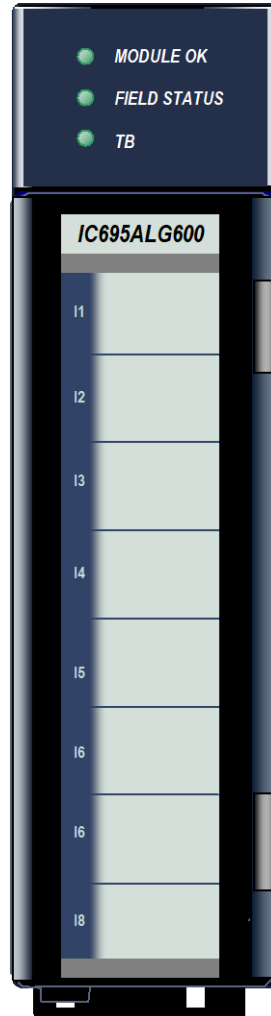# PACSystems™ RX3i

UNIVERSAL ANALOGUE INPUT MODULE (IC695ALG600)

Product Description

The PACSystems **Universal Analog Input module,** IC695ALG600 provides eight general purpose input channels and two Cold Junction Compensation (CJC) channels. Inputs are divided into two equal groups of four. Channels can be individually-configured using the PAC Machine Edition software for:

- Any combination of up to eight channels of voltage, current, thermocouple, RTD, and resistance inputs.
- Thermocouple Inputs: B, C, E, J, K, N, R, S, T
- RTD Inputs: PT 385 / 3916, N 618 / 672, NiFe 518, CU 426
- Resistance Inputs: 0 to 250 / 500 / 1000 / 2000 / 3000 / 4000 Ohms
- Current: 0–20 mA, 4–20 mA, $\pm$20 mA
- Voltage: $\pm$50mV, $\pm$150 mV, 0–5 V, 1–5 V, 0–10 V, $\pm$10V

This module must be located in an RX3i Universal Backplane. An RX3i CPU with firmware version 2.80 (Build ID 43A1) or later. PAC Machine Edition 5.0 SP1A LD-PLC Hotfix 1) or later is required for configuration.

This module can be used with a Box-style (IC694TBB032), Extended Box-style (IC694TBB132), spring-style (IC694TBS032), or Extended Spring-style (IC694TBS132)) Terminal Block. Extended terminal blocks provide the extra shroud depth needed for shielded wiring. See the PACSystems RX3i System Manual, GFK-2314 revision B or later for more information about Terminal Blocks. Terminal Blocks are ordered separately.

Module Features

- Module supports hot insertion/extraction
- Terminal Block insertion or removal detection
- Module Status, Field Status, and TB LEDs
- Module meets CE, UL/CUL 508 and 1604, and ATEX requirements
- Flash memory for future upgrades
- Autocalibration at power-up
- Completely software-configurable, no module jumpers to set
- Six hardware analog-to-digital filter frequencies, individually-selectable by channel
- Rapid channel acquisition times based on filter frequency
- On-board error-checking
- Open-circuit detection for most input types
- Short-circuit detection for RTDs
- User-defined scaling
- Module fault reporting
- Overrange, underrange, high alarm, low alarm, high-high alarm, low-low alarm and calibration fault alarm detection and reporting on a per-channel basis
- Positive and negative Rate of Change Alarms
- Configurable interrupts for channel alarms and faults
- Supports diagnostic point fault contacts in the logic program
- CJC compensation on terminal block
- Temperature in Celsius or Fahrenheit

