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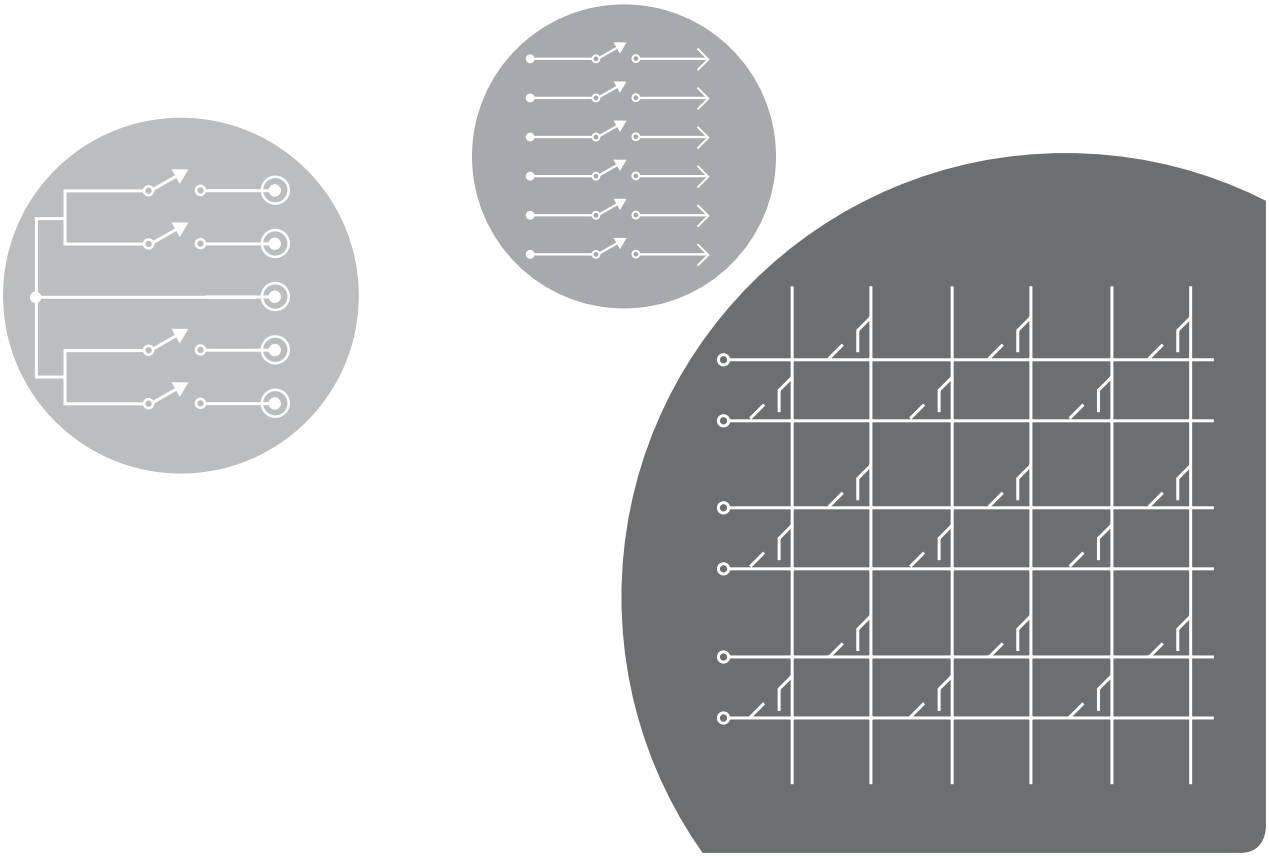
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Agilent Technologies
3499 Switch/Control System

Defining the Meaning of Quality in ATE

Data Sheet



Agilent Technologies

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High speed, high density, highly usable.
The Agilent 3499 gets high marks in ATE environments worldwide.

Performance Overview

There are three modular mainframes in the 3499 family:

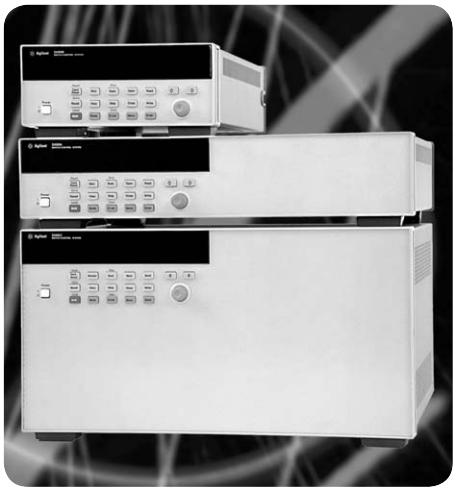
- 3499B - two-slots, up to 80 channels
- 3499A - five-slots, up to 200 channels
- 3499C – 9/14 slots, up to 360 channels

The 3499C can accommodate up to nine plug-in modules that can occupy up to fourteen physical slots, thus providing a cost efficient configuration for modules that are one, two or three slots wide. All mainframe configurations of Agilent can scan at rates up to 350 channels per second, or open/close 200 channels in less than 0.1 second.

You can choose from different plug-in modules to switch:

- electronic signals from DC to 26.5 GHz
- voltages to 250 V, or currents to 8 A

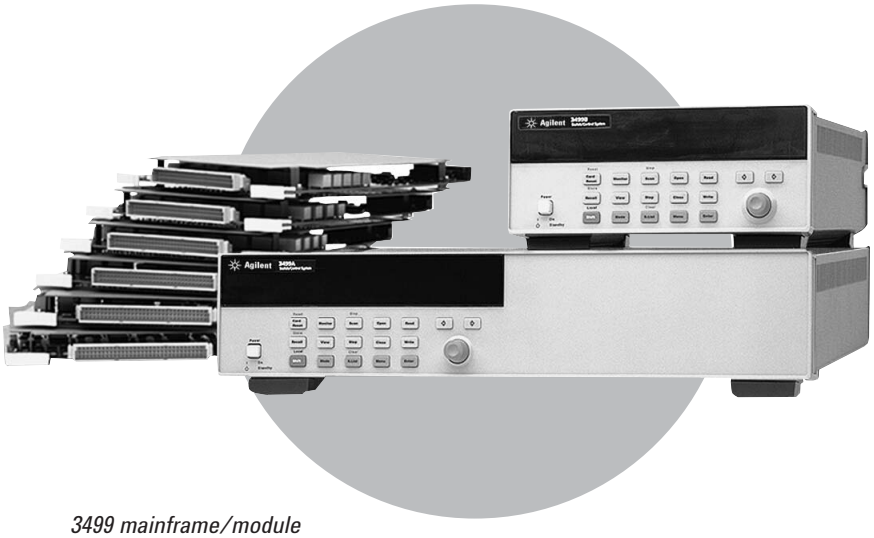
All units have an efficient user interface that works equally well on the manufacturing floor and in desktop applications. High-performance switching modules, multifunction modules, built-in relay cycle counters and straightforward connections all contribute to the performance and day-to-day usability of the 3499. Here's what it means in the real world...



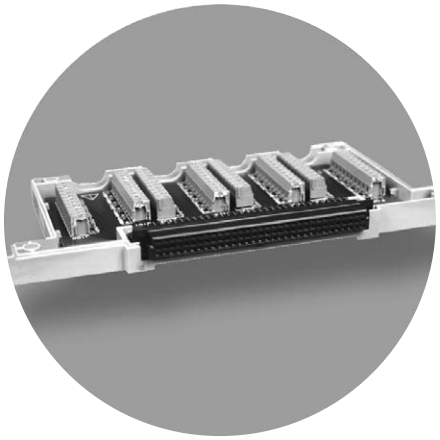
Improved Throughput

While traditional switching mainframes open/close relays in sequence, the Agilent 3499A/B/C systems use innovative parallel driving circuits to open/close switches simultaneously, significantly increasing test throughput. The systems also provide high-density modules with up to 40 channels per module.

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3499 mainframe/module



Screw terminal block

Total Flexibility

The 3499A/B/C mainframes accommodate a full range of modules, including multiplexers, general-purpose relays, matrices, digital I/O, VHF modules, RF modules, microwave modules, Form-C relays, and multifunction modules. By combining these mainframes and modules, a test system can be set up with fewer modules in less space, and the cost and complexity of the system can be reduced.

Fast Set-Up

An easy-to-use interface and industry-standard connections mean fast set-up and integration with the 3499. Usability features include:
Standard RS-232 and GPIB interfaces
SCPI (Standard Commands for Programmable Instruments)
Simplified configuration procedures
Self-guiding front panel interface
Easy-to-use module connection accessories

Cost-Sensitive Test

With three mainframes and many modules to choose from, you can make sure the 3499 meets your exact needs. Build the system you need today, add more modules later as your needs change. That means you buy only the test capability you need. High-density switch modules further reduce the cost-of-test by combining a large number of channels on a single module. And with up to 40 switching channels per module, the 3499 reduces per-channel cost while saving rack and floor space. You get a simpler system with fewer modules, reducing the cost of buying, owning and maintaining your system.

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Go Configure

Broad configuration flexibility using a wide choice of plug-in modules accounts for the wide adoption of the Agilent 3499 worldwide. The following tables include the selection for your configuration. The 3499 is built for the unpredictable, ever-changing needs of ATE.



Agilent 3499A/B/C Mainframe Specifications

	Items	Specifications	
General	Display	Vacuum fluorescent	
	Rear Panel Connectors	GPIB; RS-232; 8-pin mini DIN Connector (5 pins for Digital I/O, 3 pins for external trigger)	
	Power Supply	3499A/B: 100 to 240 VAC universal input (47 Hz to 63 Hz); 100-127 VAC (400 Hz); 40 VA maximum. 3499C: 100 to 240 VAC universal input; 47 Hz to 63 Hz; 65 VA maximum.	
	Operating Environment	0 °C to 55 °C, <80%RH (0 °C to 40 °C)	
	Storage Environment	-40 °C to +70 °C	
	Net Weight	3499A: 3.8 kg (8.4 lbs); 3499B: 2.5 kg (5.5 lbs); 3499C: 7.4 kg (16.4 lbs).	
	Dimensions	3499A: H 89 mm x W 426 mm x L 348 mm 3499B: H 89 mm x W 213 mm x L 348 mm 3499C: H 222 mm x W 426 mm x L 354 mm	Note: Modules with terminal blocks extend an additional 8.5 cm beyond the rear of the mainframe.
	Safety	Conforms to CSA, UL-1244, IEC 1010 Cat I	
	RFI and ESD	CISPR 11, IEC 80 ½/¾	
	Warranty	1 year	
System	Slot Capacity	3499A: 5 slots 3499B: 2 slots. 3499C: 9 logical slots/14 physical slots	
	Memory	3499A/B mainframe with controller board 1.0 (Firmware REV1.0/2.0/3.0): Capable of storing 10 instrument setups and 10 errors in SCPI mode or 40 instrument setups and 1 error in 3488A mode. For 3499A/B/C mainframe with Controller board 2.0 (Firmware REV 4.0 or later): Capable of storing 50 instrument setups and 10 errors in SCPI mode or 40 instrument setups and 1 error in 3488A mode.	
	Relay Setting Time	Automatically selected by the mainframe for each module.	
	Trigger Source	External trigger (real panel Mini-DIN connector); GPIB bus (GET,*TRG) or RS-232 (*TRG).	
	External Trigger	Trigger pulse width: >2 µs; External trigger delay: <2ms	
	Built-in 4 digital I/O Input	TTL compatible;Vo (L): <0.8 V @ Io = -100 mA; Vo (H): >2.4 V @ Io = 1 mA; Vout (H) < = 42 V.	
	Scan Speed	350 chans/sec (equipped with N2266A)	
	Digital I/O Block Transfer Rate	20 Kbytes/sec (long word)	

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Available plug-in modules include multiplexers, RF multiplexers, general-purpose relays, matrices, digital input/output, Form-C, and multifunction modules. Please refer to the following table for plug-in module selection.

Plug-in Module Specifications

	Module	Description	Maximum Voltage	Maximum Current per Channel	Initial Closed Channel Resistance	Thermal Offset per Channel	Bandwidth	Connection Type	Relay Cycle Counter	Page
Multiplexer Modules	N2260A	40-channel	200 V	1 A	<1 Ω	<3 µV	10 MHz	T or C	Yes	6
	N2266A	40-channel	200 V	0.5 A	<1 Ω	<50 µV	40 MHz	T or C	Yes	6
	44470A	10-channel	250 V	2 A	<1 Ω	<3 µV	10 MHz	T		17
	44470D	20-channel	250 V	2 A	<1 Ω	<3 µV	10 MHz	T		17
General-purpose relay modules	N2261A	40-channel	200 V	1 A	<0.5 Ω	<3 µV	10 MHz	T or C	Yes	7
	N2267A	8-channel	250 V	8 A	<0.08 Ω	<3 µV	20 MHz	Crimp & Insert	Yes	11
	44471A	10-channel	250 V	2 A	<1 Ω	<3 µV	10 MHz	T		17
	44477A	7-channel	250 V	2 A	<1 Ω	<3 µV	10 MHz	T		17
Matrix Modules	N2262A	4 x 8 matrix	200 V	1 A	<1 Ω	<3 µV	10 MHz	T or C	Yes	8
	44473A	4 x 4 matrix	250 V	2 A	<1 Ω	<3 µV	10 MHz	T		17
Digital I/O Modules	N2263A	32-bit TTL	42 V	0.6 A	NA	NA	NA	T or C		9
	44474A	16-bit TTL	30 V	0.125 A	NA	NA	NA	T		17
Multifunction Modules	N2264A	12 GP	200 V	1 A	<0.5 Ω	<3 µV	10 MHz	T or C	Yes	10
		3 GP	125 V	5 A	<0.1 Ω	<3 µV	10 MHz	T or C	Yes	10
		16-bit DIO	42 V	0.6 A	NA	NA	NA	T or C		10
		16-bit DIO	42 V	0.6 A	NA	NA	NA	T or C		11

Note: GP = General-purpose, DIO = Digital I/O, T = Terminal Block, C = Cable.

