GFK-2501
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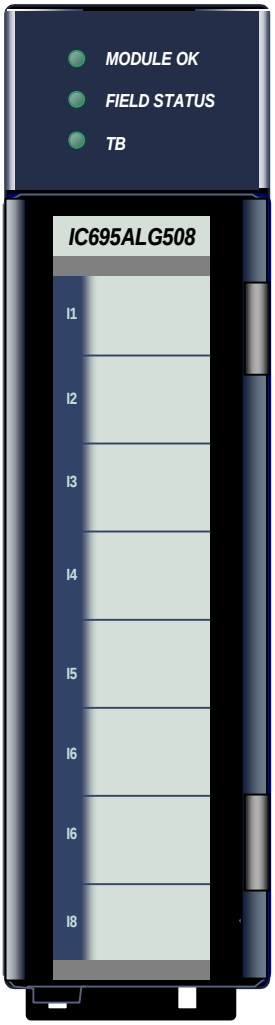
Isolated RTD Input Module, 8 Channels, IC695ALG508



Isolated RTD Input module IC695ALG508 provides eight isolated differential RTD input channels. Each channel can be individually configured for:

RTD Inputs:	50, 100, 200, 500, and 1000 ohm Pt 385 50, 100, 200, 500, and 1000 ohm Pt 391.6 100, 200, 500, and 1000 ohm Ni 618 120 ohm Ni 672 604 ohm NiFe 518 10, 50 and 100 ohm Cu 426
Resistance Inputs:	250, 500, 1000, 2000, 3000, and 4000 Ohms

The module must be located in an RX3i Universal Backplane. It requires an RX3i CPU with firmware version 5.5 or later. Machine Edition Version 5.8 Logic Developer-PLC or later must be used for configuration.

These 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. 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

- Completely software-configurable, no module jumpers to set
- RTD Linearization based on ITS-90
- Supports Removal and Insertion Under Power
- 32-bit IEEE floating point or 16 bit integer (in 32 bit field) input data format selectable per channel
- Temperature units selectable in degrees C and F
- User Scaling
- Programmable notch filter from 2.3 Hz to 28 Hz per channel
- Under range/Over range alarm detection and reporting by channel
- Alarm dead band for high alarm, low alarm, high-high alarm, and low-low alarm by channel
- Wire-off (open circuit) condition support for all inputs.
- Module fault status reporting (Watchdog, Ram Fail, Flash Fail)
- Module identity and status reporting including LED status indicators
- Support for 2, 3, or 4 wire RTD types for each channel.
- For Resistance inputs, fixed 2-wire measurement mode.
- Periodic Lead Resistance compensation measurement update enable/disable control for 3 wire RTDs. When enabled, the module will switch to measure the lead resistance once every 100 samples, and will use this value for the next 100 samples.
- RTD user offset support for all channels
- Terminal Block detection switch.

