Tutorial Plug-In Modules: Thermocouples Tutorial

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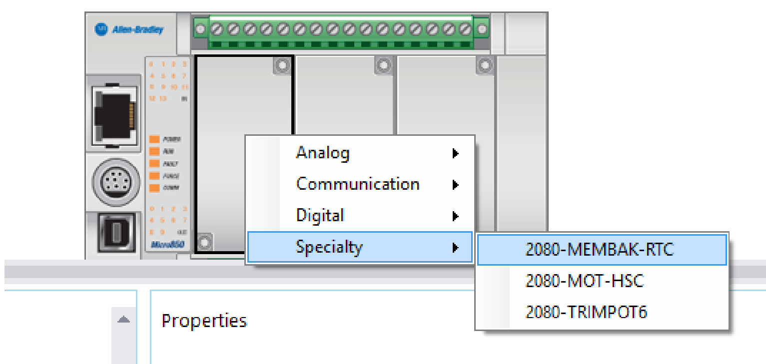
Setup: Load Connected Components Workbench > New > Project > Name Thermalcouple > Add Correct PLC and Version to Project

Adding Plug-In Modules to Board

1. Create a New Ladder Diagram > Name Tutorial Thermal
2. Adding I/O Module
    a. **Membak-RTC Module**

       Used to backup project, retrieve project, duplicate project or update data about a project.
       The precision real-time clock feature established a time-base for controller functions that need to be coordinated with real-time events. The real-time clock needs to be enabled and synched during configuration

       Place cursor on the first module on the screen (cursor will highlight module) > Right Mouse Button > Select Speciality > 2080-Membak-RTC



b. Thermocouple Plug-in Module

Used to measure temperature over a large range.
Settings:

- The module can support 8 types of sensors (B,E,J,K,N,R,S,T).
- Module Channels (0,1,CJC)

Each sensor has a temperature range. If the channel temperature is below/above the range, an under/over error is reported through CCW global variables

Sensors also have an update rate. This is the total time it takes for thermocouple module to sample and convert the input signals from the input channels and provide the resulting data values to the controller.

You need to choose the type of sensor and corresponding update rate when configuring a thermocouple plug in module.

Add the Thermocouple module to the middle plug-in by selecting the middle plug-in module > right mouse button > Analog > 2080-TC2

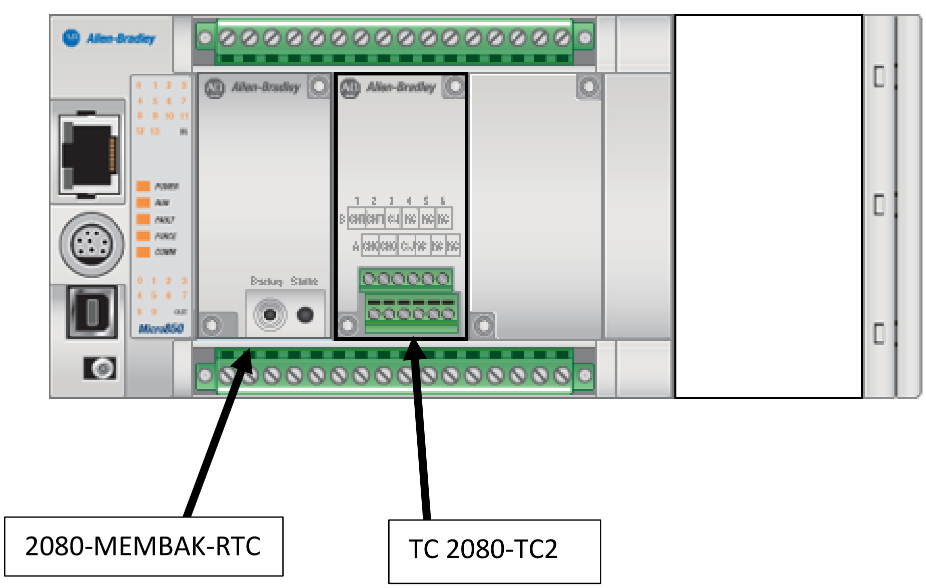
c. Analog Expansion Plug-In Modules

Used to

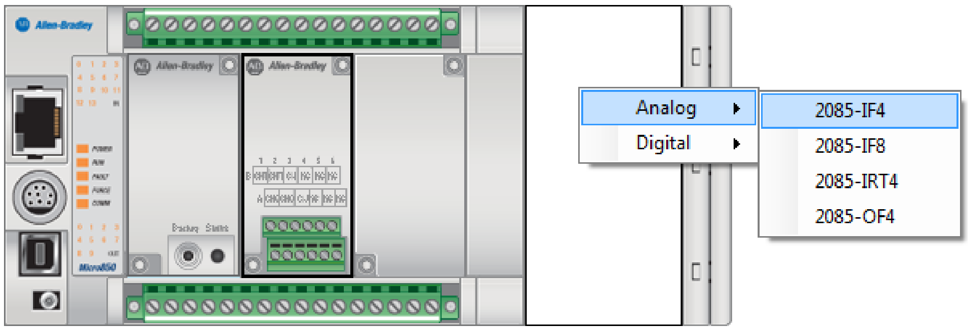
- Convert analog signals to digital values for inputs
- Convert digital values to analog signals for outputs

Types of Modules

- 4- Channel Analog Voltage/Current Input
- 8-Channel Analog Voltage/Current Input
- 4-Channel Analog Voltage/Current Output

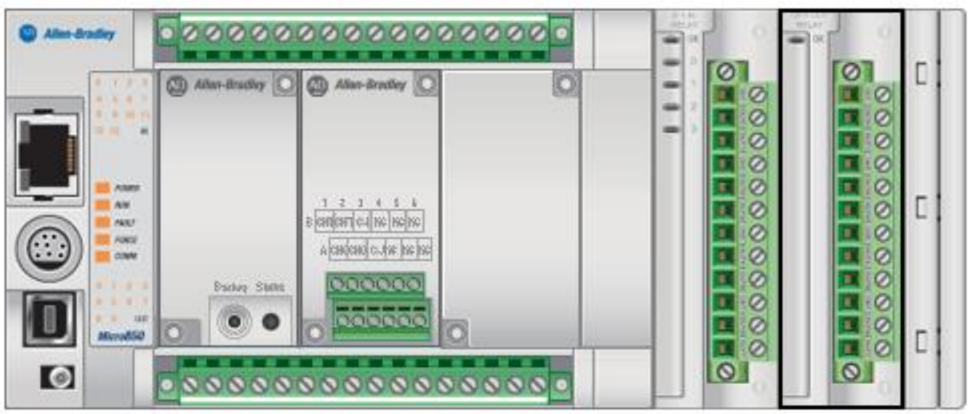


Right Mouse button > Select Analog > 2085-IF4



Repeat the process for Analog 2085-OF4

d. Final Board should look as follows



Module Configuration

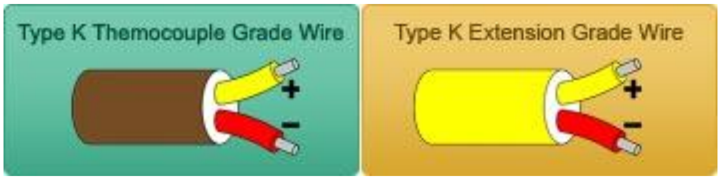
Depending on the type of plug-in or expansion I/O module, you may need to edit module properties during configuration, such as

- Alarm Limits
  - Varies with modules
- Channel input type
  - Current or voltage
- Frequency
  - Varies with module
- Input state
  - Enabled
  - Disabled

Thermocouple Tutorial

Types of Thermal Couples

Type K Thermocouple (Nickel-Chromium / Nickel-Alumel): The type K is the most common type of thermocouple. It's inexpensive, accurate, reliable, and has a wide temperature range.



Temperature Range:

- Thermocouple grade wire, –454 to 2,300F (–270 to 1260C)
- Extension wire, 32 to 392F (0 to 200C)

Accuracy (whichever is greater):

- Standard: +/- 2.2C or +/- .75%
- Special Limits of Error: +/- 1.1C or 0.4%

Type J Thermocouple (Iron/Constantan): The type J is also very common. It has a smaller temperature range and a shorter lifespan at higher temperatures than the Type K. It is equivalent to the Type K in terms of expense and reliability.

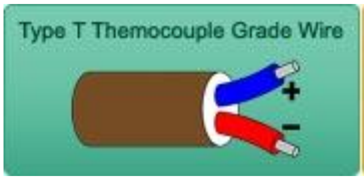
Temperature Range:

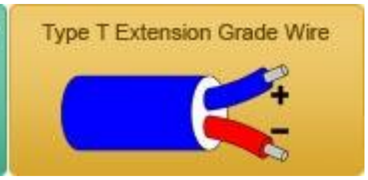
- Thermocouple grade wire, -346 to 1,400F (-210 to 760C)
- Extension wire, 32 to 392F (0 to 200C)

Accuracy (whichever is greater):

- Standard: +/- 2.2C or +/- .75%
- Special Limits of Error: +/- 1.1C or 0.4%

Type T Thermocouple (Copper/Constantan): The Type T is a very stable thermocouple and is often used in extremely low temperature applications such as cryogenics or ultra low freezers.





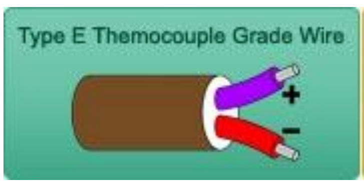
Temperature Range:

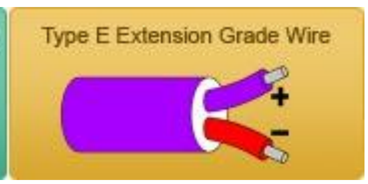
- Thermocouple grade wire, -454 to 700F (-270 to 370C)
- Extension wire, 32 to 392F (0 to 200C)

Accuracy (whichever is greater):

- Standard: +/- 1.0C or +/- .75%
- Special Limits of Error: +/- 0.5C or 0.4%

Type E Thermocouple (Nickel-Chromium/Constantan): The Type E has a stronger signal & higher accuracy than the Type K or Type J at moderate temperature ranges of 1,000F and lower. See temperature chart (linked) for details.





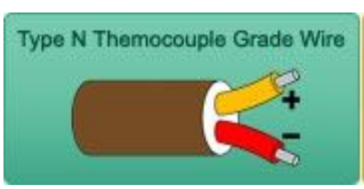
Temperature Range:

- Thermocouple grade wire, -454 to 1600F (-270 to 870C)
- Extension wire, 32 to 392F (0 to 200C)

Accuracy (whichever is greater):

- Standard: +/- 1.7C or +/- 0.5%
- Special Limits of Error: +/- 1.0C or 0.4%

Type N Thermocouple (Nicrosil / Nisil): The Type N shares the same accuracy and temperature limits as the Type K. The type N is slightly more expensive.



Temperature Range:

Thermocouple grade wire, -454 to 2300F (-270 to 392C)

- Extension wire, 32 to 392F (0 to 200C)

Accuracy (whichever is greater):

- Standard: +/- 2.2C or +/- .75%
- Special Limits of Error: +/- 1.1C or 0.4%

NOBLE METAL THERMOCOUPLES (Type S,R, & B):

Noble Metal Thermocouples are selected for their ability to withstand extremely high temperatures while maintaining their accuracy and lifespan. They are considerably more expensive than Base Metal Thermocouples.

Type S Thermocouple (Platinum Rhodium - 10% / Platinum): The Type S is used in very high temperature applications. It is commonly found in the BioTech and Pharmaceutical industries. It is sometimes used in lower temperature applications because of its high accuracy and stability.

Temperature Range:

- Thermocouple grade wire, -58 to 2700F (-50 to 1480C)
- Extension wire, 32 to 392F (0 to 200C)

Accuracy (whichever is greater):

- Standard: +/- 1.5C or +/- .25%
- Special Limits of Error: +/- 0.6C or 0.1%

Type R Thermocouple (Platinum Rhodium -13% / Platinum): The Type R is used in very high temperature applications. It has a higher percentage of Rhodium than the Type S, which makes it more expensive. The Type R is very similar to the Type S in terms of performance. It is sometimes used in lower temperature applications because of its high accuracy and stability.

Temperature Range:

- Thermocouple grade wire, -58 to 2700F (-50 to 1480C)
- Extension wire, 32 to 392F (0 to 200C)

Accuracy (whichever is greater):

- Standard: +/- 1.5C or +/- .25%
- Special Limits of Error: +/- 0.6C or 0.1%

Type B Thermocouple (Platinum Rhodium – 30% / Platinum Rhodium – 6%): The Type B thermocouple is used in extremely high temperature applications. It has the highest temperature limit of all of the thermocouples listed above. It maintains a high level of accuracy and stability at very high temperatures.

Temperature Range:

- Thermocouple grade wire, 32 to 3100F (0 to 1700C)
- Extension wire, 32 to 212F (0 to 100C)

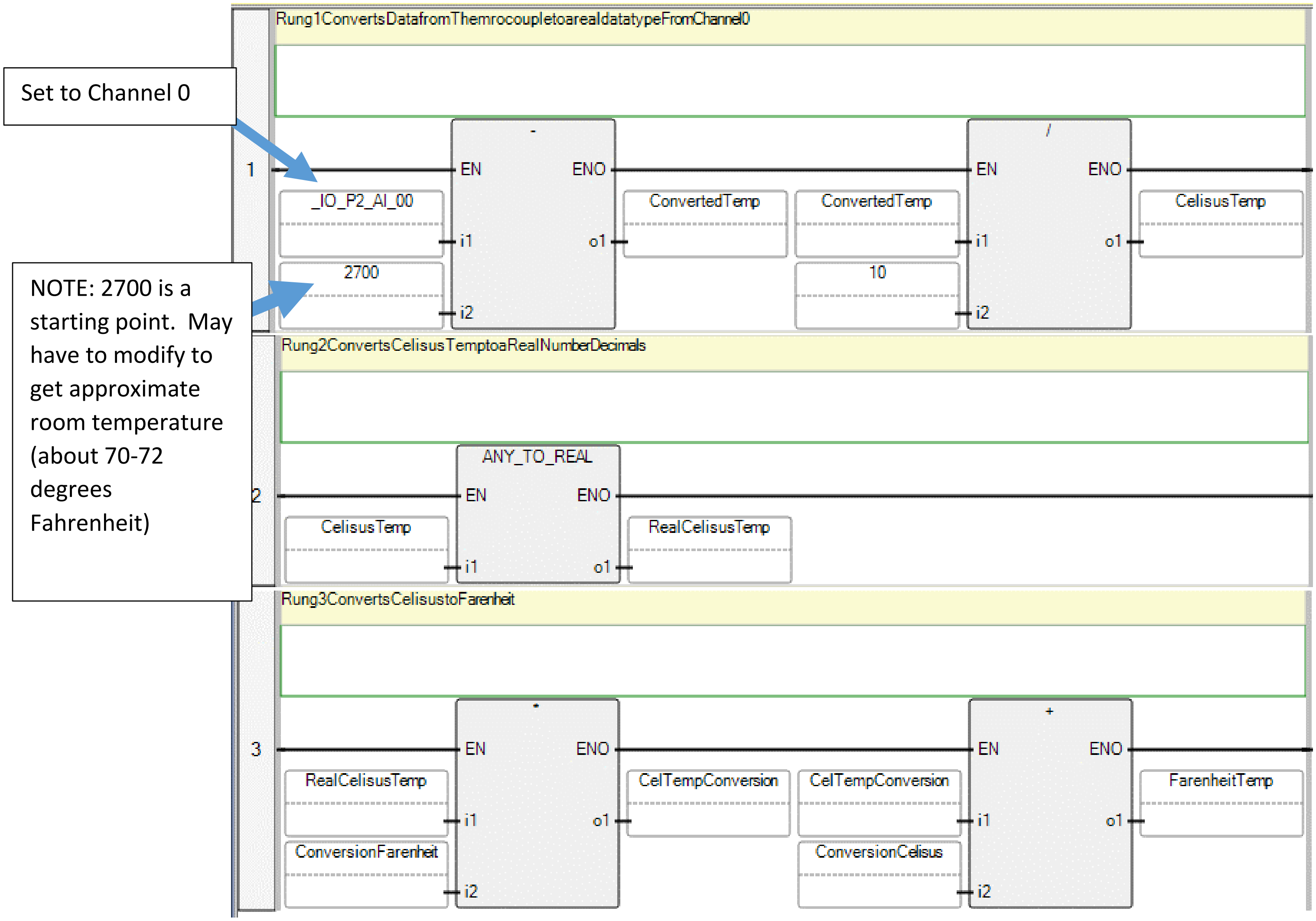
Accuracy (whichever is greater):

- Standard: +/- 0.5%
- Special Limits of Error: +/- 0.25%

1. This tutorial will use Type K 16.7 mHz. Be sure the module is set to this type of thermocouple.
2. Create a Ladder Diagram Program called BuildingTemp
3. Create the following variables

	Name	Alias	Data Type	Dimension	Project Value	Initial Value	Comment
	CelisusTemp		UINT				
	FarenheitTemp		REAL				
	ConversionFarenheit		REAL			1.8	
	ConversionCelisus		REAL			32.0	
	CelTempConversion		REAL				
	ConvertedTemp		UINT				
	RealCelisusTemp		REAL				
*							

4. Create the following Ladder Diagram (Add Labels notating each rung; Right Click above the ladder line (Green Area) > Select Add Label > Type in label)



5. Build the program and debug as needed.

Assignment 1: Room Temperature

Add a rung onto the program that will the following
If Fahrenheit Temperature is

- Less than 70 degrees turn on Green Light
- Between 70 and 80 Turn on Yellow Light
- Greater than 80 turn on the Red Light.

Assignment 2: Function Block

1. Channel 0 create as a User Defined Function Block that converts the Celsius to Fahrenheit
2. Channel 1 create as a User Defined Function Block that converts Celsius to Fahrenheit
3. Create a New Program that will do the following
    a. Compare Channel 0 and Channel 1 Temps
        i. Channel 0 = Channel 1: Both Green Lights ON
        ii. Channel 0 < Channel 1: Left Yellow Light (DO3) ON
        iii. Channel 0 > Channel 1: Right Yellow Light (DO4) ON

Submission:

Show Mr. Jourden Completed program

Print Program to turn in