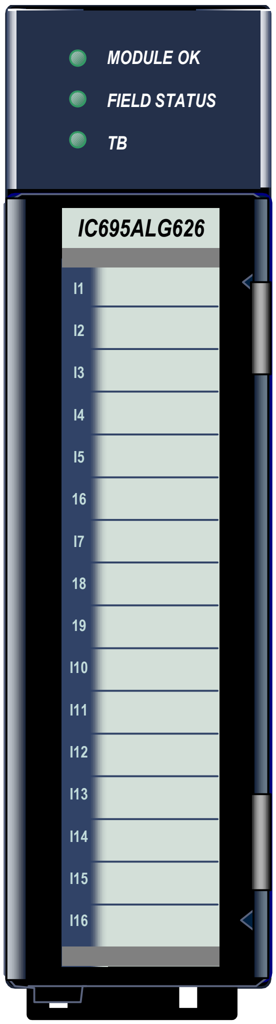
GE Fanuc IC695ALG628

Rx3i PacSystem

Analog Input HART module, 8 channels single ended, 4 channels differential IC695A IC695AL IC695ALG

Analog Input Module,16/ 8 Ch. Voltage / Current, HART: IC695ALG626
Analog Input Module, 8/4 Ch. Voltage / Current, HART: IC695ALG628



Non-Isolated Differential Analog Voltage/Current Input module IC695ALG628 provides 8 single-ended or 4 differential input channels. ***Non-Isolated Differential Analog Voltage/Current Input*** module IC695ALG626 provides 16 single-ended or 8 differential input channels. Both modules feature HART version 5.0 communications capability on each channel. Module IC695ALG626 has four internal HART modems. Module IC695ALG628 has two internal HART modems. In single-ended mode, four single-ended channels are multiplexed into each HART modem. In differential mode, two differential channels are multiplexed into each HART modem. Analog input channels can be configured for these ranges:

- Current: 0 to 20mA, 4 to 20mA, +/- 20mA
- Voltage: +/- 10V, 0 to 10V, +/- 5V, 0 to 5V, 1 to 5V.

Channels that will use HART communications must be configured for the 4-20mA range.

Module Features

- Completely software-configurable, no module jumpers to set
- Full autocalibration
- On-board error-checking
- Open-circuit detection for all voltage and 4-20mA inputs
- Configurable scaling and offsets per channel
- High alarm, low alarm, high-high alarm, low-low alarm detection and reporting selectable per channel
- Module fault reporting
- Supports diagnostic point fault contacts in the logic program
- Flash memory for future upgrades
- Positive and negative Rate of Change Alarms
- Autocalibration at startup
- Configurable interrupts for channel alarms and faults
- Terminal Block insertion or removal detection
- Version 5.0 HART communications

These modules must be located in an RX3i Universal Backplane. They require an RX3i CPU with firmware version 3.5 or later. Machine Edition Version 5.5 or later must be used for configuration. The modules 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. Terminal Blocks are ordered separately.

Specifications: IC695ALG626 and IC695ALG628

Input Ranges	Current: 0 to 20mA, 4 to 20mA, +/- 20mA Voltage: +/- 10V, 0 to 10V, +/- 5V, 0 to 5V, 1 to 5V
Backplane Power Requirements	ALG626 600 mA maximum @ 5.0V +5% / - 2.5%, 625 mA maximum @ 3.3V +5% / - 3%
	ALG628: 450 mA maximum @ 5.0V +5% / - 2.5%, 625 mA maximum @ 3.3V +5% / - 3%
Programmer	Machine Edition version 5.5 and later
Power Dissipation within Module	IC695ALG626: 7.35 watts maximum IC695ALG628: 5.55 watts maximum
Thermal Derating	Module IC695ALG628 has no thermal derating. Module IC695ALG626 has no thermal derating in voltage mode. Thermal derating for module IC695ALG626 in current mode is shown on the next page.
Resolution	24 bit ADC converted to Floating Point or Integer
Input Data Format	Configurable as floating point IEEE 32 bit or 16-bit integer in a 32-bit field
Filter Options	8Hz, 12Hz, 16Hz, 40Hz, 200Hz, 500Hz
Analog Module Scan Time (in milliseconds)	The module scan can consist of up to four acquisition cycles. Each cycle includes a specific set of channels, as described in the section "Channel Scanning". Total Scan Time depends on the number of acquisition cycles in the scan, the configured filter option, and whether the channels are analog or HART.