GFK-2501

Specifications

Number of Channels	8		
Measuring method selectable per channel	RTD/resistance: up to 4k ohms		
RTD input types	▪ 50, 100, 200, 500, and 1000 ohm Platinum 385 (IEC751 1983, Amend 2 1995; JISC 1604 1997) ▪ 50, 100, 200, 500, and 1000 ohm Platinum 391.6 (JISC 1604: 1981) ▪ 100 ohm, 200 ohm, 500 ohm, and 1000 ohm Nickel 618 (DIN 43760 Sept. 1987) ▪ 120 ohm Nickel 672 (MINCO Application Aid #18, 5/90 Type Ni) ▪ 10, 50, and 100 ohm Copper 426 (SAMA RC21-4-1966) ▪ 604 ohm Nickel-Iron 518		
Resistance Input Types	0-260, 0-525, 0-1050, 0-2100, 0-3150, 0-4200 ohms		
Maximum RTD Lead Resistance	25 ohms each side, for a total of 50 ohms.		
RTD and Resistance Input Types	*Input Type*	*Ohms Supported*	*Excitation Current*
	Resistance	0-260, 0-525	0.717 mA
		0-1050, 0-2100, 0-3150, 0-4200	0.238 mA
	Platinum 385	50	1.175 mA
		100	0.717 mA
		200, 500, 1000	0.238 mA
	Platinum 391.6	50	1.175 mA
		100, 200	0.717 mA
		500, 1000	0.238mA
	Nickel 672	120	0.717 mA
	Nickel 618	100,200	0.717 mA
		500,1000	0.238 mA
	Nickel-Iron 518	604	0.238 mA
	Copper 426	10	1.654 mA
		50, 100	1.175 mA
RTD Ranges	***RTD Type***	***Low temp (°C)***	***High temp (°C)***
	Copper 426	-100.0	+260.0
	Nickel 618	-100.0	+260.0
	Nickel 672	-80.0	+260.0
	Nickel-Iron 518	-100.0	+200.0
	Platinum 385	-200.0	+850.0
	Platinum 391.6	-200.0	+630.0
Temperature accuracy for inputs from 4-wire RTDs over temperature span (2.3, 4, and 4.7 Hz filters). This data does do not include the RTD sensor accuracy, which must be included when determining the overall system performance. Three-wire RTDs have similar accuracies, but depend on the lead resistances being balanced. For 2-wire RTDs, the lead resistance of the RTD contributes to the temperature error. All tolerances double when 24Hz or 28Hz filters are used.	***RTD Type***	***+25°C***	***0°C to +60°C***
	50 Ω Platinum 385	+/- 1.0°C	+/- 1.7°C
	100 Ω Platinum 385	+/- 0.7°C	+/- 1.2°C
	200 Ω Platinum 385	+/- 0.6°C	+/- 1.0°C
	500 Ω Platinum 385	+/- 0.5°C	+/- 0.9°C
	1000 Ω Platinum 385	+/- 0.5°C	+/- 0.9°C
	100 Ω Platinum 391.6	+/- 0.6°C	+/- 1.1°C
	200 Ω Platinum 391.6	+/- 0.5°C	+/- 0.9°C
	500 Ω Platinum 391.6	+/- 0.4°C	+/- 0.8°C
	1000 Ω Platinum 391.6	+/- 0.4°C	+/- 0.8°C
	Nickel 672	+/- 0.3°C	+/- 0.5°C
	Nickel 618:	+/- 0.3°C	+/- 0.5°C
	Nickel-Iron 518	+/- 0.4°C	+/- 0.7°C
	10 Ω Copper 426	+/- 1.0°C	+/- 2.4°C
	50 Ω Copper 426	+/- 0.8°C	+/- 1.9°C
	100 Ω Copper 426	+/- 0.8°C	+/- 1.9°C

