	5	6
Common to Port 1	Select	Select	Select	Select	Select	–	B	D	E	F	G
Common to Port 1	Select	Select	Select	Bypass	Select	–	B	D	F	E	F
Common to Port 1	Select	Select	Bypass	Select	Select	–	B	E	D	E	F
Common to Port 1	Select	Bypass	Select	Select	Select	–	C	B	D	E	F
Common to Port 1	Select	Bypass	Bypass	Select	Select	–	C	C	B	C	F
Common to Port 1	Select	Bypass	Bypass	Bypass	Select	–	C	C	C	B	D
Common to Port 1	Select	Bypass	Bypass	Bypass	Bypass	–	C	C	C	C	B
Common to Port 2	Bypass	Select	Select	Select	Select	A	–	B	D	E	E
Common to Port 2	Bypass	Select	Bypass	Select	Select	A	–	C	B	C	F
Common to Port 2	Bypass	Select	Bypass	Bypass	Bypass	A	–	C	C	C	B
Common to Port 3	Bypass	Bypass	Select	Select	Select	A	A	–	B	C	E
Common to Port 3	Bypass	Bypass	Select	Bypass	Select	A	A	–	A	B	D
Common to Port 3	Bypass	Bypass	Select	Bypass	Bypass	A	A	–	C	C	A
Common to Port 4	Bypass	Bypass	Bypass	Select	Bypass	A	A	A	–	A	C
Common to Port 5	Bypass	Bypass	Bypass	Bypass	Select	A	A	A	A	–	B
Common to Port 6	Bypass	Bypass	Bypass	Bypass	Bypass	A	A	A	A	A	–

Outline drawings



All connectors are 3.5 mm (f). Dimensions are in millimeters (inches) nominal, unless otherwise specified.

Ordering Information

Agilent 8766/67/68/69 Series Ordering Example

Agilent 876 7 K Option 011 Option 002 Option 008 Option UK6

Type
- 6: SP3T
- 7: SP4T
- 8: SP5T
- 9: SP6T

Supply Voltage
- Std: 24 Vdc
- 011: 5 Vdc
- 015: 15 Vdc

RF Connector
- Std: 3.5 mm (f)
- 002: SMA (f)

DC Connector
- Std: Viking cable connector
- 008: 8-inch ribbon cable
- 016: 16-inch ribbon cable

Calibration Documentation
- UK6: Commercial calibration test data with certificate
- UKS: Commercial calibration certificate

High Performance Multiport

Specifications

Agilent model	87104A 87104B 87104C	87106A 87106B 87106C	87204A 87204B 87204C	87206A 87206B 87206C
Configuration	SP4T	SP6T	SP4T	SP6T
Features	Terminated Break-before-make or make-before-break Optoelectronic current interrupts Optoelectronic position indicator [1] Internal control logic		Terminated Break-before-make or make-before-break Optoelectronic current interrupts Optoelectronic position indication capability [2] Direct path control	
Impedance	50 Ω (all models)			
Frequency range	**A**: dc to 4 GHz **B:** dc to 20 GHz **C:** dc to 26.5 GHz (all models)			
Insertion loss (dB)	0.3 + 0.015 x freq (GHz) (all models)			
SWR	<1.2: dc to 4 GHz <1.35: 4 to 12.4 GHz <1.45: 12.4 to 18 GHz <1.7: 18 to 26.5 GHz (all models)			
Isolation (dB)	>100 dB: dc to 4 GHz >80 dB: 12 to 15 GHz >70 dB: 15 to 20 GHz >65 dB: 20 to 26.5 GHz (all models)			
Input power Average Peak [3]	1 W 50 W (10 µs max) (all models)			
Switching time (ms)	<15 (all models)			
Repeatability (max) [4]	0.03 dB (all models)			
Life (min)	5,000,000 cycles (all models)			
Supply voltage and current Supply voltage range Supply voltage (nom) Current (nom) [5]	20 to 32 Vdc 24 Vdc 200 mA (all models)			
RF connectors	SMA (f) (all models)			
DC connectors	Ribbon cable receptacle (all models)			

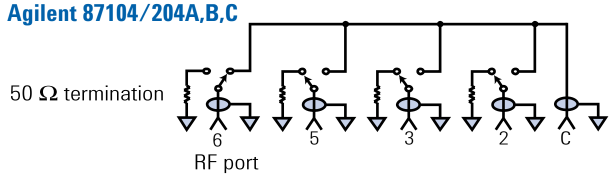
Options

	87104A,B,C	87106A,B,C	87204A,B,C	87206A,B,C
Control logic	**Opt. T24:** TTL/5V CMOS compatible logic with 24 Vdc supply		N/A	
DC connectors	**Opt. 100:** Solder terminals (all models)			
Calibration Documentation	See ordering information (all models)			

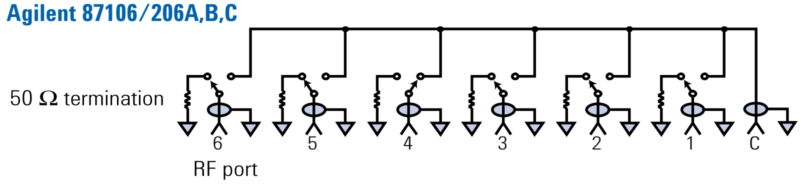
[1] Position sensing when used with customer supplied external circuitry only.
[2] Position sensing when used with Agilent 87130A/70611A switch driver or customer supplied external circuitry.
[3] Not to exceed average power (non-switching).
[4] Measured at 25 °C.
[5] Closing one RF path requires 200 mA. Add 200 mA for each additional RF path closed or opened.

Simplified schematics

Agilent 87104/204A,B,C



Agilent 87106/206A,B,C



Signal path control data

The table shown here can be used to better understand how to select a signal path for Agilent 87104/106 multiport switches. For example, there are two drive control alternatives, i.e. a standard drive scheme and a TTL/5V CMOS drive scheme. For standard drive, it is required that the supply voltage be applied to pin 1 and that pin 15 is grounded. The path from port C to port 2 can be closed by grounding pin 5. Note that all other RF paths are simultaneously opened by internal logic. Further, the Agilent 87104/106 permits closing 1 or more RF paths simultaneously, allowing make-before-break RF switching transitions. See product data sheet for more information.