Specifications

Specification	Description		
Backplane Power Requirements (no external power requirements)	190 mA maximum @ 5.0 V 250 mA maximum @ 3.3 V		
Power Dissipation within Module Thermal Dissipation	5.4 watts maximum		
LEDs	One green LED to indicate the module status One bi-color green/yellow LED to indicate the field status One bi-color red/green LED to indicate the terminal block status		
Per Channel Acquisition Time (Each group scanned independently)	10 msec @ 1000 Hz, 13 msec @ 200 Hz, 27 msec @ 40 Hz, 67 msec @ 16 Hz, 87 msec @ 12 Hz, 127 msec @ 8 Hz		
Channel Update Time	The sum of the channel acquisition times for a bank of 4 channels plus one of the following if applicable: 1. RTD Lead resistance measurement time (equals channel acquisition time) 2. CJC acquisition time 7 msec.		
Input resolution	11 to 16 bits, depending on configured range and A/D filter frequency.		
Inputs in Ohms	Resistance	0-250, 0-500, 0-1000, 0-2000, 0-3000, 0-4000	
	Platinum 385	100, 200, 500,1000	
	Platinum 3916	100, 200, 500,1000	
	Nickel 672	120	
	Nickel 618	100,200, 500,1000	
	Nickel-Iron 518	604	
	Copper 426	10	
RTD Inputs	Copper 426	-100 to 260°C	
	Nickel 618	-100 to 260°C	
	Nickel 672	-80 to 260°C	
	Nickel-Iron 518	-100 to 200°C	
	Platinum 385	-200 to 850°C	
	Platinum 3916	-200 to 630°C	
Thermocouple Inputs	Type B	300 to 1820°C	
	Type C	0 to 2315°C	
	Type E	-270 to 1000°C	
	Type J	-210 to 1200°C	
	Type K	-270 to 1372°C	
	Type N	-210 to 1300°C	
	Type R	0 to 1768°C	
	Type S	0 to 1768°C	
	Type T	-270 to 400°C	
Voltage Inputs	-10V to +10V, 0V to +10V, 0V to +5V, 1V to +5V, -50mV to +50mV, -150mV to +150mV		
Current Inputs	-20mA to +20mA, 4 to 20mA, 0 to 20mA		
Configurable Input Filter	8 Hz, 12 Hz, 16 Hz, 40 Hz, 200 Hz, 1000 Hz		
Scaling	Floating point user scaling.		
Max RTD Cable Impedance	25 ohm		
RTD Wire Length	1000 ft max w/settling time of 1mSec		
Input Impedance	>1M ohm for TC/V/RTD		

Specification	Description
Current Input Resistance	249 ohm +/- 1%
Open circuit detection time	5 seconds max. Open circuit detection is available for all configurations except +/-20mA current, 0-20mA current, and +/-10V voltage.
Max Overvoltage	+/-14.5VDC continuous
Max Overcurrent	28 mA continuous
Normal Mode Noise Rejection	95 dB minimum @ 50/60 Hz with 8 Hz filter 85 dB minimum @ 50/60 Hz with 12 Hz filter
Common Mode Noise Rejection	120dB minimum @ 50/60 Hz with 8 Hz filter 110dB minimum @ 50/60 Hz with 12 Hz filter
Settling time to 5% of Full Scale (notch filter dependent)	<80 mS
Calibrated Accuracy at 25°C	Better than 0.1% of range (except 10 ohm CU RTD) Accuracy depends on A/D filter, data format, input noise, and ambient temperature.
Calibration interval	12 months typical to meet accuracy specifications over time. Module will allow for user offset to be applied as a periodic calibration adjustment.
Input Offset Drift with Temperature	3.0 milliohm/°C maximum 2.0 uV/°C maximum
Gain Drift with Temperature	50 ppm/°C typical (90 ppm/°C maximum)
Module error over Full Temp range	0.5% of range typical (depends on range) 1.0% of range maximum
Module Scan Time (notch filter dependent)	(Assumes 2 ADC's running in parallel, no CJC or lead resistance) 10 ms per Channel × 4 Channels = 40 ms (1K Hz filter) 127 ms per Channel × 4 Channels = 508 ms (8 Hz filter) Channels that are disabled are not scanned, shortening scan time.
Module conversion method	Sigma-delta
Isolation Voltage Channel to channel Group to group Terminal block to backplane/chassis	Opto-isolated, transformer isolated +-12.5Vdc channel to channel Tc/V/I/RTD 250 VAC continuous/1500 VAC for 60 seconds 250 VAC continuous/1500 VAC for 60 seconds

LED Status

The **Module OK** LED indicates module status. The **Field Status** LED indicates the presence of a fault on at least one channel or a terminal block error. The **TB** (Terminal Block) LED indicates the presence or absence of the terminal block. LEDs are powered from the backplane power bus.