Configured Filter	***Number of Acquisition Cycles in the Scan***							
	1		***2***		***3***		***4***	
	Analog	*HART*	*Analog*	*HART*	*Analog*	*HART*	*Analog*	*HART*
8 Hz filter	121	128	241	254	362	380	482	506
12 Hz filter	81	88	161	174	242	260	322	346
16 Hz filter	61	68	121	134	182	200	242	266
40 Hz filter	21	28	41	54	62	80	82	106
200 Hz filter	5	12	9	22	14	32	18	42
500 Hz filter *[with filtering and rate detection enabled]*	3	N/A	5 *[6]*	N/A	7 *[9]*	N/A	9 *[12]*	N/A

HART Data Scan Time (in seconds)

The HART data scan can consist of up to four acquisition cycles (similar but asynchronous to the analog scan time). Each cycle includes a specific set of channels:

For ALG626 single ended: channels 1-4, 5-8, 9-12, 13-16 are separate channel groups.

For ALG626 differential: channels 1-2, 3-4, 5-6, 7-8 are separate channel groups.

For ALG628 single ended: channels 1-4, 5-8 are separate channel groups.

For ALG628 differential: channels 1-2, 3-4 are separate channel groups.

Note: If you have only 4 Hart Devices on an ALG626 module, to minimize update times it is best to connect them to channels 1, 5, 9, and 13 so you only have 1 Hart enabled channel per channel group.

Total HART scan time depends on the number of acquisition cycles in the scan, number of retries, enabling/disabling of slot variables, and use of pass-thru commands. If slot variables are enabled, update times are doubled.

HART Devices in Group	**Each HART Data Channel Updates Every:**
1	0.7 second (typical)
2	1.9 seconds (typical)
3	3.0 seconds (typical)
4	4.0 seconds (typical)

Continued ….

Specifications: IC695ALG608 and IC695ALG616, continued

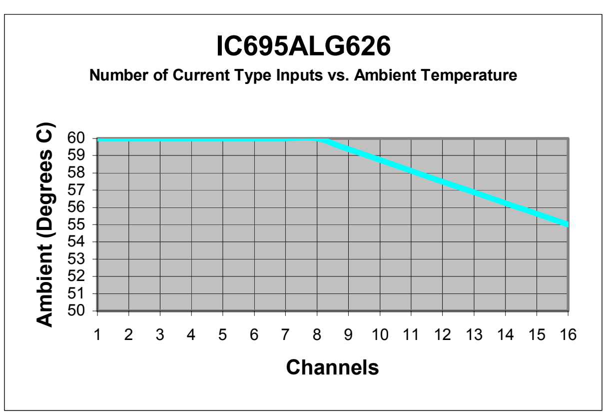
Input Impedance	>100 Kohm voltage inputs		
Current Input Resistance	249 ohms +/- 1%		
Open Circuit Detection time	1 second maximum		
Overvoltage	+/-60 VDC continuous, maximum		
Overcurrent	+/-28mA continuous, maximum		
Normal Mode Noise Rejection in dB		*At 50Hz*	*At 60Hz*
	8 Hz filter	103	97
	12 Hz filter	94	89
	16 Hz filter	39	65
	40 Hz filter	4	7
	200 Hz filter	0.1	0.2
	500 Hz	0.0	0.0
Common Mode Noise Rejection	120dB minimum @ 50/60 Hz with 8 Hz filter 110dB minimum @ 50/60 Hz with 12 Hz filter		
Channel-Channel DC Crosstalk	-80 dB minimum (single ended mode) -80 dB minimum (differential mode, grounded common) -60 dB minimum (differential mode, floating common)		
Calibrated Accuracy* @ 13°C – 33°C with 8 Hz, 12 Hz and 16 Hz filter	+/- 5V, + /- 10V, +/- 20 mA: 0.05% of range. 0 to 10V, 0 to 5V, 1 to 5V, 0 to 20 mA: 0.1% of range. 4 to 20 mA: 0.125% of range		
Calibrated Accuracy* @ 0°C – 60°C with 8 Hz, 12 Hz and 16 Hz filter	0 to 10V, 0 to 5V, 1 to 5V, 0.2% of range.0 to 20 mA: 0.25% of range. 4 to 20 mA: 0.3125% of range. +/- 5V, +/- 10V: 0.1% +/- 20 mA: 0.125% of range		
Calibration Interval	12 months typical to meet accuracy specifications over time. Offset can be applied as a periodic calibration adjustment.		
Isolation Voltage **terminal block to backplane/chassis**	Opto-isolated, transformer isolated 250 VAC continuous/1500 VAC for 1 minute		

* In the presence of severe RF interference (IC 801-3, 10V/M), accuracy may be degraded by +/- 1% of range.

Refer to Appendix A for product standards and general specifications.

Thermal Derating

For module IC695ALG626 in current mode, the number of inputs that can be on at the same time depends on the ambient temperature as shown below.



LEDs

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.

