

Mix and match 34980A modules to create your own custom configuration

The 34980A mainframe holds up to eight plug-in modules. Mix and match them to create a custom system to meet your switching and system control needs. You can easily add or replace modules as your needs change.

Table 1. 34980A modules at a glance

Module	Description	Max volts	Max current	BW (MHz)	Scan ch/sec	Thermal offset	Comments
Multiplexer modules							
34921A	40-channel armature multiplexer w/ low thermal offset	± 300 V	1 A	45 MHz	100	< 3 uV	Temperature reference 4 current channels Config as 2- or 4-wire
34922A	70-channel armature multiplexer	± 300 V	1 A	25 MHz	100	< 3 uV	Config as 2- or 4-wire
34923A	40/80-channel reed multiplexer	± 150 V	0.5 A	45 MHz	500	< 50 uV	Config as 1-, 2- or 4-wire
34924A	70-channel reed multiplexer	± 150 V	0.5 A	25 MHz	500	< 50 uV	Config as 2- or 4-wire
34925A	40/80-channel optically isolated FET multiplexer	± 80 V	0.05 A	1 MHz	1000	< 3 uV	Config as 1-, 2- or 4-wire
Matrix modules							
34931A	Dual 4x8 armature matrix	± 300 V	1 A	30 MHz	100	< 3 uV	Backplane expandable
34932A	Dual 4x16 armature matrix	± 300 V	1 A	30 MHz	100	< 3 uV	Backplane expandable
34933A	Dual/Quad 4x8 reed matrix	± 150 V	0.5 A	30 MHz	500	< 50 uV	Backplane expandable Config as 1- or 2-wire
General-purpose modules							
34937A	28-channel Form C and 4-channel Form A	300 V 250 VAC	1 A 5 A	10 MHz	N/A	< 3 uV < 3 uV	
34938A	20-channel 5-amp Form A	250 VAC	5 A	1 MHz	N/A	< 3 uV	
RF and microwave modules							
Module	Description	Insertion loss	Isolation	Freq range	VSWR	Input impedance	Comments
34941A	Quad 1x4 50 ohm 3 GHz RF multiplexer	0.6 dB	> 58 dB	3 GHz	< 1.25	50 Ω	@ 1 GHz
34942A	Quad 1x4 75 ohm 1.5 GHz RF multiplexer	0.6 dB	> 60 dB	1.5 GHz	< 1.35	75 Ω	@ 1 GHz
34945A/ 34945EXT	Microwave switch/attenuator driver	Can drive up to 64 external switch coils; 32 SPDT switches, 8 multipoint switches, 8 attenuators, or your own combination. Expand with additional 34945EXTs.					
34946A	Dual 1x2 SPDT terminated microwave switch	< 0.42 dB < 0.69 dB	> 85 dB > 67 dB	4 GHz or 20 GHz	< 1.15 < 1.30	50 Ω	@ 4 GHz @ 20 GHz
34947A	Triple 1x2 SPDT unterminated microwave switch	< 0.42 dB < 0.69 dB	> 85 dB > 67 dB	4 GHz or 20 GHz	< 1.15 < 1.30	50 Ω	@ 4 GHz @ 20 GHz
System control modules		Description					
34950A	64-bit digital I/O with memory and counter	Eight 8-bit digital I/O channels with programmable polarity, thresholds up to 5 V, with handshaking protocols and pattern memory. Two 10 MHz frequency counter and programmable clock output to 20 MHz.					
34951A	4-channel isolated D/A converter with waveform memory	Output DC voltage up to ± 16 V or DC current up to ± 20 mA. Output waveforms with a 200 kHz update rate and 16 bits of resolution. Use on-board memory to create point-to-point waveforms with more than 500,000 points.					
34952A	Multifunction module with 32-bit DIO, 2-ch D/A and totalizer	Four 8-bit digital I/O channels, two ± 12-V analog outputs, and a 100 kHz gated totalizer.					
34959A	Breadboard module	Create your own custom designs with access to the +12 V and +5 V supplies, 16 GPIO ports and 28 relay drive lines.					

34980A multiplexer switch modules

The 34980A multiplexer modules can be used to connect one of many different points to a single point. You can connect to an external instrument, or scan multiple analog signals to the internal DMM.

Choose from the following features:

- 1-wire, 2-wire, or 4-wire configurations
- High voltage—up to 300 V, 1 A
- High density—70 2-wire or 80 1-wire channels
- Bandwidths up to 45 MHz
- Temperature measurements with built-in thermocouple reference junction (34921T)
- AC or DC current measurements without external shunts
- Connections via standard 50- or 78-pin Dsub cables or detachable terminal block

Figure 2. 34921A 40-channel armature multiplexer with low thermal offset (bank 2)

