

# 3 *Single Loop Template Lab*

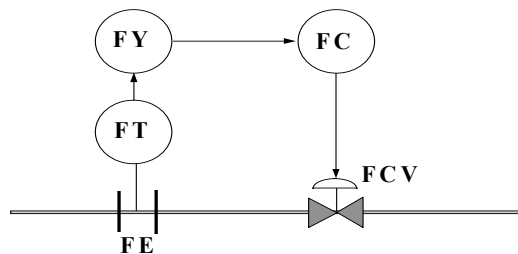
## 3.1 Foreword

Many processes involve flow control loops, whether they are in the food, pharmaceutical, chemical, pulp & paper, mining or virtually any of the industries served by MODCELL Multi-loop Processors. This lab is designed to help you learn simple PID loop configuration from the MOD 30ML front face.

## 3.2 Objectives

In this lab we will design a simple flow loop with a 4-20mA signal from a dP transmitter, a square root extractor, a PID control loop and a modulating control valve. The P&ID for this loop looks like this:

**Figure 3 .1.**  
Sample Flow PID  
Loop



After completing this lab, you should know how to configure a MOD 30ML database using ViZapp Configurator for a simple PID Control loop.

### 3.3 Instructions

#### 3.3.1 Power up the controller

1. We will remove the memory module if any from the controller. Loosen 2 screws on Faceplate on controller and remove Instrument from housing. Remove Memory module from Instrument. Return Instrument to housing. Removing the memory module will prevent downloading of configuration from the memory module in case the instrument is powered up.
2. Power-up Instrument if it is not already powered up.

#### 3.3.2 Acknowledge Alarms:

3. Press ALARM key. This will list all unacknowledged and active acknowledged alarms and diagnostics that are currently present in the controller.
4. Read lines 1 and 2 on the display. These lines describe the alarm.
5. Read line 3. This line will describe condition of alarm. If line 3 displays **UAK** then the current alarm displayed is an unacknowledged alarm. If line 3 displays **ACT** then the alarm is acknowledged, but still active.

**Figure 3 .2.**  
MOD 30ML Alarm  
UnAcknowledge  
Alarm



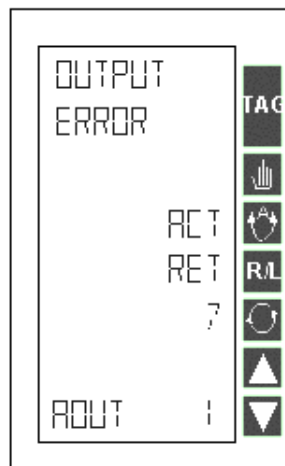
6. Acknowledge the alarm: Press the key next to line 3 (the AUTO or “A” key) to acknowledge. This will change the condition of the alarm. For example, if the alarm was unacknowledged (UAK), then the message will change to ACT if the alarm is still active or CLR if the alarm cleared.

**Figure 3 .3.**  
MOD 30ML Alarm  
**CLeaRed Alarm**



- The next figure shows an active alarm.

**Figure 3 .4.**  
MOD 30ML Alarm  
**ACTive Alarm**  
(Acknowledged, but still active)



### 3.3.3 Front face Configuration Map:

The front face configuration map shows an overview of the menus available from the front of the MOD 30ML controller. The major menu items at the top level can be scrolled through, by selecting **NXT** from the front face while **DEVICE** is displayed on line 1.