Temperature accuracy for Resistance inputs		***Resistance***	***+25°C***	***0°C to +60°C***
		250 ohms	+/- 0.25 Ω	+/- 0.35 Ω
		500 ohms	+/- 0.3 Ω	+/- 0.45 Ω
		1000 ohms	+/- 0.5 Ω	+/- 0.8 Ω
		2000 ohms	+/- 0.9 Ω	+/- 1.5 Ω
		3000 ohms	+/- 1.3 Ω	+/- 2.2 Ω
		4000 ohms	+/- 1.7 Ω	+/- 2.9 Ω
Measurement Units		Degrees C or F, or Ohms		
Repeatability		0.05% of span at a constant temperature over a 30-second period (0.1% for 10-ohm copper, 28Hz filter)		
Diagnostics reported to the controller		User configurable for Over Range, Under Range, High and Low Alarm, High-high and Low-low alarm, Open Circuit Detection, Positive and Negative Rate of change alarm		
Service Requests		Report module firmware revision		
Hot-Swap		Supports removal and replacement under power as described in the *RX3i System Manual* (GFK-2314).		
Calibration		Module should be field calibrated via the configuration software.		
Channel-to-channel crosstalk		70 dB minimum at 120mS update rate for all channels		
Common Mode Rejection		2.3 Hz filter, 50/60Hz: 100 dB for 4-wire, 90 dB for 2 and 3 wire 4 Hz filter, 50/60Hz: 100 dB 4.7 Hz filter, 50/60Hz: 100 dB 24 Hz, 28 Hz filter 50/60 Hz: 80 dB		
Default or Hold Last State		For each of fault and disabled modes, the configuration will specify either to default a channel input to 0 or hold the last state of the input		
Fault Reporting		The configuration can enable or disable fault reporting for either of under or over range alarm, open circuit, and rate of change alarm.		
Rate of change		For each channel, the configuration can enable/disable and specify positive and negative rate of change alarms.		
Channel Value Format		16-bit integer (in a 32-bit field) or 32-bit real number data for each channel.		
Current Consumption		3.3V: 400mA; 5.1V: 200mA		
Excitation Current		0.238mA-1.654 mA, depending on the input range.		
Power Dissipation		2.5W max		
Isolation Voltage (Field to Backplane and Channel to Channel)		250VAC Continuous 1500VAC 1 minute 2550VDC 1 second		
Normal Mode Noise Rejection		2.3 Hz filter, 50Hz: 67dB 2.3 Hz filter, 60Hz: 67dB 4 Hz filter, 50Hz: 80dB 4.7 Hz filter, 60Hz: 80dB 24 Hz filter, 50Hz: 25dB 28 Hz filter, 60Hz: 25dB		
Filter Settings, Update Times, Rejection, and Resolution	*Filter Frequency (-3dB frequency)*	*Update Time (milliseconds)*	*Normal Mode Rejection at 50/60 Hz*	
	2.3 Hz	120 (130 max)	67dB @ 50/60 Hz	
	4 Hz	70 (80 max)	80dB @ 50 Hz	
	4.7 Hz	60 (70 max)	80dB @ 60 Hz	
	24 Hz	20 (30 max)	25dB @ 50 Hz	
	28 Hz	15 (25 max)	25dB @ 60 Hz	

Update Time

The module update time (see above) assumes all channels are configured with the same parameters. If channels are configured differently, the module update time corresponds to the slowest channel update time chosen. Update time is the time required for the module to sample and convert the input signals provide the resulting data values to the processor. The channel times include channel scan time and filter delay time.

Module Resolution

The module resolution depends on the input type and the filter chosen. The following table summarizes the effective resolution for the module by filter chosen, and input type selected for 2- or 4-wire modes. If 3-wire mode is used, the resolution values shown are reduced by 1.2 bits. If integer format is used, the resolution is limited to 16 bits.

RTD Type / Filter Setting	2.3Hz		4.0 and 4.7 Hz		24 Hz		28 Hz	
	Bits*	m°C	Bits*	m°C	Bits*	m°C	Bits*	m°C
Platinum 385	16.5	13.2	16.3	15.2	13.4	113	12.8	172
Platinum 391.6	16.5	10.6	16.3	12.2	13.4	91.0	12.8	138
Nickel 672	16.5	5.2	16.3	6.0	13.4	44.7	12.8	67.8
Nickel 618	16.2	7.3	16.0	8.3	13.1	56.2	12.5	94.3
Nickel-Iron 518	16.5	5.7	16.3	6.5	13.4	48.6	12.8	73.7
Copper 426								
10 ohm	13.6	29.0	13.4	33.3	10.5	249	9.9	377
50 ohm	15.6	7.8	15.4	8.9	12.5	66.5	11.9	101
100 ohm	16.2	5.2	16.0	5.9	13.1	44.3	12.5	67.2
Resistance	**Bits**	**mOhm**	**Bits**	**mOhm**	**Bits**	**mOhm**	**Bits**	**mOhm**
250	16.6	2.6	16.4	3.0	13.5	22.4	12.9	34.0
500	16.6	5.3	16.4	6.1	13.5	45.3	12.9	68.7
1000	16.6	10.6	16.4	12.1	13.5	90.6	12.9	137
2000	17.0	16.0	16.8	18.4	13.9	137	13.3	208
3000	16.6	31.7	16.4	36.4	13.5	272	12.9	412
4000	17.0	32.0	16.8	36.8	13.9	275	13.3	416

* The effective number of bits is based on the full-scale range of the input type.

