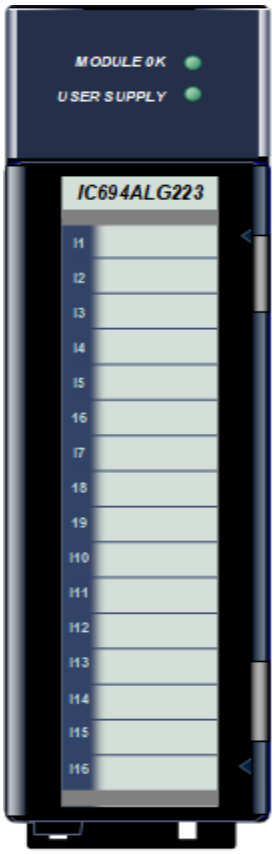
IMPORTANT PRODUCT INFORMATION

GFK-2655D

Dec 2020

PACSystems™ RX3i

16-CHANNEL ANALOG CURRENT INPUT MODULE (IC694ALG223)



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Warning Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury to exist in this equipment or may be associated with its use.
In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Notes: Notes merely call attention to information that is especially significant to understanding and operating the equipment.

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Introduction

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.

Specifications: ALG223

Specification	Description
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: 4µA per count on 4 to 20 mA range 5µA per count on 0 to 20mA and 4 to 20 mA Enhanced range
Update Rate	Update Rate: 6ms
Resolution at 4–20 mA	4µA (4µA/bit)
Resolution at 0–20 mA	5µA (5µA/bit)
Resolution at 4–20 mA Enhanced	5µA (5µA/bit)
Absolute Accuracy 1	±0.25% of full scale @ 25°C (77°F): ± 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 100µA to 20 mA (0 to 20 mA and 4 to 20 mA Enhanced ranges)

Specification	Description
Isolation, Field to Backplane (optical) and to frame ground	250VAC continuous; 1500 VAC for 1 minute
Common Mode Voltage2	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 ±5% of full scale.
2. In the presence of severe Conducted RF interference (IEC 61000-4-6, 10Vrms), accuracy may be degraded to ±1% of full scale.

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

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 6.
I/O Scan Set	1 through 32	Assigns the module to an I/O Scan Set defined in the CPU configuration.

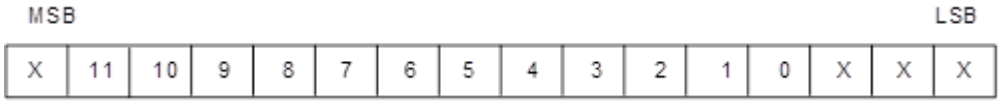
Input Channel Data

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.

Figure 1: Data Format



Input Scaling

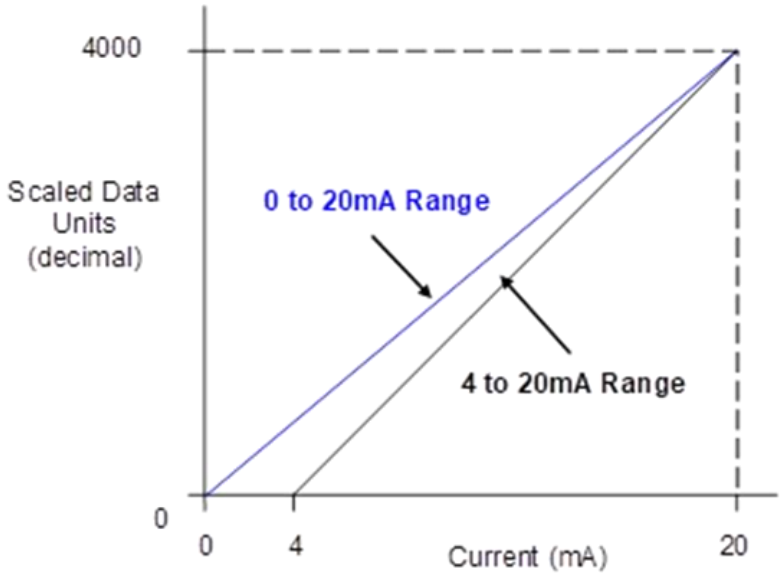
In the 4 to 20 mA range, input data is scaled so that 4 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32000.

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 (4µA/bit). This calibration leaves a normal 12–bit converter with 4000 counts (normally 212 = 4096 counts). The data is then scaled with the 4000 counts over the analog range. The data is scaled as shown below.

