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Keysight 34937A–34939A General Purpose Switch Modules

KEYSIGHT TECHNOLOGIES

User's Guide

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.

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 on 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)		

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.

General

Do not use this products in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Before Applying Power

Verify that all safety precautions are taken. Make all connections to the unit before applying power.

Ground the Instrument

This product is provided with protective earth terminals. To minimize shock hazard, the instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Only qualified, service-trained personal who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Keysight Sales and Service Office for service and repair to ensure that safety features are maintained.

In Case of Damage

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

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.

Product category:

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is as shown below.



Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit http://about.keysight.com/en/companyinfo/environment/takeback.shtml for more information.

Sales and Technical Support

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

- www.keysight.com/find/xxxxx
  (product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
  (worldwide contact information for repair and service)

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General Purpose Switch Modules

This User's Guide covers the following two plug-in modules for the Keysight 34980A Multifunction Switch/Measure Unit:

34937A	28-channel Form C and 4-channel Form A
34938A	28-channel 5-amp Form A
34939A	64-Channel High-Density Form A

- The 34937A provides independent control of 32 relays, including:
  - Twenty-eight Form C relays, each rated for 1 A at 60 W per channel
  - Four Form A (SPST) relays, each rated for 5 A at 150 W per channel.
- The 34938A, for power switching applications, offers 20 Form A relays, each rated for 5 A at 150 W per channel.
- The 34939A provides independent control of 64 Form-A relays, each rated for 1 A at 60 W per channel.

All three modules utilize armature-latching relays.

You can use these general-purpose switches in your 34980A mainframe for device actuation, digital output, signal routing, or – combined with other switch modules – to create flexible switching topologies. You can close multiple channels at the same time. These modules do not connect to the 34980A's analog buses.

Operating Considerations.

WARNING **Do not connect either the 34937A, 34938A or 34939A module directly to a mains power outlet. If it is necessary to switch a mains voltage or any circuit where a large inductive load may be switched, you must add signal conditioning elements to reduce the potential transients before they reach the module or the Analog Buses.**

Electrical Considerations

See the *Introduction to the Plug In Modules* chapter of the 34980A Mainframe User's Guide for detailed environmental operating conditions for the 34980A mainframe and its installed modules. That guidance sets maximum per channel current and power ratings at rated voltage for pollution degree 1 (dry) and pollution degree 2 (possible condensation) conditions, for each of the GP modules.

Temperature Sensor

A temperature sensor on these modules triggers system interrupts when high-carry current-induced heat on the modules is excessive and sets the HOT annunciator on the front panel. This over-temperature situation generates an SRQ event when the factory-set 70 ^{o}C threshold is reached. It is up to the user to determine what, if any, action should be taken.

Switching Reactive Loads

Reactive loads (those that include significant inductance or capacitance) can cause voltage spikes or current spikes during switching operations. The general purpose modules *are* designed for switching reactive loads. The optional 34937T and 34938T terminal blocks have solder pads for adding snubber circuits for the 5 A relays to reduce the reactive transients. See the drawings on page 17 and page 20 for the locations of snubber circuit pads and installation information about a snubber circuit.