Release History

Version	*Firmware Revision*	*Upgrade Kit*
IC695ALG508-AA	1.00	None: Initial Release

LEDs

The **Module OK** LED indicates module status. The **Field Status** LED indicates whether the external +24 VDC power supply is present and is above the minimum level and whether or not faults are present. All LEDs are powered from the backplane power bus.

LED	*Indicates*
Module OK	ON Green: Module OK and configured. Quick Flashing Green: Module performing powerup sequence. Slow Flashing Green or Amber: Module OK but not configured. OFF: Module is defective or no backplane power present
Field Status	ON Green No faults on any enabled channel, Terminal Block is present, and field power is present. ON Amber and TB Green: Terminal Block is installed, fault on at least one channel, or field power is not present. ON Amber and TB Red: Terminal Block not fully removed, field power still detected. OFF and TB Red: Terminal block not present and no field power is detected.
TB	ON Red: Terminal block not present or not fully seated. See above. ON Green: Terminal block is present. See above. OFF: No backplane power to module.

Installation in Hazardous Locations

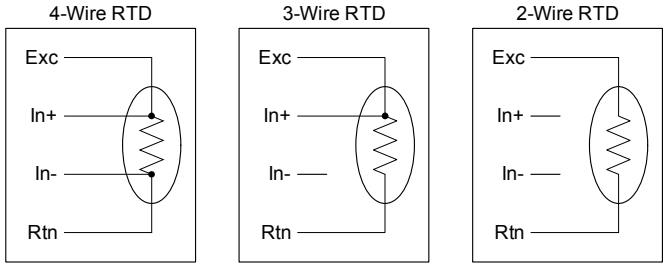
- EQUIPMENT LABELED WITH REFERENCE TO CLASS I, GROUPS A, B, C & D, DIV. 2 HAZARDOUS LOCATIONS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, D OR NON-HAZARDOUS LOCATIONS ONLY
- WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;
- WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES; AND
- WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.
- EQUIPMENT OF LESSER ENCLOSURE TYPE RATING MUST BE INSTALLED IN AN ENCLOSURE PROVIDING AT LEAST IP54 PROTECTION WHEN APPLIED IN CLASS I, ZONE 2 ENVIRONMENTS
- THIS DEVICE MUST BE USED WITH AN ATEX CERTIFIED BACKPLANE
- THE DEVICES SHALL PROVIDE EXTERNAL MEANS TO PREVENT THE RATED VOLTAGE BEING EXCEEDED BY TRANSIENT DISTURBANCES OF MORE THAN 40%

Field Wiring

The table below lists wiring connections for the Isolated RTD Input Modules. There are no shield terminals.

Terminal	Assignment	Assignment	Terminal
1	No Connect	No Connect	19
2	RTD 1 Exc	RTD 5 Exc	20
3	RTD 1 In +	RTD 5 In +	21
4	RTD 1 In -	RTD 5 In -	22
5	RTD 1 Rtn	RTD 5 Rtn	23
6	RTD 2 Exc	RTD 6 Exc	24
7	RTD 2 In +	RTD 6 In +	25
8	RTD 2 In -	RTD 6 In -	26
9	RTD 2 Rtn	RTD 6 Rtn	27
10	RTD 3 Exc	RTD 7 Exc	28
11	RTD 3 In +	RTD 7 In +	29
12	RTD 3 In -	RTD 7 In -	30
13	RTD 3 Rtn	RTD 7 Rtn	31
14	RTD 4 Exc	RTD 8 Exc	32
15	RTD 4 In +	RTD 8 In +	33
16	RTD 4 In -	RTD 8 In -	34
17	RTD 4 Rtn	RTD 8 Rtn	35
18	No Connect	No Connect	36

The pinout is set up for two, three or four-wire RTD sensors. No additional jumper or shorting wires are needed for wiring in any of the three modes. Connect the RTD sensor as shown:



Depending on the Terminal block type chosen, the wire gauge supported ranges from .081…1.5mm^2 (28…14AWG) solid or stranded wire.

