6 Advanced Configuration Lab

6.1 Foreword

Many control strategies involve calculations and math functions besides PID control. The 53MC5000 controller can perform math and logic functions in addition to PID control. Table 5.1 lists the function blocks that are available in the 53MC5000 controller.

6.2 Objectives

In this lab we will add 2 inputs and show the result in a display. We will also configure a display for this purpose.

After completing this lab, you should know how to

- Identify the function of a Math Block
- Select function to sum two inputs and attach 2 inputs to the math block for addition
- Set-up a parameter display to indicate the two inputs and the result of the math block
- Simulate inputs in the 53MC5000 controller for the addition

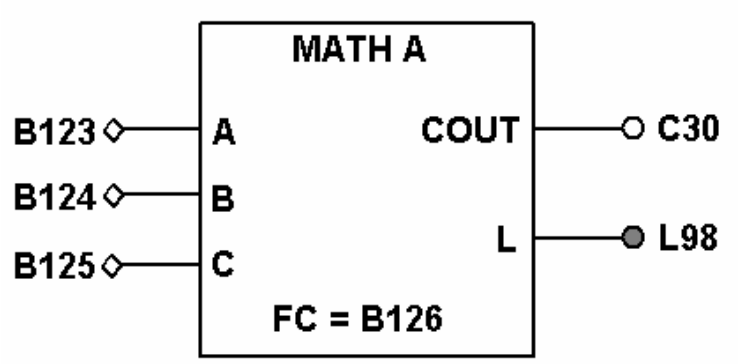
6.3 Instructions

Part A: Math Function Block:

The Math function block (or module) allows the user to select a math function and attach input values that will use the selected function. The inputs for the math function will be assigned specific database locations. The output of the block can be accessed from another math function.

Each math block has 3 inputs and a Function Code to select a specific math function. The schematic of the math block is as shown in the next figure:

Figure 6.1.
MATH A function



In the above figure example, A, B and C are the inputs for the math function. Math module A inputs are assigned in database locations B123, B124 and B125 respectively. The math function result is stored in location C30. The Math A function code is stored in location B126. The selected math function can have one or more coefficients (or constants) that can be used in the function. These coefficients are store in locations C76, C77 and C78 respectively.

The following table shows the possible math functions that can be performed using the math block:

Table 6.1.
Math Block
Function Codes

Function Code	Math Function
0	A
1	(K1*A)+K2
2	(K1*A)+(K2*B)+(K3*C)
3	(K1*A*B*C)+K2
4	(K1*(A/B))+(K2*C)
5	((K1*A)+(K2*B)/C)+K3
6	((K1*A*B)/C)+K2
7	((A+K1)/B+K2))*K3
8	(K1*ABS(A))+K2
9	K1*(A*A((K2*B)+K3))
10	K1*(2*2((K2*A)+K3))
11	K1*LOG((K2*A)+K3)
20	Limiter (K1<A<k2)
21	Limiter ((K1*C)<A<(K2*B)

To sum 2 inputs we will use the Function Code 2. The formula is:

(A*K1) + (B*K2) + (C*K3)

where A, B and C are inputs and K1, K2 and K3 are coefficients. We will not connect anything to input C and assign a value of 1 to coefficients K1 and K2. We will also assign a value of 0 for K3 to disable the third input C.

1. Configuration of the Math A module:

- Press the E-mode button (dot button) until you see DISPLAY/ CONFIGURE/ PROGRAM at the bottom of the display.
- Press the F2 button until `CONFIGURE` is displayed at the bottom.
- Press F3 to accept the configuration mode. On design level A controllers, the bottom line should now display the following: `POINT` ⌞. On a design level B controller, the bottom line should read `DATAPOINT` or `MODULE`. Press the F2 button until `DATAPOINT` is displayed.
- Press F3 to accept the DATAPOINT configuration mode. The bottom line should now display the following: `POINT` ⌞

2. **Assign database locations to the controller math block**

   - We will assign database locations C090 and C091 to the math block inputs, database location B123 and B124 (math block's A & B inputs). When using FCS for control purposes any "C" type data in the range 0-255 can be assigned to the math block inputs including those "C" type data assigned to analog inputs and outputs.
   - Select location B123 using the / buttons to select the digit and then use the / buttons to modify the value of the digit. The point entry should look like `POINT  ⌞B123`. Press the F3 to accept the entry.
   - The screen should now display the current contents of B123, `B123  ⌞ 21`. Enter a value of 90 (for database location C090), `B123  ⌞ 90` and then press F3 to enter.
   - Similarly select location B124 and enter a value of 91 (for database location C091).