Configuration Parameters: IC695ALG626 and IC695ALG628

Module Parameters		
Parameter	***Default***	***Description***
Channel Value Reference Address	%AIxxxxx	Starting address for the module's input data. This defaults to the next available %AI block. The format of this data is shown on page 11-14.
Channel Value Reference Length	ALG628: 16 ALG626: 32	The number of words used for the module's input data. This parameter cannot be changed.
Diagnostic Reference Address	%Ixxxxx	Starting address for the channel diagnostics status data. The format of this data is shown on page 11-16.
Diagnostic Reference Length	0	The number of bit reference bits required for the Channel Diagnostics data. When set to 0, Channel Diagnostics is disabled. To enable Channel Diagnostics mapping, change this to a non-zero value.
Module Status Reference Address	%Ixxxxx	Starting address for the module's status data. The format of this data is shown on page 11-17.
Module Status Reference Length	0	The number of bits (0 to 32) required for the Module Status data. When set to 0, mapping of Module Status data is disabled. To enable Module Status data mapping, change this to a non-zero value.
HART Data Scan Control	No data	Selects whether the CPU will automatically scan from the HART module: no data, changed data only, or all data for each HART-enabled channel. See the below for details of memory usage. Dynamic Data Only: the first 18 words or 288 bits of HART data per input device. All Data: all of the HART data (88 words or 1408 bits for each HART input device.
HART Pass-thru Service Options	Once per two channel scans	Selects whether the module will automatically service a HART pass-through command i each 1, 2, or 4 channel scans or only upon change of the HART device configuration or if data hasn't been read for 10 seconds (Pass-Thru Only). If Pass-Thru Only is selected, scan data is not automatically available to the application program. However, it can be read using COMMREQ 1.
HART Status Reference Address		Starting address for the HART Status data. The format of this data is shown on page 11-41.
HART Status Reference Length		Length of the HART Status data; 4 words or 64 bits.

Continued ….

<table>
<tr><th colspan="4">Module Parameters, continued</th></tr>
<tr><th>Parameter</th><th>Default</th><th colspan="2">Description</th></tr>
<tr><td>HART Data Reference Address</td><td></td><td colspan="2">Starting address for the HART data for the module in %I, %Q, %AI, %AQ, %R, %W, %G, %M, or %T memory. Format of this data is shown on page 11-42.</td></tr>
<tr><td rowspan="5">HART Data Reference Length</td><td rowspan="5">0</td><td colspan="2">Length of the HART data. If Data Scan Control is set to no data, the length is 0. The length is automatically set according to the selection made for HART Data Scan Control</td></tr>
<tr><td>HART Data Scan Control</td><td>HART Data Reference Length</td></tr>
<tr><td>No Data</td><td>0</td></tr>
<tr><td>Dynamic Data Only</td><td>Highest HART-enabled Channel Number X (18 words or 288 bits)</td></tr>
<tr><td>All Data</td><td>Highest HART-enabled Channel Number X (88 words or 1408 bits)</td></tr>
<tr><td>I/O Scan Set</td><td>1</td><td colspan="2">The scan set 1 – 32 to be assigned to the module by the RX3i CPU</td></tr>
<tr><td>Inputs Default</td><td>Force Off</td><td colspan="2">In the event of module failure or removal, this parameter specifies the state of all Channel Value References for the module.
Force Off = Channel Values clear to 0.
Hold Last State = Channel Values hold their last state.</td></tr>
<tr><td>Inputs Default w/o Terminal Block</td><td>Enabled</td><td colspan="2">Enabled / Disabled: Controls whether inputs will be set to their defaults if the Terminal Block is removed.</td></tr>
<tr><td>Channel Faults w/o Terminal Block</td><td>Disabled</td><td colspan="2">Enabled / Disabled: Controls whether channel faults and configured alarm responses will be generated after a Terminal Block removal. The default setting of Disabled means channel faults and alarms are suppressed when the Terminal Block is removed. This parameter does not affect module faults including the Terminal Block loss/add fault generation.</td></tr>
<tr><td>Analog Input Mode</td><td>Single-ended Input Mode</td><td colspan="2">Single-ended / Differential: This selection must match the input wiring to the module.</td></tr>
<tr><td>A/D Filter Frequency</td><td>40Hz</td><td colspan="2">Low pass A/D hardware filter setting for all inputs on the module: 8, 12, 16, 40, 200, or 500Hz. Default is 40Hz. Frequencies below the filter setting are not filtered by hardware.</td></tr>
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Channel Parameters		
Parameter	***Default***	***Description***
Range Type	Disabled	Voltage/Current, Disabled
Range (Not for Range Type Disabled)	-10V to +10V	For voltage/current: -10V to +10V, 0V to +10V, 0 V to +5V, 1V to +5V, -5V to +5V, -20mA to +20mA, 4 to 20 mA, 0 to 20 mA
Channel Value Format	32-bit Floating Point	16-bit integer or 32-bit floating point
High Scale Value (Eng Units)	The defaults for the 4 Scaling parameters depend on the configured Range Type and Range. Each Range and Range Type have a different set of defaults.	Note: Scaling is disabled if both High Scale Eng. Units equals High Scale A/D Units and Low Scale Eng. Units equals Low Scale A/D Units. Default is High A/D Limit of selected range type.
Low Scale Value (Eng Units)		Default is Low A/D Limit of selected range type. Must be lower than the high scaling value.
High Scale Value (A/D Units)		Default is High A/D Limit of selected range type. Must be greater than the low scaling value.
Low Scale Value (A/D Units)		Default is Low A/D Limit of selected range type.