**1. DEV STAT** – This menu allows you to access the following sub menus: *(The sub menus are reached by pressing the DOWN arrow from the main menu.)*

- **INSTSTATE** – Read and change instrument state
- **SHUTDOWN** – Read and acknowledge the instrument shut down
- **COMMANDS** – Issue commands like acknowledge alarms, clear event queue, delete and restore main database etc., to the controller
- **XTIME** – Read the scan times
- **TIME** – Read and setup the real time clock of the controller
- **DATE** – Read and setup the real time date of the controller
- **DAY** – Read and setup the real time day of the week of the controller

**2. SETUP** – This menu is further divided into the following sub menus

- **BI COMM** – Setup built-in communication port parameters and instrument address
- **PASSWORD** – Setup configuration and tuning password for the controller

**3. I/O** – Read I/O and change outputs

**4. EVENTS** – Read and clear system event queue

**5. ABOUT** – Read the controller and display firmware revision levels

**6. TEMPLATE** – Read and edit System compound for system parameters and insert and edit user templates for configuring Single loop and Cascade PID control loops. This menu has the following sub menus:

- System Compound
- User Compounds

The front face configuration map is shown in appendix. You can use this map for reference and as a navigation tool for going through and setting up the menus and configuration from the controller front face.

### 3.3.4 Scroll through the top level front face menus:

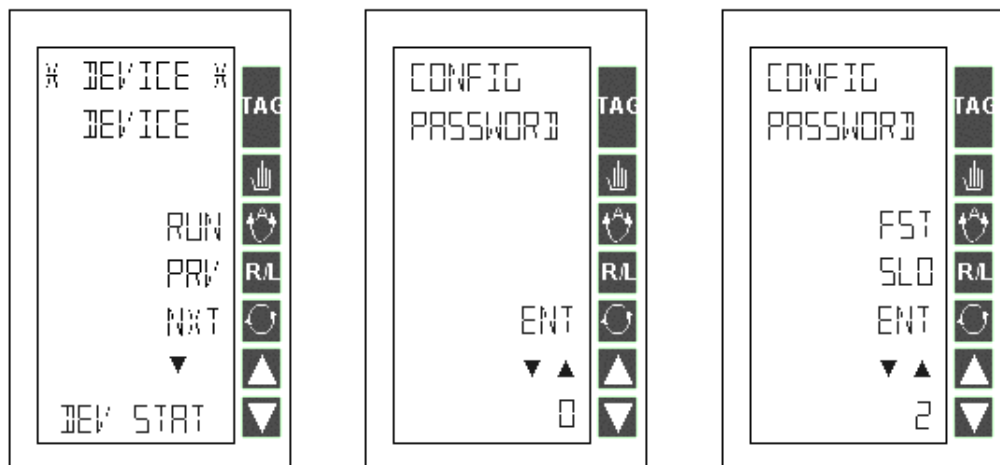
Step	Procedure	Comments
1	Press and hold TAG key until *DEVICE* is displayed on line 1.  See the figure below:	
2	Press the NXT (the key next to the NXT display on the front face).	See the menu items changing in line 6.
3	If you pressed any other key and do not know where you are, press and hold the TAG key until *DEVICE* is displayed at the top.	

### 3.3.5 Delete the main database and familiarize with the DEV STAT menu:

We will delete the database that is running in the controller, before configuring a new one. Follow the steps below to delete the main database:

1	Press and hold TAG key until *DEVICE* is displayed on line 1.  See the figure below:	DEV STAT will be displayed on line 6. DEV STAT provides access to State Commands, Shutdown information and acknowledgment, Status Commands, Execution Times and Current Time, Date and Day.
2	Press DOWN key once. If PASSWORD is not displayed on line 2, go to step 6. Otherwise continue with Step 3.	

Figure 3.5.



3	Use UP key three times to select the PASSWORD and then use ENT to enter.	Lines 1 and 2 will display CURRENT LEVEL and Line 6 will display CONFIG indicating that the controller is in configuration mode.
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**Single Loop Template Lab**