	Modules	Description	Insertion Loss	Cross talk	SWR	Bandwidth	Impedance	Connector	Page
RF & Microwave Modules	N2268A	Dual 1 x 4	<0.35 dB	<-64 dB	<1.20	3.0 GHz	50 Ω	SMA	12
	N2272A	Single 1 x 9	<0.5 dB	<-75 dB	<1.20	1.0 GHz	50 Ω	BNC	13
	N2276A	Dual 1 x 6	<0.36 dB	<-100 dB	<1.20	26.5 GHz	50 Ω	SMA	14
	44472A	Dual 1 x 4	<0.75 dB	<-85 dB	<1.12	300 MHz	50 Ω	BNC	17
	44478A	Dual 1 x 4	<1.1 dB	<-70 dB	<1.35	1.3 GHz	50 Ω	BNC	16
	44478B	Dual 1 x 4	<1.1 dB	<-70 dB	<1.35	1.3 GHz	75 Ω	BNC	16
	44476A	Triple 1 x 2	<0.25 dB	<-90 dB	<1.15	18 GHz	50 Ω	SMA	15
	44476B	Relay driver can support 2 microwave switches. Technical specs depend on the mounted relays.							15
Module Connection	N2290A	Screw terminal block for N2260A, N2266A							
Accessories	N2291A	Screw terminal block for N2261A							
	N2292A	Screw terminal block for N2262A							
	N2293A	Screw terminal block for N2263A							
	N2294A	Screw terminal block for N2264A							
	N2297A	1.5 m cable for connecting DUT to N2260/1/¾/5/6A, one DIN96-to-Twin-D50.							
	N2299A	1.5 m cable for connecting to N2260/1/¾/6A, one DIN96-to-Quad D25.							
	N2327A	Crimp & Insert Connection kit for N2267A							

In addition to the 3499 Series switching, Agilent offers the 34980A Switch/Measure unit for high density switching and the L4400 Series for small distributed applications both at a fraction of the 3499 cost.

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2-wire, 40-channel Multiplexer Module

Agilent N2260A, N2266A

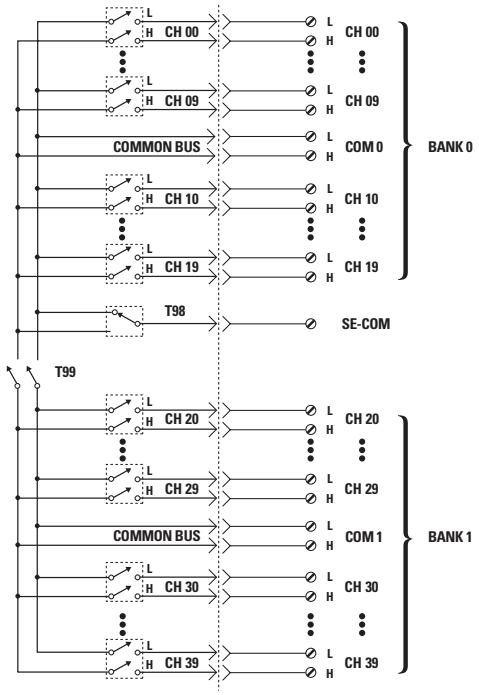
- High speed switching
- Reconfigurable to 1, 2, and 4-wire mode
- Built-in relay cycle counters

The N2260A and N2266A are high-density reconfigurable multiplexer (MUX) modules for high-throughput production test. They can be operated in either SCPI or 3488A mode. In SCPI mode, they can be configured in any of the following ways:

- one 80-channel, 1-wire MUX
- one 40-channel, 2-wire MUX
- dual independent 20-channel 2-wire MUXs
- one 20-channel 4-wire MUX.

Up to five N2260/66As can be included in an 3499A mainframe to build a 1- to 200-channel, 2-wire MUX. Screw terminal block, crimp & insert terminal block, and DIN96-to-D50/25 cables are available for ease of wiring. The N2266A can scan at up to 350 channels/second. Low thermal offset voltage makes the N2260A ideal for low-level signal switching.

N2260A/66A MUX Module **Terminal Block**



Specifications

General Specifications

Relays:

N2266A	Reed non-latching relay
N2260A	Armature latching relay

Thermal Offset:

N2266A	<50 µV
N2260A	<3 µV

Relay Life:

N2266A	10^9 @ 1 V, 1 mA
N2260A Mechanical:	10^8
Electrical:	5×10^6 @ 1 A

Maximum Scan Rate:

N2266A	350 Chan/sec
N2260A	80 Chan/sec

Input Characteristics

Maximum Current:

N2266A	0.5 A DC or AC peak
N2260A	1 A
Maximum Voltage:	200 V (AC peak for N2266A)

Maximum Power:

N2266A	10 W DC or AC peak
N2260A	60 W or 62.5 VA
Initial Closed Channel Resistance:	<1 Ω

DC Isolation

Open Channel, Channel-Channel: <(40 °C, 50% RH)	$>10^{10}$ Ω
HI-LO: <(40 °C, 50% RH)	$>10^{10}$ Ω
Channel-Chassis: <(40 °C, 50% RH)	$>10^{10}$ Ω

Note: All voltage and current are in DC or AC RMS if not specified.

AC Isolation/Performance

Capacitance (with 1 channel closed):

	Open Channel,	Channel-Channel
	N2266A	<7 pF
	N2260A	<7 pF
HI-LO	N2266A	<50 pF
	N2260A	<75 pF
Channel-Chassis		
	N2266A	<140 pF
	N2260A	<150 pF

Insertion Loss (with 50 Ohm termination):

N2266A	100 kHz	<0.20 dB
	1 MHz	<0.30 dB
	10 MHz	<2.0 dB
	40 MHz	<3.0 dB
N2260A	100 kHz	<0.20 dB
	1 MHz	<0.25 dB

Crosstalk (with 50 Ohm termination):

N2266A	100 kHz	<-75 dB
	1 MHz	<-55 dB
	10 MHz	<-33 dB
N2260A	100 kHz	<-70 dB
	1 MHz	<-50 dB

Module Accessories

N2290A	Screw terminal block for N2260A, N2266A
N2297A	DIN96-to-Twin-D50 cable
N2299A	DIN96-to-Quad-D25 cable

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40-channel General-purpose Relay Module

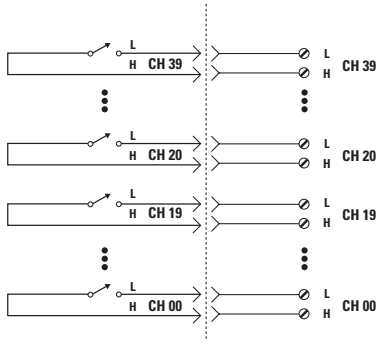
Agilent N2261A

- 40 independent relays in one module
- High-speed switching in parallel operation
- Built-in relay cycle counters

The N2261A general-purpose relay module provides 40 independent single-pole-single-throw (SPST) latching relays. Each channel can switch up to 200 V, 1 A, and 60 W or 62.5 VA. The innovative parallel driving circuits allow 10 channels to be operated simultaneously for high throughput. It can be operated in either SCPI mode or 3488A mode.

A pair of signals can be switched together by using a pair of channels on two N2261A modules. The N2261A can be operated in single-channel break-before-make (BBM) or multiple-channel open/close mode. Screw terminal block, and DIN96-to-D25/50 cables are available to simplify wiring.

N2261A GP Relay Module **Terminal Block**



Specifications

General Specifications	
Relays:	Armature latching relay
Thermal Offset:	<3 µV
Relay Life	
Mechanical:	10^8
Electrical:	5×10^5 (at 1 A load)
Maximum Scan Rate:	80 Chan/sec

Input Characteristics	
Maximum Voltage:	200 V
Maximum Current:	
Per channel	1 A
Per module	20 A
Maximum Power:	
Per channel	60 W or 62.5 VA
Per module	1200 W or 1250 VA
Initial Closed Channel Resistance:	<0.5 Ω

DC Isolation	
Open Channel, Channel-Channel:	
<(40 °C, 50% RH)	$>10^{10}$ Ω
Channel-Chassis:	
<(40 °C, 50% RH)	$>10^{10}$ Ω

AC Isolation		
Capacitance (with 1 channel closed):		
Open Channel	Channel-Channel	<10 pF
	Channel-Chassis	<20 pF
Insertion Loss (with 50 Ω termination):		
100 kHz		<0.10 dB
1 MHz		<0.20 dB
10 MHz		<0.50 dB
Crosstalk (with 50 Ω termination):		
100 kHz		<-70 dB
1 MHz		<-50 dB
10 MHz		<-30 dB

Module Accessories	
N2291A	Screw terminal block
N2297A	DIN-to-Twin-D50 cable

Note: All voltage and current are in DC or AC RMS if not specified.

