Chapter 15 Thermocouple 6 Input Blocks

Thermocouple Input Blocks are primarily used to monitor temperature inputs from standard thermocouples. They can also be used to measure low–level voltage input signals. Two blocks are available:

- **115 VAC/125 VDC Thermocouple Block** (IC660BBA103)
- **24/48 VDC Thermocouple Block** (IC660BBA023)

They are the same except for the power supply.

Features

A Thermocouple block has six input circuits, in three isolated groups. " 10 V common mode voltage (maximum) allowed between 2 points in a group. Each group has two thermocouple input circuits and two remote cold junction compensation inputs. Group to group isolation is 300 volts.

Each input can interface to type J, K, T, E, B, R, S, and N (#14 AWG Nicrosil vs. Nisil) thermocouples. The block provides cold junction compensation for all thermocouple input measurements. Each channel can be configured to use an internal sensor, an external sensor, or a user–defined value for cold–junction compensation. An external signal from a remote junction can be either a voltage (XJV) or a current (XJI) analog of temperature. The XJV input is scaled for 1.0mV per degree Celsius and the XJI input is scaled for 1.0uA per degree Kelvin. After compensation, the block linearizes each thermocouple input measurement according to the NBS monograph for the type in use.

Each input measurement can be adjusted up to " 100.0C or " 100.0F for greatest accuracy.

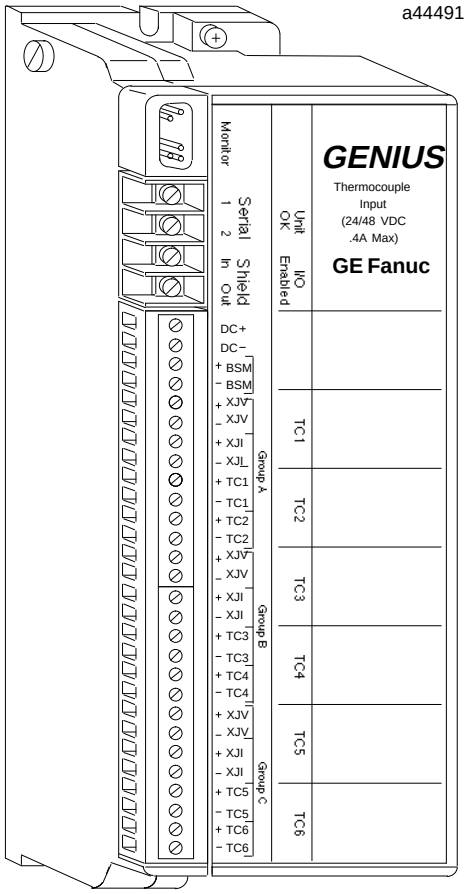
The blocks perform the following diagnostics:

- Internal fault detection
- Open Wire detection
- Overrange and Underrange input indication
- High and low input alarms

An output is provided to drive a Bus Switching Module (version IC660BSM021 only).

Compatibility

These blocks are compatible with PCIM and QBIM modules. Hand–held Monitor IC660HHM501D, version 3.5 (or later) is required.



For a Series 90™–70 PLC, the CPU must be rel. 2 (IC697CPU731 or 771) or later. The bus controller must be rel. 2 (IC697BEM731) or later. The programming software must be Logicmaster™ 90–70 rel. 2.02 or later.

For a Series Six™ PLC, the CPU must be rev. 105 or later. For a Series Six Plus PLC, rev. 110 or later is required. The programming software must be Logicmaster™ 6 rel. 4.02 or later.

For a Series Five PLC, the CPU must be rev. 3.0 or later. The Logicmaster 5 programming software must be rel. 2.01 or later.

Specifications

Block Type:	Six thermocouple–compatible inputs, three isolated groups of two.	
Catalog Numbers: 115 VAC / 125 VDC Thermocouple Block Terminal Assembly Only Electronics Assembly Only 24 / 48 VDC Thermocouple Block Terminal Assembly Only Electronics Assembly Only	 IC660BBA103 IC660TBA103 IC660EBA103 IC660BBA023 IC660TBA023 IC660EBA023	
Size (Height x width x depth): **Weight:** **LEDs (I/O Block)**: **Heat Dissipation:**	8.83" (22.44cm) x 3.50" (8.89cm) x 3.94" (10.00cm) 4 lbs. (1.8 kg) Unit OK, I / O Enabled 9W maximum	
Block to Block Isolation: **Group to Group Isolation**:	1500 V for one minute 300 V	
115 VAC/125 VDC block power: Power supply voltage Power supply dropout time:	**115 VAC** 93–132 VAC @ 9W 47–63 Hz 1 cycle	**125 VDC** 105–145 VDC @ 9W 10% max. ripple 10 mS
24/48 VDC block power: Power supply voltage Power supply dropout time	 18–56 VDC @ 9W, 10% max. ripple 10mS minimum	
Input Characteristics: Voltage measurement: Range Resolution Accuracy (at 25C) Bandwidth of input amplifier filter Temperature coefficient	 –25.0mV to +150mV Less than $ 4 µV Less than $ 10µV error typ, $ 20µV max. 8 Hz $ 2µV / C typical	
Internal Cold Junction Measurement: Range Offset at 25C Linearity Resolution Temperature coefficient	 0 to 60C $ 2 C typ. User adjustable to zero at any temperature. $ 0.15C Less than $ 0.01C $ 0.05 per C	
External Cold Junction Measurement: Range Scale factors Resolution Accuracy	 –25.0C to +150.0 C 1.0C per millivolt, 1.0K per microampere Less than $ 0.01 C $ 0.1C	
Input update time (all channels):	2.0 sec (typ), 3.0 sec (max)	
Open wire detection response:	less than 5.0 seconds	
Diagnostics:	Open Wire, Overrange, Underrange, High Alarm, Low Alarm, Internal Fault	
Environmental: Operating Temperature Storage Temperature Humidity Vibration:	 0C to +60C (+32F to +140F) –40C to +100 C (–40F to +212F) 5% to 95% (non–condensing) 5–10 Hz 0.2" (5.08mm) displacement, 10–200 Hz at 1G	

Block Operation

A Thermocouple Input Block has three isolated pairs of inputs. Transformers isolate power and optical couplers provide signal isolation.

For each pair of inputs:

1. After filtering, each signal input is sequentially switched into a common amplifier whose output is applied to a voltage–to–frequency converter. The output signal frequency of the VFC is applied to a frequency counter via an optical coupler. The output frequency is counted for a 400 millisecond gate time, which is a common multiple of all the common line frequency periods. This provides considerable rejection of line frequency pickups.
2. The multiplexer intersperses other inputs between the two main thermocouple input times. The other inputs come from the cold junction sensors and from internal references. The cold junction inputs are measured and stored for later compensation of the normal thermocouple input measurement errors.
3. To detect and correct for any gain or offset drift in the amplifier or VFC, the block takes new readings of factory–calibrated internal reference levels during operation. These new measurements are compared to reference values stored by the block.
4. The processor converts the cold junction temperature value to a voltage as specified by the NBS monograph for the thermocouple type in use. This voltage is then added to the thermocouple measurement before converting to thermal units. Since there may be some small differences between the cold junction temperature measurement and the actual cold junction temperature, an offset adjustment can be entered using a Hand–held Monitor. These offsets are due to variances in the terminal strip assembly and the correction factors are therefore stored in the Terminal Assembly EEPROM.