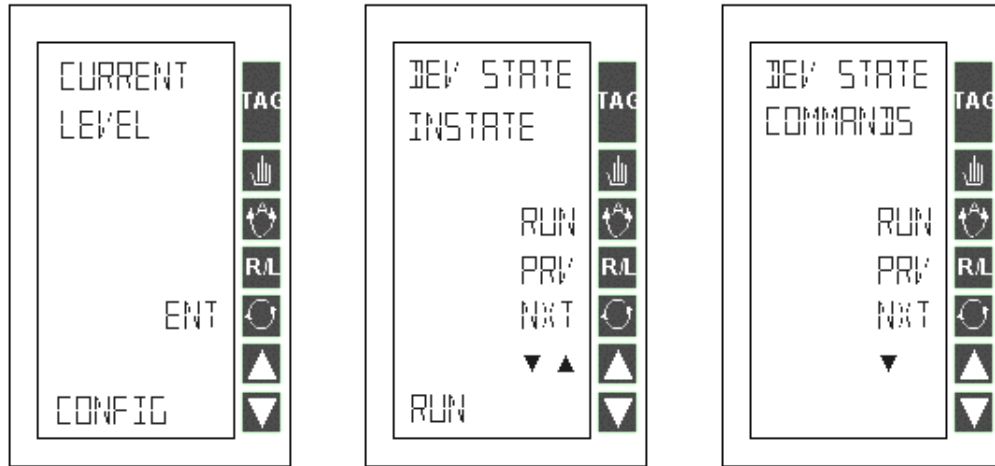
4 Press **ENT** again to enter Configuration mode. You will be in **DEV STAT** menu now. See the sequence of figures below:

Lines 1 and 2 will display **DEV STATE** and **INSTATE** (Instrument state). Line 6 will display **RUN** indicating that the controller is running a valid database.

5 Press the **NXT** key until **COMMANDS** is displayed on line 2.

You can issue commands to the controller from this menu.

**Figure 3 .6.**



6 Press the **DOWN** key once.

7 Press **NXT** key until **ACK ALL** is displayed on line 2.

Used for sending global acknowledge command causing all diagnostics, alarms and notification /request messages to be acknowledged.

8 Clear **ACK ALL** by pressing the **DOWN** key.

**YES** will be displayed on line 6.

9 Press the **ENT** key. Press **NXT** key

**RESET** is used to complete tasks and then perform a power-up

10 Press **NXT** key

**KILL** is used to perform an immediate power-up

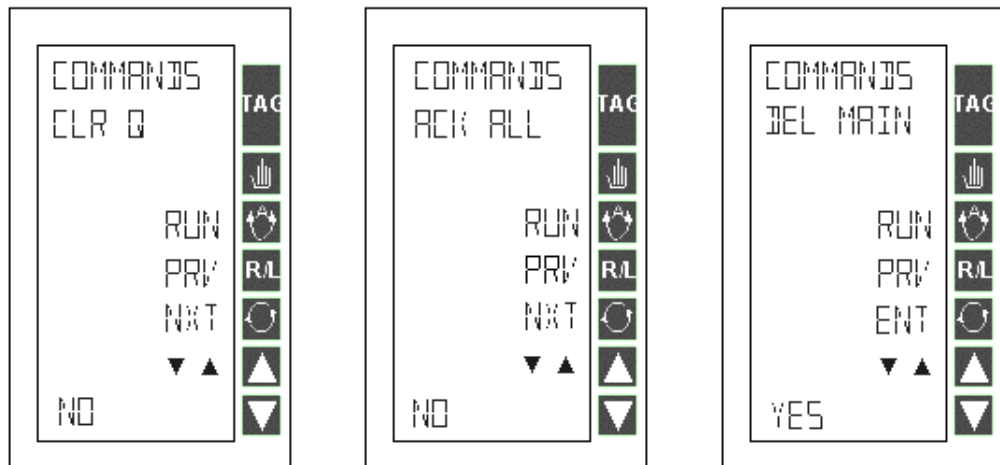
11 Press **NXT** key

**DEL MAIN** will be displayed on Line 2.

12 Delete Main database by pressing the **DOWN** key, then press the **ENT** key

**DEL MAIN** is used to mark the main database as bad and set the instrument state to **DEFAULT**. The controller **ALARM** light will be flashing at this time.

