

PACSystems* RX3i and Series 90*-30 IC694ALG223 and IC693ALG223

GFK-2655B
May 2014

Analog Current Input Module – 16 Channel



The PACSystems* RX3i/Series 90* 16-Channel Analog Current Input module provides 16 single-ended input channels. Each input can be configured using the configuration software for any of three input ranges:

- 4 to 20 mA
- 0 to 20 mA
- 4 to 20 mA Enhanced

High and Low alarm limits are available on all ranges. In the 4 to 20 mA Enhanced range, a low alarm limit can be set up to detect input current from 4 mA to 0 mA, providing open-wire fault detection in 4 to 20 mA applications.

The module also reports module status and external power supply status to the CPU using its assigned program reference addresses.

This module can be installed in any I/O slot that has a serial connector in an RX3i or Series 90-30 system.

Module Power

This module consumes 120 mA from the 5 VDC bus on the Controller backplane. It also requires 65 mA plus current loop current(s) from a user-supplied +24 VDC supply.

LEDs

The MODULE OK LED provides module status information on power-up as follows:

ON: status is OK, module configured;

OFF: no backplane power or software not running (watchdog timer timed out);

Continuous rapid blinking: configuration data not received from CPU;

Slow blinking, then OFF: failed power-up diagnostics or encountered code execution error.

The USER SUPPLY LED indicates that the external 24 VDC supply is within specifications.

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Specifications: ALG223

| | |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Number of Channels | 1 to 16 selectable; single-ended |
| Input Current Ranges | 0 to 20 mA, 4 to 20 mA and 4 to 20 mA Enhanced (selectable per channel) |
| Calibration | Factory calibrated to: 4 μ A per count on 4 to 20 mA range 5 μ A per count on 0 to 20 mA and 4 to 20 mA Enhanced range |
| Update Rate | Update Rate: 6 ms |
| Resolution at 4–20 mA | 4 μ A (4 μ A/bit) |
| Resolution at 0–20 mA | 5 μ A (5 μ A/bit) |
| Resolution at 4–20 mA Enhanced | 5 μ A (5 μ A/bit) |
| Absolute Accuracy ¹ | $\pm 0.25\%$ of full scale @ 25°C (77°F): $\pm 0.5\%$ of full scale over specified operating temperature range |
| Linearity | < 1 LSB from 4 to 20 mA (4 to 20 mA range) < 1 LSB from 100 μ A to 20 mA (0 to 20 mA and 4 to 20 mA Enhanced ranges) |
| Isolation, Field to Backplane (optical) and to frame ground | 250 VAC continuous; 1500 VAC for 1 minute |
| Common Mode Voltage ² | 0 volts (single-ended channels) |
| Cross-Channel Rejection | > 70dB from DC to 1kHz |
| Input Impedance | 250 Ω |
| Input Low Pass Filter Response | 19 Hz |
| External Supply Voltage Range | 20 to 30 VDC |
| External Supply Voltage Ripple | 10% |
| Internal Power Consumption | 120 mA from the +5 VDC bus on the backplane 65 mA from 24 VDC external user power supply (in addition to current loop currents) |

- 1 In the presence of severe Radiated RF interference (IEC 61000-4-3, 10V/m), accuracy may be degraded to $\pm 5\%$ of full scale.
- 2 In the presence of severe Conducted RF interference (IEC 61000-4-6, 10Vrms), accuracy may be degraded to $\pm 0.5\%$ of full scale.

Refer to the applicable manual for product standards, general operating specifications, and installation requirements:

Series 90-30 Installation Manual, GFK-0356

Series 90-30 systems: Installation Requirements for Conformance to Standards, GFK-1179

PACSystems RX3i System Manual, GFK-2314

Configuration: ALG223

Module ALG223 is configured with the configuration software. Its configurable parameters are described below.