Continued ….

Input Scaling

By default, the module converts a voltage or current input over the entire span of its configured Range into a floating point value for the CPU. For example, if the Range of a channel is 4 to 20mA, the module reports channel input values from 4.000 to 20.000. By modifying one or more of the four channel scaling parameters (Low/High Scale Value parameters) from their defaults, the scaled Engineering Unit range can be changed for a specific application. Scaling can provide inputs to the PLC that are already converted to their physical meaning, or convert input values into a range that is easier for the application to interpret. Scaling is always linear and inverse scaling is possible. All alarm values apply to the scaled Engineering Units value, not to the A/D input value.

The scaling parameters only set up the linear relationship between two sets of corresponding values. They do not have to be the limits of the input.

Example 1

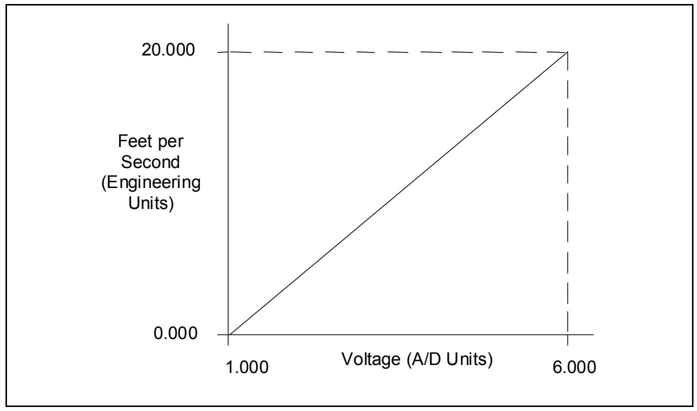
For a voltage input, 6.0 volts equals a speed of 20 feet per second, and 1.0 volt equals 0 feet per second. The relationship in this range is linear. For this example, the input values should represent speed rather than volts. The following channel configuration sets up this scaling:

High Scale Value (Eng Units) = 20.000

Low Scale Value (Eng Units) = 0.000

High Scale Value (A/D Units) = 6.000

Low Scale Value (A/D Units) = 1.000



For this example, 1.0V to 6.0V is the normal voltage range, but the module will attempt to scale the inputs for a voltage that lies outside the range. If a voltage of 10.0V were input to the channel, the module would return a scaled channel value of 36.000. The application should use alarms or take other precautions for scaled inputs that are outside the acceptable range or invalid.

Example 2

An existing application uses traditional analog to digital (A/D) count integer values. With scaling and the optional 16-bit integer input option, a channel can be configured to report integer count values. In this example, the application should interpret +10V as 32000 counts and -10V as -32000 counts. The following channel configuration will scale a +/-10V input channel to +/-32000 counts.

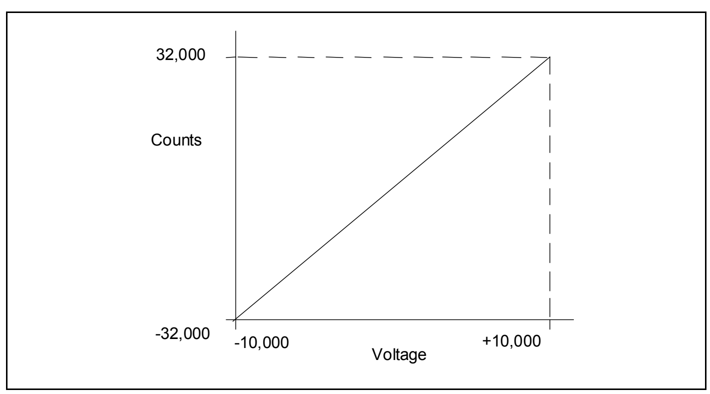
Channel Value Format = 16 Bit Integer

High Scale Value (Eng Units) = 32000.0

Low Scale Value (Eng Units) = -32000.0

High Scale Value (A/D Units) = 10.000

Low Scale Value (A/D Units) = -10.000



Channel Parameters continued		
Parameter	***Default***	***Description***
Positive Rate of Change Limit (Eng Units)	0.0	Rate of change in Engineering Units per Second that will trigger a Positive Rate of Change alarm. Default is disabled. Used with “Rate of Change Sampling Rate” parameter.
Negative Rate of Change Limit (Eng Units)	0.0	Rate of change in Engineering Units per Second that will trigger a Negative Rate of Change alarm. Default is disabled. Used with “Rate of Change Sampling Rate” parameter.
Rate of Change Sampling Rate	0.0	Time from 0 to 300 seconds to wait between comparisons. Default of 0.0 is to check after every input sample.