Agilent 87104/106 series signal path control data [1]

RF Path	Pin No. [2]	Drive Control Voltages [2]	
		Standard	TTL/5V CMOS
1 to C [3]	3	Ground	"High"
2 to C	5	Ground	"High"
3 to C	7	Ground	"High"
4 to C [3]	9	Ground	"High"
5 to C	11	Ground	"High"
6 to C	13	Ground	"High"
Open all paths	16 [4]	Ground	"High"

[1] Agilent recommends the Agilent 87130A/70611A switch driver for Agilent 87204/206 series products. See data sheet for additional information related to driving these switches.

[2] Pin 1 is supply voltage. Pin 15 is common ground.

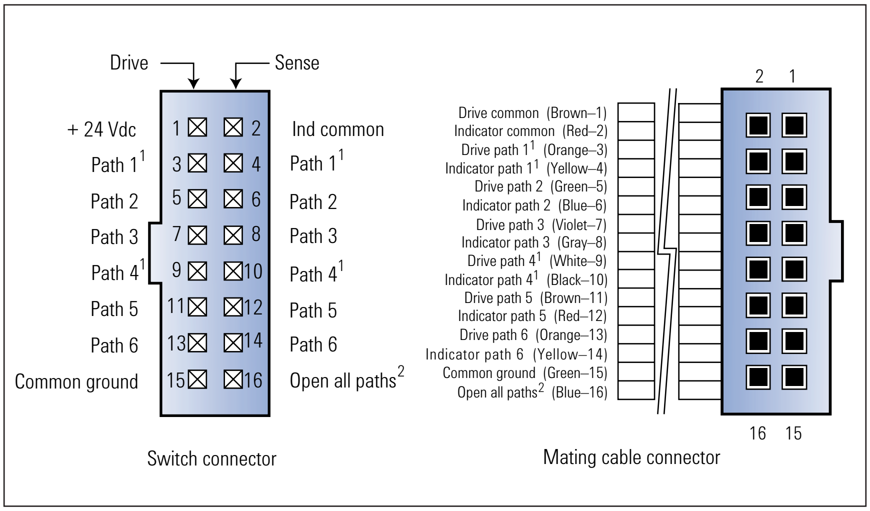
[3] Paths 1 and 4 are not available for Agilent 87104A,B,C.

[4] Not available on Option 100.

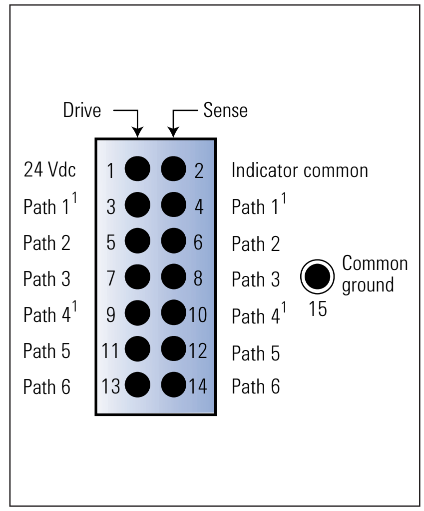
Drive connection diagrams

Agilent 87104/106 series

Standard/Option T24

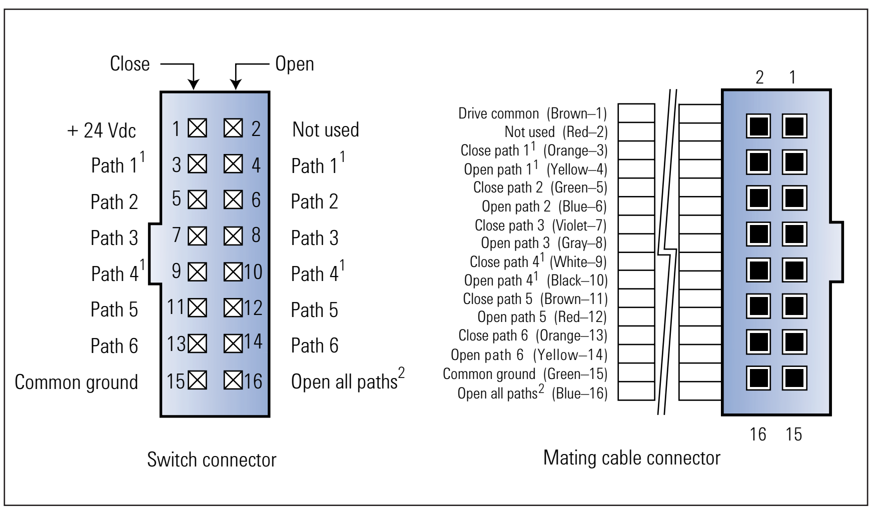


Option 100 (solder terminals)

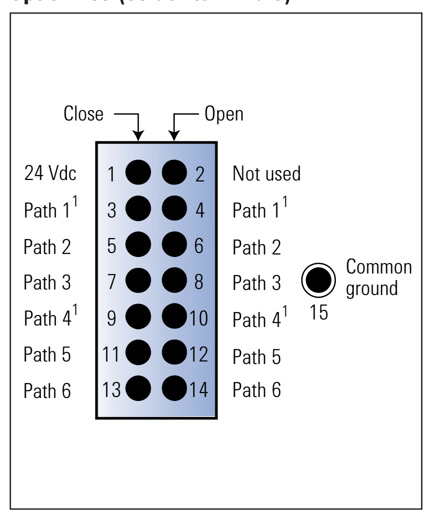


Agilent 87204/206 series

Standard



Option 100 (solder terminals)

