

Function Block Diagram Programming with PLC

Tutorial

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Definition: Function Block Diagram programming is a language in which elements appear as blocks that are connected together resembling a circuit diagram.

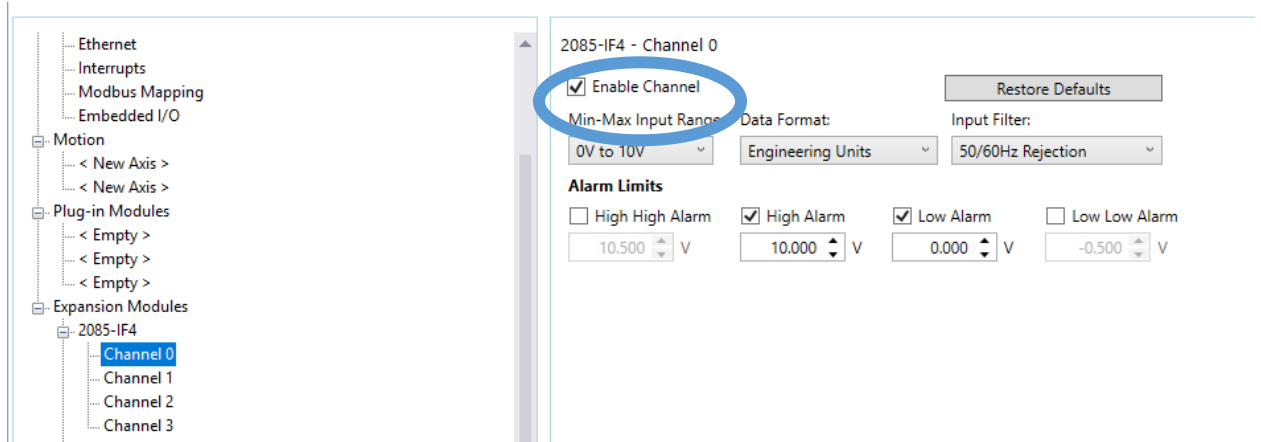
Function block diagrams show the relationship between the principal parts of a total system and are well-suited for process or drives control.

Function (Instruction) Block is a graphical representation of a series of executable code that contains user-defined control algorithms.

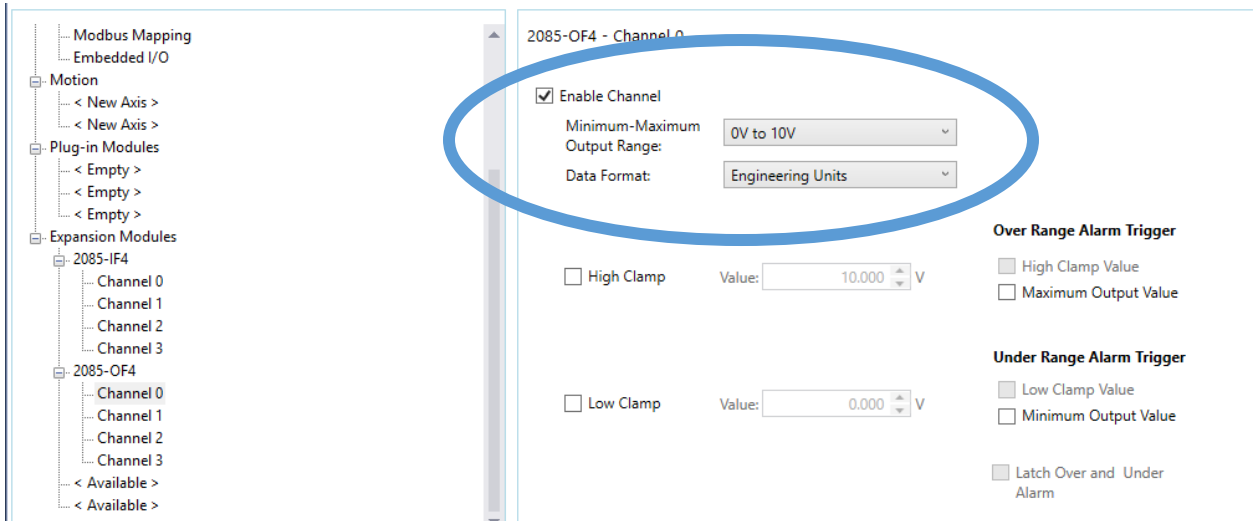
1. Open Connected Components Workbench (CCW) > New Project > Change Project Name > Add Controller 2080-LC50-24QBB Version 9
2. Setup the modules
 - a. 2080-MEMBAK-RTC
 - b. 2080-TC-2
3. Add on Modules
 - a. 2085-IF4
 - b. 2085-OF4