Hardware Power-Fail Jumper

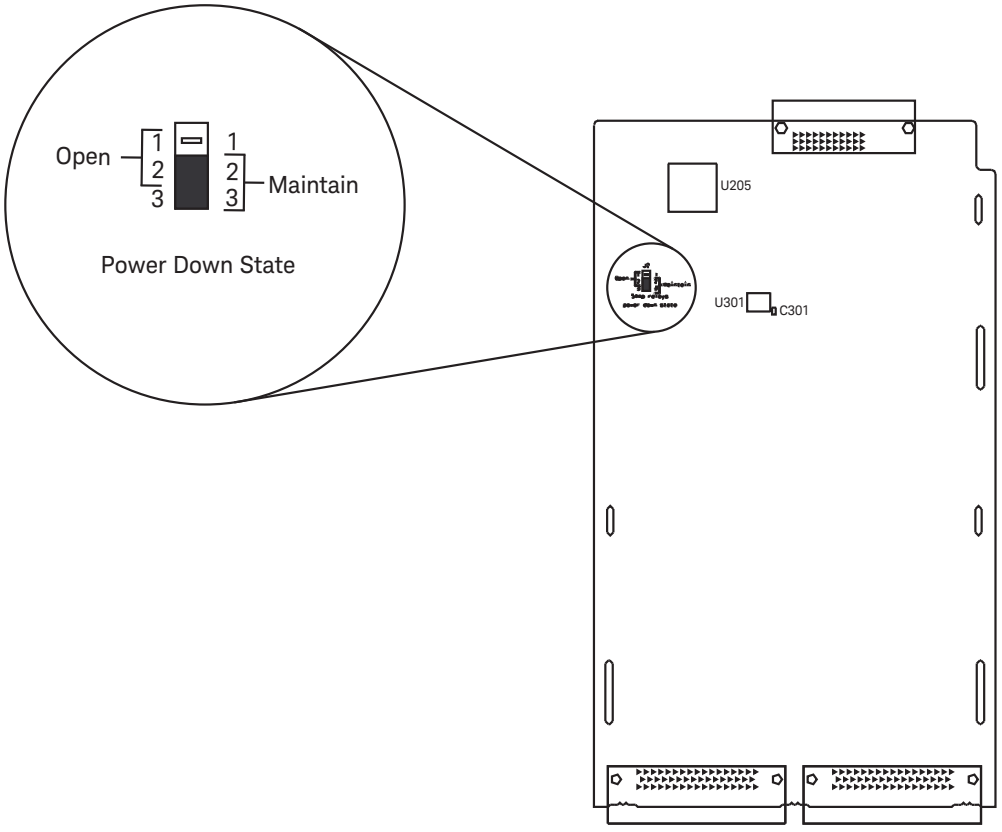
A hardware jumper on the 34937A and 34938A modules allows you to define the power-failure states for the modules' 5 A latching relays. Depending on the position of the jumper, the 5 A relays will either open or maintain state when system power failure occurs.

On the 34939A module, a hardware jumper allows you to define the power-failure state affecting *all 64* of the module's 1 A latching relays. Depending on the position of the jumper, these relays will either open or maintain state when system power failure occurs.

The jumpers are positionable across pins 1–2 ("Open" position) or across pins 2–3 ("Maintain" position). When shipped from the factory, the power-fail jumper is in the Maintain position (i.e. all relays maintain their present state when power fails).

WARNING **Before changing the position of the jumper, remove external connections from the module. Wait five to ten seconds to allow the module's internal capacitors to discharge.**

After a five- to ten-second delay, remove the sheet metal cover from the module and move the position of the jumper mounted on the module. See the figure below for the jumper's location on the module.



34937A, 34938A and 34939A 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 complete information on the SCPI commands used to program the 34980A, and for example programs, refer to the Keysight 34980A Programmer's Reference which can be downloaded from www.keysight.com/find/34980A.

Opening and Closing Channels

Example: Closing and opening channels The first two commands close channel 3 for a module in slot 2, then channel 5 for that module. The last command opens both channel 3 and channel 5.

```
ROUTe:CLOSe (@2003)
ROUTe:CLOSe (@2005)
ROUTe:OPEN (@2003,2005)
```

Example: Querying channels for open or closed state The following command returns a 1 (true) or 0 (false) state of channel 016 for a module in slot 3.

```
ROUTe:CLOSe (@3016)
ROUTe:CLOSe? (@3016) !Returns a 1
ROUTe:OPEN? (@3016) !Returns a 0
```