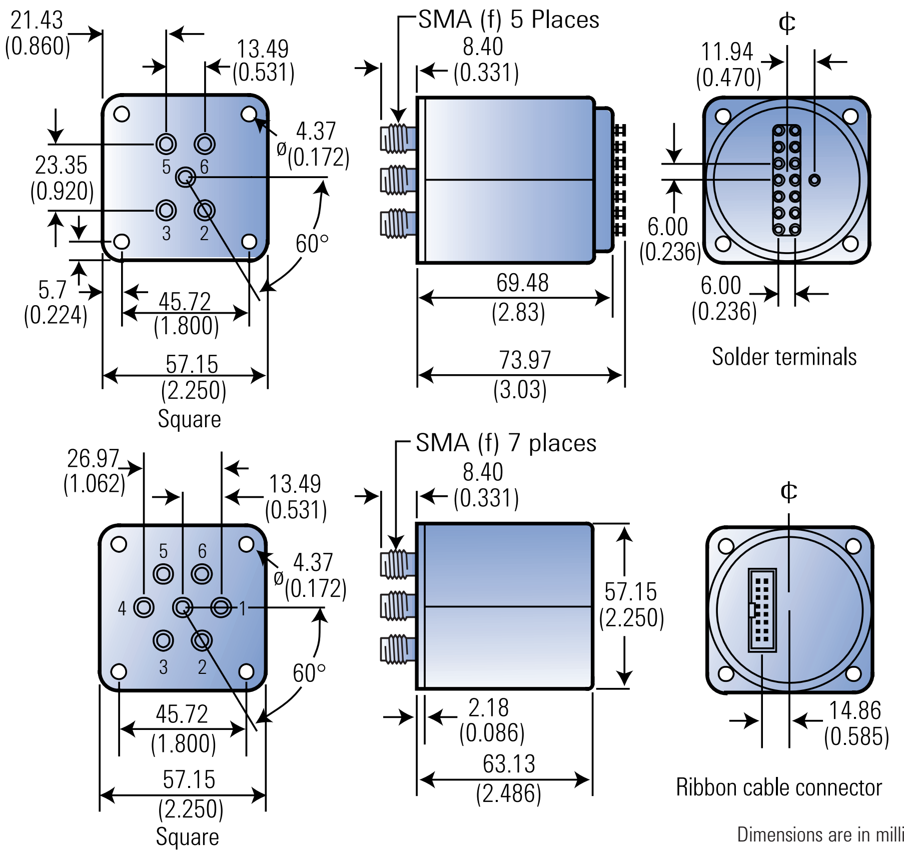


¹ Paths 1 and 4 are not connected for Agilent 87104/204 series.

² This function is not available on Option 100.

Outline drawings

Agilent 87104/106, 87204/206 series



Dimensions are in millimeters (inches) nominal, unless otherwise specified.

Ordering information

Agilent 87104/106/204/206 series ordering example

Sensing type

1: Provides position sensing when used with customer supplied external circuitry only.
2: Provides position sensing when used with Agilent 87130A/70611A driver or customer supplied external circuitry.

Agilent 87204B Option 100 Option T24 Option UK6

Switch type
4: SP4T
6: SP6T

Frequency range
A: 4 GHz
B: 20 GHz
C: 26.5 GHz

DC connector
Std: Ribbon receptacle
100: Solder terminals

Control logic[1]
T24: TTL/5V CMOS compatible logic with 24 Vdc supply

Calibration documentation
UK6: Commercial calibration test data with certificate
UKS: Commercial calibration certificate

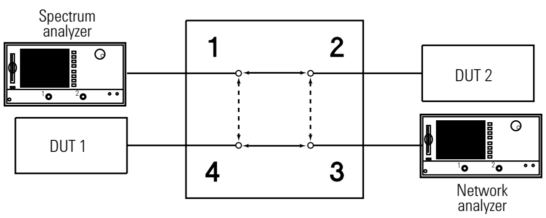
[1] Option T24 not available with Agilent 87204/206 series products.

High Performance Transfer Switch

Applications

The Agilent 87222C/D/E transfer switches can be used in many different applications to increase system flexibility and simplify system design. The following are five examples: switch between two inputs and two outputs, use as a drop-out switch, use for signal reversal, configure as a SPDT switch, and bypass an active device.

The Agilent 87222C/D/E transfer switches have the ability to exchange two signals between two inputs and two outputs. The transfer switches can connect two different instruments with two devices under test (DUT). Once switched, the signals are exchanged between the two instruments and the two DUTs. The exchanged signals allow complete network and spectrum analysis on two devices with a single switch and one test setup. See Figure 1 for an example of this application.



	DUT 1	DUT 2
Network analyzer	Position A	Position B
Spectrum analyzer	Position B	Position A

Figure 1. Switching two instruments and two DUTs

In the signal reverse configuration, a device can be connected across two diagonal ports of the Agilent 87222C/D/E transfer switch. This will allow the signal direction through the device to be reversed. See Figure 2.

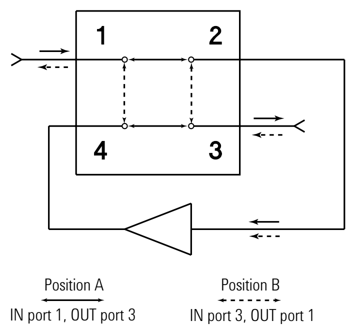


Figure 2. Signal reversal

The Agilent 8782C/D/E can be used as a simple drop-out switch where a signal is either run through the device under test or straight through the switch, bypassing the device. See Figure 3.

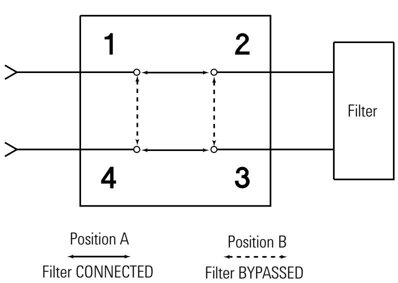


Figure 3. Drop-out switch

By attaching an external termination, the designer can use the Agilent 87222C/D/E in a SPDT terminated switch configuration. See Figure 4.