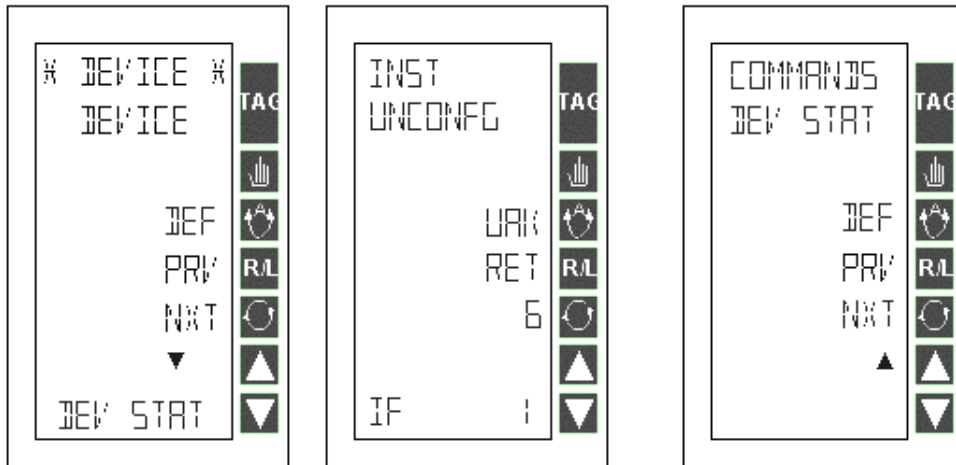
Figure 3 .7.



- |    |   |   |
|----|---|---|
| 13 | Acknowledge <b>UNCONFIG</b> alarm by pressing the ALARM key and the AUTO key.   | The Alarm display will show <b>INST UNCONFIG</b> saying that the instrument is unconfigured.  |
| 14 | Press RET key   |   |
| 15 | If line 2 displays <b>DEL MAIN</b> go to Step 17 otherwise continue at step 16. | If the instrument state has not changed, you will return to the same line in the database <b>DEL MAIN</b> . If the instrument state has changed you will abort to top level with <b>DEL STAT</b> displayed on line 6. |
| 16 | Press DOWN and NXT key 2 times. Press DOWN key again. Press NXT key 5 times.    | Line 2 should now display <b>DEL MAIN</b>   |
| 17 | Press NXT key   | <b>RES MAIN</b> is displayed on Line 2. This is "Restore Main Database" which can be used to "upload" what is in the running database and restore it to the configuration database.                                   |

Single Loop Template Lab

Figure 3 .8.

