Analog Input, 16-Bit Thermocouple Module

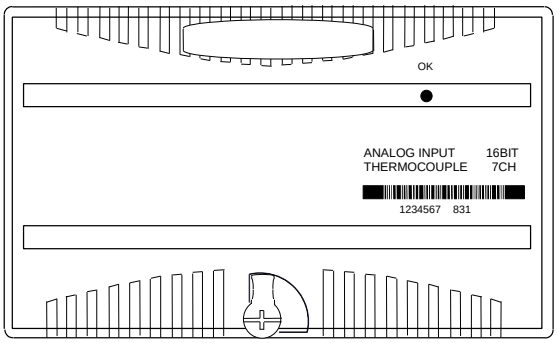
IC200ALG630

January 2012 GFK-1700M

Product Description

The IC200ALG630 Analog Input Thermocouple Module is an intelligent module that accepts seven independent thermocouple or millivolt inputs.

The module receives power from the backplane power supply. No external power source is required.



Each input channel can be configured to report millivolts ranges as 1/100 of millivolts, or thermocouple inputs as linearized temperature in tenths of degrees Celsius or Fahrenheit, with or without cold junction compensation.

The module automatically performs A/D calibration at powerup. Automatic calibration is then repeated periodically to compensate for changes in the ambient temperature. New calibration values are filtered into the current calibration values.

Host Interface

The Analog Input Thermocouple Module uses the following data types:

- 7 words of analog input data.
- 7 optional words of analog output data.

The module exchanges data in the same manner as other types of I/O modules: it provides all its input data when requested.

Diagnostics

The Analog Input Thermocouple Module performs diagnostics and provides the following information.

- Alarm faults are reported if the processed value for a channel exceeds its configured alarm limit.
- Over/underrange faults are reported if the millivolt value for an input exceeds the limits of its span.
- Open circuit is checked every time a thermocouple input is read (unless Open TC checking is disabled). If the circuit is open, a fault is reported and the input defaults to the configured channel default.
- Thermistor fault will be reported as Internal fault in the I/O Fault table.

A thermistor fault occurs if the calculated temperature value from the thermistor is less than -10 °C or greater than +75 °C.

LED Indicators

The green OK LED is on when backplane power is present to the module. If this LED is amber, it indicates a module fault.

Module Characteristics

Channels	Seven thermocouple or millivolt inputs
Module ID	FFFF9804
Isolation: User input to logic (optical) and to frame ground Group to group Channel to channel	 250VAC continuous; 1500VAC for 1 minute Not applicable None
LED indicators	OK LED: Green indicates backplane power is present. Amber indicates module fault.
Backplane current consumption	5V output: 125mA maximum. 3.3V output: 125mA maximum.
External power supply	None
Thermal derating	None
Diagnostics	Open Thermocouple, over/under range, and high/low alarm, thermistor fault (reported as internal fault).

Input Characteristics

Thermocouple types	J, K, T, S, R, none (used for mV inputs)
Spans (+/–)	19.5mV, 39mV, 78.125mV, 156.25mV, 312.5mV, 625mV
Converter resolution	15 bits + sign
Cold junction compensation	If used, reference junction temperature is measured at thermocouple termination using a precision thermistor, or supplied by system, or by fixed configuration value.
Cold junction temperature error	+/–0.25 degree Celsius (local measurement). To reduce temperature transients, thermocouple terminations should not be installed in the same cabinet as heat dissipation assemblies.
Conformity error	+/–0.3 degree Celsius, +/–0.5 degree Fahrenheit.
Accuracy, at 25° C on voltage measurement: on temp. measurement:	 +/–0.2% +/- 3 degrees Celsius.
Temperature sensitivity (0° to 60°C)	+/–0.004% of reading, +/–1.5µV per ° Celsius referred to input
Normal mode rejection	60dB, at 50/60 Hz, 100% span
Common mode rejection	120 dB at 50/60Hz, 100 ohm imbalance
Common mode voltage	3 VDC maximum
Maximum voltage between channels	50V
Normal mode voltage	5 VDC maximum
Scan time	60 Hz: approximately 60 milliseconds per point 50 Hz: approximately 70 milliseconds per point.