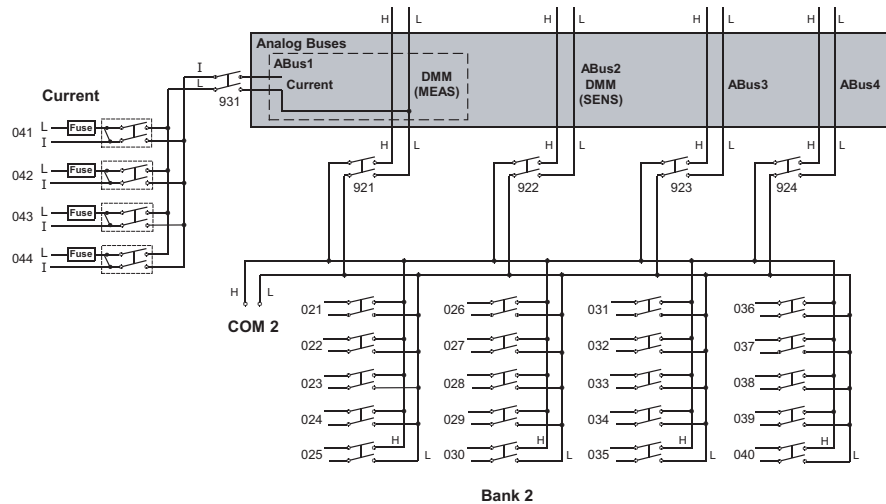


Table 2. Multiplexer measurement functions

	Voltage AC/DC	Current AC/DC	Freq/ Period	Ω 2-Wire	Ω 4-Wire	Thermo- couple	RTD 2-Wire	RTD 4-Wire	Thermistor
34921A Armature Multiplexer	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
34922A Armature Multiplexer	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
34923A Reed Multiplexer (2-wire)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
34923A Reed Multiplexer (1-wire)	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
34924A Reed Multiplexer	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
34925A FET Multiplexer (2-wire)	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
34925A FET Multiplexer (1-wire)	Yes	No	Yes	Yes	No	Yes	No	No	No

Note: See User's Guide for additional information.

Multiple multiplexers can connect to the built-in analog buses, allowing you to scan up to 560 2-wire channels or 640 1-wire channels in a single mainframe. The 34921A also offers 4 channels for directly measuring current. Or if you need more current channels, shunts can be added to the terminal block for easy current measurements.

The multiplexer modules feature break-before-make connections to ensure that no two signals are connected to each other during a scan. Or, if you prefer, you can control switching manually to create your own switch configuration. All the multiplexer switches have a relay counter to help predict when relays need to be replaced.

Figure 3. 34923A 40-channel reed multiplexer (bank 1 shown)

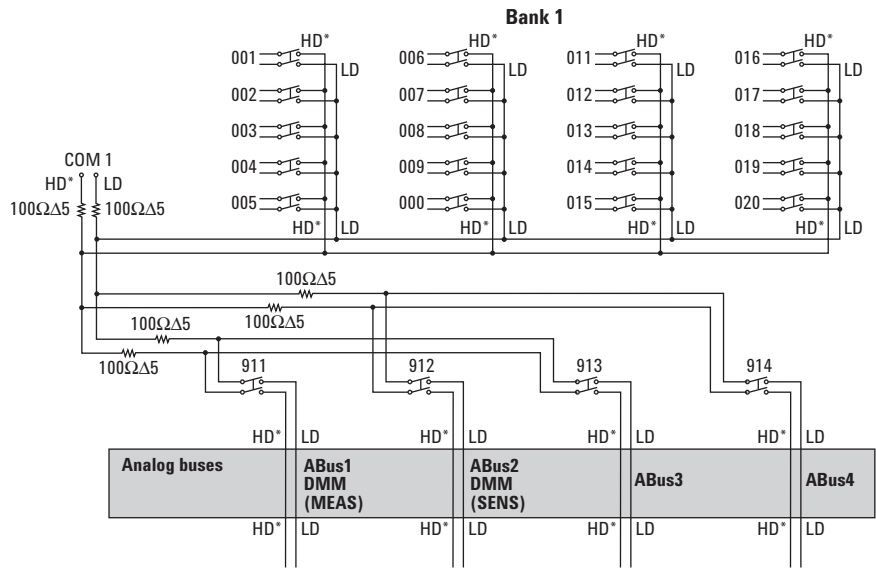
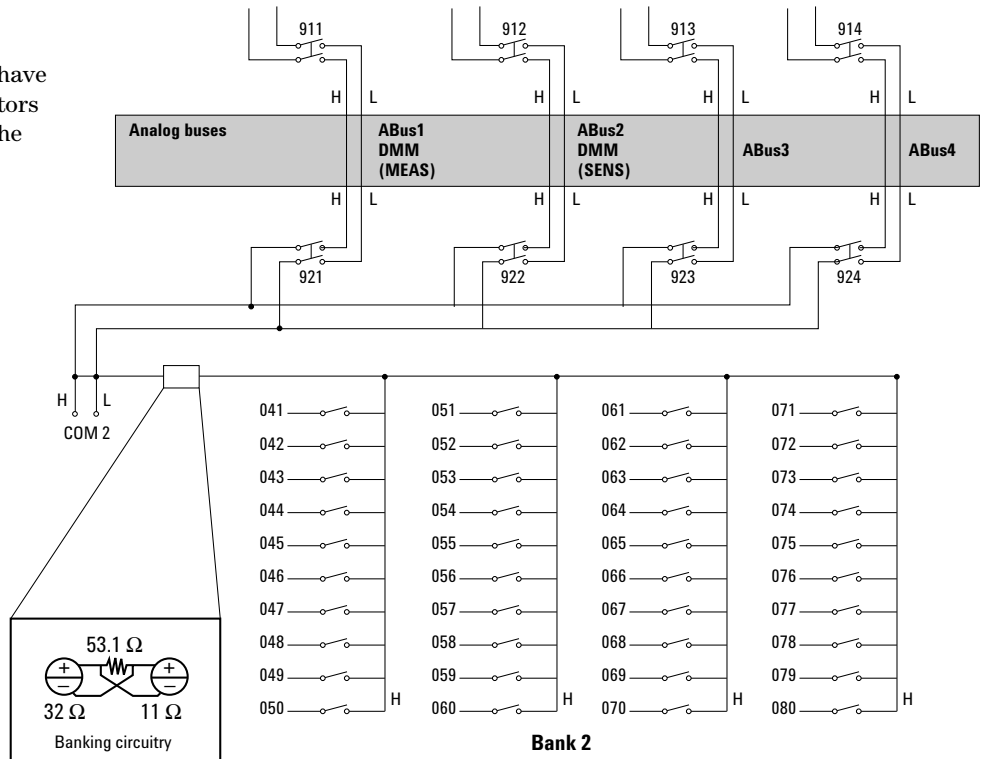