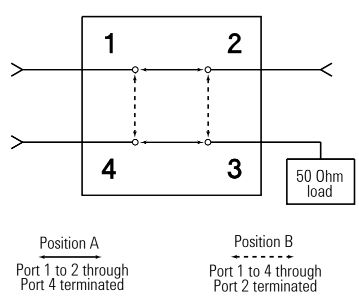
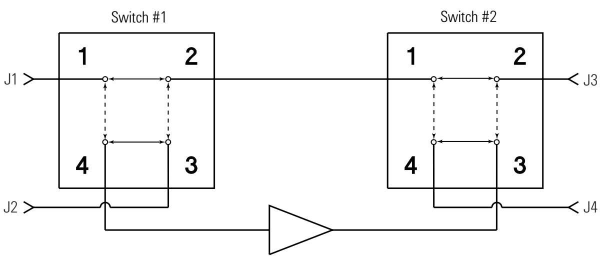


Figure 4. SPDT terminated

In Figure 5, an active device, such as an amplifier, is inserted into a signal path presenting a unique problem. A single transfer switch has the undesirable characteristic of shunting the output of the amplifier to its input when the signal is bypassing the amplifier. The advantage of using two transfer switches is that an additional signal path is available, however two SPDT switches can also be used. This additional path can utilize the same amplifier when the original path is bypassed.



Switch states		Signal paths	
Switch #1	Switch #2		
Position A	Position A	J1 — J3	J2 —▷— J4
Position B	Position A	J2 — J3	J1 —▷— J4
Position A	Position B	J2 —▷— J3	J1 — J4
Position B	Position B	J1 —▷— J3	J2 — J4

Figure 5. Bypassing an active device

Driving the switch

There are two positions for the Agilent 87222C/D/E transfer switch. See Table A. 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. The 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.

Caution for users of the 11713A Switch Driver: Do not drive the 8722C/D/E using the S9 or S0 outputs from either the banana-plug outputs or the Viking connectors located on the rear panel of the 11713A.

(I) Standard drive:

See Figure 6 for drive connection diagrams.
- Connect Pin 1 to supply (+20 VDC to +32 VDC)
- Connect Pin 9 to ground (see note 1)
- Select position “A” by applying ground to Pin 3 (see note 3)
- Select position “B” by applying ground to pin 5 (see note 3)

(II) Single line TTL drive:

See Figure 6 for drive connection diagrams.
See Figure 7 for TTL Voltage States.
- Connect Pin 1 to supply (+20 VDC to +32 VDC)
- Connect Pin 9 to ground (see notes 2,4)
- Connect Pin 8 to TTL “High”
- Select position “A” by applying TTL “High” to pin 7 (see note 3)
- Select position “B” by applying TTL “Low” to pin 7 (see note 3)

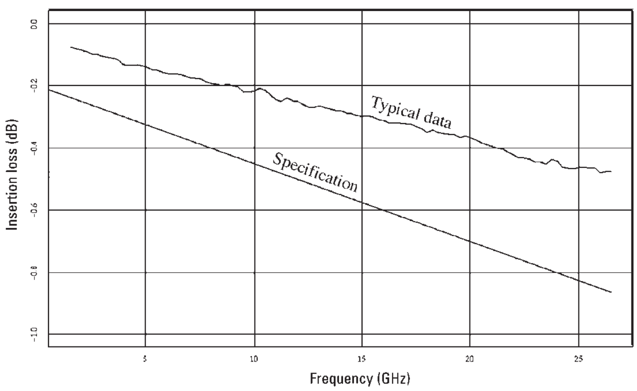
(III) Dual line TTL drive:

See Figure 6 for drive connection diagrams.
See Figure 7 for TTL Voltage States.
- Connect Pin 1 to supply (+20 VDC to +32 VDC)
- Connect Pin 9 to ground (see notes 2,4)
- Select position “A” by applying TTL “High” to pin 7 and TTL “Low” to pin 8 (see note 3)
- Select Position “B” by applying TTL “Low” to pin 7 and TTL “High” to pin 8 (see note 3)

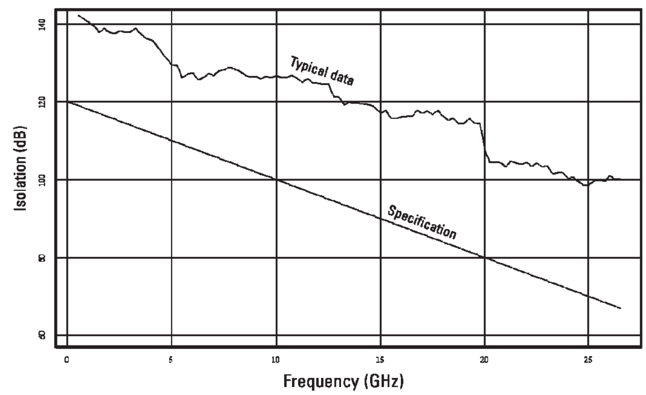
Notes:

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

High Performance Transfer Switch



Agilent 87222C/D/E insertions loss versus frequency



Agilent 87222C/D/E isolation versus frequency

Specifications

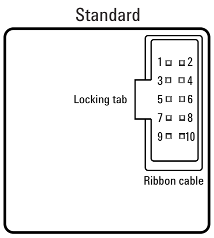
Agilent model	87222C	87222D	87222E
Configuration	4-Port	4-Port	4-Port
Features	Opto-electronic indicators and interrupts[1] TTL/5V CMOS compatible Unterminated	Opto-electronic indicators and interrupts[1] TTL/5V CMOS compatible Unterminated	Opto-electronic indicators and interrupts[1] TTL/5V CMOS compatible Unterminated
Impedance	50 ohms	50 ohms	50 ohms
Frequency range	dc to 26.5 GHz	dc to 40 GHz	dc to 50 GHz
Insertion loss (dB)	0.2 dB + 0.025x frequency (GHz)	0.2 dB + 0.025x frequency (GHz)	0.15 dB + 0.025x frequency (GHz)
SWR	1.10 maximum dc to 2 GHz 1.15 maximum 2 to 4 GHz 1.25 maximum 4 to 12.4 GHz 1.40 maximum 12.4 to 20 GHz 1.65 maximum 20 to 26.5 GHz	1.30 maximum dc to 12.4 GHz 1.40maximum 12.4 to 25 GHz 1.70 maximum 25 to 40 GHz	1.30 maximum dc to 12.4 GHz 1.40 maximum 12.4 to 20 GHz 1.50 maximum 20 to 30 GHz 1.60 maximum 30 to 40 GHz 1.70 maximum 40 to 50 GHz
Isolation (dB)	120 dB -2.0x frequency (GHz)	dc to 26.5 GHz 120 dB -2.0x frequency (GHz)	dc to 26.5 GHz 120 dB -2.0x frequency (GHz)
		26.5 to 40 GHz 60 dB	26.5 to 50 GHz 60 dB
Input power			
Average	1W	1W	1W
Peak[2]	50W	50W	50W
Switching speed (max)	15 ms	15 ms	15 ms
Repeatability (max)[3]	0.03 dB	<0.03 dB typical	<0.03 dB typical
Life (min)	5 million cycles	5 million cycles	5 million cycles
RF connectors	SMA (f)	2.92 mm (f)	2.4 mm (f)

Options	
100	Solder terminals in addition to ribbon cable
201	Mounting bracket; assembly required

[1] Provides position sensing when used with Agilent87130A/70611A switch driver and the Agilent 11764-60010 accessory cable.