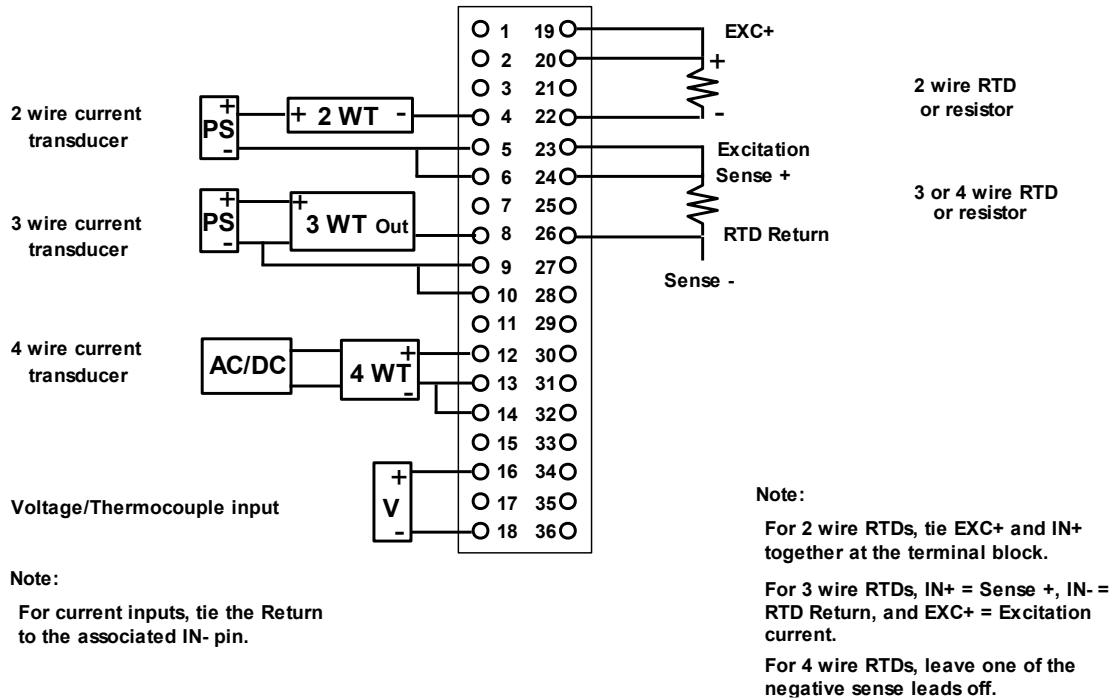| LED	Indicates
Module OK	ON Green: Module OK and configured. Slow Flashing Green or Amber: Module OK but not configured. Quick Flashing Green: Error. OFF: Module is defective or no backplane power present
Field Status	ON Green: No faults on any enabled channel, and Terminal Block is present. ON Yellow: Fault on at least one channel. OFF: Terminal block not present or not fully seated.
TB	ON Red: Terminal block not present or not fully seated. ON Green: Terminal block is present. OFF: No backplane power to module.

Module Wiring

The table below lists wiring connections for the module. Except for RTD and resistance type inputs, channels are wired as differential inputs. There are no shield terminals.

Terminal	RTD or Resistance	TC / Voltage / Current	RTD or Resistance	TC / Voltage / Current	Terminal
1		CJC1 IN+	Channel 1 EXC+		19
2		CJC1 IN-	Channel 1 IN+	Channel 1 IN+	20
3	Channel 2 EXC+			Channel 1 iRTN	21
4	Channel 2 IN+	Channel 2 IN+	Channel 1 IN-	Channel 1 IN -	22
5		Channel 2 iRTN	Channel 3 EXC+		23
6	Channel 2 IN-	Channel 2 IN -	Channel 3 IN+	Channel 3 IN+	24
7	Channel 4 EXC+			Channel 3 iRTN	25
8	Channel 4 IN+	Channel 4 IN+	Channel 3 IN-	Channel 3 IN-	26
9		Channel 4 iRTN	Channel 5 EXC+		27
10	Channel 4 IN-	Channel 4 IN -	Channel 5 IN+	Channel 5 IN+	28
11	Channel 6 EXC+			Channel 5 iRTN	29
12	Channel 6 IN+	Channel 6 IN+	Channel 5 IN-	Channel 5 IN-	30
13		Channel 6 iRTN	Channel 7 EXC+		31
14	Channel 6 IN-	Channel 6 IN-	Channel 7 IN+	Channel 7 IN+	32
15	Channel 8 EXC+			Channel 7 iRTN	33
16	Channel 8 IN+	Channel 8 IN+	Channel 7 IN-	Channel 7 IN-	34
17		Channel 8 iRTN		CJC2 IN+	35
18	Channel 8 IN-	Channel 8 IN-		CJC2 IN-	36

Wiring Diagram

Figure 1: Wiring Diagram for IC695ALG600

This module doesn't provide loop power for 2 Wire Current Transducers.