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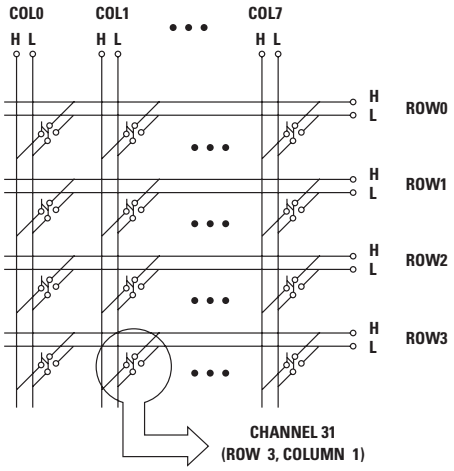
4 x 8 Matrix Module

Agilent N2262A

- Multiple inputs connecting to multiple outputs
- High-speed switching in parallel operation
- Built-in relay cycle counters

The N2262A 4x8 matrix module contains 32 cross points organized in a 4-row by 8-column config-uration. It provides a convenient way to connect a group of test instruments to multiple test points on DUTs. Each cross point in the module switches two wires for the high and low measurement. Multiple matrix modules can be connected for applications that require large matrices. For example, four N2262As can be combined as a 16x8 matrix.

N2262As can be used in con-junction with other modules (such as multiplexer modules) to provide a wide variety of switching combinations. More than one switch can be closed at the same time, allowing any combination of rows to be connected to columns. Up to eight channels can be operated in parallel for high-speed switching. The N2292A screw terminal blocks.



Specifications

General Specifications	
Relays:	Armature latching relay
Thermal Offset:	<3 µV
Relay Life	
Mechanical:	10^8
Electrical:	5×10^5 (at 1 A load)

Input Characteristics	
Maximum Voltage:	200 V
Maximum Current:	
Per channel	1 A
Per module	4 A
Maximum Power:	
Per channel	60 W or 62.5 VA
Per module	240 W or 250 VA
Initial Closed Channel Resistance:	<1 Ω

DC Isolation		
Open Channel, Channel-Channel:		
	<(40 °C, 50% RH)	$>10^{10}$ Ω
HI-LO:	<(40 °C, 50% RH)	$>10^{10}$ Ω
Channel-Chassis:	<(40 °C, 50% RH)	$>10^{10}$ Ω

AC Isolation	
Capacitance (with 1 channel closed):	
Open Channel, Channel-Channel	
	<7 pF
HI-LO	<30 pF
Channel-Chassis	<50 pF
Insertion Loss (with 50 Ω termination):	
100 kHz	<0.10 dB
1 MHz	<0.20 dB
10 MHz	<0.60 dB
Crosstalk (with 50 Ω termination):	
100 kHz	<-73 dB
1 MHz	<-53 dB
10 MHz:	<-28 dB

Module Accessories	
N2292A	Screw terminal block

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32-Bit Digital Input/Output Module

Agilent N2263A

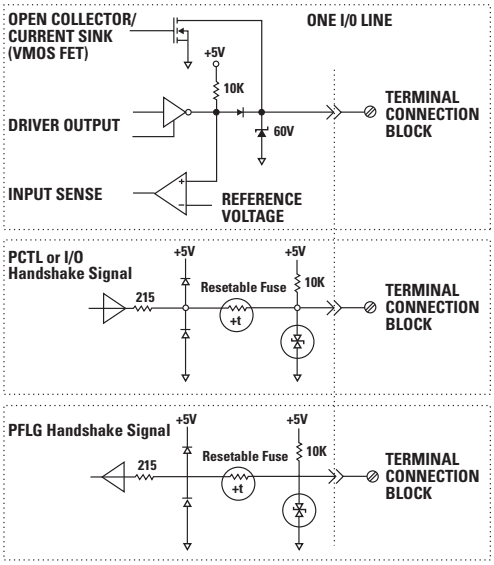
- TTL compatible, sinking up to 0.6 A
- Input /output configurable byte-by-byte
- Three I/O control modes: static, strobe, and handshake

The N2263A provides 32-bit bi-directional lines and three hand-shake and control lines. The 32-bit I/O lines are TTL compatible input/ output, or TTL compatible input and open collector output up to 42 V. The 32-bit I/O lines can be addressed individually (byte-by-byte), either as a 32-bit port, four independent 8-bit ports, or as two independent 16-bit ports. A Zener diode is used in each channel for input voltage over-protection (> 42 VDC), including ESD protection.

Each I/O line can sink up to 0.6 A to control external devices, including:

- High-voltage/high current relays
- Microwave relays and attenuators (8710xx , 876xx and 849xx)
- Solenoid coils

The polarities of the I/O and handshake lines can be operated in positive or negative logic mode. With the three control lines (PCTL, I/O, and PFLG), you can define five handshake modes for communication with peripherals. The screw terminal block and DIN96-to-Twin-D50 cable are available for simple wiring.



Specifications

General Specifications

I /O Lines

Maximum Voltage(line-chassis):

+42 VDC

Maximum Sink Current(per bit):

0.6 A

Output Characteristics:

V_{out} (high)	≥ 2.4 V @ I ≤ 10 mA output
V_{out} (low)	≤ 0.8 V @ I ≤ 600 mA input

Input Characteristics:

V_{in} (high)	≥ 2.0 V
V_{in} (low)	≤ 0.8 V

Handshake Lines

Maximum Voltage(line-chassis): +5 VDC

Output Characteristics:

V_{out} (high)	≥ 2.4 V @ I ≤ 400 µA output
V_{out} (low)	≤ 0.5 V @ I ≤ 1 mA input
I_{out} (low)	<25 mA (when shorted to + 5 V)

Input Characteristics:

V_{in} (high)	≥ 2.0 V
V_{in} (low)	≤ 0.8 V

Module Accessories

N2293A	Screw terminal block
N2297A	DIN96-to-Twin-D50 cable
N2299A	DIN96-to-Quad-D25 cable

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Multifunction Module

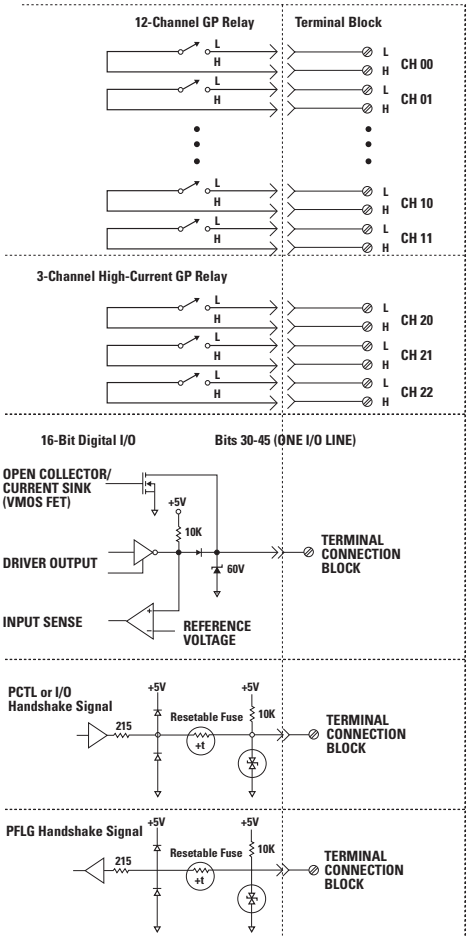
Agilent N2264A

- 12 + 3 GP + 16-bit digital I/O in one module
- High-speed switching in parallel operation
- Built-in relay cycle counters

The Agilent N2264A multifunction module combines 12 general-purpose relays, three high-current relays, and 16-bit digital input/ output in one module, saving cost and space. Its three high-current channels are especially useful in automated test systems for cellular phone test or battery test, where only two or three low-resistance channels are needed. Four connection accessories simplify wiring.

The 12 general-purpose channels are non-latching relays that can switch up to 200 V, 1 A, 60 W or 62.5 VA. The three high-current channels are non-latching relays switching up to 5 A, 125 VDC, or 200 VAC RMS. The 16-bit digital I/O provides 16 bi-directional data lines (bits) plus three lines used for control and handshaking. The 16-bit I/O lines are TTL compatible input/output, or TTL compatible input and open collector output. The 16 I/O bits can be addressed individually, as two independent 8-bit ports, or as one 16-bit port. A Zener diode is used in each channel for input overvoltage protection (>42 VDC), including ESD protection. Each I/O line can sink up to 0.6 A to control external devices.

N2264A Multifunction Module



Specifications

12-channel General-purpose Relay

General Specifications

Relays:	Armature non-latching relay
Thermal Offset:	<3 µV
Relay Life	
Mechanical:	10^8
Electrical:	5×10^5 (at 1 A load)
Maximum Scan Rate:	80 Chans./ sec

Input Characteristics

Maximum Voltage:	200 V
Maximum Current:	Per channel 1 A
Maximum Power:	Per channel 60 W; 62.5 VA
Initial Closed Channel Resistance:	<0.5 Ω

DC Isolation

Open Channel, Channel-Channel:	
	<(40 °C, 50% RH) $>10^{10}$ Ω

AC Isolation

Capacitance (with 1 channel closed):		
Open Channel	Channel-Channel	<10 pF
	Channel-Chassis	<20 pF

For 16-bit Digital I/O specifications, please refer to the Agilent N2263A.

3-channel High-current Relay

General Specifications

Relays:	Armature non-latching relay
Relay Life	
Mechanical:	5×10^7
Electrical:	10^5 (at 5 A load)
Thermal Offset:	<3 µV
Time to close one channel:	16 ms

Input Characteristics

Maximum Voltage:	125 VDC or 200 VAC
Maximum Current:	5 A
Maximum Power:	150 W; 1250 VA
Initial Closed Channel Resistance:	<0.1 Ω

DC Isolation

Open Channel, Channel-Channel:	
<(40 °C, 50% RH)	$>10^{10}$ Ω
Channel-Chassis:	
<(40 °C, 50% RH)	$>10^{10}$ Ω

Module Accessories

N2294A	Screw terminal block for N2264A
N2297A	DIN96-to-Twin-D50 cable
N2299A	DIN96-to-Quad-D25 cable

Note: All voltage and current are in DC or AC RMS if not specified.

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8-channel General-purpose Relay Module

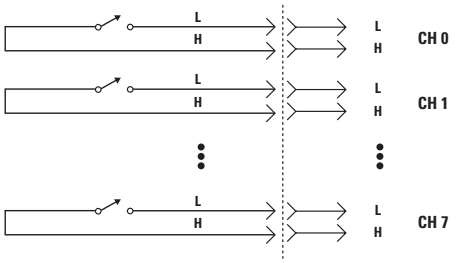
Agilent N2267A

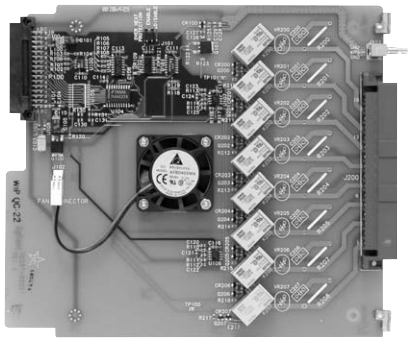
- Switching up to 8 A, 250 V
- Built-in overheat protection for high reliability

The N2267A is designed for high-current (up to 8 A contin-uous), low-resistance switching applications, such as AC/DC power supply testing. It can also be used to switch on/off AC (up to 250 V) or DC (up to 125 V) power supplies and current sources. Each channel can carry 8 A current at the same time. For thermal protection and reliability, the N2267A has built-in temper-ature control circuitry that uses sensor ICs and a cooling fan. An over-temperature warning signal is also available to activate an external LED or buzzer. A crimp & insert con-nector (N2327A) is available.

A protection network area is provided on the module's PCB, for switching inductive loads such as electric motors, solenoids, contacts, chokes, electromagnets and incandescent lamps. To protect relays from over-voltage damage, the RC network or the varistors must be placed on this module, which can effectively absorb the surge voltage.

N2267A GP Relay Module Connection Kit





Specifications

General Specifications	
Relays:	Non-latching relay
Thermal Offset:	<3 µV
Relay Life	
Mechanical:	5 x 10^7 (180cpm)
Electrical:	10^5
Maximum Scan Rate:	20 Chans./sec

Input Characteristics	
Maximum Current:	
(per channel)	8 A
(per module)	64 A
Maximum Voltage:	125 VDC, 250 VAC
Maximum Power:	
Per channel	150 W or 2000 VA
Per module	1200 W or 16000 VA
Initial Closed Channel Resistance:	<0.08 Ω

DC Isolation	
Open Channel, Channel-Channel:	
<(40 °C, 50% RH)	
>10^{10} Ω	
Channel-Chassis:	
<(40 °C, 50% RH)	
>10^{10} Ω	

AC Isolation	
Capacitance (with 1 channel closed):	
Open Channel, Channel-Channel	<10 pF
Channel-chassis	<10 pF
Insertion Loss (with 50 Ω termination):	
100 kHz	<0.10 dB
1 MHz	<0.20 dB
Crosstalk (with 50 Ω termination):	
100 kHz	<-75 dB
1 MHz	<-55 dB

Module Accessories	
N2327A	Crimp & insert connection kit for N2267A

Note: All voltage and current are in DC or AC RMS if not specified.

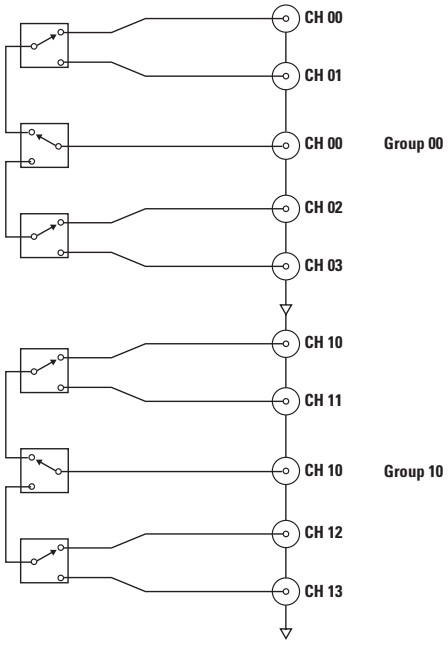
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Dual 1 x 4 RF Multiplexer (3.0 GHz, 50 Ω)

Agilent N2268A

- Ideal for wireless communication test
- Insertion loss <1.7 dB at 3.0 GHz

The N2268A multiplexer module has two 1x4 independent multi-plexers with SMA connectors, delivering high performance, very low insertion loss, high isolation, and excellent VSWR performance. This high-density RF multiplexer module is an economical RF signal switching solution. Its 3.0 GHz bandwidth guarantees signals will not be degraded when switched from source to destination. Each group of four channels is isolated from the other and from the chassis to prevent ground loops. The wide-bandwidth performance enables quality dynamic-range RF signal measurements using oscilloscopes, spectrum analyzers, network analyzers, and GSM/CDMA test sets. Typical test applications include switching signals of Bluetooth transceivers and L1/L2 GPS receivers, 1.8/1.9 GHz wireless communication devices (such as GSM, CDMA, 3G, DCS1800, and PCS1900 base stations), and mobile phones. It can be also used to route satellite signals.