[2] Not to exceed 1W average

[3] Measured at 25° C



PIN #	Function
1	+24 VDC
2	Ind. Comm.
3	Drive "A"
4	Ind. "A"
5	Drive "B"
6	Ind. "B"
7	TTL
8	TTL Compl.
9	Comm. Gnd.
10	Not Used

NOTE:
RF Port 1 is located directly behind the 10-pin ribbon cable connector.

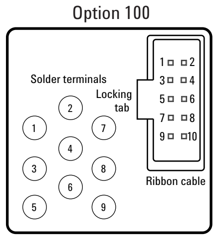


Figure 6. Drive connections

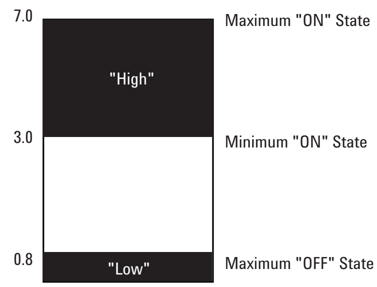


Figure 7. TTL control voltage states

Drive control alternatives

RF path	(I) Standard drive voltage		(II) Single line TTL/5V CMOS Drive voltage		(III) Dual line TTL/5V 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

Table A

Specifications

Specifications describe the instrument's warranted performance. Supplemental and typical characteristics are intended to provide information useful in applying the instrument by giving typical, but not warranted performance parameters.

Standard switch drive specifications

Parameter	Conditions	Min	Nom	Max	Units
Supply voltage		20	24	32	V
Supply current, Icc	Switching: Pulse width > 15 ms: Vcc = 24 VDC		200		mA
Supply current (Quiescent)		25		50	mA

Table B

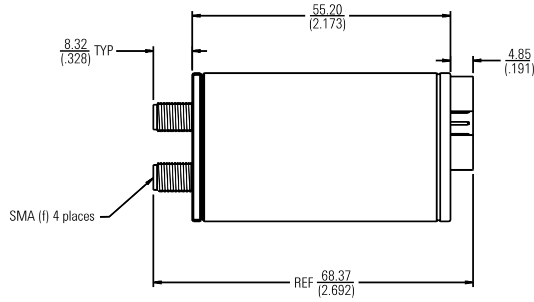
TTL Specific drive specifications

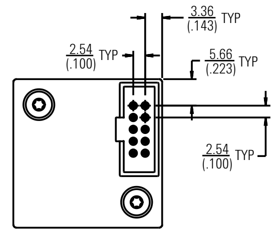
Parameter	Conditions	Min	Nom	Max	Units
High level input		3		7	V
Low level input				0.8	V
Max high input current	Vcc = Max V input = 3.85 VDC		1	1.4	mA

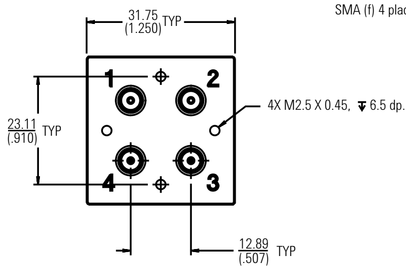
Table C

Product outlines

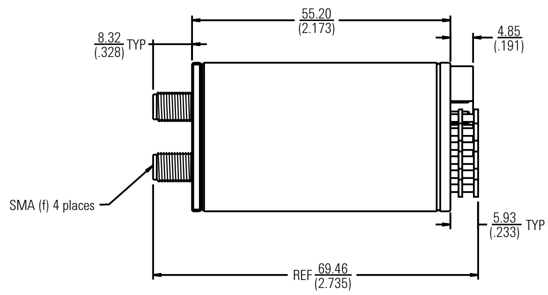
Agilent 87222C standard

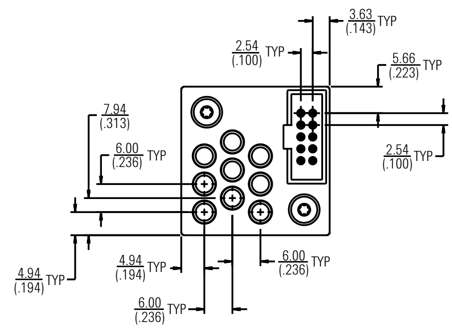




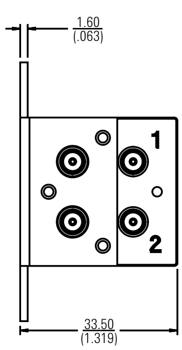


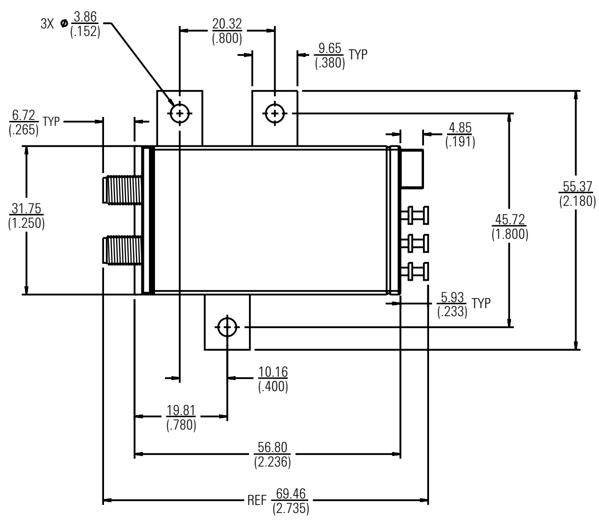
Agilent 87222C Option 100





Agilent 87222C Option 100 and 201





Note: Dimensions are in millimeters and (inches) nominal unless otherwise specified.
For further information see publication 5968-2216E.

