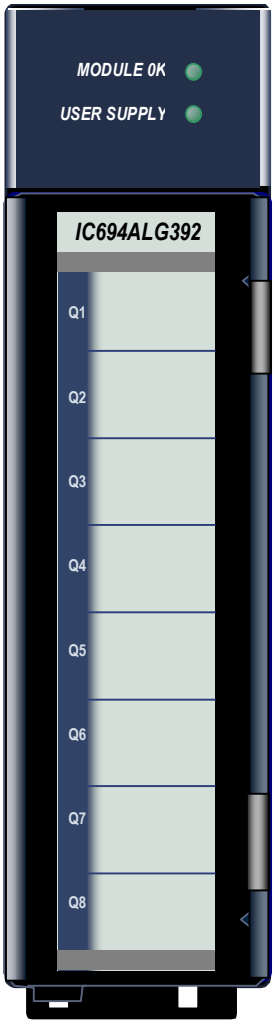
Analog Output Module, Current/Voltage, 8 Channel: IC694ALG392



The ***8–Channel Analog Current/Voltage Output*** module; IC694ALG392, provides up to eight single-ended output channels with current loop outputs and/or voltage outputs. Each output channel can be set up using the configuration software for any of these ranges:

- 0 to +10 volts (unipolar)
- 10 to +10 volts (bipolar)
- 0 to 20 milliamps
- 4 to 20 milliamps

Each channel is capable of converting 15 to 16 bits (depending on the range selected) of binary data to an analog output. All eight channels are updated every 12 milliseconds.

In current modes, the module reports an Open Wire fault to the CPU for each channel. The module can go to a known last state when system power is interrupted. As long as external power is applied to the module, each output will maintain its last value or reset to zero, as configured.

This module can be installed in any I/O slot of an RX3i system.

Isolated +24 VDC Power

The module must receive its 24 VDC power from an external source.

If the module is located in an RX3i Universal Backplane, the external source can be connected via the TB1 connector on the left side of the backplane or directly on the module's terminal block.

If this module is located in an Expansion Backplane, the external source must be connected to the module's terminal block.

LEDs

The **Module OK** LED indicates module status. The **User Supply** LED indicates whether the external +24 VDC power supply is present and is above the minimum level. Both LEDs are powered from the +5 VDC backplane power bus.

LED	Indicates
OK	ON: Module OK and configured Flashing: Module OK but not configured OFF: Module is defective or no +5V backplane power present
USER OK	ON: External power supply present OFF: No user power

Specifications: ALG392

Number of Output Channels	1 to 8 selectable, single–ended
Output Current Range	4 to 20 mA and 0 to 20 mA
Output Voltage Range	0 to 10 V and –10 V to +10 V
Calibration	Factory calibrated to .625 µA for 0 to 20 mA; 0.5 µA for 4 to 20 mA; and .3125 mV for voltage (per count)
User Supply Voltage (nominal)	+24 VDC, from user supplied voltage source
External Supply Voltage Range	20 VDC to 30 VDC
Power Supply Rejection Ratio (PSRR)	
Current	5 µA/V (typical), 10 µA/V (maximum)
Voltage	25 mV/V (typical), 50 mV/V (maximum)
External Power Supply Voltage Ripple	10% (maximum)
Internal Supply Voltage	+5 VDC from PLC backplane
Update Rate	8 milliseconds (approximate, all eight channels) Determined by I/O scan time, application dependent.
Resolution:	**4 to 20mA:** 0.5 µA (1 LSB = 0.5 µA)
	0 to 20mA: 0.625 µA (1 LSB = 0.625 µA)
	0 to 10V: 0.3125 mV (1 LSB = 0.3125 mV)
	-10 to +10V: 0.3125 mV (1 LSB = 0.3125 mV)
Absolute Accuracy: *	
Current Mode	+/-0.1% of full scale @ 25°C (77°F), typical +/-0.25% of full scale @ 25°C (77°F), maximum +/-0.5% of full scale over operating temperature range (maximum)
Voltage Mode	+/-0.25% of full scale @ 25°C (77°F), typical +/-0.5% of full scale @ 25°C (77°F), maximum +/-1.0% of full scale over operating temperature range (maximum)
Maximum Compliance Voltage	V_{USER} –3 V (minimum) to V_{USER} (maximum)
User Load (current mode)	0 to 850 Ω (minimum at V_{USER} = 20 V, maximum 1350 Ω at V_{USER} = 30 V) (Load less than 800 Ω is temperature dependent.)
Output Load Capacitance (current mode)	2000 pF (maximum)
Output Load Inductance (current mode)	1 H
Output Loading (voltage mode)	5 mA (2 K Ohms minimum resistance)
Output load Capacitance	(1 µF maximum capacitance)
Isolation, Field to Backplane (optical) and to frame ground	250 VAC continuous; 1500 VAC for 1 minute
Power Consumption	110 mA from +5 VDC PLC backplane supply
	315 mA from +24 VDC user supply