Module Settings

| Parameter | Choices | Description |
|---------------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Active Channels | 1 to 16 | The number of channels to be scanned. Channels are scanned in sequential, contiguous order. |
| Channel Value Reference Address | Valid memory type: %AI | The starting address for input data from the module. |
| Channel Value Reference Length | Read-only. | Each channel provides 16 bits (1 word) of analog input data to the Controller CPU. |
| Module Status Reference Address | Valid memory type: %I | The starting address for status information from the module. |
| Module Status Reference Length | 0, 8, 16, 24, 32, 40 | The number of status bits (0 to 40) reported to the Controller CPU. When set to 0, status reporting is disabled. To enable status reporting, set this parameter to a value other than 0. Data formats are shown on page 5. |
| I/O Scan Set | 1 through 32 | Assigns the module to an I/O Scan Set defined in the CPU configuration. |

Input Channel Data

| Parameter | Choices | Description |
|--------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Range | 4-20 mA (default), 0-20 mA, or 4-20 mA enhanced | In the 4-20 mA range, input currents from 4 to 20 mA are reported to the CPU as values from 0 to 32000 units. In the 0 to 20 mA range, input currents from 0 to 20 mA are reported to the CPU as values from 0 to 32000 units. In the 4 to 20 mA enhanced range, currents from 4 to 20 mA are reported to the CPU as values from 0 to 32000 units. Currents below 4 mA are reported as negative values with 0 represented as -8000 units. |
| Alarm Low (Engineering Units) | 4-20 mA = 0 to 32759 | Each channel can be assigned a low alarm limit alarm. Values entered without a sign are assumed to be positive. Be sure the alarm low values are appropriate for the selected range. |
| | 0-20 mA = 0 to 32759 | |
| | 4-20 mA enhanced = -8000 to +32759 | |
| Alarm High (Engineering Units) | 4-20 mA = 1 to 32760 | Each channel can also be assigned a high alarm limit. Values entered without a sign are assumed to be positive. Be sure the alarm high values are appropriate for the selected range. |
| | 0-20 mA = 1 to 32760 | |
| | 4-20 mA enhanced = -7999 to +32760 | |

Data Format: ALG223

The 12-bit resolution module analog input data is stored in the CPU in 16-bit 2's complement format as shown below.



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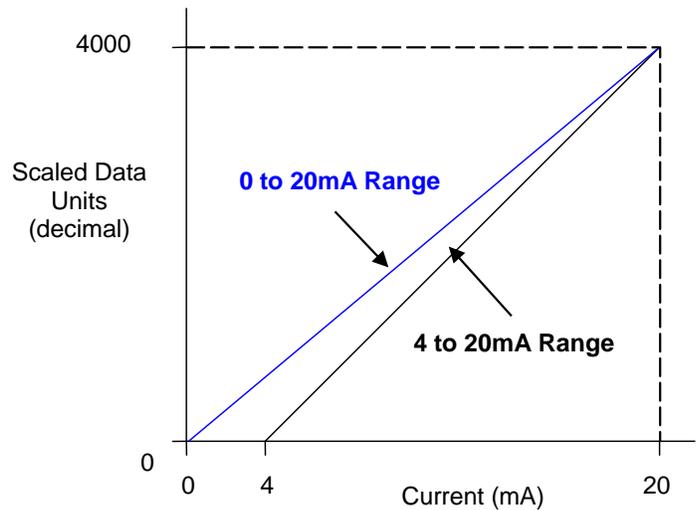
Input Scaling

In the 4 to 20 mA range, input data is scaled 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, 0 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32000. Full 12-bit resolution is available over the 4 to 20 mA and 0 to 20 mA ranges.