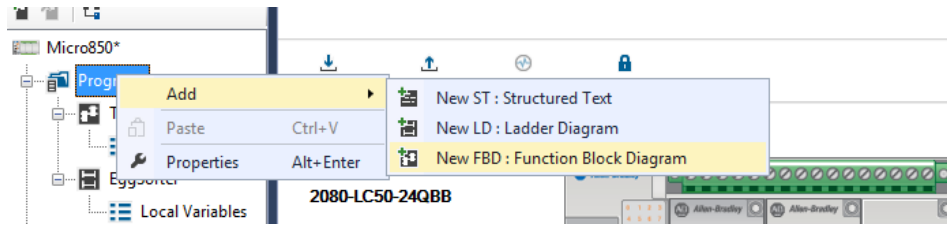
4. Modify the IF4 (Potentiometer) and OF4 (Voltmeter) modules to the proper readings
 - a. IF4 Modification
 - i. Select Micro 850 Tab to Show the Controller and its modules > Select Channel 0 for the 2085-IF4 > Set Min-Max Input Range to 0V to 10V
 - ii. Note can repeat the process for Channels 1-3 or set Disable Channels by unchecking the Enable Channel Box



- b. OF4 Modification
 - i. Select Micro 850 Tab to Show the Controller and its modules > Select Channel 0 for the 2085-OF4 > Select Enable Channel > Set Min-Max Input Range to 0V to 10V
 - ii. Note can repeat the process for Channels 1-3 or set Disable Channels by unchecking the Enable Channel Box



5. Setting of New File: File > New > Left Click on Program in the model tree > Select Add > Function Block Programming



6. Rename Program: TEMPS > Double Click on the program to open it

Types of Function Code Blocks

Instruction Blocks: Represent instructions for the program: Comparisons, arithmetic, timers, etc.

Variable used for inputs and outputs. NOTE: There is not rung needed when using a variable

Return will end/terminate the program at that point

Rungs Represents a group of function block elements leading to the initiation of an output.
Rungs Include: Input, Output, Power Rails
Left/Right Power Rail Represent the start/end of a rung

Toolbox

Search Toolbox

▲ FBD

- Pointer
- Variable
- Instruction Block
- Jump
- Return
- Comment
- Label
- Rung
- Left Power Rail
- Right Power Rail

- Vertical Bar
- Direct Coil
- Reverse Coil
- Set Coil
- Reset Coil
- Direct Contact
- Reverse Contact
- Pulse Rising Edge Contact
- Pulse Falling Edge Contact

Jumps are used to skip a portion of the program instead of logically flowing to the next rung

Comment allows the user to provide detail information about the program/line of code

Label is used with the Jump command to tell the program what rung to jump to. I.E Jump from rung 2 to rung 5

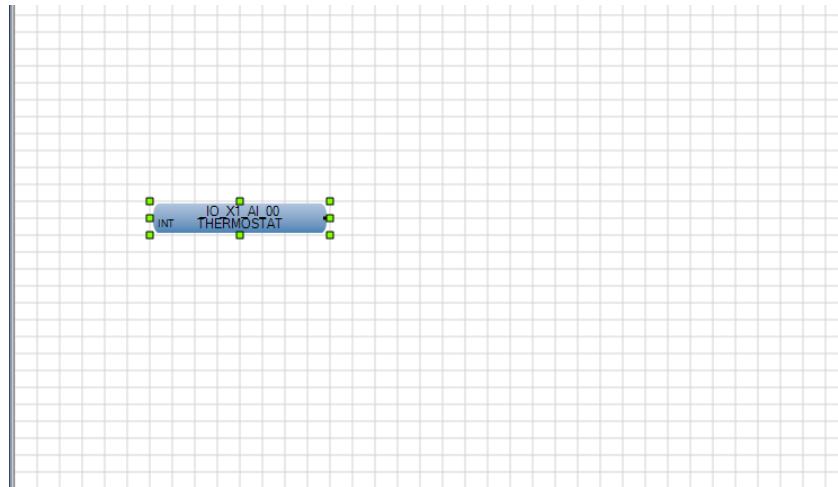
Symbols used within a rung. Used same as a Ladder Logic Program sequence.

Scenario: HVAC System: The function specification state

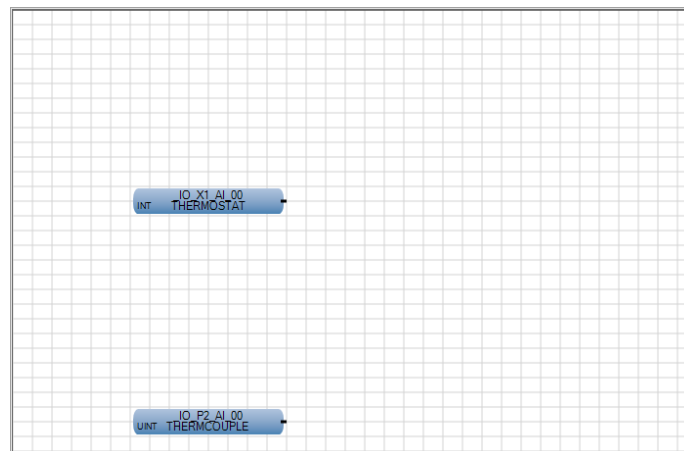
- a. Blue status light (DO6) indicates the cooling system is running
- b. The cooling system runs when the thermostat's (potentiometer) meter reading (analog output meter) is less than the temperature probe (thermocouple channel 0)
- c. A red status light (DO0) indicates the heating system is running
- d. The heating system runs when the thermostat's meter reading is greater than the temperature probe

Program Temp

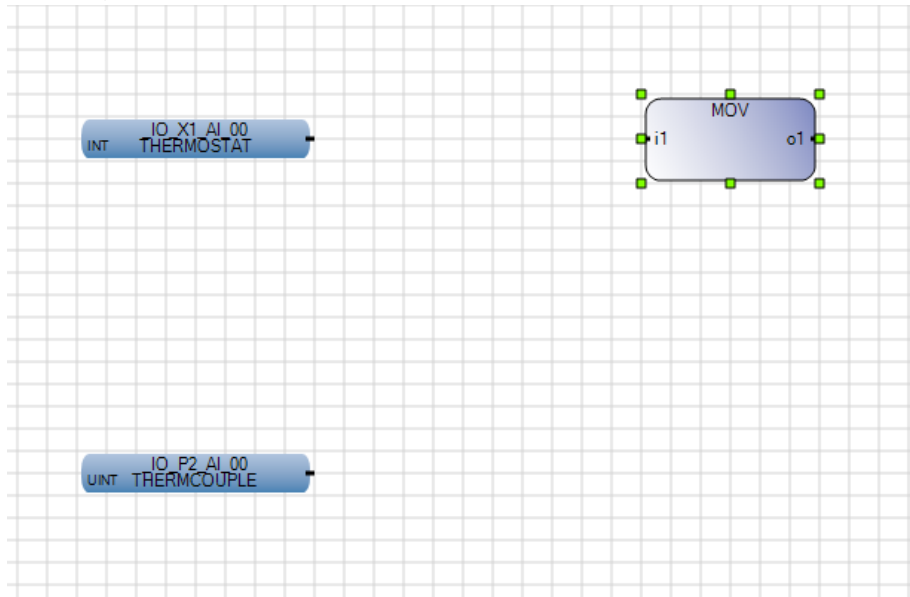
1. Drag a Variable symbol from the toolbox and place in the top left area of the work space > once placed the system will prompt user to set the I/O variable > Select the Potentiometer I/O (IO_X1_A1_00) > rename Thermostat