Reading Jumper State and System Identity

Example: Querying the power-failure state of 5 A relays The following command returns the position of the power-fail jumper, either "MAIN" (all relays maintain their present state when power fails) or "OPEN" (all relays open when power fails) for a module in slot 4. If this command is sent to a module other than the 34937A or 34938A, "NONE" is returned (no error is generated). In particular, the position of the power-fail jumper on the 34939A module *cannot* be queried using this commmand.

```
SYSTem:MODule:PFAil:JUMPer:AMP5? 4
```

Example: Querying the system for module identify (all modules) The following command returns the identify of the module installed in slot 7.

```
SYSTem:CTYPe? 7
```

Reading Cycle Count and Resetting Modules to Power-On State

Example: Reading the cycle count for a relay (all switch modules) The following command returns the relay cycle count on channel 7 and channel 16 for a module in slot 1.

```
DIAGnostic:RELay:CYCLes? (@1007,1016)
```

Example: Clearing the cycle count for a relay (all switch modules) The following command resets the relay cycle count on channels 7 and 16 for a module in slot 1.

```
DIAGnostic:RELay:CYCLes:CLEar (@1007,1016)
```

Example: Resetting Module(s) to power-on state (all modules) The following command resets a module in slot 4 to its power-on state.

```
SYSTem:CPON 4
```

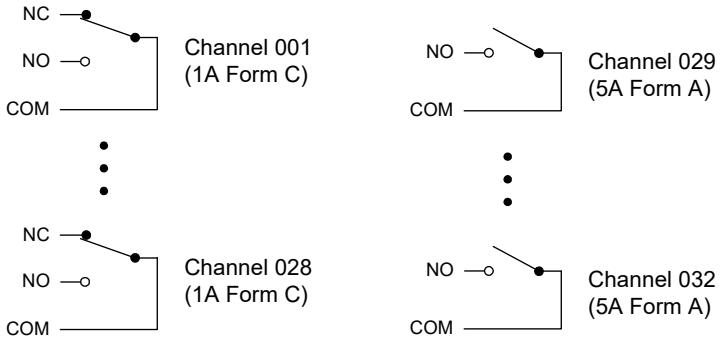
34937A 32-Channel GP Switch Module

The 34937A general-purpose switch module provides independent control of:

- Twenty-eight Form C (SPDT) latching relays rated at 1 A
- Four Form A (SPST) latching relays rated at 5 A. You can set the power-failure state for these 5 A relays (see "Hardware Power-Fail Jumper" on page 11).

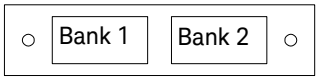
NOTE A temperature sensor on these modules triggers system interrupts when high-carry current-induced heat on the modules reaches a threshold of 70 °C. See description of the "HOT" annunciator on page 10.

34937A Simplified Schematic

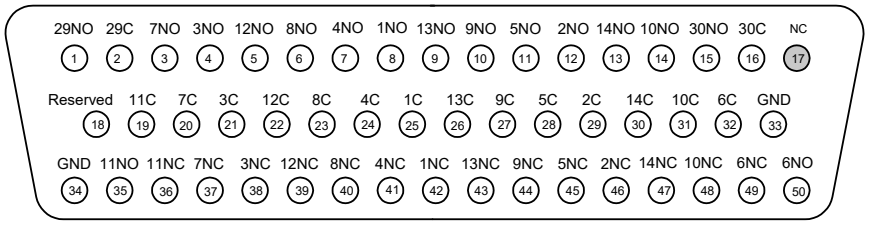


34937A D-Sub Connectors

Bank 1

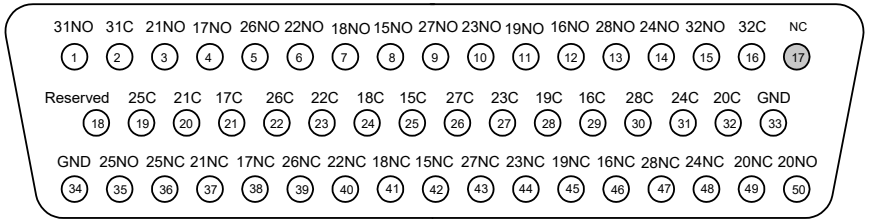


For orientation, the D-sub connector end of the module is facing you.



Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin
1 NC	42	4 NC	41	7 NC	37	10 NC	48	13 NC	43	30 NO	15
1 Common	25	4 Common	24	7 Common	20	10 Common	31	13 Common	26	30 Common	16
1 NO	8	4 NO	7	7 NO	3	10 NO	14	13 NO	9	Reserved	18
2 NC	46	5 NC	45	8 NC	40	11 NC	36	14 NC	47	GND	33
2 Common	29	5 Common	28	8 Common	23	11 Common	19	14 Common	30	GND	34
2 NO	12	5 NO	11	8 NO	6	11 NO	35	14 NO	13	No Connect	17
3 NC	38	6 NC	49	9 NC	44	12 NC	39	29 NO	1		
3 Common	21	6 Common	32	9 Common	27	12 Common	22	29 Common	2		
3 NO	4	6 NO	50	9 NO	10	12 NO	5				

Bank 2



50-Pin D-Sub
Male Connector

Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin
15 NC	42	18 NC	41	21 NC	37	24 NC	48	27 NC	43	32 NO	15
15 Common	25	18 Common	24	21 Common	20	24 Common	31	27 Common	26	32 Common	16
15 NO	8	18 NO	7	21 NO	3	24 NO	14	27 NO	9	Reserved	18
16 NC	46	19 NC	45	22 NC	40	25 NC	36	28 NC	47	GND	33
16 Common	29	19 Common	28	22 Common	23	25 Common	19	28 Common	30	GND	34
16 NO	12	19 NO	11	22 NO	6	25 NO	35	28 NO	13	No Connect	17
17 NC	38	20 NC	49	23 NC	44	26 NC	39	31 NO	1		
17 Common	21	20 Common	32	23 Common	27	26 Common	22	31 Common	2		
17 NO	4	20 NO	50	23 NO	10	26 NO	5				

34937T Terminal Block

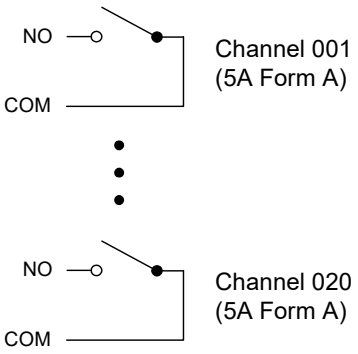
This terminal block with screw-type connections is labeled with the model number and the abbreviated module name. In addition, space is available on the label for you to write the slot number.

34938A 20-Channel High-Current GP Switch Module

The 34938A high-current GP switch module provides twenty 5 A Form A (SPST) relays for general purpose switching needs. You can set the power-failure state for these 5 A relays (see "Hardware Power-Fail Jumper" on page 11).

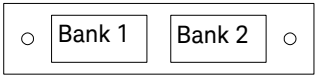
NOTE A temperature sensor on these modules triggers system interrupts when high-carry current-induced heat on the modules reaches a threshold of 70 °C. See description of the "HOT" annunciator on page 10.

