KEYSIGHT 34952A Multifunction Module User Guide

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Notices

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Safety Information

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.
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WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Safety Symbols

The following symbols or markings that may be on or with the instrument and in the documentation indicate precautions which must be taken to maintain safe operation of the instrument.

~	Alternating current (AC)	⏚	Frame or chassis (ground) terminal
⏻	Standby supply. Unit is not completely disconnected from ac mains when switch is off	⚡	Caution, risk of electric shock
⚠	Caution, risk of danger (refer to this manual for specific Warning or Caution information)	⎓	Direct current (DC)
○	Off (mains supply)	|	On (mains supply)
3 ~	Three phase alternating current	✸	Presence of a laser device
⏚	Protective earth (ground) terminal	⧈	Equipment protected throughout by double insulation or reinforced insulation
♨	Caution, hot surface	⚠	Product is sensitive to electrostatic discharge

Additional Safety Notices

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or instructions elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability of the customer's failure to comply with the requirements.
Refer to the 34980A User's Guide before using the equipment. The 34980A User's Guide contains additional important information about the modules.

WARNING GENERAL

If this product is not used as specified in the operating instructions, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only. Any external connections must be made prior to applying power.

WARNING DO NOT REMOVE THE INSTRUMENT COVER

No operator serviceable parts inside. Do not install substitute parts or perform any unauthorized modifications to the instrument. Return the instrument to Keysight for service and repair to ensure the safety features are maintained in operational condition. Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired.

GROUND THE INSTRUMENT

This is a Safety Protection Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited. The mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Inadequate earth grounding can damage the instrument. Always use the three-prong AC power cord supplied with the instrument.

Connect the AC power cord as follow:

– Ensure that the power cord is not damaged.

- Install the signal generator so that one of the following items is readily identifiable and easily reached by the operator: AC power cord, alternative switch or circuit

Insert the mains plug into a socket outlet provided with a protective earth groundinWARNING IN CASE OF DAMAGE

Do not use the instrument if it is damaged. Before you use the instrument inspect all connections. Pay particular attention to the insulation surrounding connectors and / or cable assembly insulation. NEVER use a cable showing any signs of damage. Faulty cables can cause electrical shock and /or fire hazards and could lead to personal injury or death.
Refer to the User Guides of the 34980A and relevant modules before using the equipment.

The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device). The instrument power cord does not disconnect or de-energize external circuits connected to the analog bus, terminal blocks or modul
Safety of any system incorporating the equipment is the responsibility of the assembler of the system.
Keysight Customers utilizing the Open Platform Test Systems are classified as follows and require the user to have the appropriate skillset:

Operator: Interacts with the test system in a production environment, selection of test sequences, defining

variables, running tests (test results, test statistics, control of marking devices)

Supervisor: Includes access to maintenance functions and utility sequences (control of hardline system functions, access to test area

Developer: Full ac

Dangerous voltage levels capable of causing death, may be present on a channel. Use extreme caution when handling and testing and adjusting this instrument. Any voltages greater than 30 Vrms, 42.4 Vpeak and 60 Vdc are considered hazardous (IEC 61010-1).

Removal of the instrument's cover is to be conducted by qualified personnel only. Only qualified, trained personnel who are aware of the hazards involved should remove instrument covers. Prevent operators from accessing any external circuits, test fixtures, cables or wherever hazardous voltages may be present. Failure to recognize and observe normal safety precautions could result in personal injury or death.

ENVIRONMENTAL HEALTH & SAFETY: When any channel is connected to a hazardous voltage source, the instrument and the device under test should be supervised, following local EHS practices to restrict access.

Environmental Conditions

Keysight 34980A is designed for indoor use in an installation category II and low condensation environment. Table below shows the general environmental conditions for this instrument. Refer to the product data sheet at **https://literature.cdn.keysight.com/litweb/pdf/5989-1437EN.pdf** for more information on the instrument general specifications.

Temperature	Operating condition: 0°C to 55°C Storage condition: -40°C to 70°C
Humidity	Maximum Relative Humidity (non-condensing): 80% RH up to 40°C, decreases linearly to 37% RH at 55°C[a]
Altitude	Up to 2,000 m
Pollution degree	1 or 2

[a] From 40°C to 55°C, the maximum % Relative Humidity follows the line of constant dew point.