Specifications

Input Characteristics	
Maximum Scan Rate:	20 Chans./sec
Maximum Voltage:	30 V, DC + AC peak
Maximum Current:	0.5 A, DC + AC peak
Maximum Power: (per channel)	10 W
Characteristic Impedance:	50 Ω

DC Performance	
Thermal Offset:	<3 µV (<2 µV, typ.)
Initial Closed Channel Resistance:	<1 Ω
Insulation Resistance (between terminals):	<(40 °C, 50% RH) $>10^{10}$ Ω

Capacitance	
Center-Center	<0.06 pF
Center-Shield	<20 pF
Rise Time:	<150 psec
Signal Delay:	<1.5 nsec

AC Performance	
Insertion Loss	
1 GHz	<0.9 dB
2 GHz	<1.2 dB
2.5 GHz	<1.4 dB
3 GHz	<1.7 dB

Crosstalk (Channel-Channel, Channel-Common)	
1 GHz	<-64 dB
2 GHz	<-64 dB
2.5 GHz	<-50 dB
3 GHz	<-50 dB

VSWR	
1 GHz	<1.20
2 GHz	<1.35
2.5 GHz	<1.35
3 GHz	<1.35

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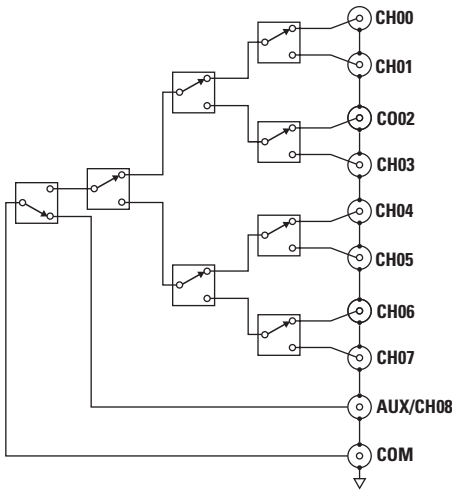
1 x 9 RF (1 GHz) Multiplexer Module

Agilent N2272A

- Ease of channel density extension
- Ideal for high density RF signal routing
- Ease of wiring with BNC connectors

The N2272A RF high-density module provides a 1x9 multi-plexer that can be widely used in RF test and measurement system. It consists of a series of eight RF latching relays in a tree structure. The module's low insertion loss, high isolation and excellent VSWR performance guarantee that the RF signals will not be degraded when routed from source to destination. In order to decrease the degradation when cascading, the auxiliary channel (channel 08) with smaller insertion loss and lower VSWR, is provided. In order to extend the channel count, channel 08 can be connected to the COM channel of the next N2272A module. It can also be used as a standard channel. BNC connectors on the module's front panel are provided for ease of wiring.

The N2272A can only be operated in SCPI mode when installed in 3499A/B mainframes with firmware 3.0 or later.



Specifications

Input Characteristics		
Total Channels:	9	
Maximum Voltage:	24 V	
Maximum Current:	1 A	
Maximum Power:	24 W	
Characteristic Impedance:	50 Ω	
Connector:	BNC	
Relay life	Mechanical	$5x10^6$
	Electrical (24 V @ 1 A DC)	10^5

DC Performance	
Thermal Offset:	<8 µV
Initial Closed Channel Resistance:	<0.8 Ω
Insulation Resistance (between terminals): <(25 °C, 50% RH)	$>10^{10}$ Ω

Capacitance:	
Center-Center	<0.006 pF
Center-Shield	<60 pF
Rise Time:	<500 psec
Signal Delay:	<2.5 nsec

AC Performance	100 MHz	300 MHz	800 MHz	1 GHz
Insertion Loss	<0.5 dB	<0.8 dB	<1.8 dB	<2.5 dB
Crosstalk (Channel-Channel)	<-75 dB	<-65 dB	<-55 dB	<-50 dB
VSWR	<1.20	<1.30	<1.35	<1.55

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Dual 1x6 Microwave (26.5 GHz) Multiplexer

Agilent N2276A

- Quick set-up microwave switching to save integration time
- Modular microwave switching to fit each application
- Can also drive two external microwave attenuators

The 3-slot N2276A module (option 206) provides dual 1 x 6 microwave multiplexers, with excellent insertion loss, isolation and VSWR performance. With option 204, the N2276A becomes a dual 1 x 4 microwave multi-plexers, while keeping all the other features. The modular N2276A can exactly fit your application channel density needs, minimizing the redundant channel, thus offering the most cost effective microwave switching. The SMA connectors on module's front panel are provided for high performance connections. The N2276A can also drive two external microwave attenuators (Agilent 84904/6/7/K/L).

The N2276A can be used in the testing of cellular phone, cordless phone, mobile radios, cellular base station, broad-band wireless communication transceivers, RFICs, and high-speed digital circuits.

The N2276A can only be operated in SCPI mode when installed in 3499A/C mainframes with firmware 3.0 or later.

Specifications

Total Channels (N2276A)	Dual 1 x 4 (option 204) Dual 1 x 6 (option 206)
Connector	SMA
Frequency range	DC to 26.5 GHz
Insertion loss	0.3 dB + 0.015 dB * frequency (GHz)
Isolation	>100 dB @ 12 GHz; >80 dB @ 15 GHz; >70 dB @ 26.5 GHz
VSWR	<1.2 @ 4 GHz; <1.35 @ 12.4 GHz; <1.45 @ 18 GHz; <1.7 @ 26.5 GHz
Repeatability (5 M cycle @ 25 °C)	< 0.03 dB
Switching time	25 ms
Switch life	5 M cycles

Module Accessories	
84904/6/7/K/L	0-11 dB, 0-90 dB, 0-70 dB microwave attenuators (26.5, 40 GHz)



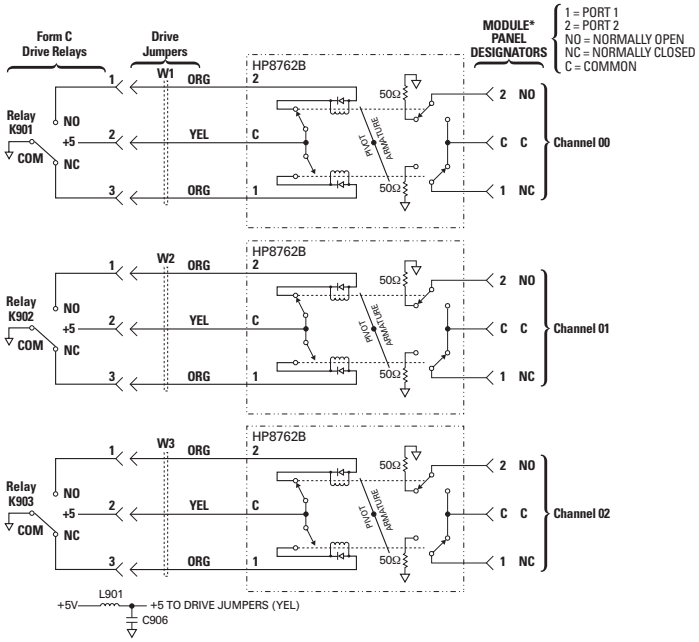
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Microwave Multiplexer Module

Agilent 44476A

- Switching signals from DC to 18 GHz
- Triple 1-to-2 microwave multiplexers

The 44476A includes three independent SPDT 50 Ω coaxial relays with excellent electrical performance from DC to 18 GHz. For general-purpose microwave switching applications, the module can be used to switch separate signal sources for a multi-band receiver/transmitter testing application. The 3 mm SMA connector on the module edge simplifies wiring.