34938A Simplified Schematic

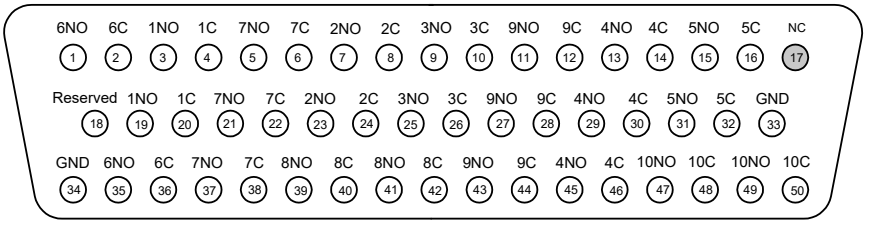


34938A D-Sub Connectors

Bank 1



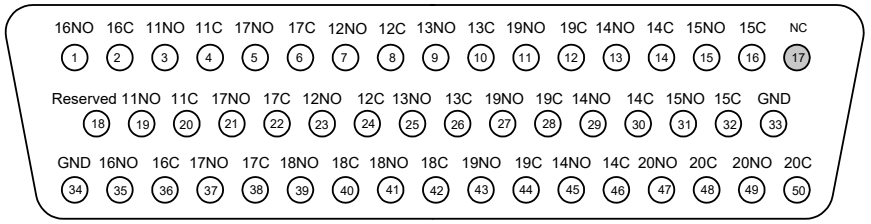
For orientation, the D-sub connector end of the module is facing you.



50-Pin D-Sub Male Connector

Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pins	Channel	Pins
1NO	3	3NO	25	5NO	31	7NO	37	9NO	43
1Common	4	3Common	26	5Common	32	7Common	38	9Common	44
1NO	19	4NO	13	6NO	1	8NO	39	10NO	47
1Common	20	4Common	14	6Common	2	8Common	40	10Common	48
2NO	7	4NO	29	6NO	35	8NO	41	10NO	49
2Common	8	4Common	30	6Common	36	8Common	42	10Common	50
2NO	23	4NO	45	7NO	5	9NO	11	Reserved	18
2Common	24	4Common	46	7Common	6	9Common	12	GND	33
3NO	9	5NO	15	7NO	21	9NO	27	GND	34
3Common	10	5Common	16	7Common	22	9Common	28	No Connect	17