2 wire current transducer

3 wire current transducer

4 wire current transducer

Voltage/Thermocouple input

EXC+

2 wire RTD or resistor

Excitation Sense +

3 or 4 wire RTD or resistor

RTD Return

Sense -

Note:

For current inputs, tie the Return to the associated IN- pin.

Note:

For 2 wire RTDs, tie EXC+ and IN+ together at the terminal block.

For 3 wire RTDs, IN+ = Sense +, IN- = RTD Return, and EXC+ = Excitation current.

For 4 wire RTDs, leave one of the negative sense leads off.

Installing CJC Sensors

When using any thermocouple inputs on this module, the use of CJC sensors is recommended. Installing one CJC sensor will greatly improve the accuracy of thermocouple readings. Installing two CJC sensors will provide the highest thermocouple input accuracy for the module. Refer to GFK-2314, PACSystems RC3i System Manual, the section, CJC Scan Enable (Revision A or later) for information about configuring and using CJC sensors. A CJC sensor compensates for offset voltages introduced into the input signal where the thermocouple wires are connected to the module. A set of two CJC sensors is available as part number IC695ACC600.

Using both CJCs provides highest thermocouple compensation accuracy. Using only CJC1 lowers the thermocouple compensation accuracy, but can improve scan time for channels 5-8. Using only CJC2 lowers the thermocouple compensation accuracy, but can improve scan time for channels 1-4.

Figure 2: Installing CJC Sensors
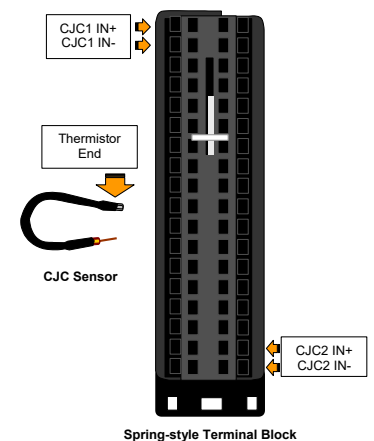
The thermistor end of the CJC sensor must be installed in the CJC1 IN+ or CJC2 IN+ terminal for accurate temperature measurements. The gold pin end of the CJC sensor must be installed in the CJC1 IN- or the CJC2 IN- terminal.

Open the Terminal Block contacts fully before installing the CJC sensor. Insert the sensor into the Terminal Block contact, maintaining metal-to-metal contact between the thermistor and the Terminal Block contact.

For a Box-style Terminal Block, maintain pressure while screwing down the contact.

Isolated Input Groups

This module provides two isolated groups of four input channels each. This allows fast inputs and slower or highly-filtered inputs to be connected to the same module without adversely affecting the update rate of the fast inputs. To take advantage of this feature, up to four inputs requiring fast response should be placed together in one isolated group while slower inputs should be connected to the other isolated group. For example, voltage and current inputs with higher frequency input filter settings should be grouped together on one of the isolated groups while thermocouple, RTD, resistance, or voltage/current inputs with low-frequency input filter settings should be grouped together on the other isolated group.

Each isolated group provides a CJC input. The CJC input is considered a slow-response input and will reduce the update rate for the associated channel group when enabled.

Connecting Channels to the Same Thermocouple Point

When connecting one or more channels from channels 1–4 and one or more channels from channels 5 - 8 to the same thermocouple point electrically, the point should be grounded. It can be grounded at either the sensor or the module, by adding a jumper wire from frame ground to the low side of one thermocouple input.

Resolution and Update Time

The actual resolution and update time for each input depend on the channel's configured Range Type and A/D Filter Frequency, as described in GFK-2314, *RX3i System User's Manual*. At higher Filter Frequencies, channel update time increases while input resolution decreases. The approximate number of bits for each Filter Frequency and Range Type are shown in the table below.