Regulatory Markings

CE	The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives.	C SA US	The CSA mark is a registered trademark of the Canadian Standards Association.
UK CA	The UK conformity mark is a UK government owned mark. Products showing this mark comply with all applicable UK regulations.	ccr.keysight@keysight.com	The Keysight email address is required by EU directives applicable to our product.
CAN ICES/NMB-001(A)	This indicates that this ISM device complies with the Canadian ICES-001. Interference-Causing Equipment Standard for industrial, scientific and medical (ISM) equipment. Matériel industriel, scientifique et médical (ISM)	ISM 1-A	This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPR 11, Clause 5)
CE CAN ICES/NMB-001(A) ISM GRP 1-A	The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives. ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada. ISM GRP.1 Class A indicates that this is an Industrial Scientific and Medical Group 1 Class A product.	CAN ICES/NMB-001(A) ISM GRP 1-A	This is a combined marking to indicate product compliance with the Industry Canadian Interference-Causing Equipment Standard (ICES/NMB-001). This is also a symbol of an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 5).
KC	This symbol is a South Korean Class A EMC Declaration. This is a Class A instrument suitable for professional use and in electromagnetic environment outside of the home.		The RCM mark is a registered trademark of the Australian Communications and Media Authority.

40	This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.		This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.
	Universal recycling symbol.	IP x y	This mark indicates product has been designed to meet the requirements of "IP x y", where "x" is the solid particle protection and "y" is the liquid ingress protection.

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC
The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation.
Please refer to **keysight.com/go/takeback** to understand your Trade in options with Keysight in addition to product takeback instructions.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- keysight.com/find/34980a

(product-specific information and support, software and documentation updates)

- keysight.com/find/assist

(worldwide contact information for repair and service)

34952A Multifunction Module

The 34952A Multifunction Module with DIO, D/A, and Totalizer combines four 8-bit ports of digital input/output, a 100 kHz totalizer, and two ±12 voltearth-referenced analog outputs. You can include digital inputs and totalizer input in a scan list. You can make connections via standard 50-pin D-sub cables or the optional 34952T terminal block.

Digital Input/Output

The Digital Input/Output (DIO) consists of four 8-bit ports with TTL-compatible inputs and output. The open-drain outputs can sink up to 400 mA. From the front panel, you can read data from only one 8-bit input port at a time. You can configure the DIO ports for 8, 16, or 32-bit operations. The DIO channels are connected by internal 5 V pull-up resistors when configured as inputs.

Totalizer Input

The 32-bit totalizer can count pulses at a 100 kHz rate. You can configure the totalizer to count on the rising edge or falling edge of the input signal. A TTL high signal applied to the Gate terminal enables counting and a low signal disables counting. A TTL low signal applied to the Not-Gate terminal enables counting and a high signal disables counting. The totalizer counts only when both terminals are enabled.
When a gate is not connected, the gate terminal is pulled to the enabled state, effectively creating a “gate always” condition.

Analog Output (DAC)

The two analog outputs are capable of outputting voltages between ±12 volts with 16 bits of resolution. Each DAC channel is capable of 10 mA maximum current. Use the two analog outputs to source bias voltages to your DUT, to control your analog programmable power supplies, or as set points for your control systems. The outputs are programmed directly in volts.

34952A SCPI Programming Examples

The programming examples below provide you with SCPI command examples to use for actions specific to the general purpose switch modules.
The slot and channel addressing scheme used in these examples follow the form sccc where s is the mainframe slot number (1 through 8) and ccc is the channel number. For information on specific configurations, refer to the

simplified schematic on **page 18**For complete information on the SCPI commands used to program the 34980A, refer to the *Keysight 34980A Programmer's Reference* which can be downloaded from **www.keysight.com/find/34980A**.