Figure 4. 34925A 40/80-channel optically isolated FET mux (shown in 1-wire mode bank 2)



Note: The 34923A and 34924A have 100 ohm input protection resistors that limit current and protect the reed relays.

Table 3. Multiplexer selection table—specifications and characteristics

	34921A	34922A	34923A	34924A	34925A
Channels/configurations	40 2-wire 20 4-wire 4-current 1.5 A Fused	70 2-wire 35 4-wire	80 1-wire 40 2-wire 20 4-wire	70 2-wire 35 4-wire	80 1-wire 40 2-wire 20 4-wire
Switch type	Armature latching	Armature latching	Reed	Reed	Optically isolated FET
Input characteristics (per channel)					
Max volts	± 300 V ^[1]	± 300 V ^[1]	± 150 V peak ^[2]	± 150 V peak ^[2]	± 80 V peak ^[2]
Max current (DC, AC RMS)					
Switch current	1 A	1 A	0.5 A ^[5] / 0.05 A ^[11]	0.5 A ^[5] / 0.05 A ^[11]	0.02 A ^[8]
Carry current	2 A	2 A	1.5 A ^[5] / 0.05 A ^[11]	1.5 A ^[5] / 0.05 A ^[11]	
Power (W, VA) ^[6]	60 W	60 W	10 W	10 W	1.6 W
Volt-Hertz limit	10 ⁸	10 ⁸	10 ⁸	10 ⁸	10 ⁷
General specifications					
Offset voltage ^[3]	< 3 uV	< 3 uV	< 50 uV < 100 uV 1-wire	< 50 uV	< 3 uV
Initial closed channel res ^[3]	< 1.5 Ω	< 1.5 Ω	< 1.5 Ω ^[5] /200 Ω ^[11]	< 1.5 Ω ^[5] /200 Ω ^[11]	< 700 Ω
DC Isolation (ch-ch, ch-earth)	>10 GΩ	>10 GΩ	>10 GΩ	>10 GΩ	>10 GΩ
Leakage current ^[3]	N/A	N/A	N/A	N/A	20 nA ^[9]
T/C cold junction accuracy ^[3, 10]	< 1°C	N/A	N/A	N/A	N/A
AC characteristics					
Bandwidth at terminal block ^[4]	45 MHz	25 MHz	45 MHz ^[5] /4 MHz 10 MHz 1-wire	25 MHz ^[5] /4 MHz ^[11]	1 MHz
Crosstalk at terminal block (ch-ch) ^[4]					
300 kHz	-75 dB	-75 dB	-75 dB	-75 dB	N/A
1 MHz	-75 dB	-75 dB	-75 dB	-70 dB	
20 MHz	-50 dB	-50 dB	-50 dB	-45 dB	
45 MHz	-40 dB		-40 dB		
Capacitance at terminal block					
HI-LO	150 pF	250 pF	130 pF	200 pF	100 pF
LO – earth	150 pF	200 pF	120 pF	170 pF	300 pF (600 pF 1-wire)
General characteristics					
Relay life, typical					
No load	100 M	100 M	1000 M	1000 M	unlimited
10 V, 100 ma	10 M	10 M	10 M	10 M	unlimited
Rated load	100 k	100 k	10 k	10 k	unlimited
Scanning speeds ^[7]	100 ch/sec	100 ch/sec	500 ch/sec	500 ch/sec	1000 ch/sec
Open/ close time, typical	4 ms/4 ms	4 ms/4 ms	0.5 ms/0.5 ms	0.5 ms/0.5 ms	0.25 ms/0.25 ms
Analog bus backplane connection	Yes	Yes	Yes	Yes	Yes

[1] DC or AC RMS voltage, channel-to-channel or channel-to-earth

[2] Peak voltage, channel-to-channel or channel-to-earth

[3] Into analog bus. System errors are included in the internal DMM measurement accuracy specifications

[4] 50 Ω source, 50 Ω load, differential measurements verified with 4-port network analyzer (Sdd21)

[5] With input resistors bypassed. Bypassing resistors will reduce lifetime of relays. See the rated load relay life characteristics.

[6] Limited to 6 W of channel resistance power loss per module

[7] Speeds are for 4-1/2 digits, delay 0, display off, autozero off, and within bank

[8] DC or peak AC current

[9] Ambient temperature < 30°C

[10] Includes 0.5°C temperature reference sensor and 0.5°C terminal block isothermal gradient error. Measured under worst case loading of the mainframe. See User's Guide for information on supported external reference sensors.

[11] With 100 Ω input protection resistors.