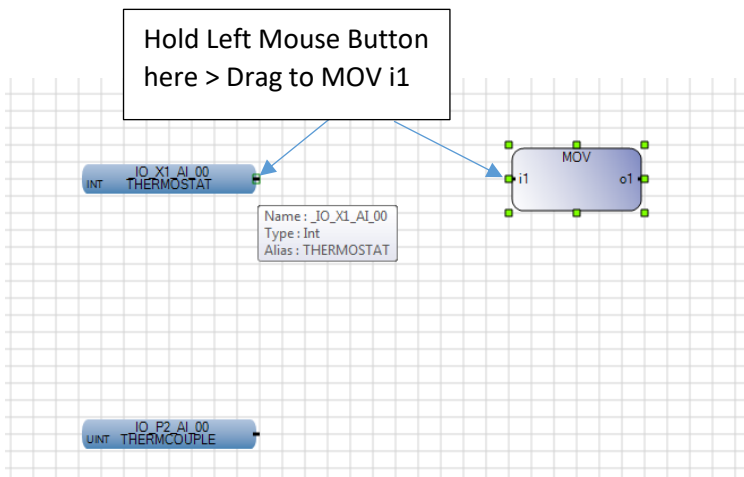
2. Drag a Variable symbol from the toolbox and place it below the Thermostat variable (See below for spacing) > set the variable type to the Thermocouple I/O (IO_P2_A1_00) > Rename Thermocouple



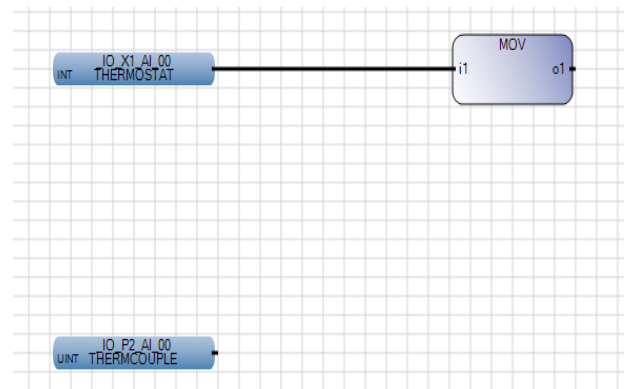
- Place a function block to the right of Thermostat > Set it as MOV (converts one variable to another)



- Connecting wires. Place the cursor on the right edge of the Thermostat variable where the black line is showing > Hold Left Mouse Key down and drag to connect to the MOV Instruction Block.