Preinstallation Check

Carefully inspect all shipping containers for damage. If any equipment is damaged, notify the delivery service immediately. Save the damaged shipping container for inspection by the delivery service. After unpacking the equipment, record all serial numbers. Save the shipping containers and packing material in case it is necessary to transport or ship any part of the system.

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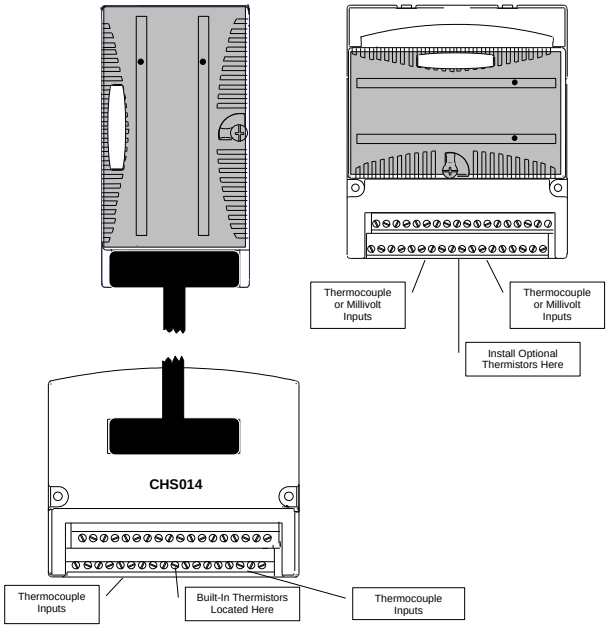
Installation Instructions

The preferred installation technique is to mount the Thermocouple Module on a Connector-style I/O Carrier and connect thermocouples to an Interposing Thermocouple Carrier as shown below. The Interposing Thermocouple-style I/O Carrier provides both box-style wiring terminals and a built-in thermistor for Local Cold Junction Compensation. It connects to the Connector-Style Carrier via a cable as shown. This allows the thermocouple connections to be located away from the I/O modules in the system. Each TC terminal on the Interposing Thermocouple Carrier accommodates one solid or stranded AWG #14 (avg. 2.1mm^2 cross section) to AWG #22 (avg. 0.36mm^2 cross section) wire, or two wires up to AWG #18 (avg. 0.86mm^2 cross section).

However, it is also possible to mount the Thermocouple Module on one of the terminal-style carriers (box-style, spring-style, or barrier-style) and provide Local Cold Junction Compensation by using a kit that includes the correct type of thermistor, as described in the *I/O Modules User Manual*. Both methods are shown below. The thermistor kit must be installed on the A9 and A10 terminals of the carrier.

If the module will only be used to measure millivolt inputs, not thermocouple inputs, it can be mounted on any type of I/O Carrier. The thermistor terminals A9 and A10 cannot be used as millivolt input terminals.



Installation in Hazardous Locations

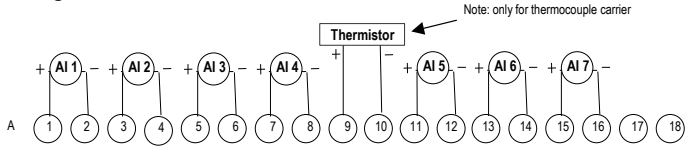
- EQUIPMENT LABELED WITH REFERENCE TO CLASS I, GROUPS A, B, C & D, DIV. 2 HAZARDOUS LOCATIONS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, D OR NON-HAZARDOUS LOCATIONS ONLY
- WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;
- WARNING - 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.

Field Wiring Terminals

The terminal assignments shown below are the same for all carriers.