Bank 2

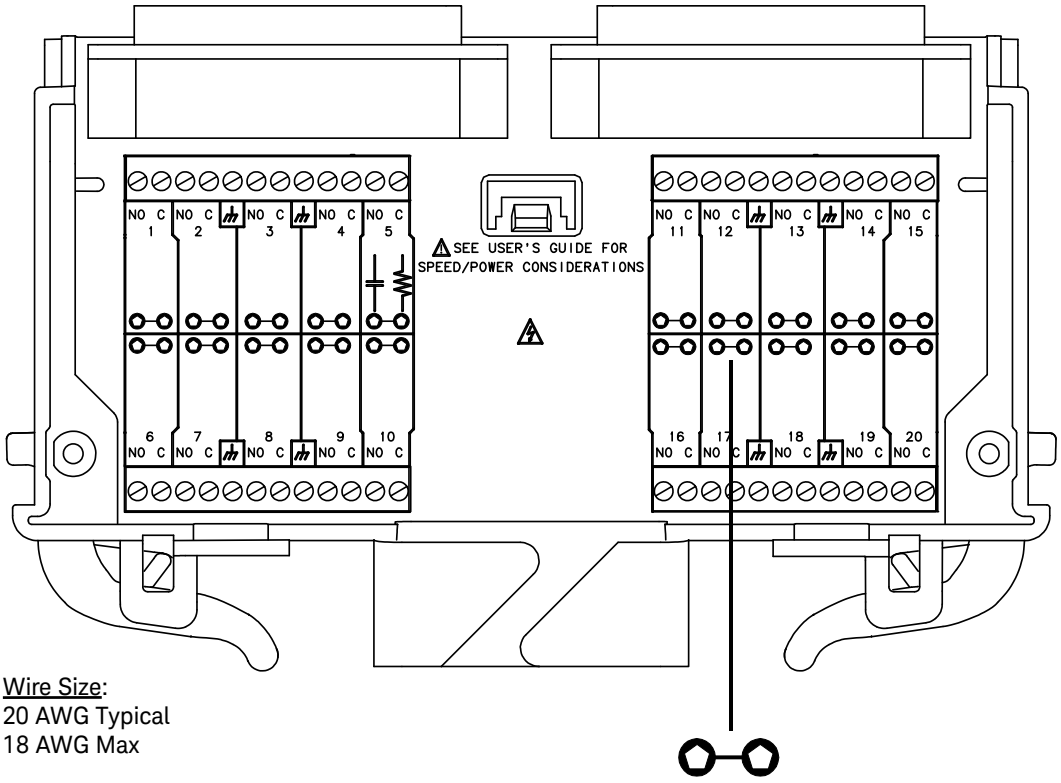


50-Pin D-Sub
Male Connector

Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pins	Channel	Pins
11NO	3	13NO	25	15NO	31	17NO	37	19NO	43
11Common	4	13Common	26	15Common	32	17Common	38	19Common	44
11NO	19	14NO	13	16NO	1	18NO	39	20NO	47
11Common	20	14Common	14	16Common	2	18Common	40	20Common	48
12NO	7	14NO	29	16NO	35	18NO	41	20NO	49
12Common	8	14Common	30	16Common	36	18Common	42	20Common	50
12NO	23	14NO	45	17NO	5	19NO	11	Reserved	18
12Common	24	14Common	46	17Common	6	19Common	12	GND	33
13NO	9	15NO	15	17NO	21	19NO	27	GND	34
13Common	10	15Common	16	17Common	22	19Common	28	No Connect	17

34938T Terminal Block

This terminal block with screw-type connections 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.



Wire Size:
20 AWG Typical
18 AWG Max

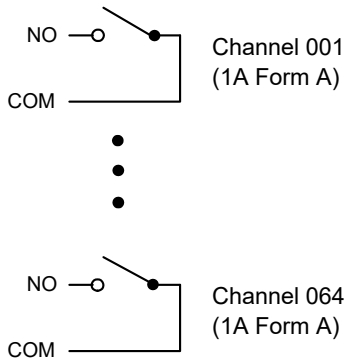
Pads for user-supplied snubber circuity to alleviate reactive transients. The circuits may consist of resistors, capacitors, varistors, or other elements as needed to reduce the switching voltage and current transients inherent in reactive circuits.

34939A 64-Channel High-Density Form-A GP Switch Module

The 34939A high-density GP switch module provides sixty-four 1 A Form A (SPST) relays for general purpose switching needs. You can set the power-failure state for these relays (see "Hardware Power-Fail Jumper" on page 11).

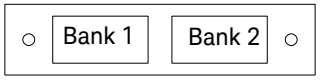
NOTE A temperature sensor on these modules triggers system interrupts when high-carry current-induced heat on the modules reaches a threshold of 70 °C. See description of the "HOT" annunciator on page 10.

34939A Simplified Schematic

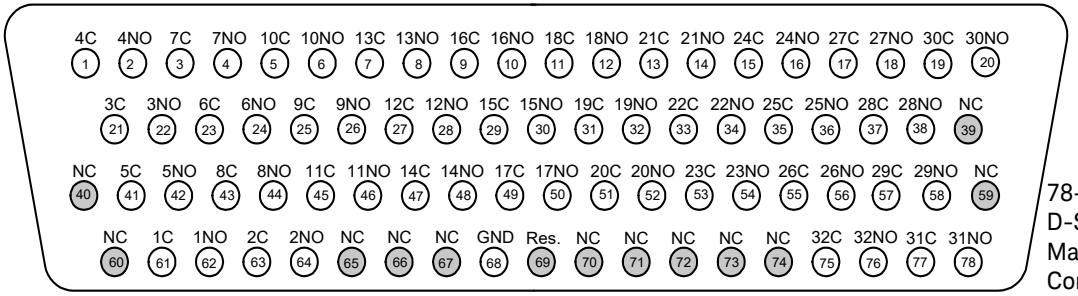


34939A D-Sub Connectors

Bank 1



For orientation, the D-sub connector end of the module is facing you.