* NOTE: Terminal designations inside the dashed boxes refer to the HP8762B only. Module panel designators outside the dashed boxes are those silkscreenedon the HP44476A panel. Any reference in this manual to a port refers to the module panel designators.

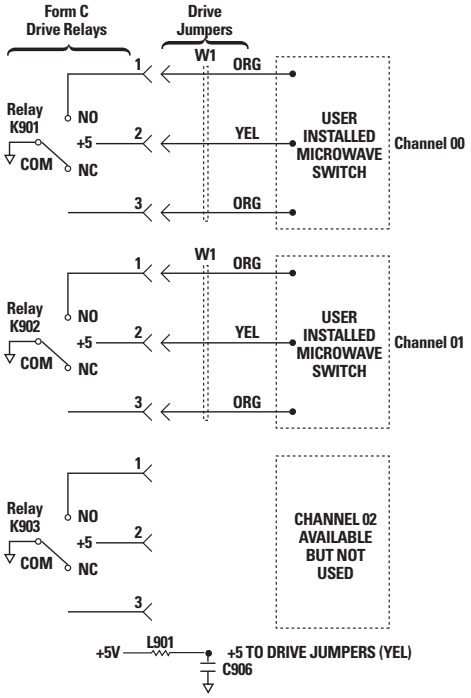
Specifications

Input Characteristics		
Frequency Range:		DC to 18 GHz
Characteristic Impedance:		50 Ω
Input Power Rating: (Also less than ± 7 VDC)		1 W average 100 W peak
Repeatability (after 10^6 operation):		0.03 dB
Connector:		SMA

AC Isolation / Performance		
Isolation:	DC-18 GHz	>90 dB
Insertion Loss:	DC-2 GHz	<0.25 dB
	DC-18 GHz	<0.50 dB
VSWR (3 mm SMA):	DC-2 GHz	<1.15 dB
	DC-12.4 GHz	<1.25 dB
	DC-18.0 GHz	<1.40 dB

Microwave Relay Driver Module

Agilent 44476B



- Supporting varieties of microwave coaxial relays
- Two set mounting holes for coaxial relays

The 44476B brings multi-port 50/75 Ω coaxial switching flexibility to your test system. It has two set mounting panels, so any two Agilent 876XX coaxial switches can be mounted. The coaxial switches come in three-, four-, and five-port configurations. This flexibility allows you to use the different switches for a variety of applications, constructing transfer switches, switch matrices and more. Using the 876XX in conjunction with the 44476B allows you to extend your automated three-port switching to 26.5 GHz. Coaxial relays must be ordered separately when using with this module. The coaxial switches that can be used are listed below. Option 011 designates the switches for a coil voltage of 5 VDC.

Agilent Technologies

Coaxial Switch	Port	Frequency
8762A/Option 011	3	DC to 4 GHz
8762B/Option 011	3	DC to 18 GHz
8762C/Option 011	3	DC to 26.5 GHz
8762F/Option 011	3	DC to 4 GHz
8763B/Option 011	4	DC to 18 GHz
8763C/Option 011	4	DC to 26.5 GHz
8764B/Option 011	5	DC to 18 GHz
8764C/Option 011	5	DC to 26.5 GHz

Note: For details of Agilent 876XX specifications, please refer to publication number 5968-4314.

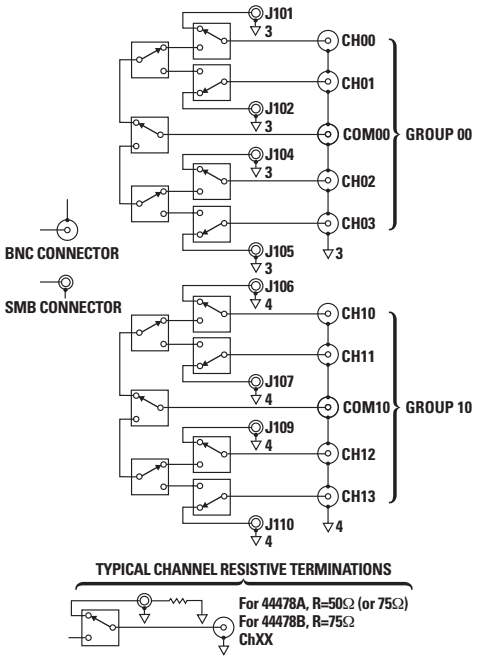
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Dual 1 x 4 RF Multiplexer (1.3 GHz, 50/75 Ω)

Agilent 44478A/B

- Switching up to 1 A, 24 W or 24 VA
- Insertion loss less than 1.9 dB at 1.3 GHz

The 44478A/B multiplexer module is an ideal choice for broadband switching of high-frequency or fast pulse signals. Dual 1-to-4 multiplexers provide bi-directional switching of signals from DC to 1.3 GHz. High channel isolation (>55 dB at 1 GHz) assures quality dynamic-range measurements using spectrum, network, or distortion analyzers. Each 1-to-4 multiplexer consists of seven relays in a "tree" structure, which provides high isolation and low VSWR (voltage standing wave ratio). All the connectors on the module's edge are female BNC for ease of wiring. Off-channels can be terminated in resistors to maintain proper operation of DUT circuitry. Simply plug a 50/75 Ω SMB-type resistive termination onto the on-board male SMB connectors provided for each channel.



Specifications

Input Characteristics	
Maximum Scan Rate:	43 Chans./sec
Maximum Voltage:	42 V, DC + AC peak
Maximum Current:	1 A
Maximum Power: (Per channel)	24 W, 24 VA or 44 dBm
Characteristic Impedance:	
44478A:	50 Ω
44478B:	75 Ω

DC Performance	
Thermal Offset:	<6 µV (<2 µV, Typ.)
Initial Closed Channel Resistance:	<1 Ω
Insulation Resistance (between terminals): <(25 °C, 40% RH)	$>10^{10}$ Ω

Capacitance:	
Center-Center:	<0.006 pF
Center-Shield:	<60 pF
Rise Time:	<300 psec
Signal Delay:	<3 nsec

AC Performance		
Insertion Loss		
≤(40 °C, 95% RH)	10 MHz	<0.3 dB
	100 MHz	<0.7 dB
	500 MHz	<1.5 dB
	1.3 GHz	<3.0 dB
≤(25 °C, 40% RH)	10 MHz	<0.2 dB
	100 MHz	<0.5 dB
	500 MHz	<1.1 dB
	1.3 GHz	<1.9 dB
Crosstalk		
Channel-Channel, Channel-Common		
	10 MHz	<-90 dB
	100 MHz	<-80 dB
	500 MHz	<-65 dB
	1.3 GHz	<-55 dB
Group-Group, Module-Module		
	10 MHz	<-90 dB
	100 MHz	<-80 dB
	500 MHz	<-70 dB
	1.3 GHz	<-60 dB
VSWR	10 MHz	<1.20
	100 MHz	<1.25
	500 MHz	<1.35
	1.3 GHz	<1.55

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Agilent 44470A, 44470D, 44471A, 44471D, 44472A, 44473A, 44474A Modules

44470A
10-channel Multiplexer Module
(2 A, 250 V)

44470D
20-channel Multiplexer Module
(2 A, 250 V)

44471A
10-channel General-purpose Module
(2 A, 250 V)

44471D
20-channel General-purpose Module
(1 A, 250 V)

The 44470A, 44470D, 44471A, and 44471D are designed for low-channel count applications, with higher switching capability (current or voltage) than N2260A or N2261A modules.