Applications

Matrix signal routing

Figures 1 and 2 show the Agilent 87406B and 87606B configured for blocking 2 x 4 and 3 x 3 applications. With outstanding repeatability and life greater than 5 million cycles, these switches enhance measurement confidence and reduce cost of ownership. In addition, the matrix switch has the versatility to provide single pole multiple throw signal routing up to 1 x 5 (SP5T).

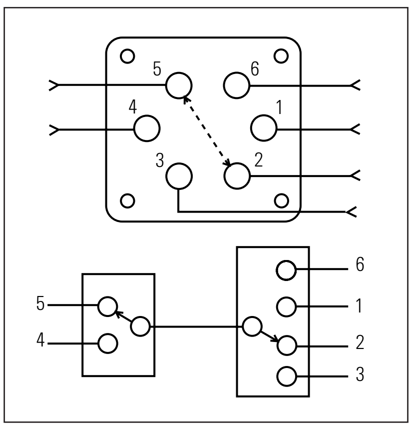


Figure 1. **Matrix switch configured for a 2 x 4 blocking application (RF Path 5 to 2 shown)**

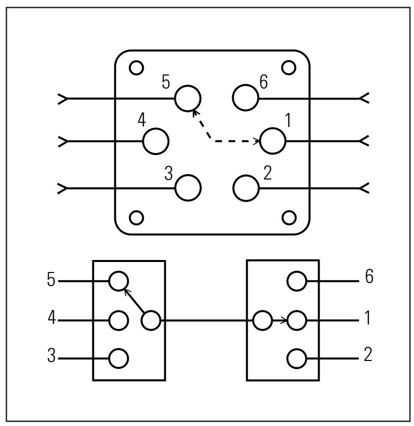


Figure 2. **Matrix switch configured for a 3 x 3 blocking application (RF Path 5 to 1 shown)**

Driving the switch

DC power connection

- Connect pin 1 to supply (+20 V DC to +32 V DC)
- Connect pin 15 to chassis ground to enable the electronic position-indicating circuitry and drive logic circuitry.
  WARNING: DAMAGE TO SWITCH WILL OCCUR IF PIN 15 IS NOT GROUNDED

RF path selection

To connect any two RF ports, apply control signals to the corresponding drive pins as shown below:

Agilent 87406B RF port drive pin control data

RF port	6	5	4	3	2
1	3, 13	3, 11	3, 9	3, 7	3, 5
2	5, 13	5, 11	5, 9	5, 7	
3	7, 13	7, 11	7, 9		
4	9, 13	9, 11			
5	11, 13				

Table 1.
Agilent 87406B
RF port control data

Using this table, **select** (close) the desired RF path by connecting ground (standard and Option 100) or applying TTL "High" (Option T24 or Option T00) to the corresponding "drive" pins.

Unselect (open) RF paths by disconnecting ground (standard and Option 100) or applying TTL "Low" (Option T24 or Option T00) to the corresponding "drive" pins.

Example: Configure the RF path from port 2 to port 5
Using the data in Table 1, select pins 5 and 11 while ensuring no other pins are selected:

RF port	1	2	3	4	5	6	Open All*
Drive pin	3	5	7	9	11	13	16
Standard, Option 100	U	G	U	U	G	U	X**
Options T24, T00	L	H	L	L	H	L	X**

U = Ungrounded, G = Grounded, L = TTL "Low", H = TTL "High", X = Don't care
***** "Open All Ports" is not available with Option 100 and Option T00.
****** "Open all RF Ports" feature is overridden by port selection.

Selected ports will be closed and unselected ports will be automatically opened by the internal logic circuits when new port selections are made. After the RF port is switched and magnetically latched, the solenoid current is interrupted by the solid-state position sensing circuitry. The drive voltage must be maintained to avoid RF path disconnection by the internal logic. For this reason, pulsed drive is NOT recommended. Use the Agilent 87606B if pulse drive, such as used on Agilent 70611A or 87130A, is desired.

Open all RF ports

Unselecting all RF ports and selecting Pin 16 on standard and Option T24 opens all RF ports:

U = Ungrounded, G = Ground, L = TTL "Low", H = TTL "High"

Drive pin	3	5	7	9	11	13	16
Standard	U	U	U	U	U	U	G
Option T24	L	L	L	L	L	L	H

Selecting an RF port will override the "open all RF ports" for each selected port. If desired, pin 16 can be wired directly to ground (standard) or TTL "High" (Option T24) to open all RF ports at power-up.

Break-before-make

Remove the control inputs from the undesired port, then select the desired port. The internal logic will unselect the old port automatically upon application of the new port selection.

Make-before-break

Select the new RF port while maintaining the control input on the original ports. Allows 15 ms for the switching action to be completed, then unselect the original port; the original port will be automatically disconnected by the internal logic.

RF path selection

Close an RF port

To connect any two RF ports, apply control signals to the corresponding drive pins as shown below:

Table 2. **Agilent 87606B "Close" RF port control data**

RF port	6	5	4	3	2
1	3, 13	3, 11	3, 9	3, 7	3, 5
2	5, 13	5, 11	5, 9	5, 7	
3	7, 13	7, 11	7, 9		
4	9, 13	9, 11			
5	11, 13				

Using Table 2, **select** (close) the desired RF path by connecting ground to the corresponding "drive" pins.

Open an RF port

To open RF ports, apply control signal to the corresponding drive pins as shown below:

Table 3. **Agilent 87606B "Open" RF port control data**

RF port	1	2	3	4	5	6
Drive pin	3	5	7	9	11	13

Using Table 3, **unselect** (open) the desired RF path by connecting ground to the corresponding "drive" pins.