Digital Input/Output

Example: Configuring a DIO channel The following program segment configures channel 1 on the DAC module in slot 3 as an output and then reads the output value (the channel is not reconfigured as an input). Then, the channel is reconfigured as an input and the value is read again.
The second command below returns 64 as it is physically reading the output data.
SOURce:DIGital:DATA:BYTE 64,(@3001) SENSe:DIGital:DATA:BIT? 0,(@3001)
The second command below returns whatever is being input externally.
CONFigure:DIGital:STATe INPut,(@3001) SENSe:DIGital:DATA:BIT? 0,(@3001)

Totalizer

Example: Reading totalizer channel count The following command reads the count on totalizer channel 5 on the Multifunction module in slot 3.
SENSe:TOTalize:DATA? (@3005)
Example: Configuring the totalizer reset mode To configure the totalizer reset mode, send either of the following commands.
The following command configures totalizer channel 5 on the Multifunction module in slot 3 to be read without resetting its count.

SENSe:TOTalize:TYPE READ,(@3005)

The following command configures totalizer channel 5 on the Multifunction module in slot 2 to be reset to "0" after it is read (RRESet means "read and reset").

CONFigure:TOTalize RRES,(@2005)

Example: Configuring the totalizer for count This command configures the totalizer to count on the rising edge (positive) or falling edge (negative) of the input signal. The following command configures the totalizer (channel 5) on a Multifunction module in slot 3 to count on the negative edge (falling) of the input signal.

TOTalize:SLOPe NEGative,(@3005)

Example: Clearing count on the totalizer channel This command immediately clears the count on the specified totalizer channels. The following command clears the count on the totalizer (channel 5) on a Multifunction module in slot 3.

TOTalize:CLEAR:IMMediate (@3005)

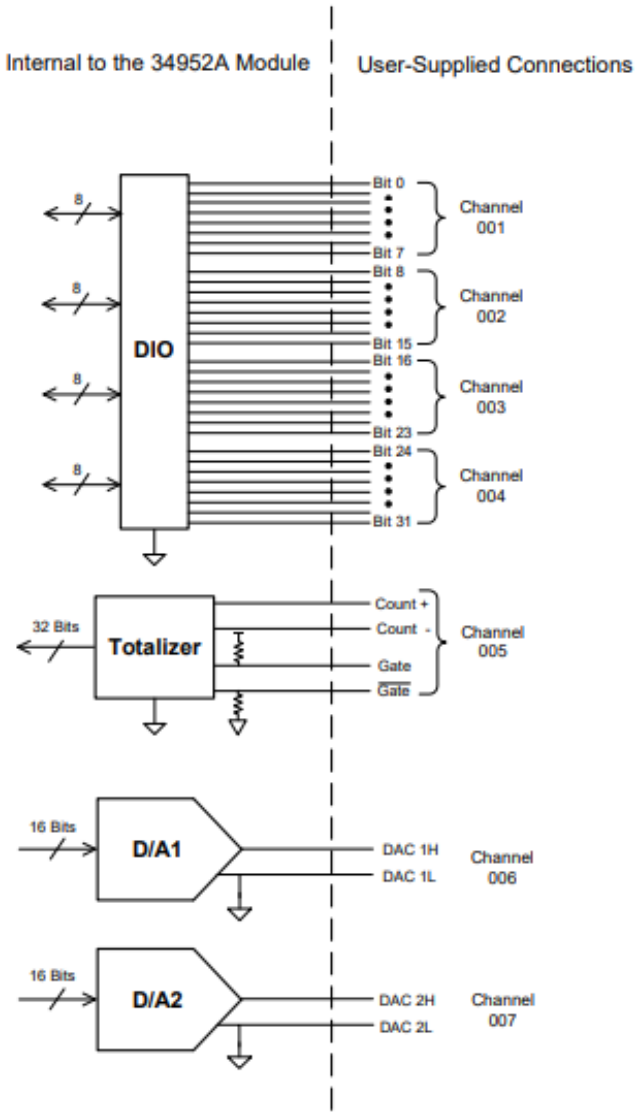
DAC Output

Example: Setting output voltage This command sets the output voltage level for the specified DAC channels. The following command outputs +2.5 V DC on DAC channels (6 and 7) of a Multifunction module in slot 4.