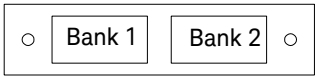


78-Pin D-Sub Male Connector

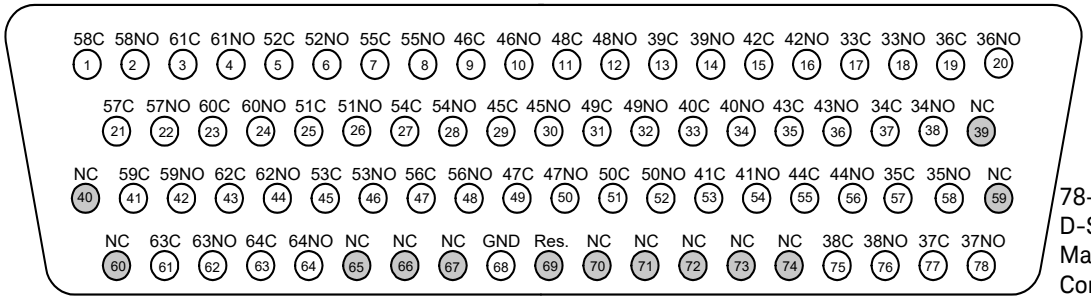
Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin
1 NO	62	8 NO	44	15 NO	30	22 NO	34	29 NO	58	No Connect	67
1 Common	61	8 Common	43	15 Common	29	22 Common	33	29 Common	57	No Connect	70
2 NO	64	9 NO	26	16 NO	10	23 NO	54	30 NO	20	No Connect	71
2 Common	63	9 Common	25	16 Common	9	23 Common	53	30 Common	19	No Connect	72
3 NO	22	10 NO	6	17 NO	50	24 NO	16	31 NO	78	No Connect	73
3 Common	21	10 Common	5	17 Common	49	24 Common	15	31 Common	77	No Connect	74
4 NO	2	11 NO	46	18 NO	12	25 NO	36	32 NO	76	Chassis GND	68
4 Common	1	11 Common	45	18 Common	11	25 Common	35	32 Common	75	Reserved	69
5 NO	42	12 NO	28	19 NO	32	26 NO	56	No Connect	39		
5 Common	41	12 Common	27	19 Common	31	26 Common	55	No Connect	40		
6 NO	24	13 NO	8	20 NO	52	27 NO	18	No Connect	59		
6 Common	23	13 Common	7	20 Common	51	27 Common	17	No Connect	60		

Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin
7 NO	4	14 NO	48	21 NO	14	28 NO	38	No Connect	65		
7 Common	3	14 Common	47	21 Common	13	28 Common	37	No Connect	66		

Bank 2



For orientation, the D-sub connector end of the module is facing you.