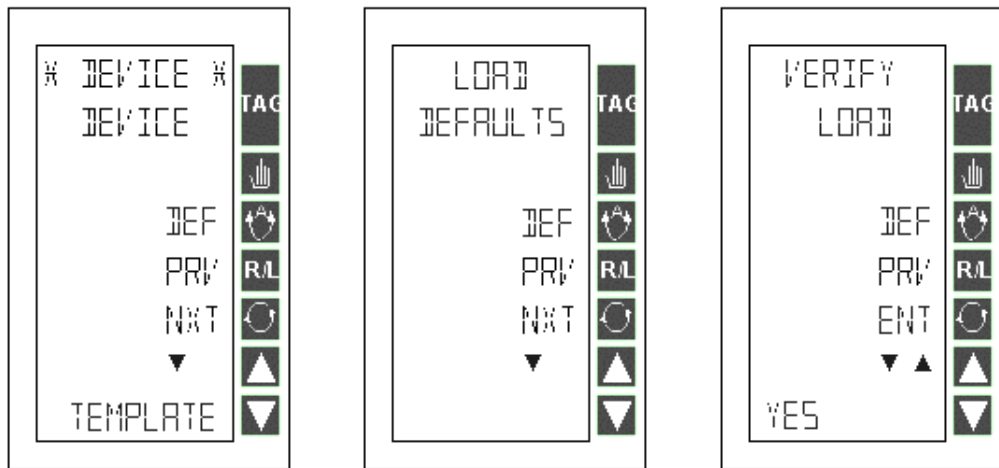


- |    |                                      |  |
|----|--------------------------------------|--|
| 18 | Press NXT key, then press the UP key | You are exiting the [COMMAND] section  |
| 19 | Press NXT key                        | <p>XTIME5 is displayed on Line 2. Scan groups 1 through 5 are user-defined intervals for loops. The fastest group has the highest priority. The lower numbered group has a higher priority if the interval is the same.</p> <p>Scan group 6 is a system group. Scan groups 7 to 9 are communications groups.</p> |
| 20 | Press NXT key                        | <p>TIME is displayed on Line 2. Current time. The instrument maintains this time even when off. Always keep set to current time</p>  |
| 21 | Press NXT key.                       | <p>DATE is displayed on Line 2. Current date. The instrument maintains this date even when off. Always keep set to current date</p>  |
| 22 | Press NXT key                        | <p>DAY is displayed on Line 2. Current day (Sunday = 1, Saturday = 7). The instrument maintains this day even when off. Always keep set to current day.</p>  |
| 23 | Press NXT key                        | <p>DEV STAT is displayed on Line 1 and DEVICE is displayed on Line 2.</p>  |
| 24 | Press UP key.                        | <p>You are now at the “top” level of the template configuration tree. Line 1 will display DEVICE and Line 6 will display DEV STAT</p>  |

### 3.3.6 System Compound – Load Defaults:

- 1 Press NXT until TEMPLATE is displayed on line 6. See figure below:
  - 2 Press DOWN
  - 3 Press DOWN
- LOAD DEFAULTS will be displayed on lines 1 and 2. We use the default template as a starting point for creation of a database. Default values are the basis for what is shown in the Operation manual. "VERIFY LOAD" will be displayed on lines 1 and 2

Figure 3.9.



- 4 Answer YES by pressing DOWN and ENT Defaults are the safe or most commonly used values.
- 5 Press PRV TEMPLATE is displayed on lines 2 and 6 as shown in the figure below.
- 6 Press DOWN EDIT TEMPLATE appears on lines 1 and 2



There are two types of compounds available in the instrument database. They are:

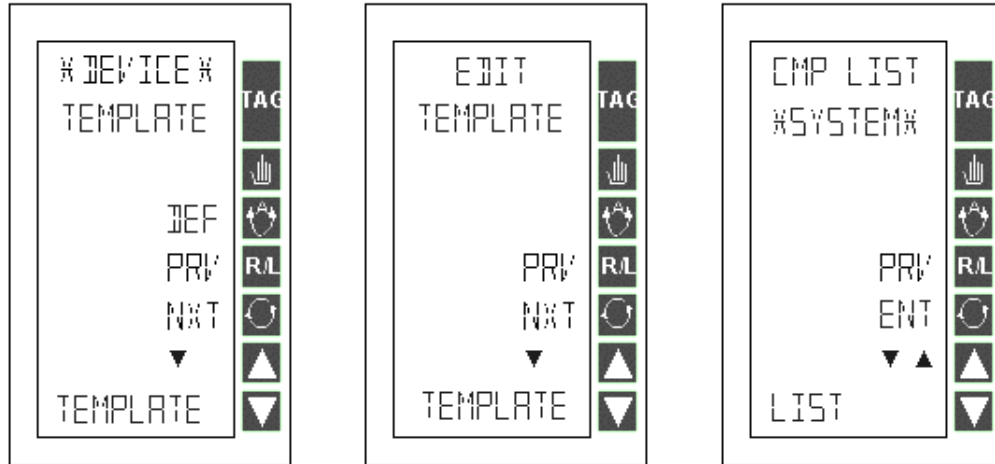
- System Compound and
- User Compound.

The System Compound sets some global parameters that will be used by user compounds. We do not want to make changes to the System compound. We will insert a template for a User compound and edit it to perform our Flow control loop.