34980A matrix switch modules

The 34980A matrix modules are full cross-point matrices that allow you to connect any row to any column. This is a convenient way to connect multiple test instruments to multiple points on a device under test.

Choose from the following features:

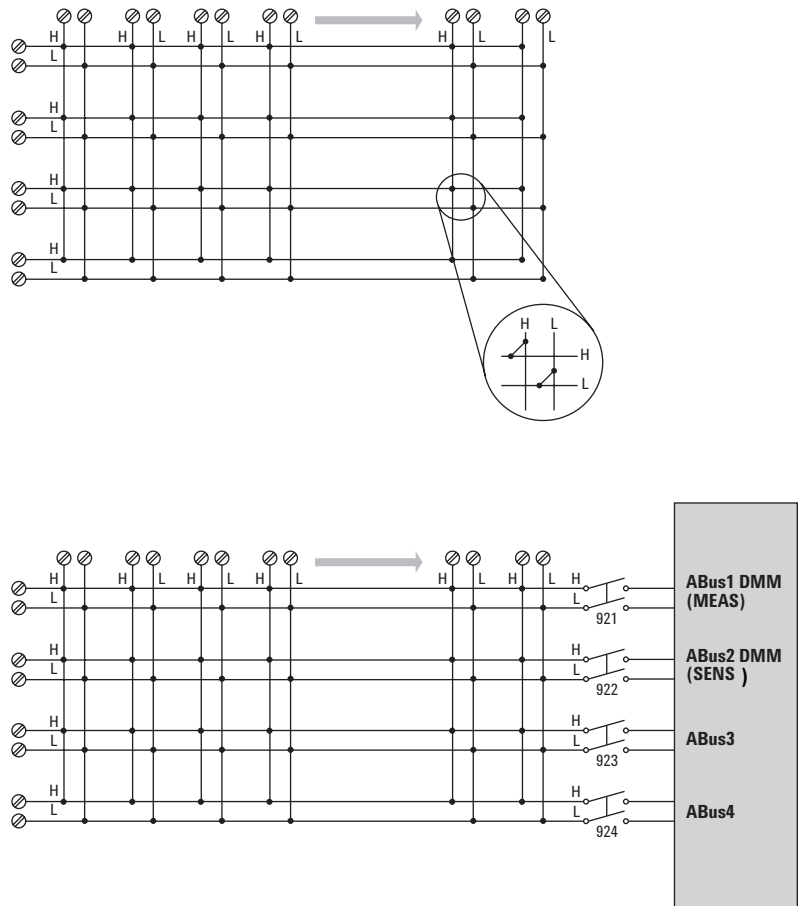
- Latching armature relays—300 V, 1 A
- High-speed reed relays—150 V, 0.5 A
- Configurable dual 4x8 or dual 4x16 modules
- Single-wire configuration (34933A)
- Analog bus expandable rows to create larger matrices
- Connections via standard 50-pin Dsub cables or detachable terminal block

Each cross-point in the matrix switch has two wires—a high and a low for the measurement. Or, if you prefer, the 34933A can be configured as a single-wire matrix, increasing the number of channels. The 34933A also has in-rush resistors on each column for added protection.

Combine multiple matrix modules through the 34980A analog buses to create a larger matrix. Two matrix rows also can be connected to the internal DMM for easy measurements.

Combine your matrix with a multiplexer switch to achieve the desired switching topology and get a lower-cost solution with better specifications. All the matrix switches include a relay counter to help predict when relays need to be replaced. Use the sequencing feature to easily change between different cross-point setups.

Figure 5. 34932A dual 4x16 armature matrix



Note: The 34933A has 100 ohm input protection resistors to limit current and protect the reed relays.

Table 4. Matrix selection table—specifications and characteristics

	34931A	34932A	34933A
Channels/configurations	dual 4x8 8x8 4x16	dual 4x16 8x16 4x32	dual 4x8 8x8 4x16 quad 4x8, 1-wire
Switch type	Armature latching	Armature latching	Reed non-latching
Input characteristics (per channel)			
Max volts	± 300 V ^[1]	± 300 V ^[1]	± 150 V peak ^[2]
Max current (DC, AC RMS)			
Switch current	1 A	1 A	0.5 A ^[5] /0.05 A ^[8]
Carry current	2 A	2 A	1.5 A ^[5] /0.05 A ^[8]
Power (W, VA) ^[2, 6]	60 W	60 W	10 W ^[7]
Volt-Hertz limit	10 ⁸	10 ⁸	10 ⁸
General Specifications			
Offset voltage ^[3]	< 3 μ V	< 3 μ V	< 50 μ V < 100 μ V 1-wire
Initial closed channel res ^[3]	< 1.5 Ω	< 1.5 Ω	< 1.5 Ω ^[5] /200 Ω ^[8]
DC Isolation (ch-ch, ch-earth)	> 10G Ω	> 10G Ω	> 10G Ω
AC characteristics			
Bandwidth at terminal block ^[4]	30 MHz	30 MHz	30 MHz ^[5] /4 MHz ^[8] 2 MHz 1-wire
Crosstalk at terminal block (ch-ch) ^[4]			
300 kHz	-65 dB	-65 dB	-65 dB
1 MHz	-55 dB	-55 dB	-55 dB
20 MHz	-30 dB	-30 dB	-40 dB
Capacitance at terminal block			
HI-LO	50 pF	50 pF	80 pF
LO – earth	80 pF	80 pF	75 pF
General characteristics			
Relay life, typical			
No load	100 M	100 M	1000 M
10 V, 100 ma	10 M	10 M	10 M
Rated load	100 k	100 k	10 k
Open/close time	4 ms/4 ms	4 ms/4 ms	0.5 ms/0.5 ms
Analog bus backplane connection	Bank 2	Bank 2	Bank 2

[1] DC or AC RMS voltage, channel-to-channel or channel-to-earth

[2] Peak voltage, channel-to-channel or channel-to-earth

[3] Into analog bus. System errors are included in the internal DMM measurement accuracy specifications

[4] 50 Ω source, 50 Ω load, differential measurements verified (Sdd21)

[5] With input resistors bypassed. Bypassing resistors will reduce lifetime of relays. See the rated load relay life characteristics.