78-Pin D-Sub Male Connector

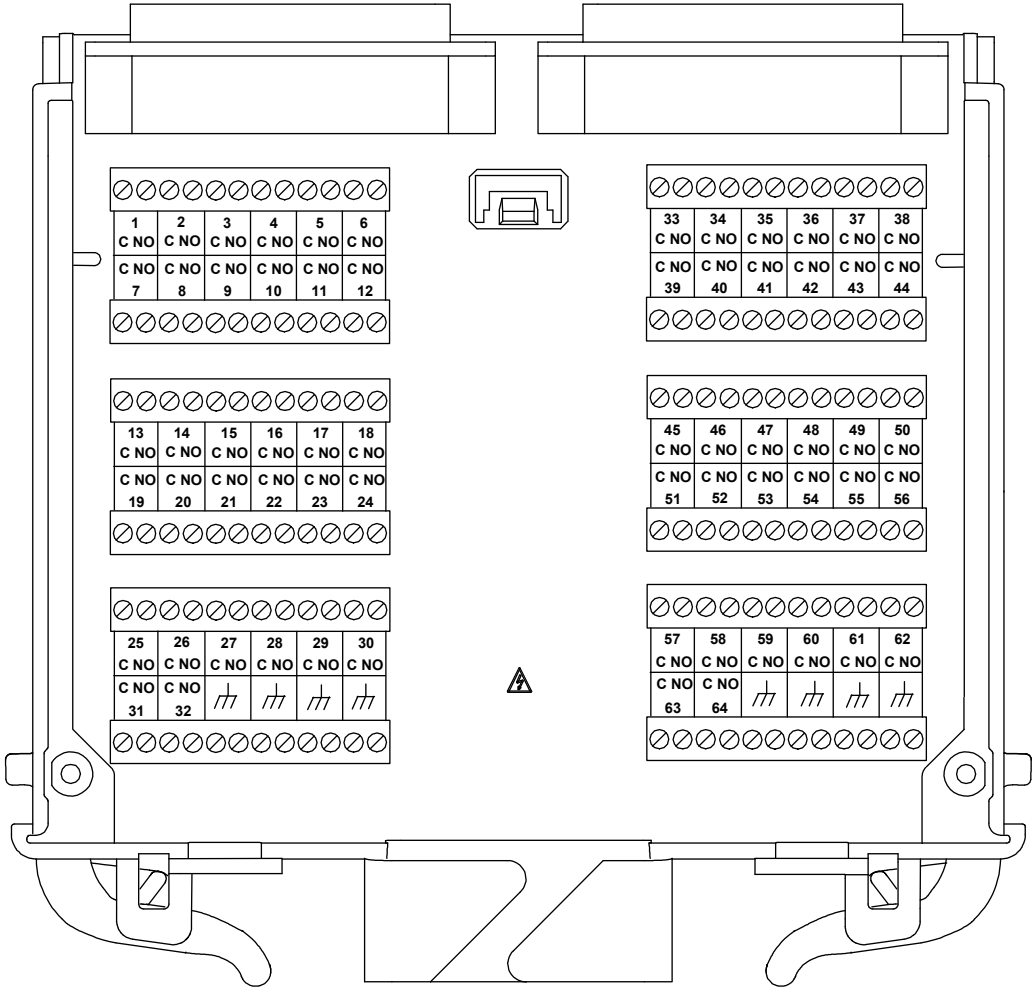
Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin
33 NO	18	40 NO	34	47 NO	50	54 NO	28	61 NO	4	No Connect	67
33 Common	17	40 Common	33	47 Common	49	54 Common	27	61 Common	3	No Connect	70
34 NO	38	41 NO	54	48 NO	12	55 NO	8	62 NO	44	No Connect	71
34 Common	37	41 Common	53	48 Common	11	55 Common	7	62 Common	43	No Connect	72
35 NO	58	42 NO	16	49 NO	32	56 NO	48	63 NO	62	No Connect	73
35 Common	57	42 Common	15	49 Common	31	56 Common	47	63 Common	61	No Connect	74
36 NO	20	43 NO	36	50 NO	52	57 NO	22	64 NO	64	Chassis GND	68
36 Common	19	43 Common	35	50 Common	51	57 Common	21	64 Common	63	Reserved	69
37 NO	78	44 NO	56	51 NO	26	58 NO	2	No Connect	39		
37 Common	77	44 Common	55	51 Common	25	58 Common	1	No Connect	40		

Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin	Channel	Pin
38 NO	76	45 NO	30	52 NO	6	59 NO	42	No Connect	59		
38 Common	75	45 Common	29	52 Common	5	59 Common	41	No Connect	60		
39 NO	14	46 NO	10	53 NO	46	60 NO	24	No Connect	65		
39 Common	13	46 Common	9	53 Common	45	60 Common	23	No Connect	66		

34939T Terminal Block

This terminal block with screw-type connections 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.

Wire Size:
20 AWG
Typical
18 AWG
Max



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