3. **Assign a value of 2 for the math block's function code.**

   - Select location B126 and enter a value of 2 for that location. The function we will be using is: (A*K1) + (B*K2). C is ignored and will be zero.

4. **Assign K1 and K2 a value of 1.**

   - Select location C76 and enter 1 as its value
   - Similarly select location C77 and enter value 1.
   - Select location C78 and enter value 0. This will disable the unused input C. This will complete the Math block configuration.

Part B: Parameter Module Display:

1. **Configuration of the Parameter Module Display:**

   - Press the F1 button until you see `CONFIGURE` at the bottom of the display.
   - Press F3 to accept the configuration mode. On design level A controllers, the bottom line should now display the following: `POINT  ⌞`. On a design level B controller, the bottom line should read `DATAPOINT` or `MODULE`. Press the F2 button until `MODULE` is displayed.
   - Press F3 to accept the `MODULE` configuration mode. The Module Configuration Menu is now displayed.

2. **Select Parameter Module 0**

   - Using the / buttons, select the PARAMETER Module configuration from the menu list.
   - Press F3 to enter the Parameter module configuration.
   - Select Parameter Module 0, 0-CON-0 TUNE using the / buttons.
   - Press F3 to enter Parameter 0 configuration menu.

3. **Parameter Module 0 parameter configuration**

   - Select and modify the module tag name. Using the / pushbuttons, select TAG : CON-O TUNE and press F3 to change the tag name. Change the tag name to MATH DEMO. Remember to use the F2 fushbutton when making changes to the tagname.
   - When the tag name has been changed, press F3 to accept the changes and return to the previous screen.
   - Continue making changes to the remainder of the Parameter module using the information supplied in Table 5.2

Table 6.2. Parameter display Locations

Location	Legend	Default value for the CON0 TUNE display	Change the value to the following:
A010	Tag	CON-0 TUNE	MATH DEMO
A011	Point A Name (PNA)	PROP. BAND	INPUT 0
F084	Point A Designator (PDA)	C106	C090
A012	Point B Name (PNB)	RESET TIME	INPUT 1
F085	Point B Designator (PDB)	C107	C091
A013	Point C Name (PNC)	DERV. TIME	RESULT
F086	Point C Designator (PDC)	C108	C030

4. **Exit Engineering Mode**

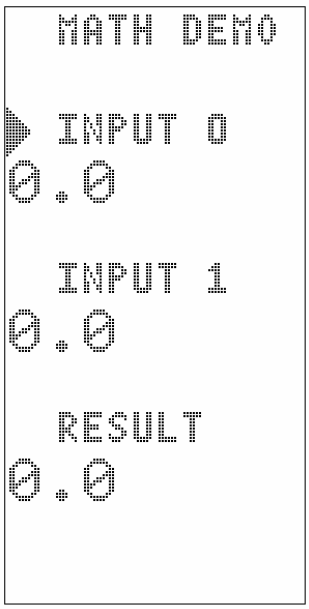
- When all the changes have been entered, simply press the DOT button to exit engineering mode.

Part C: Displaying the Modified Parameter Module:

1. **Configuration of the Parameter Module Display:**

   - Press the F2 button until the MATH DEMO parameter module is displayed. It should look like the figure below.

Figure 6.2.
MATH DEMO Display



2. **Testing the results**

   Remember we tied Input 0 and Input 1 of the controller as the inputs for the math function. In this part of the lab, we will modify those inputs to verify the result. We will do this in two steps

   - Input 0 can be modified from the front panel of the display. The arrow to the left of the INPUT 0 selection will allow us to modify the value in C090 (Input 0).
   - Press the F3 button. At the bottom of the screen, the current value of INPUT 0 is displayed. Using the / buttons to select the digit and then use the / buttons, change the value in INPUT 0 to 100.0.

- Press the F3 key to accept the value. INPUT 0's value should now indicate 100.0. The result of the math module sum should also be displayed as the RESULT.
- Use the  /  buttons to select INPUT 1 on the Parameter module display.
- Repeat the procedure above to change the value of INPUT 1 to 100.0. The sum should now be 200 in the RESULT parameter value.

Notes: