

Function Block Diagram Programming with PLC

Tutorial

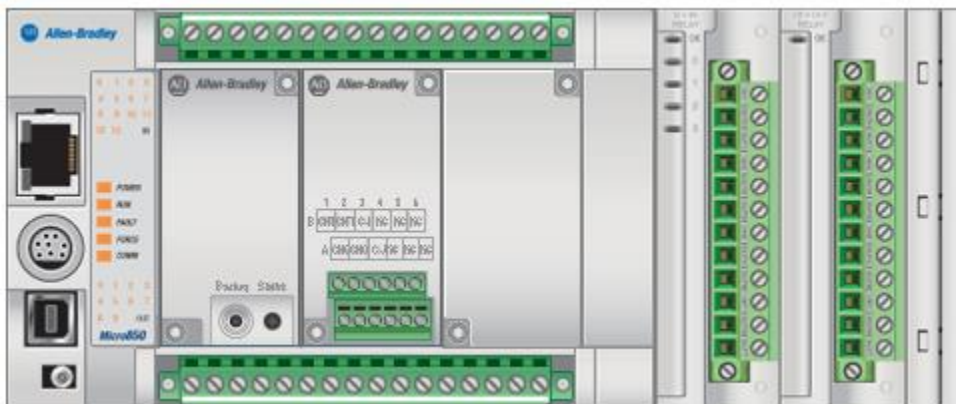
By: Matthew Jourden
Brighton High School

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

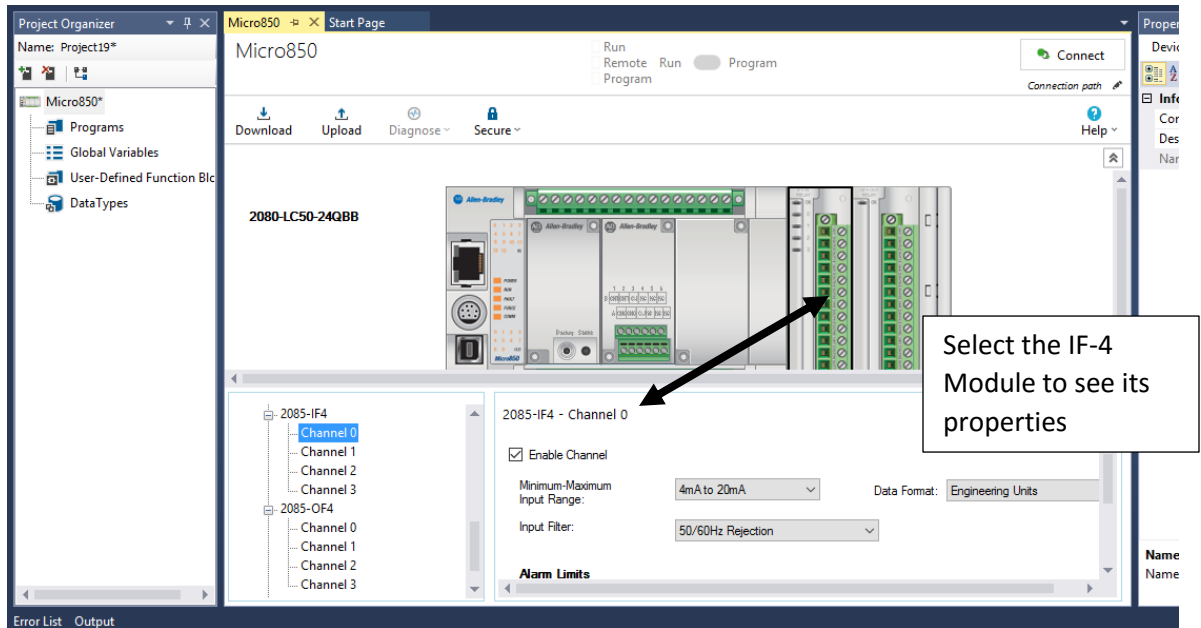
Function block diagrams show the relationship between the principal parts of a total system and are well-suited for process or drives control.

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

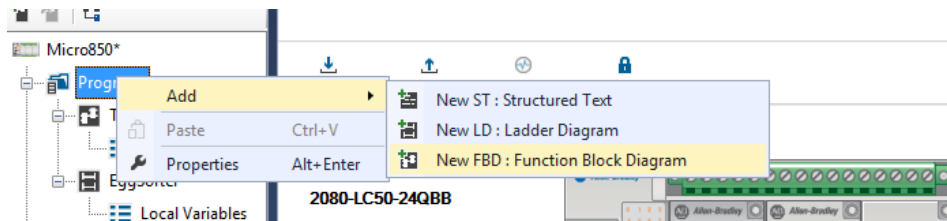
1. Open Connected Components Workbench (CCW) > New Project > Change Project Name > Add Controller 2080-LC50-24QBB Version 9
2. Setup the modules
 - a. 2080-MEMBAK-RTC
 - b. 2080-TC-2
3. Add on Modules
 - a. 2085-IF4
 - b. 2085-OF4



4. Modifying the Analog Module IF-4. Click on the module to activate the feature in the module properties in the lower part of the screen



5. Change the following
 - a. Channel 0L Minimum/Maximum Input Range -10V to 10V
 - b. Channel 1, 2, and 3 > Check the Enable Channel. This will deactivate the channel so the module on the board will not try to look for input where there is no input value(s)
6. File > New > Select
7. Left Click on Program in the model tree > Select Add > Function Block Programming



8. Rename Program: TEMPS > Double Click on the program to open it
9. Modify the Analog IF-4 Module
 - a. Click on the IF-4 Module

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

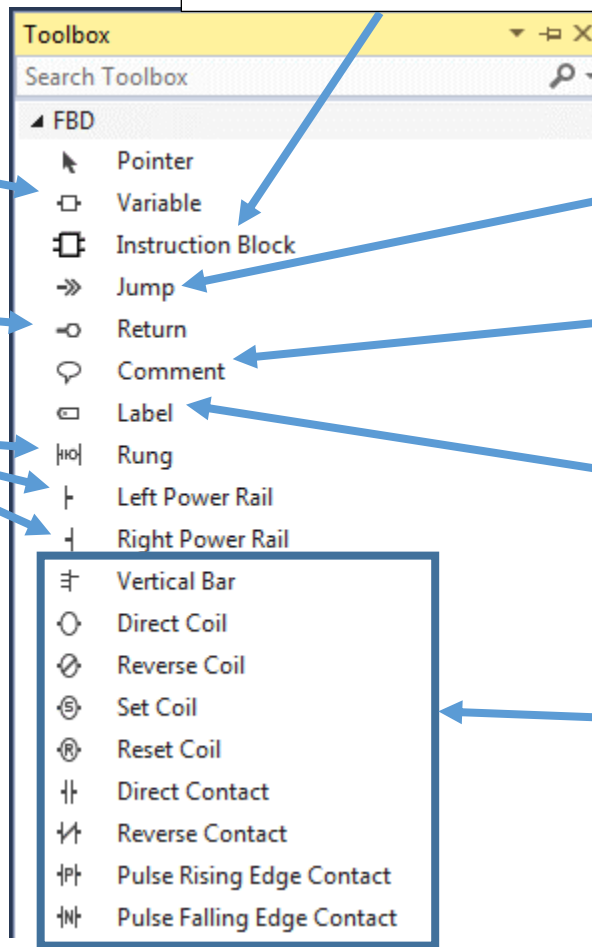
Left/Right Power Rail Represent the start/end of a rung

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.

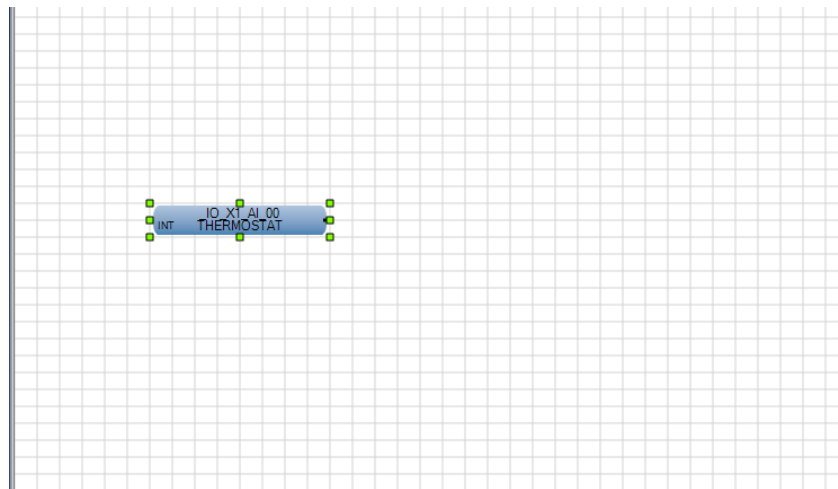


Scenario: HVAC System: The function specification state

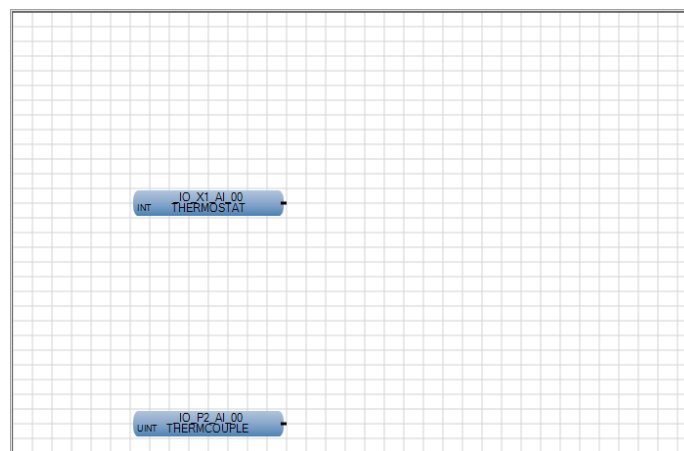
- b. Blue status light (DO6) indicates the cooling system is running
- c. The cooling system runs when the thermostat's (potentiometer) meter reading (analog output meter) is less than the temperature probe (thermocouple channel 0)
- d. A red status light (DO0) indicates the heating system is running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

Program Temp

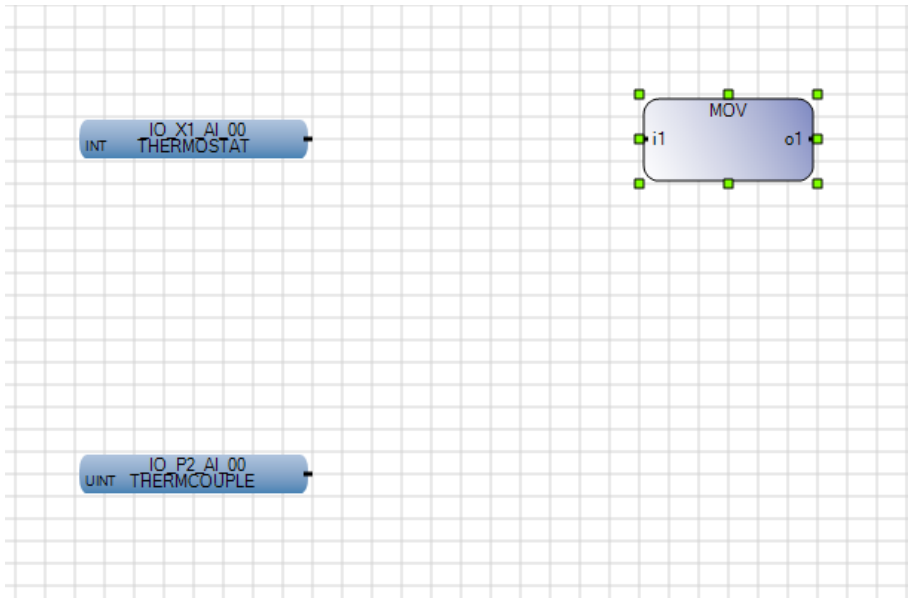
1. Drag a Variable symbol from the toolbox and place in the top left area of the work space > once placed the system will prompt user to set the I/O variable > Select the Potentiometer I/O (IO_X1_A1_00) > rename Thermostat



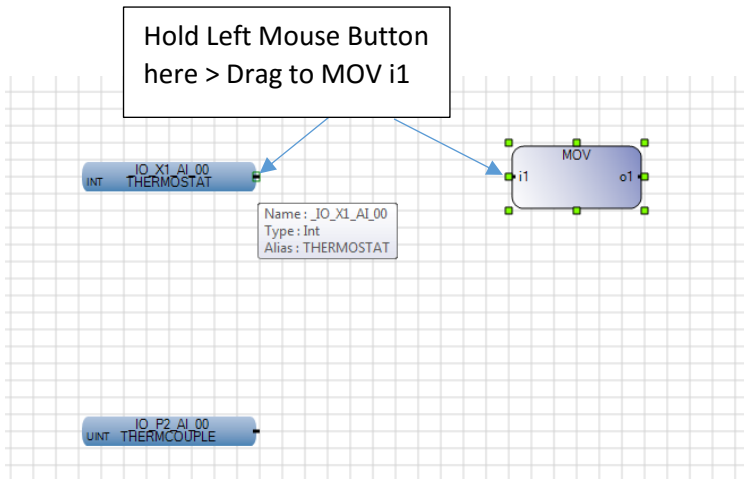
2. Drag a Variable symbol from the toolbox and place it below the Thermostat variable (See below for spacing) > set the variable type to the Thermocouple I/O (IO_P2_A1_00) > Rename Thermocouple



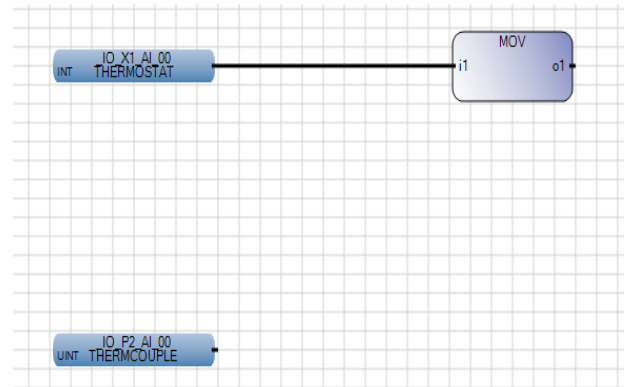
3. Place a function block to the right of Thermostat > Set it as MOV (converts one variable to another)



4. 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.

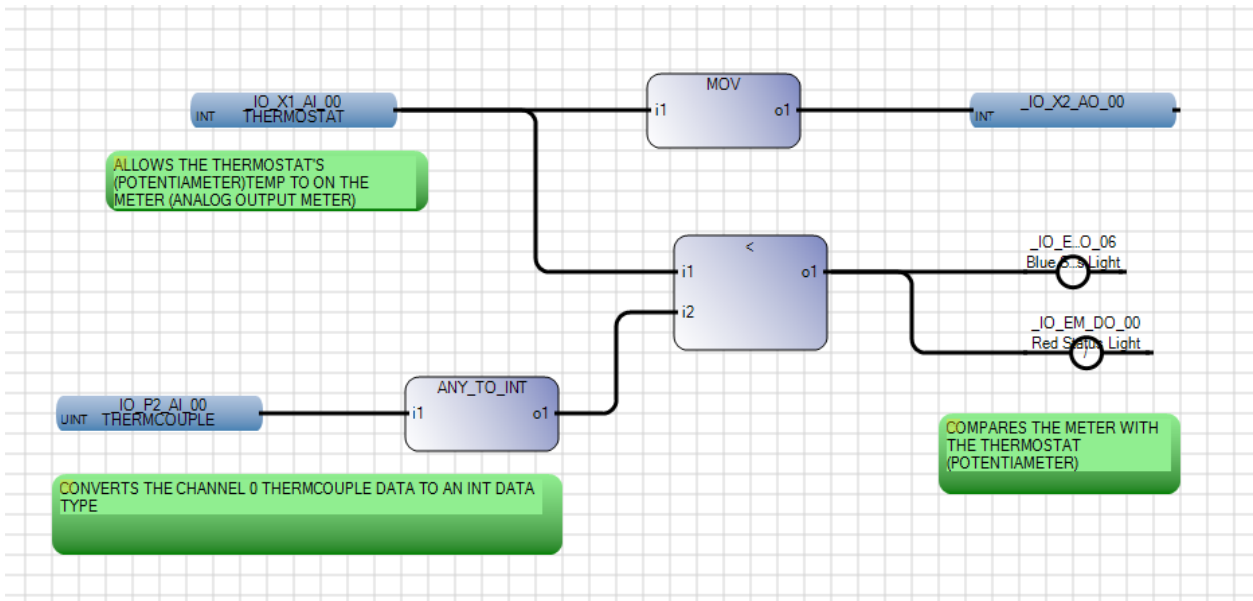


Before



After

- 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)



- 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. Turn the Potentiometer (AI0) to simulate temperature change.
- 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.
- Test the original program using a hair dryer. (See Teacher for hair dryer)

Submission

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

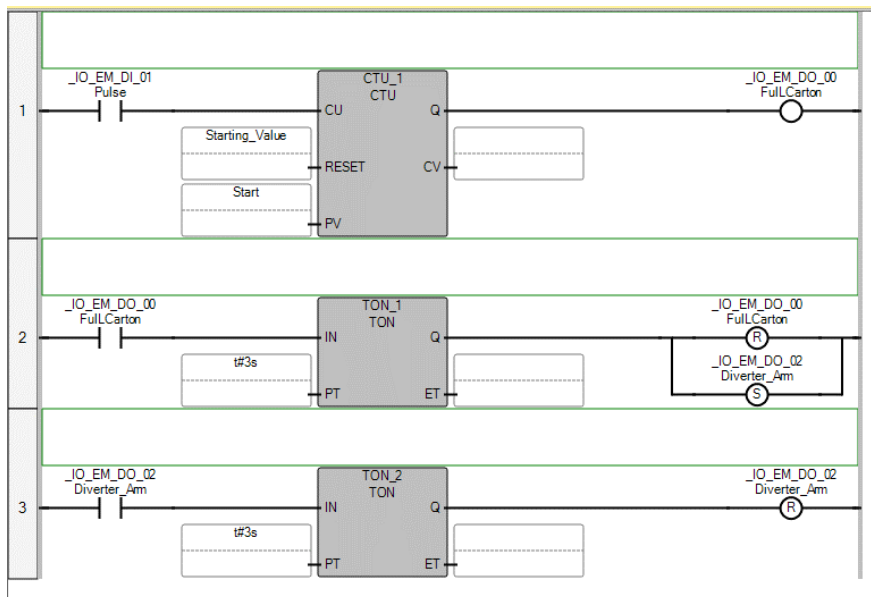
Assignment 9: Egg Carton Packing Machine

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

Add code that will use the Potentiometer (AI0) to simulate that there is a bad egg on input. If the Potentiometer is above 6V then the egg is bad. Turn on one of the red lights, pause for 3 seconds (simulates the bad egg being removed from the line), and do not count the egg as part of the dozen that go into a carton.

Submission

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



Assignment 10: 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