Number	Connection	Number	Connection
A1	Channel 1 (+)	B1	No connection
A2	Channel 1 (-)	B2	Shield
A3	Channel 2 (+)	B3	No connection
A4	Channel 2 (-)	B4	Shield
A5	Channel 3 (+)	B5	No connection
A6	Channel 3 (-)	B6	Shield
A7	Channel 4 (+)	B7	No connection
A8	Channel 4 (-)	B8	Shield
A9	(Thermistor (+))	B9	No connection
A10	(Thermistor (-))	B10	Shield
A11	Channel 5 (+)	B11	No connection
A12	Channel 5 (-)	B12	Shield
A13	Channel 6 (+)	B13	No connection
A14	Channel 6 (-)	B14	Shield
A15	Channel 7 (+)	B15	No connection
A16	Channel 7 (-)	B16	No connection
A17	No connection	B17	No connection
A18	No connection	B18	No connection

Wiring Connections for Carriers with Two Rows of Terminals:



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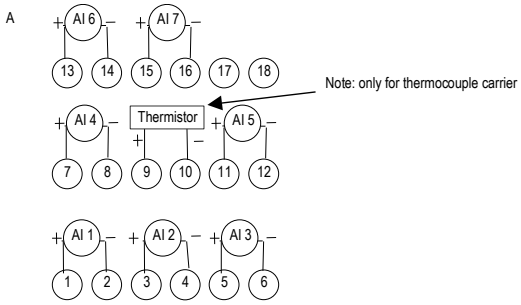
Wiring Connections for Carriers with Three Rows of Terminals:



Cable Shield Connections

Shielded twisted pair cable is recommended for the analog channel connections. If possible, the cable should be grounded at the source device. If that is not possible, the cable shield must be grounded at the I/O module. This can be done using an Auxiliary I/O Terminal strip.

If the module is installed on a Terminal-style I/O Carrier, shield connections can be made on an Auxiliary I/O Terminal that is attached to the I/O carrier.

If the module is installed on a Compact Terminal-style I/O Carrier, shield connections can be made on an Auxiliary I/O Terminal that is mounted near the I/O carrier.

If the module is installed on a Connector-style I/O Carrier, the cable shield can be connected directly to an Interposing Terminal. A shielded interposing cable (shielded cables are available separately) must be used between the Connector-style I/O Carrier and the Interposing Terminal. An Auxiliary I/O Terminal Strip can also be added to the Interposing Terminal if additional shield connections are required.

Product Version Information

Revision letters:	JF
Firmware version:	1.25
Firmware upgrades:	44A750342-G05. Available as a free download at http://ge-ip.com/support.

Product Revision History

Revision	*Date*	*Description*
IC200ALG630-JF	January 2012	Label change. No changes to features, performance or compatibility.
IC200ALG630-HF	April 2011	Firmware release 1.25. Resolves component obsolescence issue. No change to features, performance or compatibility.
IC200ALG630-HE	February 2011	Labeling change. No changes to compatibility, functionality or performance.
IC200ALG630-GE IC200ALG630-FE	September 2010	Firmware release 1.24. Resolved fault reporting issue in Remote/Local IO configuration.
IC200ALG630-GD	August 2009	Changed manufacturing location. No changes to compatibility, functionality or performance.
IC200ALG630-FD BXIOAI7-FD	October 2008	Updated Power Supply OK signal circuitry.
IC200ALG630-ED BXIOAI7-ED	September 2007	Firmware release 1.20. Improved I/O scanning.
IC200ALG630-EC BXIOAI7-EC	April 2005	Plastic change on locking mechanism
IC200ALG630-DC BXIOAI7-DC	February 2005	Configurable for 50Hz line frequency
IC200ALG630-DB BXIOAI7-DB	April 2004	Changed to V0 plastic for module housing.
IC200ALG630-CB BXIOAI7-CB	January 2004	ATEX approval for Group 2 Category 3 applications.
IC200ALG630-BB BXIOAI7-BB	November 2002	Improved reporting of Open Input error at higher temperatures.
IC200ALG630-AB BXIOAI7-AB	June 2001	Firmware version 1.01. Enhanced Open Circuit reporting
IC200ALG630-AA BXIOAI7-AA	July 1999	Initial product release

Compatibility

Firmware version 1.25 is compatible with all hardware versions of the ALG630.