[6] Limited to 6 W channel resistance power loss per module

[7] Power restrictions allow only 20 channels to be closed at one time

[8] With 100 Ω inport protection resistors.

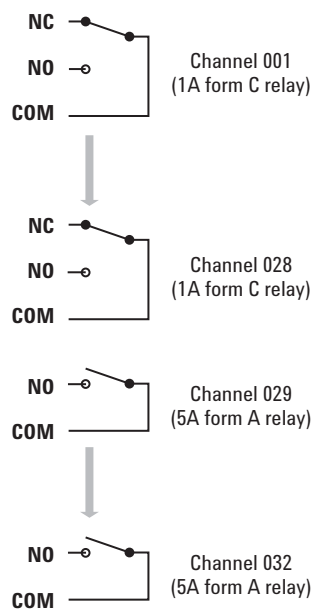
34980A general-purpose switch modules

The 34980A general-purpose switches can be used to route signals or to control other system devices. These switches are ideal for device actuation and switching loads or power supplies.

Choose from the following features:

- Form C channels up to 1 A, 50 W
- Form A channels up to 5 A, 150 W

Figure 6. 34937A 32-channel Form A/ Form C switch



- Armature latching relays
- Simultaneous channel switching
- Temperature sensor to detect overheating conditions
- Connections via standard 50-pin Dsub cables or detachable terminal block

The 34937A is the most versatile general-purpose switch with 28 Form C channels that can switch up to 1 A of current. In addition, this module has four Form A channels that can switch up to 5 A of current. For power

switching applications, the 34938A has 20 5-amp channels in a Form A topology. Each Form A general-purpose switch can handle up to 150 W, enough for many power line-switching applications.

The 34937A and 34938A contain latching armature relays where multiple channels can be closed at the same time. Additionally, for switching reactive loads, the optional terminal blocks have pads for snubbing circuits.

The built-in relay counter helps predict when relays need to be replaced.

Table 5. GP actuator selection table—specifications and characteristics

	34937A	34938A
Channels/configurations	28 Form C 4 Form A	20 Form A
Switch type	Armature, latching	Armature, latching
Input characteristics (per channel)		
Max volts (DC, AC RMS) ^[1]	Form C – 300 V Form A – 30 VDC/250 VAC	30 VDC/250 VAC
Max current (DC, AC RMS)	Form C – 1 A (2 A carry) Form A – 5 A switch (8 A carry)	5 A switch (8 A carry)
Power (W, VA) ^[2]	Form C – 60 W Form A – 150 W	150 W
Volt-Hertz limit	10 ⁸	10 ⁸
General specifications		
Offset voltage	3 μ V	3 μ V
Initial closed channel res	Form C – 125 m Ω Form A – 50 m Ω	< 60 m Ω
DC Isolation (ch-ch, ch-earth)	> 10G Ω	> 10G Ω
AC characteristics		
Bandwidth at terminal block ^[3]	10 MHz	1 MHz
Channel Isolation at terminal block ^[3]		
100 kHz	55 dB	60 dB
1 MHz	35 dB	40 dB
10 MHz	15 dB	
Capacitance at terminal block		
CH – CH	Form C 12 pF/ Form A 10 pF	65 pF
CH – earth	Form C 21 pF/Form A 18 pF	105 pF
General characteristics		
Relay life no load/rated	Form C – 100 M/100 k Form A – 50 M/30 k	50 M/30 k
Open/close time	Form C – 4 ms/4 ms Form A – 10 ms/10 ms	10 ms/10 ms
Initial/reset relay state	Form C – maintain state Form A – user configurable	user configurable
Analog bus backplane connection	No	No

[1] DC or AC RMS voltage, channel-to-channel or channel-to-earth

[2] Limited to 6 W of channel resistance power loss per module

[3] 50 Ω source, 50 Ω load, differential measurements verified (S21)

34980A system specifications and characteristics

DMM accuracy ± (% of reading + % of range)