44472A
Dual 1x4 RF Multiplexer Module
(300 MHz, 50 Ω)

The 44472A RF multiplexer module offers broadband switching capability for high-frequency and pulse signals. Two independent 50 Ω characteristic impedance 1x4 switches are provided for signal from DC to 300 MHz. BNC connectors on the module allow for easy connection.

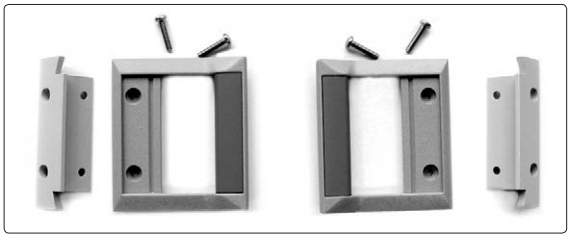
44473A
4 x 4 Matrix Module (2 A, 250 V)

44474A
16-Bit Digital I/O Module
(TTL compatible)

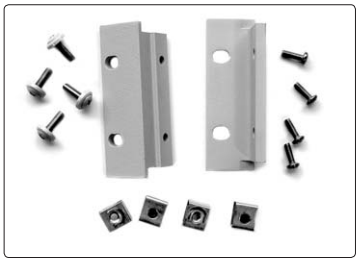
All of the modules listed are designed for 3488A mainframes, work in the 3499A/B/C.

Rack Mounting Kits

3499A

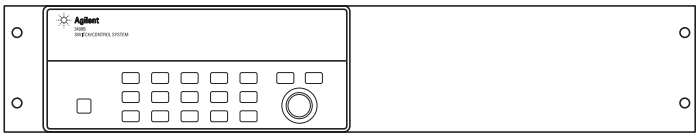


Agilent 3499A Rack Mount Kit with Handles (Opt. 1CP)



Agilent 3499A Rack Mount Kit (Opt. 1CM)

3499B



To rackmount an Agilent 3499B with a fill panel, order Option 1CM.

3499C

To rackmount the 3499C without handles, order the Agilent standard cabinet accessory 5063-9216.

To rackmount the 3499C with handles, order the Agilent standard cabinet accessory 5063-9223.

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Ordering Information

Mainframes	
3499A	5-Slot Switch/Control Mainframe. Includes hard copy manual and power cord. Plug-in modules are ordered separately and are required for operation.
3499A-1CP	Rack Mount Kit with Handles
3499A-1CM	Rack Mount Kit
3499B	2-Slot Switch/Control Mainframe.Includes hard copy manual and power cord. Plug-in modules are ordered separately and are required for operation.
3499B-1CM	Rack Mount Kit with half-rack filler panel
3499C	9/14-Slot Switch/Control Mainframe. Includes hard copy manual and power cord. Plug-in modules are ordered separately and are required for operation. • For rackmount kit w/o handles, order the Agilent standard cabinet accessory 5063-9216. • For rackmount kit with handles, order the Agilent standard cabinet accessory 5063-9223.
Mainframe Filler Panels	
3499C-FP1	1-slot width filler panel for 3499A/B/C mainframes
3499C-FP2	2-slot width filler panel for 3499A/B/C mainframes. Plug-in modules, screw terminal blocks NOT included.
N2260A	40-channel Multiplexer Module
N2261A	40-channel General Purpose Relay Module
N2262A	4 x 8 Matrix Module
N2263A	32-bit Digital I/O Module
N2264A	12 + 3 GP + 16-bit Digital I/O Module
N2266A	40-channel High-speed Multiplexer Module
N2267A	8-channel 8 A General Purpose Relay Module
N2268A	Dual 1 x 4 RF (3.0 GHz) Multiplexer Module
N2272A	1 x 9 RF (1GHz) Multiplexer Module
N2276A	Dual 1 x 6 Microwave Multiplexer Module
N2276A-204	Dual 1 x 4 Multiplexer
N2276A-206	Dual 1 x 6 Multiplexer
N2290A	Screw terminal block for N2260A and N2266A
N2291A	Screw terminal block for N2261A
N2292A	Screw terminal block for N2262A
N2293A	Screw terminal block for N2263A
N2294A	Screw terminal block for N2264A
N2297A	DIN96-to-Twin-D50 cable for N2260-5A
N2299A	DIN96-to-Quad-D25 cable for N2260-5A
N2327A	Crimp & Insert Connection kit for N2267A
Plug-in modules (Agilent 3488A family), screw terminal blocks included	
44470A	10-channel Relay Multiplexer Module
44470D	20-channel Relay Multiplexer Module
44471A	10-channel GP Relay Module
44471D	20-channel GP Relay Module
44472A	Dual 1 x 4 RF (300MHz) Multiplexer Module (50 Ω)
44473A	4x4 Matrix Switch Module
44474A	16-bit Digital I/O Module
44476A	Microwave Multiplexer Module
44476B	Microwave Switch Driver Module
44478A	Dual 1x4 RF (1.3 GHz) Multiplexer (50 Ω)
44478B	Dual 1x4 RF (1.3 GHz) Multiplexer (75 Ω)
44480A	Connector Kit for 44470A
44480B	Connector Kit for 44470D
44480-85001	44470A Terminal
44480-85002	44476D Terminal
44481-85001	44471A Terminal
44481-85002	44471D Terminal
44483-85001	44473A Terminal
44484-85001	44474A Terminal

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3499 Product Alternative

Although the 3499A/B/C Switch/Control system has been a great addition to many test systems, the new

- 34980A Mainframe and Modules, and the
- L4400 Series Switch and Control Instruments

are even better product alternatives. The 34980A and L4400 series both offer a greater selection of modules plus measurement capability, standard PC connections for communication, and a selection of easy to connect to modules. The wide offering of modules for the 34980A and L4400 series enables you to select a configuration for your specific application needs. The 34980A Switch/Measure unit and L4400 series products can be used in the same applications as the 3499A/B/C including design verification, functional test and data acquisition applications. They can also be used in many new applications such as for data logging, data acquisition systems and/or switch systems. The 34980A and L4400 offer great switching, measurement and test system control solutions at a great value.

Agilent 34980A Mainframe and Modules

The Agilent 34980A is an eight-slot mainframe that includes an optional built-in 6½ digit DMM. Choose from 19 optional plug-in modules that offer a broad range of functionality that includes DC to 20 GHz switching, counter/totalizer, digital I/O with pattern capabilities, and D/A converters - in one compact, high-performance modular platform. In addition to data logging, data acquisition or switch system the 34980A can even provide a solution for applications requiring transducer-based measurements such as thermocouple or strain.

Agilent L4400 Series Switch and Control Instruments

The Agilent L4400 series switch and control instruments offer high performance switching, digital I/O, D/A converters, counter/totalizer and more in standalone LXI instruments. With their small size and Ethernet connectivity, these LXI instruments can be placed wherever your application needs them.

For more details please see **www.agilent.com/find/34980A** or **www.agilent.com/find/L4400.**

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