This module is compatible with:

- PLC CPU Firmware version 1.20 or later.
- Ethernet NIU EBI001 all versions.
- Genius NIU GBI001 Firmware version 1.10 or later*
- Profibus NIU PBI001 Firmware version 1.10 or later*
- DeviceNet NIU DBI001 Firmware version 1.10 or later. The DeviceNet NIU does not support software configuration. Therefore, analog modules used with a DeviceNet NIU must be autoconfigured and use only their default configuration settings.

* For GBI001, NIU version 2.0 or above is required to perform software configuration. For PBI001, NIU version 2.01 or above is required to perform software configuration.

Restrictions and Open Issues

- Additional faults may be logged when a new configuration containing parameter changes such as the Alarm High limit or Alarm Low limit in the hardware configuration of an analog module is stored followed by a Clear All operation. The additional faults are logged against the previous configuration. This issue is observed when Machine Edition is connected to Versamax CPUs (IC200CPU001, IC200CPU002, IC200CPU005 and IC200CPUE05) and does not occur with Versamax NIUs (IC200GBI001, IC200EBI001, IC200PBI001, and IC200DBI001).
- When more than 20 faults are sent to a GBC70 within a single Genius scan, under rare conditions one fault or fault contact may not be reported by the GBC70. This has been observed when simultaneous open wire condition occurs in all eight channels of IC200ALG240 module or if several I/O modules in a GNIU rack generate multiple faults simultaneously. This issue has only been observed when the GBC70 was in a rack with an RX7i CPU.
- When 45 or more faults are sent to a GBC70 within a single Genius scan, a few faults or fault contacts may not be reported by the GBC70. This is most likely to be caused by the sudden loss of numerous blocks at each bus controller in the system. The resulting PLC diagnostics and diagnostic contacts may be incorrect.

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Operational Notes

- If hot insertion of a module is done improperly, the operation of other modules on the same backplane may be disrupted. See *Installing a Module on a Carrier* in the *VersaMax Modules Manual,* GFK-1504.
- Clarification of Default/Hold Last State configurations:
  If there is an error on a specific input channel, the modules will always report the Channel Default value from the Input Parameters tab of the module configuration.

  When a Loss of I/O Module fault is logged for a module, the CPU or NIU will use the Default/Hold Last State setting from the Module Parameters tab of the module configuration to determine what value should be reported to the reference tables.
- After an Open Circuit fault *condition* is corrected, the module takes a few seconds to return to normal operation. During this time, the module continues reporting the channel default input value. After the module has recovered from the Open Circuit fault, it returns to normal inputs and normal operation.
- If there is a very large change in an input (for example, an input quickly goes from 50mV to 400mV), the module may briefly report an Over-range fault on that circuit even though the circuit is not actually over its configured upper range limit. This is only temporary.
- When IC200ALG630 or IC200ALG620 modules are present in GNIU or PNIU rack and a 'Clear all' command is issued from Machine Edition software, Machine Edition may get disconnected, displaying timeout error "error 8097 - host disconnect has occurred". When this error is logged, the Configuration is still cleared. To avoid this error, the “Request Timeout” value in “Additional Configuration” in “Target Properties” should be increased to 30s or more.
- When all the channels of IC200ALG630 are set inactive *and* the Reference Junction Type parameter is not set to "local", VersaMax CPUs / NIUs will report a “Loss of IO modules” fault, that points to the IC200ALG630 itself.

  To avoid this fault, either configure at least one thermocouple channel to active or set reference junction type parameter to “local”.

Configuration

The default parameters of the Thermocouple Input module can be used in many applications. The module can be software-configured when it is installed in a PLC system, or an I/O Station controlled by an NIU that supports software configuration.