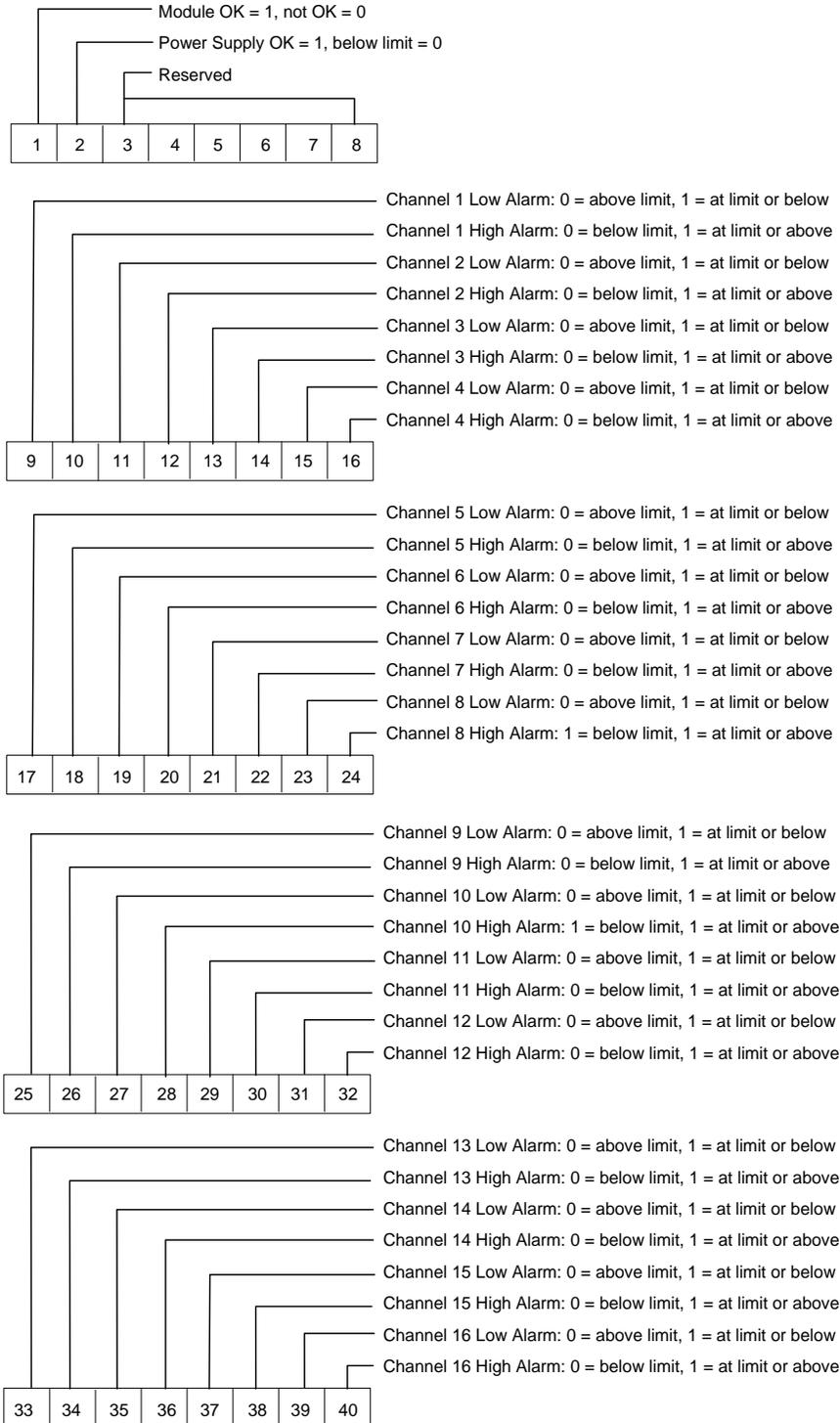
The 4 to 20 mA Enhanced range can also be configured. In that range, 0 mA corresponds to a count of -8000, 4 mA corresponds to a count of 0 (zero) and 20 mA corresponds to a count of +32000. A low alarm limit can be set up to detect input current from 4 mA to 0 mA, providing open-wire fault detection in 4 to 20 mA applications.