Includes measurement error, switching error, and transducer conversion error

Function	Range ^[4]	Frequency, etc.	Measurement including switch error ^[1]					
			24 hour ^[2,3] Tcal ± 1°C	90 days Tcal ± 5°C	1 year Tcal ± 5°C	Temperature coefficient >Tcal ± 5°C		
DC voltage (with 34921A/22A/ 31A/32A) ^[10]	100.0000 mV		0.0030 + 0.0035	0.0040 + 0.0040	0.0050 + 0.0040	0.0005 + 0.0005		
	1.000000 V		0.0020 + 0.0006	0.0030 + 0.0007	0.0040 + 0.0007	0.0005 + 0.0001		
	10.00000 V		0.0015 + 0.0004	0.0020 + 0.0005	0.0035 + 0.0005	0.0005 + 0.0001		
	100.0000 V		0.0020 + 0.0006	0.0035 + 0.0006	0.0045 + 0.0006	0.0005 + 0.0001		
	300.0000 V		0.0020 + 0.0020	0.0035 + 0.0030	0.0045 + 0.0030	0.0005 + 0.0003		
True RMS AC voltage ^[5]	100.0000 mV to 100.0000 V	3 Hz-5 Hz	1.00 + 0.03	1.00 + 0.04	1.00 + 0.04	0.100 + 0.004		
		5 Hz-10 Hz	0.35 + 0.03	0.35 + 0.04	0.35 + 0.04	0.035 + 0.004		
		10 Hz-20 kHz	0.04 + 0.03	0.05 + 0.04	0.06 + 0.04	0.005 + 0.004		
		20 kHz-50 kHz	0.10 + 0.05	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005		
		50 kHz-100 kHz	0.55 + 0.08	0.60 + 0.08	0.60 + 0.08	0.060 + 0.008		
		100 kHz-300 kHz ^[6]	4.00 + 0.50	4.00 + 0.50	4.00 + 0.50	0.20 + 0.02		
	300.0000 V	3 Hz-5 Hz	1.00 + 0.05	1.00 + 0.08	1.00 + 0.08	0.100 + 0.008		
		5 Hz-10 Hz	0.35 + 0.05	0.35 + 0.08	0.35 + 0.08	0.035 + 0.008		
		10 Hz-20 kHz	0.04 + 0.05	0.05 + 0.08	0.06 + 0.08	0.005 + 0.008		
		20 kHz-50 kHz	0.10 + 0.10	0.11 + 0.12	0.12 + 0.12	0.011 + 0.012		
		50 kHz-100 kHz	0.55 + 0.20	0.60 + 0.20	0.60 + 0.20	0.060 + 0.020		
		100 kHz-300 kHz ^[6]	4.00 + 1.25	4.00 + 1.25	4.00 + 1.25	0.20 + 0.05		
		Resistance ^[7]	100.0000 Ω	1 mA	0.0030 + 0.0035	0.008 + 0.004	0.010 + 0.004	0.0006 + 0.0005
			1.000000 kΩ	1 mA	0.0020 + 0.0006	0.008 + 0.001	0.010 + 0.001	0.0006 + 0.0001
10.00000 kΩ	100 μA		0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	0.0006 + 0.0001		
100.0000 kΩ	10 μA		0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	0.0006 + 0.0001		
1.000000 MΩ	5.0 μA		0.002 + 0.001	0.008 + 0.001	0.010 + 0.001	0.0010 + 0.0002		
10.00000 MΩ	500 nA		0.015 + 0.001	0.020 + 0.001	0.040 + 0.001	0.0030 + 0.0004		
100.0000 MΩ	500 nA/10 MΩ		0.300 + 0.010	0.800 + 0.010	0.800 + 0.010	0.1500 + 0.0002		
Frequency and period ^[8]	100 mV to 300 V	3 Hz-5 Hz	0.10	0.10	0.10	0.005		
		5 Hz-10 Hz	0.05	0.05	0.05	0.005		
		10 Hz-40 Hz	0.03	0.03	0.03	0.001		
		40 Hz-300 kHz	0.006	0.01	0.01	0.001		
DC current (34921 only)	10.00000 mA	< 0.1 V burden	0.005 + 0.010	0.030 + 0.020	0.050 + 0.020	0.002 + 0.0020		
	100.0000 mA	< 0.6 V	0.010 + 0.004	0.030 + 0.005	0.050 + 0.005	0.002 + 0.0005		
	1.000000 A	< 2 V	0.050 + 0.006	0.080 + 0.010	0.100 + 0.010	0.005 + 0.0010		
True RMS AC current (34921A only)	10.00000 mA and ^[5]	3 Hz-5 Hz	1.00 + 0.04	1.00 + 0.04	1.00 + 0.04	0.100 + 0.006		
		5 Hz-10 Hz	0.30 + 0.04	0.30 + 0.04	0.30 + 0.04	0.035 + 0.006		
		10 Hz-5 kHz	0.10 + 0.04	0.10 + 0.04	0.10 + 0.04	0.015 + 0.006		
	100.0000 mA ^[9]	3 Hz-5 Hz	1.00 + 0.5	1.00 + 0.5	1.00 + 0.5	0.100 + 0.006		
		5 Hz-10 Hz	0.30 + 0.5	0.30 + 0.5	0.30 + 0.5	0.035 + 0.006		
		10 Hz-5 kHz	0.10 + 0.5	0.10 + 0.5	0.10 + 0.5	0.015 + 0.006		

[1] One hour warm-up and a fixed configuration with slow AC filter, sine wave input, and 6 1/2 digits. Temperature within ± 5°C of temperature at calibration (Tcal between 18-28°C).

[2] 90 minute warm-up and a fixed configuration and 6 1/2 digits. Temperature within ± 1°C of temperature at calibration (Tcal between 18-28°C).

[3] Relative to calibration standards

[4] 20% over range on all ranges except 300VDC and AC ranges and 1 ADC and AC current ranges

[5] For single wave input > 5% of range. For inputs from 1% to 5% of range and < 50 kHz add 0.1% of range additional error. For AC filter slow.