Filter Frequency	Range Type: Voltage / Current Approximate Number of Bits	Range Type: TC / mV Approximate Number of Bits	Channel Update Time
8 Hz	16	16	127 ms
12 Hz	16	16	87 ms
16 Hz	16	16	67 ms
40 Hz	16	14	27 ms
200 Hz	14	13	13 ms
1000 Hz	11	11	10 ms

Release History

Module Revision	Description of change	FW Version
IC695ALG600-FF IC695ALG600CA-FF (conformal coat) IC695ALG600LT-FF (low temperature)	This change addresses component obsolescence with new FW to support a drop-in replacement serial flash device. There are no changes to form, fit, or function.	Primary:2.01 Boot: 2.01
IC695ALG600-FE IC695ALG600CA-FE (conformal coat) IC695ALG600LT-FE (low temperature)	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	Primary:2.00 Boot: 2.00
IC695ALG600-EE IC695ALG600CA-EE (conformal coat) IC695ALG600LT-EE (low temperature)	This version of the product is a new HW/FW design to resolve obsolescence and comply with EU RoHS 2011/65/EU	Primary:2.00 Boot: 2.00
IC695ALG600-DD	This version of the product contains an enhancement to the design that improves the tolerance of terminal block detection.	Primary:1.14 Boot: 1.10
IC695ALG600-DC	Label change only. No change in functionality, performance or compatibility.	Primary:1.11 Boot: 1.10
IC695ALG600-CC	Modified the terminal block detector switch to increase the size of the switch lever. The increased size of the switch lever allows additional tolerance to assure contact with the terminal block actuator.	Primary:1.11 Boot: 1.10
IC695ALG600-BC	Improved noise immunity	Primary:1.11 Boot: 1.10
IC695ALG600-AB	None	Primary:1.10 Boot: 1.10

Firmware Upgrades

There is a field upgrade (via the WEB or Winloader Tool). Only version -EE and -FE modules can be upgraded using the version 2.00 upgrade kit listed below.
Previous versions (-DD and earlier) and newer versions (-FF and later) cannot be upgraded to the version 2.00 FW.

Upgrade Kit: 41G2457-FW01-000-A0 = Initial FW v2.00 release

Functional Compatibility

The changes made by this revision incorporate both HW and FW changes to address obsolescence issues with the microcontroller. These designs had to be updated to accommodate the new component replacements. These HW changes do not affect form, fit, but there are minor functional differences with these new designs.

Subject	Description
Programmer Version Requirements	PAC Machine Edition Logic Developer 5.0 + Service Pack 1A with LD-PLC Hotfix 1 or later must be used to configure and program the Universal Analog Input Module.
CPU Firmware Version Requirements	PACSystems RX3i CPU version 2.80 or later must be used to configure and operate the Universal Analog Input Module.

Known Restrictions and Open Issues during this Release

Subject	Description
Temperature Offset Drift	The module exhibits offset drift with temperature. On some channels, this is enough to cause the readings to go outside the allowed over-temperature accuracy specification. Recommendation: Run an autocalibration on the module.
Incorrect Display of Deadband limits	When changing configurations from one input type to another in PAC Machine Edition, the deadband limits and/or the positive rate of change limits for the module may be incorrect. More specifically, the values for these limits may increase or become invalid each time the configuration is switched from one input type to another. For example, if Fahrenheit is selected for a thermocouple input type and the input type is then changed to voltage, the deadband limits do not change to reflect appropriate values for the voltage input type and remain in units of Fahrenheit. Switching back to a thermocouple input type could then result in all values defaulting to Celcius, but the deadband limits remaining in units of Fahrenheit.

New Features in This Release

HW/FW change to address serial Flash component obsolescence.

Problems Resolved in This Release

None.

Operational Notes

Unused RTD Channels Must Have a Jumper Installed

Channels that have been configured as an RTD channel, but are not connected *must* have a jumper installed to assure proper operation. Failure to do so could affect the accuracy of adjacent channels.

For additional information, including a wiring diagram, refer to the section, Module Wiring.

Diagnostic Reporting for Interrupts

The Universal Analog Input module has separate enable/disable options for Diagnostic Reporting and Interrupts. Normally, disabling a diagnostic (such as Low/High Alarm or Over/Under range) in the configuration means that its diagnostic bit is never set. However, if interrupts are enabled for a condition and that interrupt occurs, the diagnostic bit for that condition is also set during the same PLC scan. The next PLC input scan always clears this interrupt status bit back to 0, because Diagnostic Reporting has it disabled.

General Contact Information

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Knowledge Base: https://www.emerson.com/industrial-automation-controls/support

Technical Support

Americas
Phone: 1-888-565-4155
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Any escalation request should be sent to: mas.sfdcescalation@emerson.com

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

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