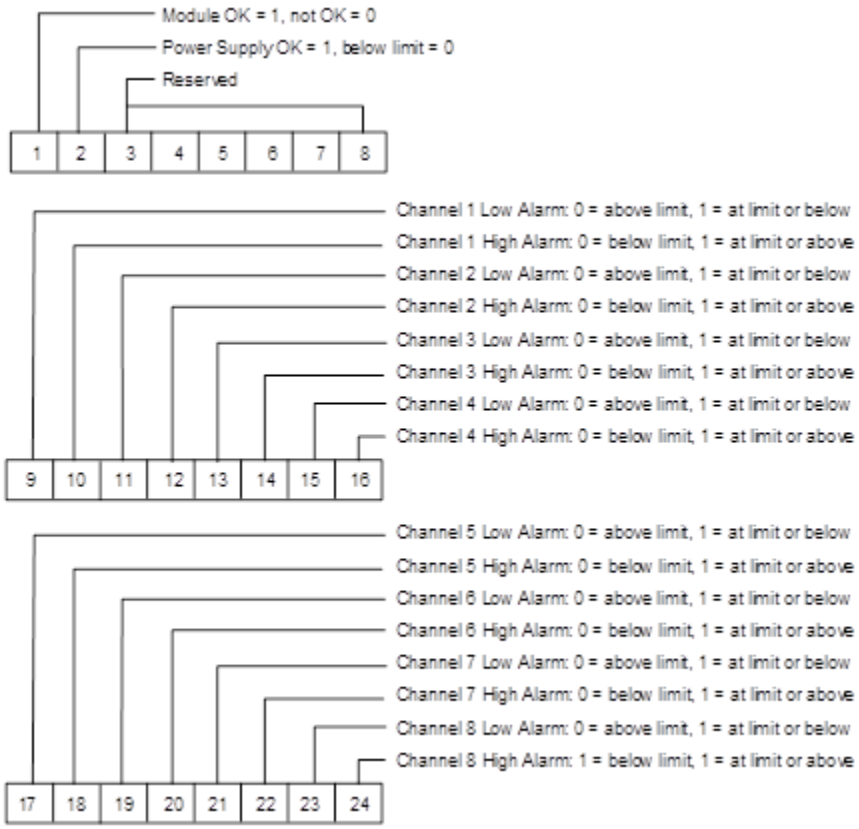
Figure 2: Input Scaling

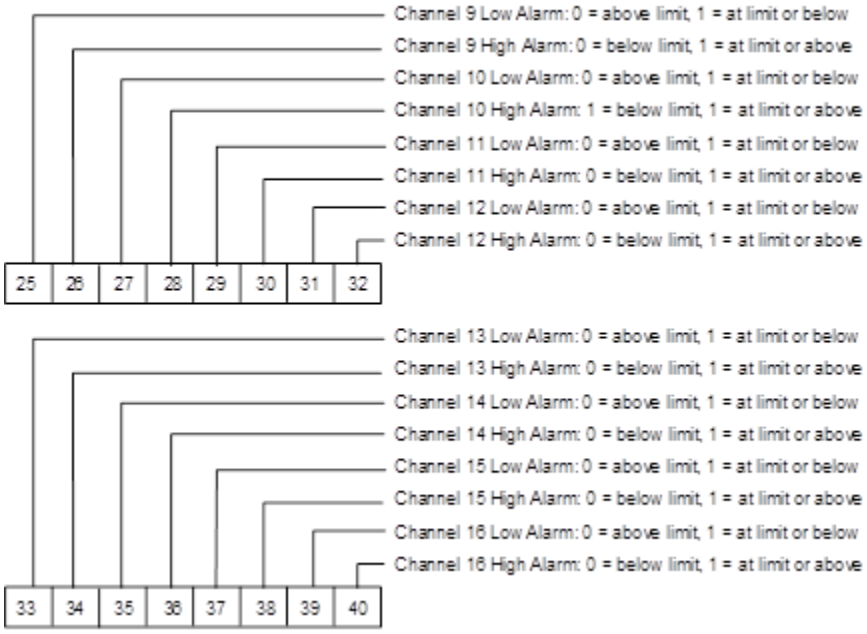


Status Data: ALG223

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:

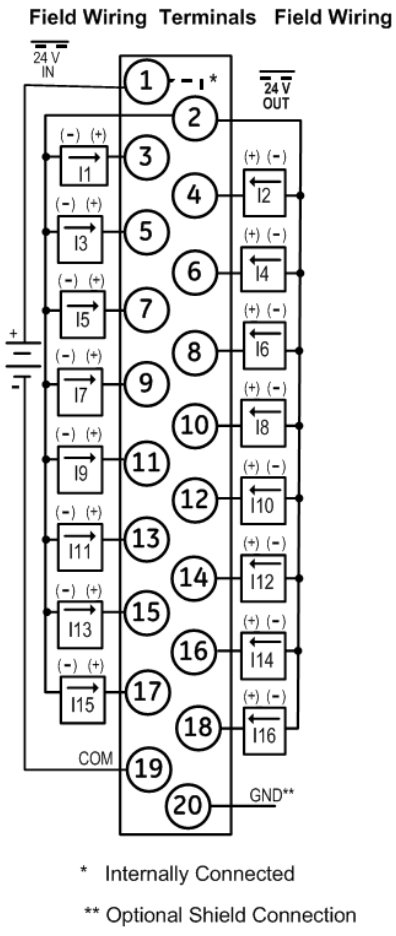
Figure 3: Data Status





Field Wiring: ALG223

Figure 4: Field Wiring



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

Figure 5: Connection Example-1

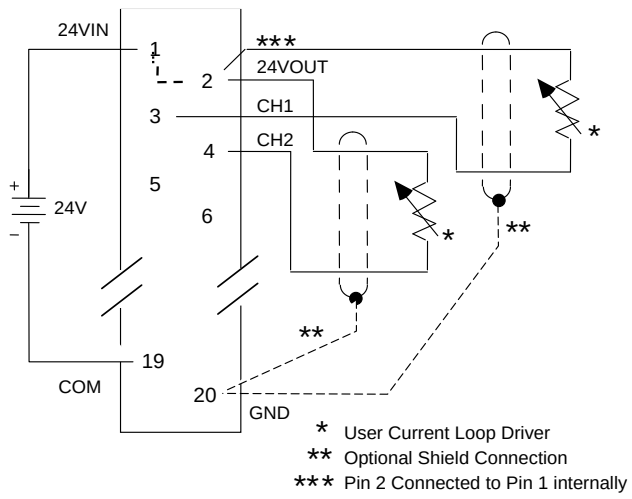
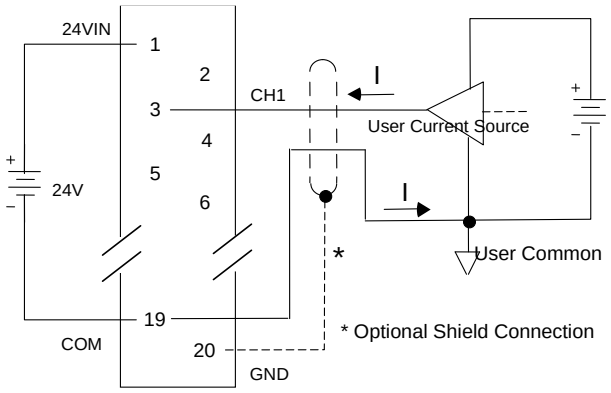


Figure 6: Connection Example-2



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

Revision History

Module Version	Firmware Version	Date	Description
IC694ALG223-FC	2.00	Dec 2020	This release addresses the module hardware obsolescence. Note 2 which specifies the accuracy in the presence of conducted RF interference is corrected (+/-0.5% changed to +/- 1%).
IC694ALG223-EB	1.60	Sep 2019	Following Emerson's acquisition of this product, changes have been made to apply appropriate branding and registration of the product with required certification agencies. No changes to material, process, form, fit or functionality.
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 2.00, 41G1485-MS10-002-A2, is available for download at https://www.emerson.com/Industrial-Automation-Controls/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 ,IC693ALG223-EA and later versions do not support the Series 90-30 Hand-Held Programmer.

Programmer version requirements	PAC 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.
Module firmware upgrade	The module revision IC694ALG223-EB or before cannot be upgraded with the firmware revision 2.00 or later as the firmware is not backward compatible. Similarly, module revision IC694ALG223-FC and later cannot be updated with any firmware revision earlier than 2.00.

Problems Resolved in this Revision

Subject	Description
Loss of I/O fault is logged for analog modules when a Clear All Memory command is sent through the RX3i CPU's serial port.	This release resolves the issue from IC694ALG223-FC, since the firmware is not compatible to revision IC694ALG223-EB or earlier. When the Rx3i CPU has more than three analog modules in a rack, PAC Machine Edition 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.

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.	This is applicable from IC694ALG223-BA to IC694ALG223-EB revisions and IC693ALG223-EA to IC693ALG223-GB revisions. When the Rx3i CPU has more than three analog modules in a rack, PAC MACHINE EDITION 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 rackISS180479	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

Operational Notes

Subject	Description
Restrictions on Hot Swap	ALG223 module should not be Hot swapped in any of the Expansion and Remote expansion Rx3i backplane racks. Doing so may damage the module or backplane hardware and disrupt the module operations.

Installation in Hazardous Locations

⚠ WARNING

- EQUIPMENT LABELED REGARDING 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
- EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;
- EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES; AND
- EXPLOSION HAZARD - DO NOT CONNECT OR DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.

Technical Support & Contact Information

Home link: http://www.Emerson.com/Industrial-Automation-Controls

Knowledge Base: https://www.emerson.com/Industrial-Automation-Controls/support

Note: If the product is purchased through an Authorized Channel Partner, please contact the seller directly for any support.

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