[6] Typically 30% of reading error at 1 MHz, limited to 1 × 10⁸ volt-hertz

[7] For 4-wire ohms or 2-wire ohms using scaling to remove offset. Add 4 ohms additional error to 2-wire ohms function without scaling. 34923/24/25/33 have series resistance that may limit low 2-wire ohm measurements.

[8] Input > 100 mV. For 10 mV inputs multiply % of reading error x 10. For 1 sec aperture (6 1/2 digits).

[9] Specified only for inputs > 10 mA. For AC filter slow.

[10] Add 50 uV error for 34923/24/33.

Additional Low Frequency Error for ACV, ACI (% of reading)

Frequency	AC Filter Slow	AC Filter Medium	AC Filter Fast
10 Hz- 20 Hz	0	0.74	–
20 Hz - 40 Hz	0	0.22	–
40 Hz - 100 Hz	0	0.06	0.73
100 Hz - 200 Hz	0	0.01	0.22
200 Hz - 1 kHz	0	0	0.18
> 1 kHz	0	0	0

Additional Error for Frequency, Period (% of reading)

Frequency	Aperature (Digits)		
	1 second (6½ digits)	0.1 seconds (5½ digits)	0.01 seconds (4½ digits)
3 Hz- 5 Hz	0	0.12	0.12
5 Hz - 10 Hz	0	0.17	0.17
10 Hz - 40 Hz	0	0.2	0.2
40 Hz - 100 Hz	0	0.06	0.21
100 Hz - 300 Hz	0	0.03	0.21
300 Hz - 1 kHz	0	0.01	0.07
> 1 kHz	0	0	0.02

Temperature measurement accuracy ± (% of reading + % of range)

Temperature 1-year accuracy	Type	Best range ^[1]	Extended range ^[1]	Temp Coefficient		
Thermocouple (34921A only, includes cold junction accuracy on terminal block)	B	1100°C to 1820°C	1.2°C	400°C to 1100°C	1.8°C	0.03°C
	E	-150°C to 1000°C	1.0°C	-200°C to -150°C	1.5°C	0.03°C
	J	-150°C to 1200°C	1.0°C	-210°C to -150°C	1.2°C	0.03°C
	K	-100°C to 1200°C	1.0°C	-200°C to -100°C	1.5°C	0.03°C
	N	-100°C to 1300°C	1.0°C	-200°C to -100°C	1.5°C	0.03°C
	R	300°C to 1760°C	1.2°C	-50°C to 300°C	1.8°C	0.03°C
	S	400°C to 1760°C	1.2°C	-50°C to 400°C	1.8°C	0.03°C
	T	-100°C to 400°C	1.0°C	-200°C to -100°C	1.5°C	0.03°C
RTD	R ₀ from 49 Ω to 2.1 K Ω	-200°C to 600°C	0.06°C			0.003°C
Thermistor	2.2 k, 5 k, 10 k	-80°C to 150°C	0.08°C			0.002°C

[1] For total measurement accuracy, add temperature probe error

Typical system speeds (Measurements made on a 3.2GHz PC running VB6 in Windows XP Pro)

Single Channel Reading times in msec	Direct measurements – direct to I/O (includes switch, measure time and I/O time)			Direct Measurement to Memory(GPIB)
	GPIB msec	USB 2.0 msec	LAN (w/ VXI 11) msec	Measurement into memory msec
Single channel [1] [2]				
Single channel, DCV	2.83	3.14	4.57	1.9
Single channel, ACV	5.00	5.35	5.75	4
Single channel, ohms	2.91	3.14	4.65	1.9
Single channel while changing scale (eg MEAS DCV 10 / MEAS DCV 1)	9.52	10.64	11.76	8.4
Single channel while changing function (eg. MEAS ACV / MEAS DCV)	128	120	120	120
Command execution time [3]				
34925A	Open or Close	0.7	0.9	1.6
	Read?	2.9	3.3	4.7
	Close/Read/Open	4.8	5.3	6.5
	Init/*WAI	1.9	2.1	3
	Close/Init/Open	3.7	4.1	4.7
34923A	Open or Close	0.9	1.2	1.8
	Read?	2.9	3.3	4.7
	Close/Read/Open	5.3	5.8	6.5
	Init/*WAI	1.9	2.1	3
	Close/Init/Open	4.2	4.7	5.2
34921A	Open or Close	4.7	5	5.3
	Read?	2.9	3.3	4.7
	Close/Read/Open	14	15	15
	Init/*WAI	1.9	2.1	3
	Close/Init/Open	12.4	14	14

[1] Readings were made with minimum NPLC, delay 0, display off, autozero off.

[2] All times include the issue of "READ?" and the retrieval of data.

[3] CLOSE or OPEN bus transfer times allowed to overlap previous command. Command parse times overlap current activity until IO latency dominant.

