



# Thermocouple Module

Part Number: **EZIO-4THIE**

*Requires EZPLC editor version 1.4 or later; firmware revision C.2 or later. See note below.*



EZIO family offers two modules for interfacing to thermocouples:

- EZIO-4THI (*not recommended for new applications*)
- EZIO-4THIE

This document describes EZIO-4THIE module.

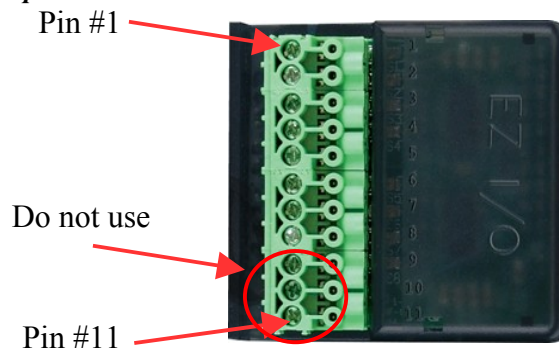
The module has following features:

- Up to 4 thermocouple inputs with user selectable thermocouple types on each input
- User programmable broken thermocouple detection
- User programmable units for temperature -- Centigrade, Fahrenheit or Kelvin
- Internal cold junction compensation

## Wiring

### Pin # Enhanced Thermocouple Input

1	INPUT1 +
2	INPUT1 -
3	INPUT2 +
4	INPUT2 -
5	INPUT3 +
6	INPUT3 -
7	INPUT4 +
8	INPUT4 -
9	DO NOT USE
10	DO NOT USE
11	DO NOT USE



**Note: This module requires EZPLC editor version 1.4 or later; firmware revision C.2 or later.**

#### **To check the firmware revision of your EZPLC:**

Using the EZPLC Editor Software access the menu item **EZPLC > INFORMATION...** a window will open displaying the current **EXEC Software** and **BOOT Software** revisions.

#### **To upgrade the firmware:**

Download firmware at [www.EZAutomation.net](http://www.EZAutomation.net) (downloads section). Once downloaded, use EZPLC editor and select **Setup>Upgrade Firmware** menu item.



## Specifications

**Number of Channels** 4

**Thermocouples supported** See table below

**Common Mode Range** -1.5 VDC to +4.0 VDC

**Common Mode Rejection** 100dB min. @ VDC 50/60Hz

**Input Impedance** 5MΩ

**Absolute Maximum Ratings** Fault-protected inputs to ±50 VDC

**Accuracy vs. Temperature** ± 15ppm/°C max., 0-1.25V ±35 ppm/°C max. (including max. offset change)

**PLC Update Rate** 4 channels per scan

**Base Power Required** 10mA @ 3.3 VDC supplied by base

**Operating Temperature** 32° to 140°F (0° to 60°C)

**Storage Temperature** -4° to 158°F (-20° to 70°C)

**Relative Humidity** 5 to 95% (non-condensing)

**Environmental Air** No corrosive gases permitted

**Vibration** MIL STD 810C 514.2

**Shock** MIL STD 810C 516.2

**Noise Immunity** NEMA ICS3-304

**Replacement Terminal Block** EZIO-TERM11

**Cold Junction Compensation** Automatic Internal

**Conversion Time** 1ms per channel

**Warm-Up Time** 30 minutes typically ± 1°C repeatability

**Linearity Error (End to End) ???**

**Maximum Inaccuracy ???**

### Type of Thermocouple & ranges supported, and error values:

Thermocouple type	Range			Value reported with Open Thermocouple or incorrect configuration		
	Centigrade	Fahrenheit	Kelvin	Do not report	Low Value	High Value
J	-210°C to +1200°C	-346°F to +2192°F	63°K to 1473°K	Random	-32768 (0x8000)	+32767 (0x7FFF)
K	-200°C to +1372°C	-328°F to +2502°F	73°K to 1645°K	Random	-32768 (0x8000)	+32767 (0x7FFF)
S	-50°C to +1768°C	-58°F to +3214°F	223°K to 2041°K	Random	-32768 (0x8000)	+32767 (0x7FFF)
T	-200°C to +400°C	-328°F to +752°F	73°K to 673°K	Random	-32768 (0x8000)	+32767 (0x7FFF)
E	-200°C to +980°C	-328°F to +1796°F	73°K to 1253°K	Random	-32768 (0x8000)	+32767 (0x7FFF)
R	-50°C to +1768°C	-58°F to +3214°F	223°K to 2041°K	Random	-32768 (0x8000)	+32767 (0x7FFF)
B	250°C to +1820°C	482°F to +3308°F	523°K to 2093°K	Random	0 (0x0000)	65535 (0xFFFF)
N	-200°C to +1300°C	-328°F to +2372°F	73°K to 1573°K	Random	-32768 (0x8000)	+32767 (0x7FFF)



## Thermocouple Module Setup

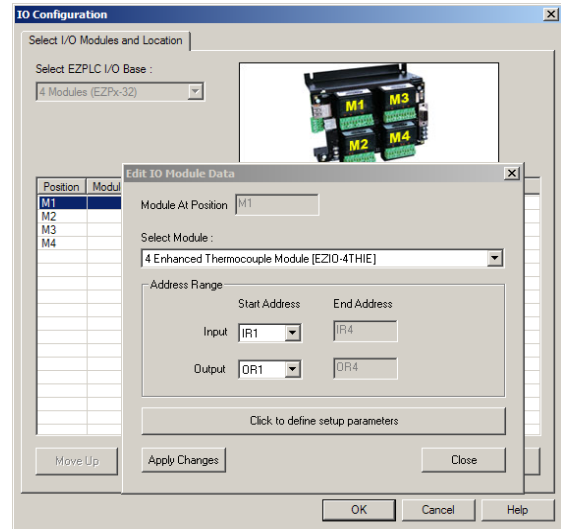
To setup the module in EZPLC, follow these steps:

1. In I/O configuration select "4 Enhanced Thermocouple Module (EZIO-4THIE) as shown below, and assign desired starting Input and starting output addresses:

The module takes up 4 input registers (IRs) and 4 output registers (ORs).