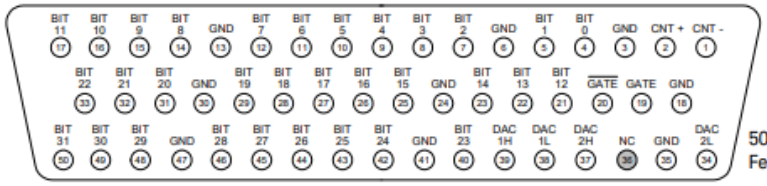
SOURce:VOLTage 2.5,(@4006,4007)

Configuring a Multifunction Module

Example: Querying the system for module identify The following command returns the identify of the module installed in slot 7.
SYSTem:CTYPe? 7
Example: Resetting module(s) to power-on state The following command resets a module in slot 4 to its power-on state.
SYSTem:CPON 4 34952A Simplified Block Diagram



34952A D-Sub Connector

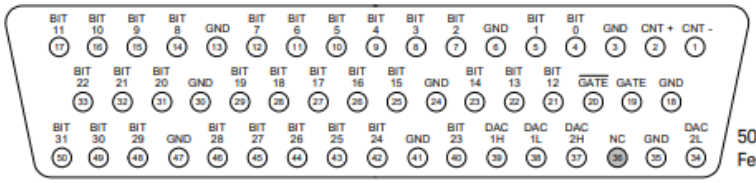


50-Pin D-Sub
Female Connector

Description		Socket	Description		Socket	Description		Socket	Description	Socket
Channel 1	Bit 0	4	Channel 3	Bit 16	26	Channel 5 Totalizer	Count -	1	GND	47
	Bit 1	5		Bit 17	27		Count +	2	No Connect	36
	Bit 2	7		Bit 18	28		Gate	19		
	Bit 3	8		Bit 19	29		Not-Gate	20		
	Bit 4	9		Bit 20	31	Channel 6	DAC 1L	38		
	Bit 5	10		Bit 21	32		DAC 1H	39		
	Bit 6	11		Bit 22	33	Channel 7	DAC 2L	34		
	Bit 7	12		Bit 23	40		DAC 2H	37		
Channel 2	Bit 8	14	Channel 4	Bit 24	42		GND	3		
	Bit 9	15		Bit 25	43		GND	6		
	Bit 10	16		Bit 26	44		GND	13		
	Bit 11	17		Bit 27	45		GND	18		
	Bit 12	21		Bit 28	46		GND	24		
	Bit 13	22		Bit 29	48		GND	30		
	Bit 14	23		Bit 30	49		GND	35		
	Bit 15	25		Bit 31	50		GND	41		

34952T Terminal Block

Each terminal block is labeled with the model number and the abbreviated module name. In addition, space is available on the label for you to write the slot number.
The 34952T provides space for breadboard and for a connector to control an external Opto-22 standard board



50-Pin D-Sub
Female Connector

Description		Socket	Description		Socket	Description		Socket	Description	Socket
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	Bit 3	8		Bit 19	29		Not-Gate	20		
	Bit 4	9		Bit 20	31	Channel 6	DAC 1L	38		
	Bit 5	10		Bit 21	32		DAC 1H	39		
	Bit 6	11		Bit 22	33	Channel 7	DAC 2L	34		
	Bit 7	12		Bit 23	40		DAC 2H	37		
Channel 2	Bit 8	14	Channel 4	Bit 24	42		GND	3		
	Bit 9	15		Bit 25	43		GND	6		
	Bit 10	16		Bit 26	44		GND	13		
	Bit 11	17		Bit 27	45		GND	18		
	Bit 12	21		Bit 28	46		GND	24		
	Bit 13	22		Bit 29	48		GND	30		
	Bit 14	23		Bit 30	49		GND	35		
	Bit 15	25		Bit 31	50		GND	41		

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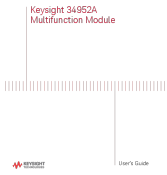	**KEYSIGHT 34952A Multifunction Module** [pdf] User Guide 34952A, 34952A Multifunction Module, Multifunction Module