Example: Configure the RF path from port 2 to port 5:

Using the data in Tables 2 and 3, close ports 2 and 5 while opening all other ports (1, 3, 4, 6); ground pins 4, 5, 8, 10, 11, 14; all other drive pins must be removed from ground. Another method is to first apply ground to pin 16; with all other drive pins (3-14) ungrounded, for 15 milliseconds to open all paths, then apply ground to pins 5 and 11, to close parts 2 and 5.

Example: Configure the RF path from port 2 to port 5:
Using the data in Tables 1 and 2, close ports 2 and 5 while opening all other ports (1, 3, 4, 6); ground pins 5, 11, 4, 8, 10, 14; all other drive pins must be removed from ground. Another method is to first apply ground to pin 16, with all other drive pins (3-14) ungrounded, for 15 milliseconds. This will open all paths. Next, apply ground to pins 5 and 11, to close ports 2 and 5.

RF port	1		2		3		4		5		6	
Drive pin	3	4	5	6	7	8	9	10	11	12	13	4
Standard, Option 100	U	G	G	U	U	G	U	G	G	U	U	G

U = Ungrounded, G = Grounded

Removing all drive pins (3-14) from ground, and grounding pin 16 will open all RF paths.
Simultaneously grounding any "RF port close" pin and pin 16 will cause rapid cycling and premature failure of the switch.

Break-before-make
Open the undesired RF path. After 15 ms (minimum), close the new RF port(s).

Make-before-break
Close the new RF port(s). After 15 ms (minimum), open the undesired RF port(s).

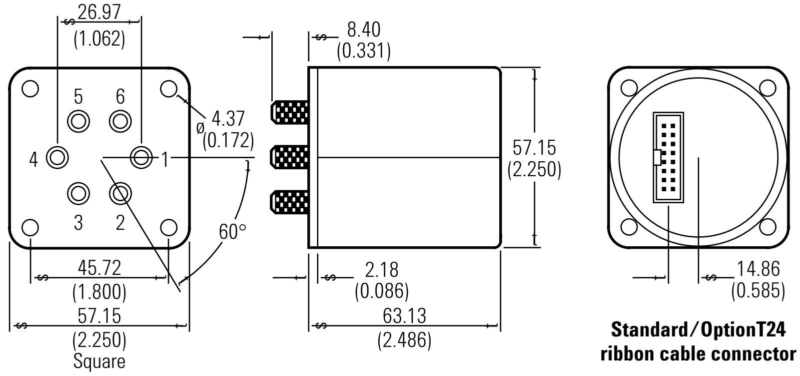
Switch drive specifications

Parameter	Conditions	Min	Nom	Max	Units
Supply voltage, Vcc		20	24	32	V
Switching current	Vcc=24 VDC		200 [1]		mA
Standby current (quiescent)		25		50	mA
Options T24 / T00					
High level input		3		7	V
Low level input				0.8	V
Max high input current	Vcc=Max ; Vinput=3.85 VDC		1	1.4	mA

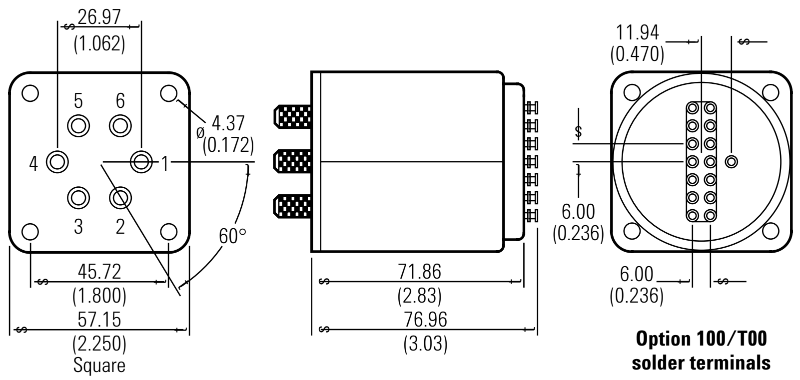
[1] 200 mA is required for each RF port closed or open. Using "open all ports" (pin 16) will require up to 1200 mA (6 ports times 200 mA each). See General Operation Section.

Product outline

Dimensions are in
millimeters (inches) nominal,
unless otherwise specified.



Standard/OptionT24 ribbon cable connector



Option 100/T00 solder terminals

Matrix

Agilent model	87406B	87606B
Configuration	SP6T	
Features	3x3, 2x4 and 1x5 blocking matrix configurations Make-before-break or break-before-make operation Terminated Ports	
	Opto electronic indicators and interrupts[1]	Self interrupting drive circuit
Impedance	50 ohms	
Frequency range	dc to 20 GHz	
Insertion loss (dB)	0.34 dB + 0.033 x frequency (GHz) maximum	
SWR	1.21 maximum from dc to 4 GHz 1.35 maximum from 4 to 10 GHz 1.5 maximum from 10 to 15 GHz 1.7 maximum from 15 to 18 GHz 1.9 maximum from 18 to 20 GHz	
Isolation (dB)	100 dB minimum to 12 GHz 80 dB minimum from 12 to 15 GHz 70 dB minimum from 15 to 20 GHz	
Input power		
Average	1 W	
Peak[2]	50 W (10 μs max)	
Switching time (max)	15 ms	
Repeatability (max)[3]	0.03 dB	
Life (min)	5,000,000 cycles	
RF connectors	SMA (f)	

Agilent model number	Options:
Agilent 87406B	**100:** Solder terminals to replace ribbon cable **T24:** TTL/5V CMOS compatibility (requires 24VDC power supply) **T00:** Solder terminals to replace ribbon cable and TTL/5V CMOS compatibility
Agilent 87606B	**100:** Solder terminals to replace ribbon cable

[1] Provides position sensing when used with Agilent 87130A/70611A switch driver or customer supplied external circuitry.
[2] Not to exceed 1 W average
[3] Measured at 25° C

Switch Cables[1]

Agilent model number	Agilent part number	Where used	Description
11761A		11713A to 8765	Viking to (4) ribbon cable connectors
	11764-60007	84941A dist bd to 87104/106[2]	16-pin DIP to (6) 4-pin Berg connector, 30-inches
	11764-60008	84941A dist bd to 87204/206	16-pin DIP to (6) 4-pin Berg connector, 30-inches
	70611-60008	84941A dist bd to 8762/63/64, 8765 Opt. 100	(31) 52-inch cables, 4-pin Berg connector to bare wires
		84941A dist bd to 87104/106 Opt. 100[2]	
		84941A dist bd to 87204/206 Opt. 100	
84941A-K03		84941A dist bd to 8769K	12-pin Viking to (5) 4-pin Berg connector, 60-inches
87106/206)	**5061-0969**	11713A to 87104/106 Opt. 100	Viking to bare wires, 60-inches (2 required for Agilent 11713A to 87204/206 Opt. 100

[1] For complete cable configuration information, used for connection to Agilent attenuator/switch drivers, request publication number 5963-2038E, *Agilent 70611A, Agilent 87130A and Agilent 11713A Switch Attenuator Driver Configuration Guide.*

[2] Does not provide sensing when used with Agilent attenuator/switch drivers.