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Rate of Change Alarms

These modules can detect both Negative Rate of Change and Positive Rate of Change in Engineering Units per Second. When either Rate of Change parameter is configured to be non-zero, the module takes the difference in Engineering Units between the previous rate of change sample and the current sample, then divides by the elapsed time between samples.

If the Engineering Units change from the previous sample to current sample is negative, the module compares the rate change with the Negative Rate of Change parameter.

If the Engineering Units change between samples is positive, the module compares the results in comparing the rate change with the Positive Rate of Change parameter value.

In either case, if the rate of change is greater than the configured rate, a rate of change alarm occurs. The actions taken by the module following the alarm depend on the enabled rate of change actions that have been set up in the "Diagnostic Reporting Enable", "Fault Reporting Enable", and "Interrupts Enabled" parameters.

The Rate of Change Sampling Rate parameter determines how frequently the module compares the Rate of Change. If the Rate of Change Sampling Rate is 0 or any time period less than the channel update rate, the module compares the Rate of Change for every input sample of the channel.

<table>
<tr><th colspan="3">Channel Parameters continued</th></tr>
<tr><th>Parameter</th><th>Default</th><th>Description</th></tr>
<tr><td>High-High Alarm (Eng Units)</td><td rowspan="8">The defaults for the High-High, High, Low, and Low-Low parameters depend on the configured Range Type and Range. Each Range and Range Type has a different set of default values.</td><td rowspan="8">Alarms and Deadbands
All of the alarm parameters are specified in Engineering Units. To use alarming, the A/D Alarm Mode must also be configured as enabled.
High-High Alarm and Low-Low Alarm: When the configured value is reached or passed, a Low-Low Alarm or High-High Alarm is triggered. The configured values must be lower than/higher than the corresponding low/high alarm limits.
High Alarm and Low Alarm: When the configured value is reached or below (above), a Low (High) Alarm is triggered.
High and Low Alarm Deadbands: A range in Engineering Units above the alarm condition (low deadband) or below the alarm condition (high deadband) where the alarm status bit can remain set even after the alarm condition goes away. For the alarm status to clear, the channel input must fall outside the deadband range.
Alarm Deadbands should not cause the alarm clear condition to be outside the Engineering Unit User Limits range. For example, if the engineering unit range for a channel is -1000.0 to +1000.0 and a High Alarm is set at +100.0, the High Alarm Deadband value range is 0.0 to less than 1100.0. A deadband of 1100.0 or more would put the High Alarm clear condition below –1000.0 units making the alarm impossible to clear within the limits.</td></tr>
<tr><td>High Alarm (Eng Units)</td></tr>
<tr><td>Low Alarm (Eng Units)</td></tr>
<tr><td>Low-Low Alarm (Eng Units)</td></tr>
<tr><td>High-High Alarm Deadband (Eng Units)</td></tr>
<tr><td>High Alarm Deadband (Eng Units)</td></tr>
<tr><td>Low Alarm Deadband (Eng Units)</td></tr>
<tr><td>Low-Low Alarm Deadband (Eng Units)</td></tr>
<tr><td>User Offset</td><td>0.0</td><td>Engineering Units offset to change the base of the input channel. This value is added to the scaled value on the channel prior to alarm checking.</td></tr>
<tr><td>Software Filtering</td><td>Disabled</td><td>Disabled / Enabled. Controls whether software filtering will be performed on the inputs.</td></tr>
<tr><td>Integration Time in milliseconds.</td><td>0</td><td>Specifies the amount of time in milliseconds for the software filter to reach 63.2% of the input value.
A value of 0 indicates software filter is disabled. A value of 100 indicates data will achieve 63.2% of its value in 100ms. Default is 0.</td></tr>
</table>

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Using Alarming

The Diagnostic Reporting Enable, Fault Reporting Enable, and Interrupt Enable configuration parameters can be used to enable different types of responses for individual channel alarms. By default, all responses are disabled on every channel. Any combination of alarm enables can be configured for each channel.

- If Diagnostic Reporting is enabled, the module reports channel alarms in reference memory at the channel's Diagnostic Reference address.
- If Fault Reporting is enabled, the module logs a fault log in the I/O Fault table for each occurrence of a channel alarm.
- If Interrupts are enabled, an alarm can trigger execution of an Interrupt Block in the application program, as explained below.

Using Interrupts

To properly configure an I/O Interrupt, the Interrupt enable bit or bits must be set in the module's configuration. In addition, the program block that should be executed in response to the channel interrupt must be mapped to the corresponding channel's reference address.