- 7 Press DOWN CMP LIST \*SYSTEM\* will be displayed on lines 1 and 2. See the third picture in the figure below. We are at the System Compound now.

Single Loop Template Lab

Figure 3 .10.

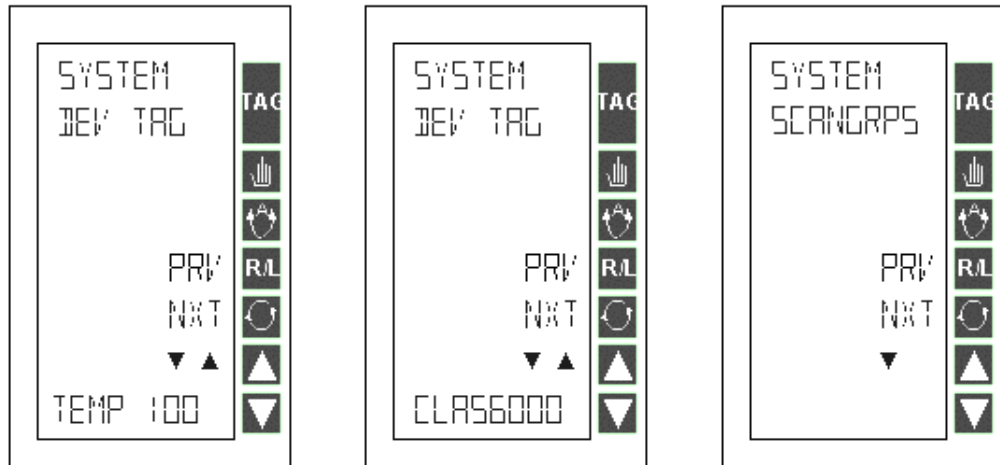


### 3.3.7 System Compound – Edit System Template:

We will change the System tag name and the system scan group 2 scan interval in this section.

- |  |   |   |
|--|---|---|
| <ol style="list-style-type: none"> <li>1</li> <li>2</li> <li>3</li> <li>4</li> <li>5</li> <li>6</li> </ol> | <p>Use the Arrow keys to scroll through INSERT, EDIT, and LIST. DO NOT PRESS ENTER</p> <p>When EDIT is displayed on line 6, press ENT</p> <p>Use the following procedure to change the Tag to <u>CLAS6000</u>:</p> <p>Use the arrow keys to make the first character display a [</p> <p>Press NXT to access the second character<br/>Continue on with this sequence until you have <u>CLAS6000</u> displayed</p> <p>Press ENT</p> | <p>INSERT is used to add a user compound after system compound.<br/>LIST allows you to use the NXT key to scroll through any configured Loop Compounds, or tags<br/>EDIT allows you to access the compound to change parameters</p> <p>We will now edit the system compound to establish some global parameters. SYSTEM DEF TAG should be displayed on lines 1 and 2. TEMP 100, the default device tag, should be displayed on Line 6 as shown in the next figure.</p> <p>Modify device tag using standard set of characters. This tag identifies instrument itself, not the individual loops in the instrument</p> <p>See the next figure.</p> |
|--|---|---|

Figure 3 .11.



- 7 Press NXT to access System Scan Groups.
- 8 Press DOWN

Scan groups defined update intervals for loops.  
 SYSTEM SCANGRPS should be displayed on lines 1 and 2. See the figure above.

The arrow key will change the Scan Group time by 50 mSec steps. Scan groups 1 through 5 are user defined intervals for loops

**Leave at 0.00 100.** The fastest group has the highest priority. The lower numbered group has a higher priority if the interval is the same

- 9 Press NXT
- 10 Press UP to select 0.00 300
- 11 Press ENT
- 12 Press NXT until SYSTEM is displayed in line 1, Lines 2 and 6 are blank and the UP arrow is on.
- 13 Press UP
- 14 Press NXT

SCAN GROUP 2 will be displayed on lines 1 and 2.