Grounding

There are no shield terminals on these modules. For shelding, tie cable shields to the ground bar along the bottom of the backplane. M3 tapped holes are provided in the ground bar for this purpose. **For optimal performance, RTD inputs should be ungrounded, and use shielded cable with the shield(s) grounded at the module end.** If a grounded thermocouple is required, a 0.1uF capacitor from the shield to the ground bar may be necessary on the module end to eliminate ground noise created from grounding both ends of the shield.

Configuration Parameters

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.
Inputs Default	Force Off	In the event of module failure or removal, this parameter specifies the state of the Channel Value References. Force Off = Channel Values clear to 0. Hold Last State = Channel Values hold their last state.
Channel Value Reference Length		The number of words used for the module's input data
Diagnostic Reference Address	%Ixxxxx	Starting address for the channel diagnostics status data. This defaults to the next available %I block.
Diagnostic Reference Length	0	The number of bit reference bits required for the Channel Diagnostics data. Default is 0, which means mapping of Channel Diagnostics is disabled. Change this to a non-zero value to enable Channel Diagnostics mapping.
Module Status Reference Address	%Ixxxxx	Starting address for the module's status data. This defaults to the next available %I block.
Module Status Reference Length	0	The number of bits required for the Module Status data. Default is 0, which means mapping of Module Status data is disabled. Change this to a non-zero value to enable Module Status data mapping.
Channel Faults w/o Terminal Block	Disabled	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.
I/O Scan Set	1	The scan set 1 – 32 to be assigned to the module by the RX3i CPU

GFK-2501

Channel Parameters		
Parameter	**Default**	**Description**
Range Type	Disabled	RTD, Resistance, Disabled
Range		For resistance: 0-250, 0-500, 0-1000, 0-2000, 0-3000, 0-4000 ohms
		For RTD: 50, 100, 200, 500, and 1000 ohm Pt 385 50, 100, 200, 500, and 1000 ohm Pt 391.6 100, 200, 500, and 1000 ohm Ni 618 120 ohm Ni 672 604 ohm NiFe 518 10, 50 and 100 ohm Cu 426
Channel Value Format	32-bit Floating Point	16-bit integer or 32-bit floating point
RTD	RTD 2 Wire	(for RTD Range Type only) RTD 2, 3 or 4 Wire
RTD Lead Resistance Compensation	Enabled	(for RTD Range Type only)Enabled, Disabled
Temperature Units	Celsius	Celsius, Fahrenheit
High Scale Value (Eng Units)	The defaults for the 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 temperature input over the entire span of its configured Range into a floating point value for the CPU. 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

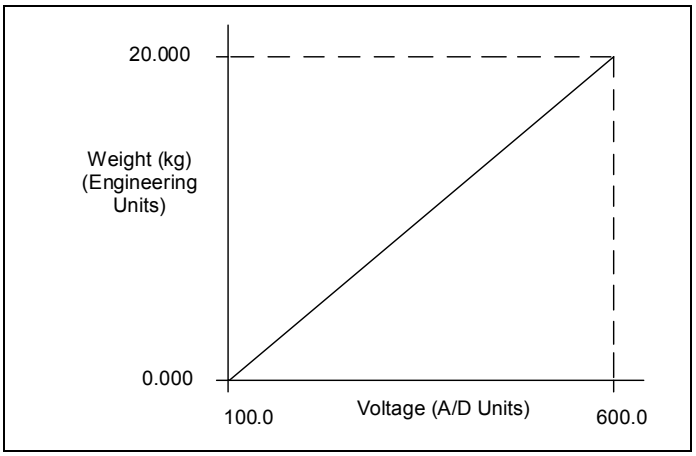
For a resistance input, 600 ohms equals a weight of 20 kg, and 100 ohms equals a weight of 0 kg. The relationship in this range is linear. For this example, the input values should represent weight rather than ohms. The following channel configuration sets up this scaling:

High Scale Value (Eng Units) = 20.000

Low Scale Value (Eng Units) = 0.000

High Scale Value (A/D Units) = 600.0

Low Scale Value (A/D Units) = 100.0



For this example, 100 to 600 is the normal resistance range, but the module will attempt to scale the inputs for a resistance that lies outside the range. If a resistance of 1000 ohms 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.

Channel Parameters continued		
Parameter	**Default**	**Description**
Positive Rate of Change Limit (Eng Units)	0.000	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)	0.000	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	0.000	Time from 0 to 300 seconds to wait between comparisons. Default of 0.0 is to check after every input sample.

Continued…

Rate of Change Alarms

An RTD Input module can detect both Negative Rate of Change and Positive Rate of Change in Engineering Units per Second. When either of the Rate of Change parameters 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 Unit 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 Unit 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.

Channel Parameters continued		
Parameter	***Default***	***Description***
High-High Alarm (Eng Units) High Alarm (Eng Units) Low Alarm (Eng Units) Low-Low Alarm (Eng Units) High-High Alarm Deadband (Eng Units) High Alarm Deadband (Eng Units) Low Alarm Deadband (Eng Units)	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.	**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 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.
User Offset	0.000	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.
Software Filter Integration Time in milliseconds.	0.000	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 disabled
A/D Filter Frequency		2, 3, 4, 4.7, 24, 28Hz

Continued…

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.

Channel Parameters continued		
Parameter	**Default**	**Description**
Diagnostic Reporting Enable *If Diagnostic Reporting is enabled, the additional parameters listed below can be used to enable specific types of alarms.*	Disabled	*Diagnostic Reporting Enable options* are used to enable reference memory reporting of alarms into the Diagnostic Reference area. *Fault Reporting Enable option*s enable fault logging of alarms into the I/O Fault Table. *Interrupts Enable options* enable I/O Interrupt trigger when alarm conditions occur. These parameters enable or disable the individual diagnostics features of a channel. When any of these parameters is enabled, the module uses associated parameters to perform the enabled feature. For example, if Over Range is enabled in the "Diagnostic Reporting Enable" menu, the module will set the Over Range bit in the Diagnostic Reference for the channel. If any of these parameters is disabled, the module does not react to the associated alarm conditions. For example, if Low Alarm Enable is set to Disabled in the "Fault Reporting Enable" menu, the Low Alarm fault is not logged in the I/O Fault Table when Low Alarm is detected on the channel.
Fault Reporting Enable *If Fault Reporting is enabled, the additional parameters listed below can be used to enable specific types of Faults.*	Disabled	
Interrupts Enable *If Interrupts are enabled, the additional parameters listed below can be used to enable specific types of Interrupts.*	Disabled	
Low Alarm Enable	Disabled	
High Alarm Enable	Disabled	
Under Range Enable	Disabled	
Over Range Enable	Disabled	
Open Wire Enable	Disabled	
Calibration Fault Enable	Disabled	
Low-Low Alarm Enable	Disabled	
High-High Alarm Enable	Disabled	
Negative Rate of Change Detection Enable	Disabled	
Positive Rate of Change Detection Enable	Disabled	

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.

Note on Using 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.

Module Input Data

The module reports its input channel data in its assigned input words, beginning at the configured Channel Value Reference Address. Each channel 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

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, 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.

Channel Diagnostic Data

In addition to the input data from field devices, the module can be configured to report 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 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

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 Data

The module can also 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 Data 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

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 1 of the Module Status Reference indicates the status of the terminal block. To enable Module Status reporting, the Module Status Reference must be configured. 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.