Single channel measurement rates—DMM reading rates [1] [2]

Function	Resolution	Rds/s
DCV	4-1/2 digits (0.02 plc)	3000
	5-1/2 digits (1 plc)	59
	6-1/2 digits (10 plc)	6
2-wire resistance	4-1/2 digits (0.02 plc)	2000
	5-1/2 digits (1 plc)	58
	6-1/2 digits (10 plc)	6
Thermocouple	(0.02 plc)	2000
	0.1°C (1 plc)	59
RTD/Thermistor	1°C (0.02 plc)	1900
	0.1°C (1 plc)	58
	0.01°C (10 plc)	6
ACV	6-1/2 fast (200 Hz)	350
	6-1/2 Med (20 Hz)	350
	6-1/2 slow (3 Hz)	300
Frequency, period	4-1/2 digits (10 ms)	70
	5-1/2 digits (100 ms)	9
	6-1/2 digits (1 s gate)	1

[1] Reading speeds for 60Hz; autozero OFF

[2] For fixed function and range, readings to memory, scaling and alarms off, autozero OFF

Scanning measurement rates to bus or memory

Scanning channels [1]	Direct measurements – direct to I/O (includes switch, measure time and I/O time)			Measurement into memory
	GPIB ch/sec	USB 2.0 ch/sec	LAN (w/ VXI 11) ch/sec	Into memory ch/sec
Scanning DCV or Ohms				
34925A	920	860	980	1000
34923A/24A	588	572	605	625
34921A/22A	109	109	109	109
Scanning ACV [2]				
34925A	318	315	323	318
34923A/24A	260	260	260	260
34921A/22A	88	88	88	88
Scanning temperature				
34921A	109	109	109	109
Scanning digital in				
34950A	660	592	815	1038

[1] Speeds are for 4 ½ digits, delay 0, display off, autozero off.
Scanning is within bank on the same module. Add 10ms for between banks or modules.

[2] Add additional time for filter setting on ACV.

Data out of memory to LAN, USB, or GPIB (data transfer rate with 1000 channel blocks)

	GPIB rds/sec	USB 2.0 rds/sec	LAN (w/ VXI 11) [1] rds/sec
Readings	2560	2400	3542
readings with timestamp	1304	1230	1826
readings with all format options ON	980	926	1361

[1] LAN large block throughput rate is increased by approximately 30% using LAN sockets

Ordering instructions

Mainframe – holds up to 8 plug-in modules			
34980A	Multifunction switch/measure mainframe	Comes standard with “DMM” option	
	Description	Module connectors	Optional terminal blocks, cables, connector kits
Multiplexer modules			
34921A	40-channel armature multiplexer w/low thermal offset (order 34921T for temp reference)	2 – 50-pin Dsub, Male	3492xT Terminal block with screw connectors
34923A	40/80-channel reed multiplexer		Y1135A – 1.5 m 50-pin M/F Dsub cable
34925A	40/80-channel optically isolated FET multiplexer		Y1136A – 3 m 50-pin M/F Dsub cable Y1139A – 50-pin female solder cup connector kit
34922A	70-channel armature multiplexer	2 – 78-pin Dsub, Male	3492xT Terminal block with solder connections
34924A	70-channel reed multiplexer		Y1137A – 1.5 m 78-pin M/F Dsub cable Y1138A – 3 m 78-pin M/F Dsub cable Y1140A – 78-pin female solder cup connector kit
Matrix modules			
34931A	Dual 4x8 armature matrix	2 – 50-pin Dsub, Male	3493xT Terminal block with screw connectors
34932A	Dual 4x16 armature matrix		Y1135A – 1.5 m 50-pin M/F Dsub cable
34933A	Dual/quad 4x8 reed matrix		Y1136A – 3 m 50-pin M/F Dsub cable Y1139A – 50-pin female solder cup connector kit
General purpose/actuator modules			
34937A	32-channel Form C/Form A general-purpose switch	2 – 50-pin Dsub, Male	3493xT Terminal block with screw connectors
34938A	20-channel 5-amp Form A switch		Y1135A – 1.5 m 50-pin M/F Dsub cable Y1136A – 3 m 50-pin M/F Dsub cable Y1139A – 50-pin female solder cup connector kit
RF and microwave modules			
34941A	Quad 1x4 50-ohm 3-GHz RF multiplexer	10 – SMA	Requires standard 50 ohm SMA RF cables, adapters
34942A	Quad 1x4 75-ohm 1.5 GHz RF multiplexer	10 – Mini SMB	Requires mini 75 ohm SMB RF cables, adapters
34945A	Microwave switch/attenuator driver	N/A	Requires 34945EXT and optional Y1150A-Y1155A distribution boards
34946A	Dual 1x2 SPDT terminated microwave switch Option 004: 4 GHz switches installed Option 020: 20 GHz switches installed	SMA	Requires standard 50 ohm SMA cables and adapters
34947A	Triple 1x2 SPDT unterminated microwave switch Option 004: 4 GHz switches installed Option 020: 20 GHz switches installed	SMA	Requires standard 50 ohm SMA cables and adapters
System measurement & control modules			
34950A	64-bit digital I/O with memory and counter	2 – 78-pin Dsub, Female	3495xT Terminal block with screw connectors Y1137A – 1.5 m 78-pin M/F Dsub cable Y1138A – 3 m 78-pin M/F Dsub cable Y1142A – 78-pin male solder cup connector kit
34951A	4-channel isolated D/A converter with waveform memory (DMM option required for calibration)	1 – 50-pin Dsub, Female	3495xT Terminal block with screw connectors
34952A	Multifunction module with 32-bit DIO, 2-ch D/A and totalizer		Y1135A – 1.5 m 50-pin M/F Dsub cable Y1136A – 3 m 50-pin M/F Dsub cable Y1141A – 50-pin male solder cup connector kit
34959A	Breadboard module	26- & 40-pin internal ribbon cable connectors	Any terminal block can be used assuming 50- or 78-pin Dsub is used