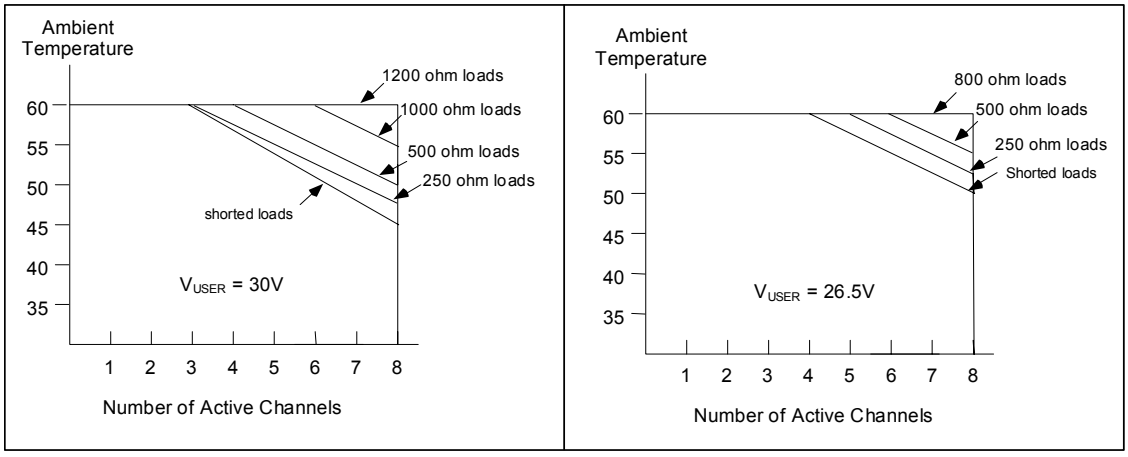
Refer to Appendix A for product standards and general specifications. In order to meet the IEC 1000-4-3 levels for RF Susceptibility specified in Appendix A, when this module is present, the system must be mounted in a metal enclosure.

- In the presence of severe RF interference (IEC 801–3, 10V/m), accuracy may be degraded to ±1% FS for current outputs and ±3% FS for voltage outputs.

Derating Curves: ALG392

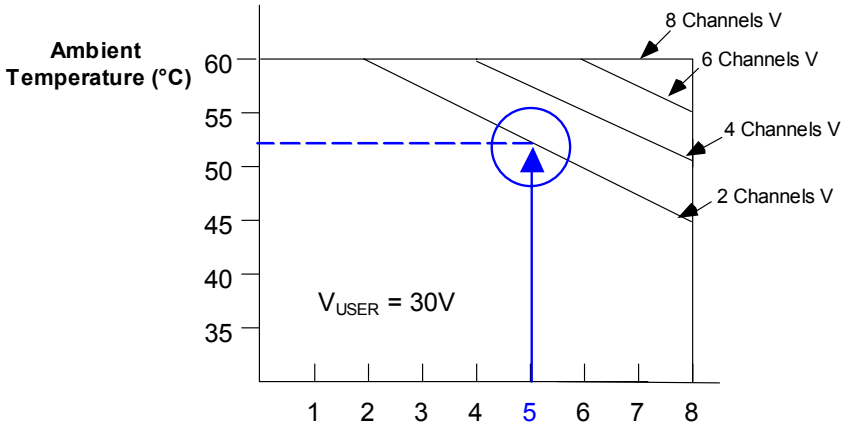
For maximum performance and module life, the module should be operated at maximum load resistance to offload heat. Module thermal deratings depend on the voltage level and the use of current and voltage outputs. The first two charts below show the maximum ambient temperature for current-only modules at 30 VDC and at 26.5 VDC.

Current Outputs Only



Mixed Current and Voltage Outputs

In the deratings shown below, voltage channels have 2 K Ohm loads and current channels have shorted loads. To determine the maximum operating temperature for mixed current and voltage outputs, select the line in the chart below that corresponds to the number of voltage channels being used. For example, a module uses 2 voltage channels and 3 current channels. The total channels are 5, and the maximum operating temperature is approximately 52.5°C:



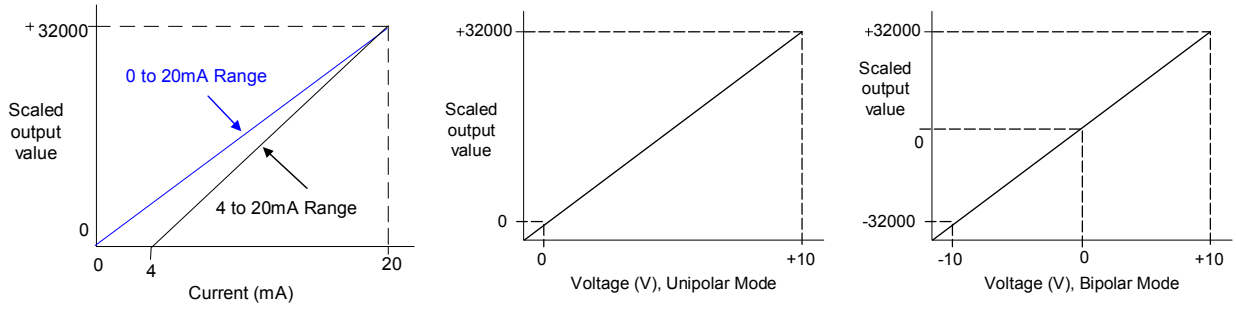
Current and Voltage Ranges and Resolution

In the 4 to 20 mA range the module scans output data from the PLC so that 4 mA corresponds to a count of 0, and 20 mA corresponds to a count of 32000. In the 0 to 20 mA range, user data is scaled so that 0 mA corresponds to a count of 0 and 20 mA corresponds to 32000. In 0 to 20 mA mode, a value up to 32767 provides a maximum output of approximately 20.5 mA. In current mode, the module also reports an open loop fault to the PLC.

For voltage operation in the default unipolar mode (0 to +10 volts), data is scaled so that 0 volts corresponds to a count of 0 and +10 volts corresponds to a count of 32000. In this mode, a value up to 32767 creates an overrange output of approximately 10.24 volts.

In the -10 to +10 volt range, data is scaled so that -10 volts corresponds to a count of -32000 and +10 volts corresponds to a count of +32000. In this range, output values from -32767 to +32767 result in an overrange of approximately -10.24 volts to +10.24 volts.

Scaling for both current and voltage ranges is shown below.



The resolution per bit depends on the channel's configured range:

4 to 20 mA:	0.5 µA
0 to 20 mA:	0.625 µA
0 to 10 V:	0.3125 mV
-10 to +10 V:	0.3125 mV

Module Data

Module ALG392 uses up to 8 output reference words. Each channel provides 16 bits of analog output data as an integer value. Output resolution is 15 bits except for the bipolar voltage mode, which has 16-bit resolution. The 16th bit is the sign bit.

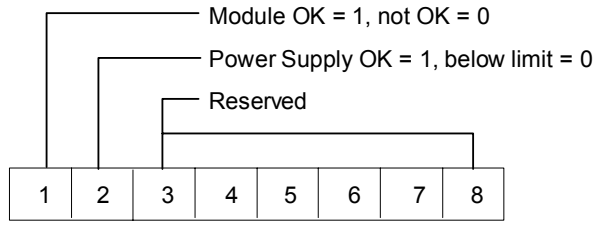
Range	Resolution	Range Limits
0 to 20 mA	15 bits	0 to 32767
4 to 20 mA	15 bits	0 to 32767*
0 to 10 V	15 bits	0 to 32767
-10 to 10 V	16 bits	- 32768 to 32767

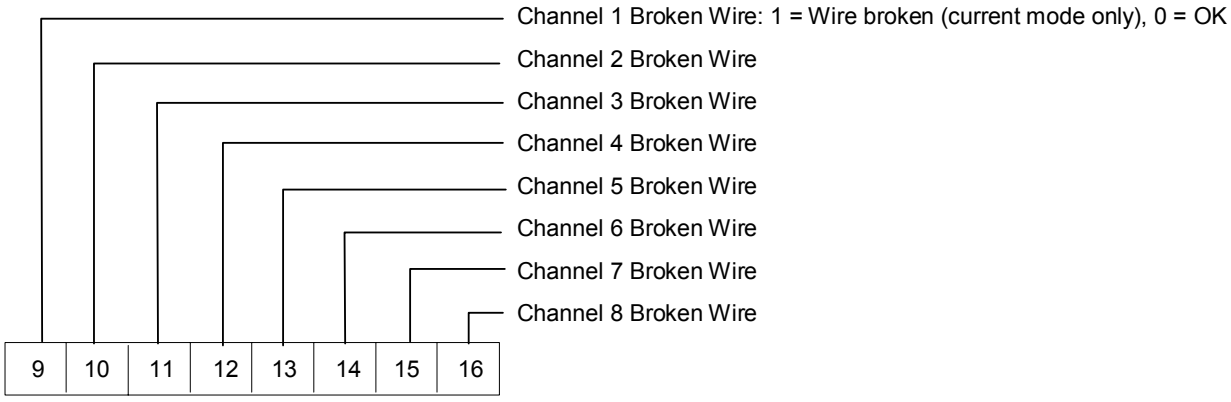
* In 4-20 mA mode, if the PLC CPU sends a channel a value that is greater than 32000, the module uses the value 32000 instead.

Status Data: ALG292

This module uses either 8 or 16 discrete input bits, as configured. The first 8 bits are used for module status information as shown below.

In current mode, individual channels can also report Broken Wire diagnostics. Those diagnostics are reported in bits 9-16:

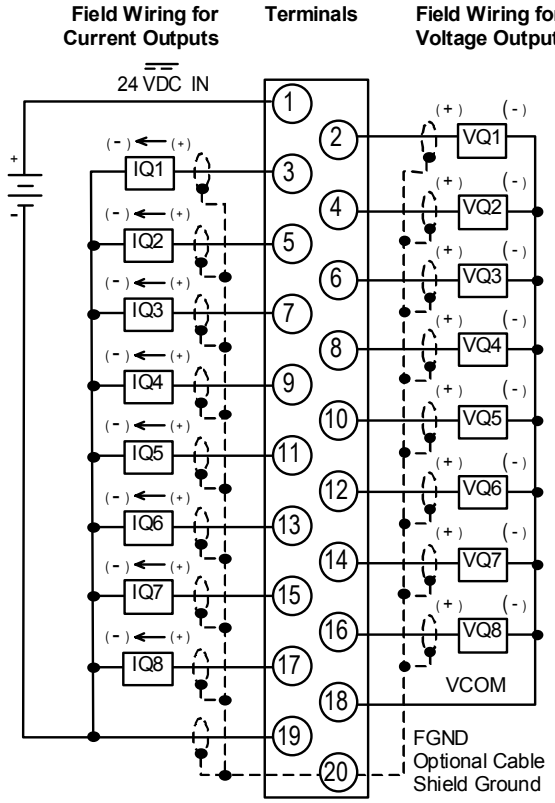




Field Wiring: ALG392

Terminal	Signal Name	Signal Definition
1	24VIN	User Supplied +24 VDC Input
2	V CH 1	Channel 1 Voltage Output
3	I CH 1	Channel 1 Current Output
4	V CH 2	Channel 2 Voltage Output
5	I CH 2	Channel 2 Current output
6	V CH 3	Channel 3 Voltage Output
7	I CH 3	Channel 3 Current output
8	V CH 4	Channel 4 Voltage Output
9	I CH 4	Channel 4 Current output
10	V CH 5	Channel 5 Voltage Output
11	I CH 5	Channel 5 Current output
12	V CH 6	Channel 6 Voltage Output
13	I CH 6	Channel 6 Current output
14	V CH 7	Channel 7 Voltage Output
15	I CH 7	Channel 7 Current output
16	V CH 8	Channel 8 Voltage Output
17	I CH 8	Channel 8 Current output
18	V COM	Voltage Common
19	I COM	Current Common/User +24 VDC Return
20	GND	Frame ground connection for cable shields

The diagram below shows connections for current and voltage outputs. Each channel can be configured to operate as a voltage output or a current output - not both simultaneously.



Configuration: ALG392

Parameter	Description	Values	Default Values
Active Channels	Number of channels scanned	1 through 8	1
Reference Address for Module Output Data	Starting address for %AQ reference type	standard range	%AQ0001, or next highest available address
Reference Address for Channel Status Data	Starting address for %I reference type	standard range	%I00001, or next highest available address
Length	Number of %I status locations	8 or 16	8
Stop Mode	Output state when module toggled from RUN to STOP mode	Hold Last State or Default to Zero	Hold Last State
Output Channel Range	Type of Output Range	0, +10V -10, +10V 4, 20 mA 0, 20 mA	0, 10V

Active Channels indicates the number of channels that will be scanned by the PLC CPU.

The choice made for Stop Mode determines whether the module's outputs will hold their last states or default to zero when the goes from Run to Stop mode.

The %AQ Reference Address parameter selects the start of the area in the %AQ memory where the output data to the module will begin.

The %I Reference Address selects the start of the area in %I memory for the module's status data. If the length is set to 8, then only module status will be reported. If the length is set to 16, channel status will also be reported for channels that are operating as current outputs.

Each channel can be set up to operate on one of four output ranges:

- 0 to 10 V (default
- -10 to +10 V range
- 4 to 20 mA, and 0 to 20 mA
- 0 to 20 mA