Example:

In this example, the Channel Values Reference Address block is mapped to %AI0001-%AI0020. An I/O Interrupt block should be triggered if a High Alarm condition occurs on channel 2.

- Configure the High-Alarm condition.
- Set the High-Alarm Interrupt Enable flag for Channel 2 in the module configuration.

Channel 2's reference address corresponds to %AI00003 (2 Words per channel), so the interrupt program block Scheduling properties should be set for the "I/O Interrupt" Type and "%AI0003" as the Trigger.

Fault Reporting and Interrupts

These modules have 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 I/O Interrupt block logic execution. The next PLC input scan always clears this interrupt status bit back to 0, because Diagnostic Reporting has it disabled.

Channel Parameters continued		
Parameter	***Default***	***Description***
HART Communications	Disabled	Enabled/disabled. Set this to enabled if the channel will use HART communications. Enabling HART communications on a channel forces the channel to 4-20mA operation.
HART Slot Variables	Disabled	Enabled/disabled. If HART Slot Variables is enabled, the module will periodically send HART command #33 to request data. Channel variables will be read and placed in the HART scan block channel data. For each slot, the variable assignment code can be set between 0 and 255.
Slot Code 0, 1, 2, 3	1	The slot transmitter variable assignment code that will be used to retrieve data from the connected HART device. This is used with HART Pass-Thru command 33, byte 0. These values are used in the request data for HART command #33.

Input Module Data Formats

This section explains how the module uses separate reference areas that can be assigned during module configuration:

- *Channel Value Reference Data*, required memory for the analog input channel values.
- *Input Channel Diagnostic Reference Data*, optional memory for channel faults and alarms.
- *Module Status Reference Data,* optional memory for general module status data.

In addition, during configuration, optional *HART Reference Data,* memory can be assigned. See the section "HART Reference Data" later in this chapter for details.

Channel Value Reference Data

The module reports its input channel data in its configured *Channel Value Reference* input words, beginning at its assigned Channel Value Reference Address. Each channel value occupies 2 words, whether the channel is used or not:

Channel Value Reference Address	***Contains this Input***
+0, 1	Channel 1
+2, 3	Channel 2
+4, 5	Channel 3
+6, 7	Channel 4
+8, 9	Channel 5
+10, 11	Channel 6
+12, 13	Channel 7
+14, 15	Channel 8
For Module IC695ALG626 Only:	
+16, 17	Channel 9
+18, 19	Channel 10
+20, 21	Channel 11
+22, 23	Channel 12
+24, 25	Channel 13
+26, 27	Channel 14
+28, 29	Channel 15
+30, 31	Channel 16

Depending on its configured Channel Value Format, each enabled channel reports a 32-bit floating point or 16-bit integer value to the CPU.

In the 16-bit integer mode, the low word of the 32-bit channel data area contains the 16-bit integer channel value. The high word (upper 16-bits) of the 32-bit value are set with the sign extension of the 16-bit integer. This sign-extended upper word allows the 16-bit integer to be read as a 32-bit integer type in logic without losing the sign of the integer. If the 16-bit integer result is negative, the upper word in the 32-bit channel data has the value 0xFFFF. If the 16-bit integer result is positive, the upper word is 0x0000.

Resolution and Range Type

The actual resolution for each input depends on the channel's configured Range Type and A/D Filter Frequency. At higher Filter Frequencies, input resolution decreases. The approximate resolution in bits for each Filter Frequency and Range Type are shown in the table below.

Filter Frequency	***Range Type***		
	+ / - 10V	***0 to 10V, + / - 5V, + / - 20V***	***0 to 5V, 1 to 5V, 0 to 20mA, 4 to 20mA***
8 Hz	18	17	16
12 Hz	17	16	15
16 Hz	17	16	15
40 Hz	16	15	14
200 Hz	15	14	13
500 Hz	14	13	12

Channel Scanning

These modules use 4 A/D converters to achieve the fastest possible channel scan times. The module has up to four acquisition cycles for each module scan. The acquisition cycles and channels acquired during each cycle are:

Acquisition Cycle	***Channels Acquired***	
	IC695ALG628	***IC695ALG626***
1	1, 5	1, 5, 9, 13
2	2, 6	2, 6, 10, 14
3	3, 7	3, 7, 11, 15
4	4, 8	4, 8, 12, 16

To bypass an acquisition cycle, all channels that would be acquired during that cycle must be disabled.

For fastest scan times, always wire by acquisition cycle. For example, if only eight channels were used on the 16-channel module, IC695ALG626, channels 1, 2, 5, 6, 9, 10, 13, and 14 should be used for optimum performance.

Input Channel Diagnostic Reference Data

If the module is configured to use a *Diagnostic Reference Address*, it reports channel diagnostics status data to the CPU. The CPU stores this data at the module's configured *Diagnostic Reference Address*. Use of this feature is optional.