Figure 1. **Agilent 11713A (upper left), Agilent 70611A (upper right), Agilent 87130A (lower).**

Figure 2. **Agilent 87130A with various attenuators and switches.**

Agilent 11713A attenuator/switch driver

The Agilent 11713A attenuator/switch driver provides simple GPIB control of up to ten 24 Vdc solenoid activated switch or attenuator sections. The Agilent 11713A supplies 24 Vdc common and ten pairs of current sinking contacts to control up to 10 relays. The internal 24 Vdc power supply of the Agilent 11713A can deliver control signals totaling 0.625 amps continuously or 1.25 amps for one second. Each Agilent 11713A comes equipped with two plug-in drive cables for driving attenuators. Other cables are also available. The convenient front panel controls allow manual control of individual attenuator sections and/or switches.

Agilent 70611A attenuator/switch driver for MMS

The Agilent 70611A is a 1/8 MMS module capable of driving up to 248 electromechanical switches or attenuator switch sections. The Agilent 70611A is MSIB, SCPI and GPIB compatible. In addition to being programmable, the Agilent 70611A features an extremely user-friendly manual interface via any MMS display unit. The highlight of the manual interface is the operator's ability to customize groups of switch control lines and their settings, then identify these switch settings with user-defined alphanumeric labels. In this manner, end users of the Agilent 70611A can define custom menus with their own identification labels for simplified manual control.

The Agilent 70611A can store up to 256 user-defined, labeled paths. Path definitions can be stored in non-volatile EPROM. Groups of paths can be stored in "directories" for easier access to similar path commands. The Agilent 70611A controls switches or attenuator sections in banks of 31 (eight banks total) through individual Agilent 84940A I/O driver cards which are, in turn, directly wired to the switches and/or attenuators.

Agilent 70612/613 series MMS interface modules

In addition to custom interface modules, Agilent offers off-the-shelf interface solutions in MMS. The Agilent 70612 (1 x 6 switch tree) series and the Agilent 70613 (2 x 5 switch tree) series are microwave matrixes available in 2/8 MMS modules with integrated controllers. They are equipped with front panel indicators to facilitate manual use and the integrated controller has all the capabilities of the Agilent 70611A attenuator/switch driver. A variety of options are available for the Agilent 70612/13 series including performance to 26.5 GHz, terminated or unterminated switches, integrated attenuators and a choice of port locations. For a more detailed description of these products, refer to publication number 5091-4897E, Modular Measurement System Technical Data Sheet.

Agilent 87130A attenuator/switch driver

The Agilent 87130A is a 3.5-inch high (2 rack units), full rack width attenuator/switch driver capable of driving up to 248 electromechanical switches or attenuator sections. The Agilent 87130A is controlled over GPIB via standard commands for programmable instruments (SCPI). The Agilent 87130A has been designed for use in both ATE switching systems and computer controlled bench-top applications. Control and programming are accomplished via application programs in IBASIC, RMB, C or Pascal. An ITG driver is also available for use separately or in conjunction with Agilent's Visual Engineering Environment (VEE).

The Agilent 87130A is electronically identical to the Agilent 70611A and shares its performance characteristics with the exception of the method of manual control. The Agilent 87130A has no front panel controls. Manual control of the Agilent 87130A is realized through its ITG driver and a computer controller. The Agilent 87130A can drive 31 switches or attenuator sections directly and up to an additional 217 switches via seven additional Agilent 84940A driver cards. A distribution board, Agilent 84941A, is available to facilitate the interconnection of the Agilent 87130A to switches or attenuators.

Agilent E1368A, E1369A and E1370A VXI attenuator and switch drivers

Agilent's VXI family of instrumentation includes modules for microwave switching and attenuation control up to 18.0 GHz. Agilent E1368A contains three factory-installed SPDT switches such as the Agilent 8762B which feature all-port termination, dc to 18.0 GHz. Agilent E1369A is identical to the Agilent E1368A except that the switches are not included. This allows user-substitution of Agilent 8763/64 series transfer switches. Agilent E1370A allows the user to customize the internal configuration for Agilent 8766 series multiport switches or Agilent 8494/95/96/97 series step attenuators.

For more information, request a copy of the Agilent VXI Catalog, Publication number 5964-3970E, 5964-6898E (CD format).

Agilent 84940A switch driver and Agilent 84941A distribution card

The Agilent 84940A is an expansion driver card for the Agilent 70611/12/13 family of MMS attenuator/switch drivers and the Agilent 87130A attenuator/switch driver. The Agilent 84940A has been designed for incorporation into large interfaces located remotely from their controller. A single Agilent 84940A can control up to 31 switches and can be located up to 150 feet (45 m) from an Agilent 70611/12/13 or Agilent 87130A. The physical interconnection to the switches or attenuators is realized via 31 four-pin output connectors which permit quick connection and disconnection of the switches or attenuators. The Agilent 84941A is a signal distribution card designed to simplify the interconnection of the drive cable from an Agilent 70611A, Option 001, or Agilent 87130A to the 31 components directly driven by these controllers. The Agilent 84941A also provides 31 four-pin connectors for convenient interconnection to switches or attenuators. Included with the Agilent 84941A is a pack of 31 cables, to connect as many as 31 switches or attenuator sections to the Agilent 84941A.