Input Registers return thermocouple readings. Output registers are used for configuration of respective thermocouple.

The starting Input Register is used for Input # 1, the next for Input# 2, etc. For example if the starting input address is IR1, then reading from thermocouple at input # 1 would be returned in IR1, from #2 in IR2, from #3 in IR3, and from #4 in IR4. Similarly Starting OR would configure Thermocouple #1, and next OR would configure Input #2, and so on.

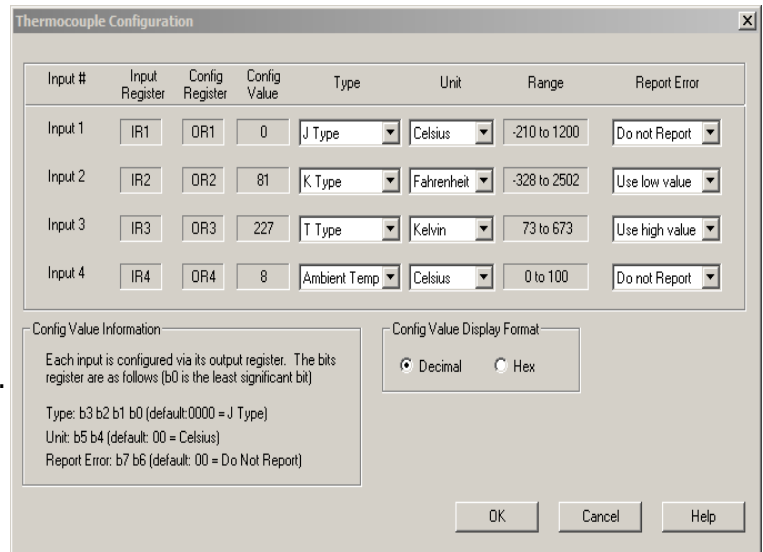


2. Click on "Click to define setup parameters. Following dialog comes up:

For each input, select Type of Thermocouple, Unit of measurement, and Option to report error (such as due to open thermocouple, wrong configuration, etc.). These choices create a config value that is written to corresponding OR registers when the program is written to EZPLC. These values can also be written or modified using ladder logic, but it may be easier to use the dialog box.

That is all required to setup the module.

The programmable parameters, namely type, unit, and report error, as well as the computed config value, are described below:



### Type

Select the type of the thermocouple using this field. The possible choices are: J Type, K Type, S Type, T Type, E Type, R Type, B Type, N Type, Ambient Type. The display-only range field depends on the type of the thermocouple selected (along with the unit).



### Unit

Select the unit for measurement for each thermocouple. The possible choices are: Celsius, Fahrenheit and Kelvin. The display-only range field depends on the unit selected (along with the type of the thermocouple).

### Report Error

The Report Error function on the thermocouple module provides diagnostic capabilities to detect open or burnt thermocouple, or incorrect configuration (which can happen if the ladder logic writes an incorrect value to the config register). The following table describes the choices and the resulting actions. You can use these values in ladder logic to detect possible problems with the thermocouples or configurations.

Choice	Value Returned	
	All types <i>EXCEPT</i> B Type	B Type
Do Not Report	Indeterminate	Indeterminate
Use low value	-32768	0
Use high value	32767	65535

### Config Value

The computed ConfigValue (determined by above choices) is the value written to the config (output) register. Each thermocouple input is configured via its config register. The Config Value Display Format option allows you to display (in this dialog box) the config value in either decimal or hex. The actual config value depends on the selections made for the type, unit and report error as shown in the following table:

Bits in Config Registers	Determined by	Default value
Bit 3 – Bit 0	Thermocouple type	0000 (J -type)
Bit 5- Bit 4	Unit Selection	00 (Celsius)
Bit 7 – Bit 6	Report-Error Selection	00 (Do not report)

The values of bits for various selections can be seen from the configuration dialog box.



## **Thermocouple Module Operation**

The Thermocouple provides 4 inputs for thermocouples. Each input can independently be configured by writing to the corresponding configuration register. The configuration can be done using the dialog box as described above. Alternately, the configuration can be done by writing appropriate values in the Output Registers of the module.

### **Tag Data Types**

In EZPLC the ladder logic accesses memory using tags. Therefore, create tags for each of the Input (IR) and output registers (OR) associated with the module. Each tag has a data type to interpret the data values appropriately. Please follow the guidelines below for the tag data types for the module:

- Tags associated with the Output Registers (OR) must be declared `UNSIGNED_INT_16`
- Tags associated with the Input Registers (IR) must be of `SIGNED_INT_16` for all thermocouple types *EXCEPT type B* in which case it should be `UNSIGNED_INT_16`.

### **Temperature Values**

The thermocouple module provides temperature values with one digit after the decimal point. However, these values are presented as integer numbers.

Thus, if a reading from the module is 1234, it should be interpreted as 123.4