The diagnostics data for each channel occupies 2 words (whether the channel is used or not):

Diagnostic Reference Address	***Contains Diagnostics Data for:***
+0, 1	Channel 1
+2, 3	Channel 2
+4, 5	Channel 3
+6, 7	Channel 4
+8, 9	Channel 5
+10, 11	Channel 6
+12, 13	Channel 7
+14, 15	Channel 8
For Module IC695ALG626 Only:	
+16, 17	Channel 9
+18, 19	Channel 10
+20, 21	Channel 11
+22, 23	Channel 12
+24, 25	Channel 13
+26, 27	Channel 14
+28, 29	Channel 15
+30, 31	Channel 16

When a diagnostic bit equals 1, the alarm or fault condition is present on the channel. When a bit equals 0 the alarm or fault condition is either not present or detection is not enabled in the configuration for that channel. For each channel, the format of this data is:

Bit	***Description***
1	Low Alarm
2	High Alarm
3	Underrange
4	Overrange
5	Open Wire
6 – 16	Reserved (set to 0).
17	Low-Low Alarm
18	High-High Alarm
19	Negative Rate of Change Alarm
20	Positive Rate of Change Alarm
21 - 32	Reserved (set to 0).

Module Status Reference Data

The module can optionally be configured to return 2 bits of module status data to the CPU. The CPU stores this data in the module's 32-bit configured *Module Status Reference* area.

Bit	***Description***
1	Module OK (1 = OK, 0 = failure, or module is not present)
2	Terminal Block Present (1 = Present, 0 = Not present)
3 - 32	Reserved

During operation, the PLC must be in an I/O Enabled mode for the current Module Status to be scanned and updated in reference memory.

Terminal Block Detection

The module automatically checks for the presence of a Terminal Block. The module's TB LED indicates the state of the terminal block. It is green when the Terminal Block is present or red if it is not.

Faults are automatically logged in the CPU's I/O Fault table when the terminal block is inserted or removed from a configured module in the system. The fault type is Field Fault and the fault description indicates whether the fault is a "Loss of terminal block" or an "Addition of terminal block". If a Terminal Block is not present while a configuration is being stored, a "Loss of terminal block" fault is logged.

Bit 2 of the Module Status Reference indicates the status of the terminal block.

Field Wiring: IC695ALG626 and ALG628, Single-Ended Mode

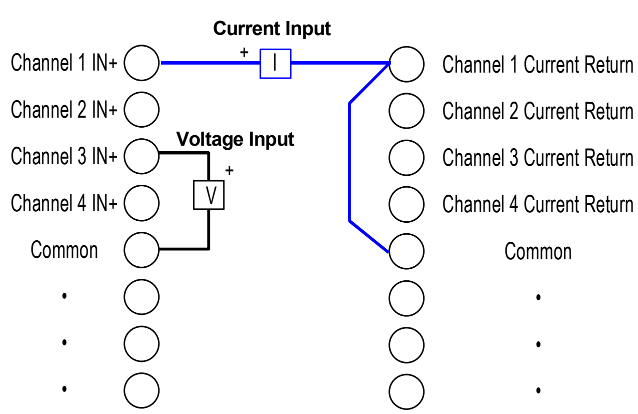
The table below lists wiring connections for Single-ended mode.

Terminal	ALG628	ALG628	ALG626	ALG628	Terminal
1	Channel 1 IN+		Channel 1 Current Return (IRTN1)		19
2	Channel 2 IN+		Channel 2 Current Return (IRTN2)		20
3	Channel 3 IN+		Channel 3 Current Return (IRTN3)		21
4	Channel 4 IN+		Channel 4 Current Return (IRTN4)		22
5	Common		Common		23
6	Channel 5 IN+		Channel 5 Current Return (IRTN5)		24
7	Channel 6 IN+		Channel 6 Current Return (IRTN6)		25
8	Channel 7 IN+		Channel 7 Current Return (IRTN7)		26
9	Channel 8 IN+		Channel 8 Current Return (IRTN8)		27
10	No Connection	Channel 9 IN+	No Connection	Channel 9 Current Return (IRTN9)	28
11	No Connection	Channel 10 IN+	No Connection	Channel 10 Current Return (IRTN10)	29
12	No Connection	Channel 11 IN+	No Connection	Channel 11 Current Return (IRTN11)	30
13	No Connection	Channel 12 IN+	No Connection	Channel 12 Current Return (IRTN12)	31
14	Common		Common		32
15	No Connection	Channel 13 IN+	No Connection	Channel 13 Current Return (IRTN13)	33
16	No Connection	Channel 14 IN+	No Connection	Channel 14 Current Return (IRTN14)	34
17	No Connection	Channel 15 IN+	No Connection	Channel 15 Current Return (IRTN15)	35
18	No Connection	Channel 16 IN+	No Connection	Channel 16 Current Return (IRTN16)	36

There are no shield terminals on these modules. For shielding, tie the cable shields to the ground bar along the bottom of the backplane. M3 tapped holes are provided for this purpose.