Analog values are scaled over the range of the converter. Factory calibration adjusts the analog value per bit (resolution) to a multiple of full scale (4 μ A/bit). This calibration leaves a normal 12-bit converter with 4000 counts (normally $2^{12} = 4096$ counts). The data is then scaled with the 4000 counts over the analog range. The data is scaled as shown below.



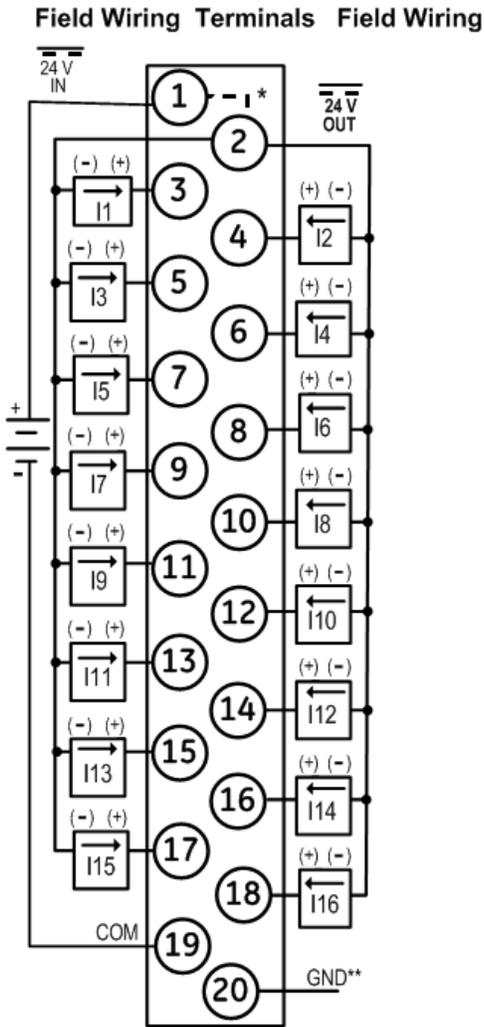
Status Data: ALG223

Analog Module ALG223 can be configured to return 8, 16, 24, 32, or 40 status bits to the Controller CPU. This status data provides the following information about module operation:



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Field Wiring: ALG223

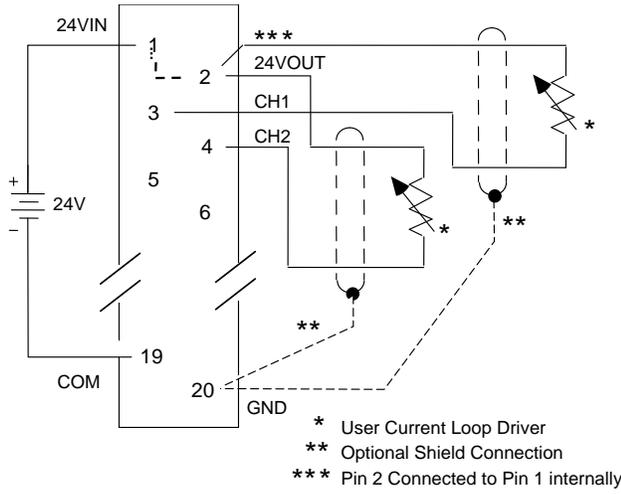


* Internally Connected

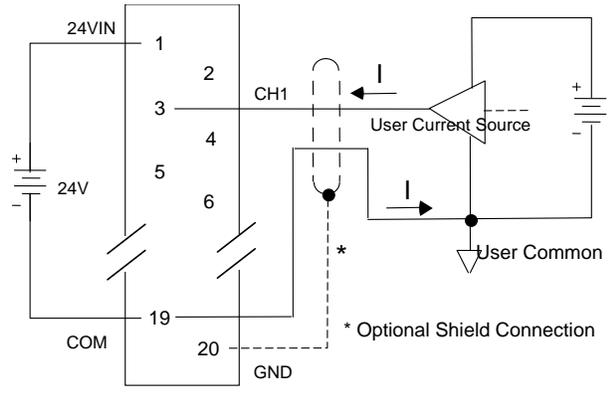
** Optional Shield Connection

| Terminal | Connection |
|----------|----------------------------------------------------------------------------------------------------|
| 1 | User supplied 24V Input; provides loop power via 24VOUT terminal (pin 2) |
| 2 | +24V loop power tie point |
| 3 | Current Input, Channel 1 |
| 4 | Current Input, Channel 2 |
| 5 | Current Input, Channel 3 |
| 6 | Current Input, Channel 4 |
| 7 | Current Input, Channel 5 |
| 8 | Current Input, Channel 6 |
| 9 | Current Input, Channel 7 |
| 10 | Current Input, Channel 8 |
| 11 | Current Input, Channel 9 |
| 12 | Current Input, Channel 10 |
| 13 | Current Input, Channel 11 |
| 14 | Current Input, Channel 12 |
| 15 | Current Input, Channel 13 |
| 16 | Current Input, Channel 14 |
| 17 | Current Input, Channel 15 |
| 18 | Current Input, Channel 16 |
| 19 | Common connection to input current sense resistors; user supplied 24V input return or 24VIN return |
| 20 | Frame ground connections for cable shields |

Connection Example 1



Connection Example 2



To limit common-mode voltages, the current source can be tied to the COM terminal if the source is floating.

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Release History

| Version | Firmware Release | Date | Description |
|----------------------------------|------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IC694ALG223-DB IC693ALG223-GB | 1.60 | May 2012 | Resolves several rarely-occurring issues that were identified in field and factory testing. |
| IC694ALG223-BA IC693ALG223-EA | 1.1 | Apr. 2011 | Adds ability to perform field upgrades in RX3i targets. Adds display of module serial number, revision and date code in programming software in RX3i targets. |

Important Product Information for this Release

Upgrades

An upgrade kit containing firmware version 1.60, 41G1485-MS10-002-A1, is available for download at <http://ge-ip.com/support>.

Note: Only ALG223 modules in RX3i racks support firmware upgrades in the field. ALG223 modules in Series 90-30 racks cannot be field upgraded.

Compatibility

The new version of the ALG223 is fully compatible with earlier versions of the ALG223 module, except the IC694ALG223-BA and IC693ALG223-EA versions do not support the Series 90-30 Hand-Held Programmer.

| | |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Programmer version requirements | Proficy Machine Edition version 6.50 SIM 5 or later is required to configure the ALG223. |
| CPU firmware requirements | RX3i: All versions of the RX3i CPUs support the ALG223. Series 90-30: The ALG223 is compatible with all versions of CPU models 311 and higher, and NIU004. |

Restrictions and Open Issues

| Subject | Description |
|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Loss of I/O fault is logged for analog modules when a Clear All Memory command is sent through the serial port of the RX3i CPU. | When the Rx3i CPU has more than three analog modules in a rack, PME is communicating with serial port and sends a Clear All Memory command, then any module may unexpectedly log a Loss of I/O Module fault. To recover from this issue, power cycle the CPU and download configuration. Or while clearing, do not use Clear All, but select the configuration item checkboxes. |
| Constant Sweep Exceeded fault is logged when ALGxxx modules are located in different racks, with at least one ALGxxx in a remote rack | With the CPU in constant sweep mode, if two or more ALG modules are placed in a system such that one ALG module is in a remote expansion rack and the others are elsewhere in the system –either in the main rack, a local expansion rack, or a remote rack—as soon the hardware configuration is downloaded and the CPU is returned to run mode, the CPU logs a fault stating "Constant sweep exceeded" in the Controller fault table |

Installation in Hazardous Locations

- EQUIPMENT LABELED WITH REFERENCE TO CLASS I, GROUPS A, B, C & D, DIV. 2 HAZARDOUS LOCATIONS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, D OR NON-HAZARDOUS LOCATIONS ONLY
- WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;
- WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES; AND
- WARNING - EXPLOSION HAZARD - DO NOT CONNECT OR DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.