Parameter	*Default*	*Choices*
Analog Input Data Length	7	1 to 7
Analog Input Data Reference		user selectable
Analog Output Data Length	0	0 to 7
Analog Output Data Reference		user selectable
Line Frequency	60 Hz	50 Hz, 60 Hz
Suppress Open Thermocouple	No	Yes, No
Channel Active	Active	Inactive (off), Active (on)
Engineering Units	1/10 degrees C	Millivolts, 1/10 degrees C, 1/10 degrees F
Thermocouple Type	J	None, J, K, T, S, R
Range	625	19.53, 39.06, 78.125, 156.25, 312.5, 625.
R J Type	Local	Local, Remote, Fixed, None
Alarm Low	–2000	–32,768 to +32,767
Alarm High	8000	–32,768 to +32,767
Reference Junction Value	250	–32,768 to +32,767
Correction Factor	0	–32,768 to +32,767
Channel Default Input	0	±32,767
Cold Junction Default	250	±32,767

Configurable Features

Channel Active: Each channel can be configured as either active or inactive. If a channel is inactive, the filtering, scaling, calibration, and alarm checks are omitted for that channel, and a value of 0 is returned for the channel. The reference parameter for the analog input data returns the byte length and is independent of the number of active channels.

Low Alarm Limit and High Alarm Limit: Each input channel can have a low alarm limit and a high alarm limit. If an input reaches one of its limits, the module reports the actual value and sends the appropriate diagnostic input bit. Alarms do not stop the process or change the value of the input. Alarm limits can be set anywhere over the dynamic range of the signal. The range for each is –32,768 to +32,767. The high alarm limit must be greater than the low alarm limit. If alarm reporting is not wanted, alarm limits can be set beyond the dynamic range of the signal so they will never be activated.

Thermocouple Limits: The table below lists millivolt and temperature limits for applicable thermocouple types.

TC Type	*Low mV Limit*	*High mV Limit*	*Low Temperature Limit (C)*	*High Temperature Limit (C)*
J	–8.0960	57.9420	–210.00	1000.00
K	–5.8910	54.8069	–200.00	1370.00
T	–5.6030	20.2520	–200.00	390.00
S	–0.1940	18.5040	–40.00	1750.00
R	–0.1880	20.8780	–40.00	1750.00

Cold Junction Compensation: The Thermocouple module provides four choices for Cold Junction Compensation.

- No Cold Junction Compensation: This is used for millivolt inputs or if cold junction is maintained at 0 degrees C.
- Remote Cold Junction Compensation: With this option, cold junction is measured externally and provided to the module from the application, via the module's analog output (word output) data. If the module has multiple thermocouples that are configured for remote compensation, the same compensation value must be used by each.
- Fixed Cold Junction Compensation: This option uses a fixed compensation value provided by the user in the configuration parameter, "Reference Junction Value." The units of this fixed value are defined in configuration parameter "Engineering Units."
- Local Cold Junction Compensation: The best way to provide local compensation is with an Interposing Thermocouple Carrier, which has a built-in thermistor. Using an Interposing Carrier allows the thermocouple connections to be placed farther away from the I/O modules in the system, which helps shield thermocouple connections from module heat.

If Local Cold Junction Compensation is configured and an Interposing Thermocouple Carrier is not used, a separate thermistor must be installed directly at the module's I/O Carrier, using the Thermistor (+) and Thermistor (–) terminals. The thermistor must be the type specified in the *I/O Modules User's Manual*. Note: If Local Compensation is selected but an Interposing Thermocouple Carrier or local thermistor is not used, erroneous temperatures may be reported and a thermistor error will be reported in the fault table.

Range Selection: The module is configurable for any of six different millivolt ranges (+/–): 19.5mV, 39mV, 78.125mV, 156.25mV, 312.5mV, and 625mV. All but the last provide input readings in hundredths of millivolts. For the 625mV range, inputs are in tenths of millivolts. When used to read millivolts, the Thermocouple Type configuration parameter must be set to "none".