All the common terminals are connected together internally, so any common terminal can be used for the negative lead of the external power supply.

Single-Ended Mode



For single-ended mode, a voltage input should be connected between its Channel IN+ terminal and a Common (COM) return terminal.

A current input should be connected between its Channel IN+ terminal and its Channel Current Return Terminal. In addition, a jumper wire should be connected between the Channel Current Return terminal and a Common (COM) return.

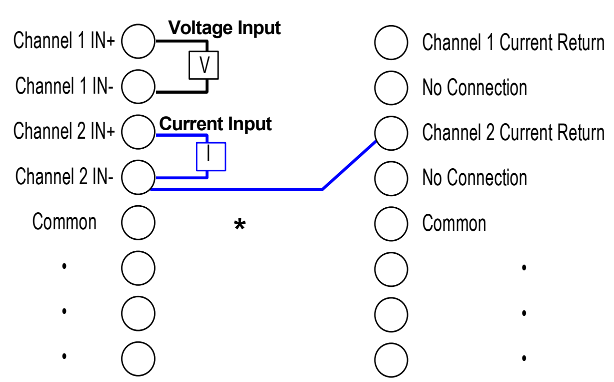
Field Wiring: IC695ALG626 and ALG628, Differential Mode

The table below lists wiring connections for modules configured for Differential mode.

Terminal	ALG628	ALG626	ALG628	ALG626	Terminal
1	Channel 1 IN+		Channel 1 Current Return (IRTN1)		19
2	Channel 1 IN -		No Connection		20
3	Channel 2 IN+		Channel 2 Current Return (IRTN3)		21
4	Channel 2 IN -		No Connection		22
5	Common		Common		23
6	Channel 3 IN+		Channel 3 Current Return (IRTN5)		24
7	Channel 3 IN-		No Connection		25
8	Channel 4 IN+		Channel 4 Current Return (IRTN7)		26
9	Channel 4 IN-		No Connection		27
10	No Connection	Channel 5 IN+	No Connection	Channel 5 Current Return (IRTN9)	28
11	No Connection	Channel 5 IN-	No Connection		29
12	No Connection	Channel 6 IN+	No Connection	Channel 6 Current Return (IRTN11)	30
13	No Connection	Channel 6 IN-	No Connection		31
14	Common		Common		32
15	No Connection	Channel 7 IN+	No Connection	Channel 7 Current Return (IRTN13)	33
16	No Connection	Channel 7 IN-	No Connection		34
17	No Connection	Channel 8 IN+	No Connection	Channel 8 Current Return (IRTN15)	35
18	No Connection	Channel 8 IN-	No Connection		36

There are no shield terminals on these modules. For shielding, tie the cable shields to the ground bar along the bottom of the backplane. M3 tapped holes are provided for this purpose. All the common terminals are connected together internally, so any common terminal can be used for the negative lead of the external power supply.

Differential Input Mode Connections



* Keep this jumper as short as possible to minimize error due to the added resistance of the wire. This resistance should be 25mΩ or less.

For differential inputs, two adjacent terminals are connected as one channel. The lower-numbered terminal acts as the high side.

A voltage input is connected between the two adjacent Channel IN terminals as shown at left.

A current input is connected between the channel's Channel IN+ and Current Return terminals. In addition, a jumper wire must be connected between the Channel IN - terminal and the corresponding Channel Current Return terminal.

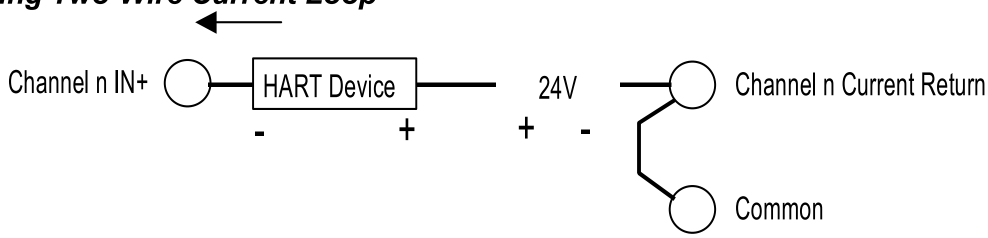
Tie common to signal ground for improved channel-to-channel Crosstalk immunity.

Two door cards are provided with the module: one shows connections for single-ended mode and the other shows connections for differential mode. Insert the card that matches the wiring that will be used.

HART Device Connections

Example connections for 2-wire transmitters are shown below.

Connecting Two-Wire Current Loop



Connecting an Active-Source Device