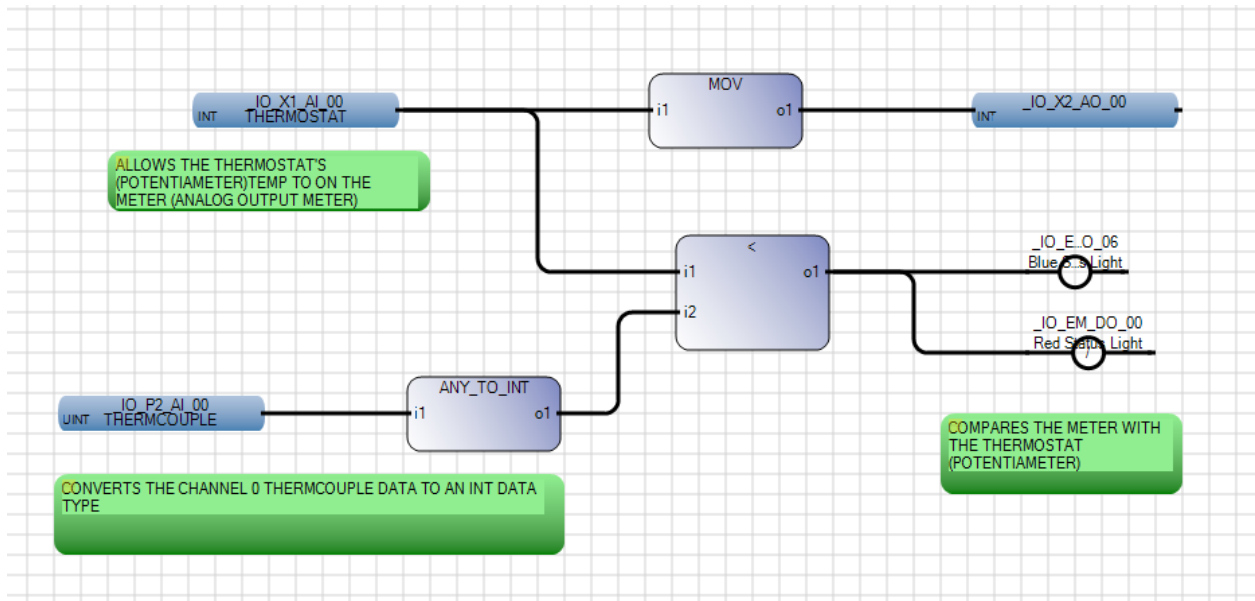


Before



After

5. Complete the program as shown below. Add all comments. (NOTE: To add a second wire from an existing wire place the cursor on the right edge of the block and drag to desired location)



6. Upload the program and see what happens. Notice the Greater Than statement is TRUE so the Blue Status Light turns ON, while the Red Status Light is turned OFF.

NOTE: Program is supposed to work by using the Potentiometer (POT) (AI0) on the control board.

7. Develop a method (other than rubbing the thermocouple), to turn the Red Status Light ON and the Blue Status Light is OFF. DO NOT Delete the original program. Add code and readjust the connection lines. Provide Notation for what the adjustment is.
8. Test the original program using a hair dryer. (See Teacher for hair dryer)

Submission

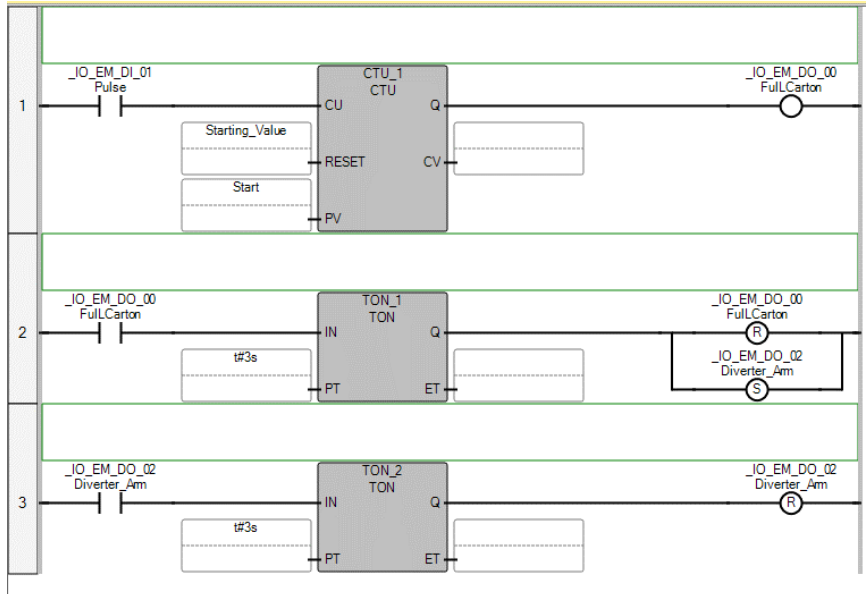
1. Show the teacher both methods. (Maybe in person or video)
2. Print out final code

Assignment 1: Egg Carton Packing Machine

Convert the following program to a Function Block Program. Add code that will reset the full carton to zero so the process can repeat.

Submission

1. Show the teacher both methods. (Maybe in person or video)
2. Print out final code



Assignment 2: Drag Racer Starting Lights

Create a function block program that will do the following

1. Push button DI4 to start program
2. Turn ON the Yellow Lights (DO1/DO2)
3. Timer 2 seconds
4. Turn ON the Red Lights (DO3/DO4); Keep Yellow Lights ON
5. Timer 2 seconds
6. Turn ON the Green Lights (DO5/DO6); Keep Yellow/Red Lights ON
7. Timer 2 seconds
8. Turn OFF all lights and turn ON Blue Lights (DO7/DO8)

Submission

1. Show the teacher both methods. (Maybe in person or video)
2. Print out final code