All loops included in Scan Group 2 will execute every 300 milliseconds

System (Tasks Exit)

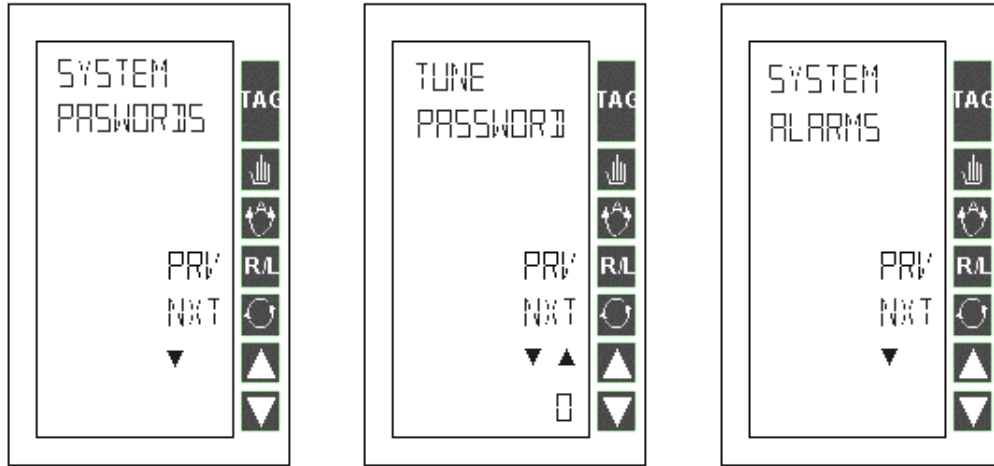
SYSTEM PASSWORDS on Lines 1 and 2.

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We will change the system tune and configuration passwords in this section.

- |   |  |  |
|---|--|--|
| 1 | Press DOWN   | TUNE PASSWORD] is displayed on lines 1 and 2.  |
| 2 | Press UP key to set 1 as password then press ENT.        | Enter a number required to access tuning parameters.   |
| 3 | Press NXT  | CONFIG PASSWORD] is displayed on lines 1 and 2.  |
| 4 | Press UP arrow to set 2 as Configure password. Press ENT | This was a password established which is required to access configuration parameters   |
| 5 | Press NXT  |  |
| 6 | ACCESS TIMEOUT is displayed on Lines 1 and 2.            | 0-54 minutes; 0=infinite. The time in minutes that the tune and configure access levels will timeout and return to the operate level after last keyboard activity. |
| 7 | Press UP to change line 6 to the number 5. Press ENT     | This will give us 5 minutes before the tune and configure access levels will timeout and return to the operator level after the last keyboard activity.            |

**Figure 3 .12.**

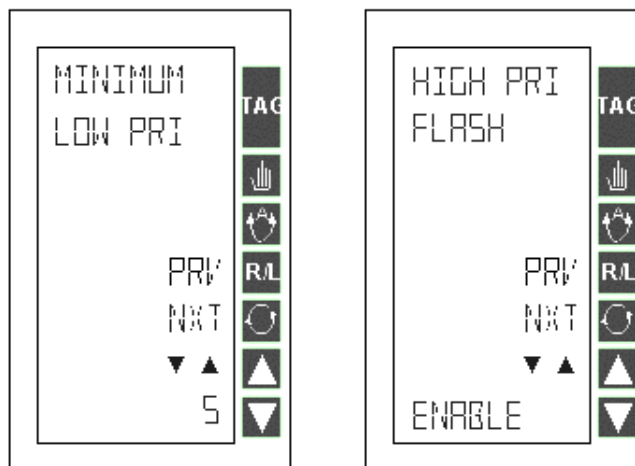


- |    |           |  |
|----|-----------|--|
| 8  | Press NXT |  |
| 9  | Press UP  | System (password exit)                   |
| 10 | Press NXT | SYSTEM ALARMS displayed on lines 1 and 2 |

Next, we will change some of the system alarm settings.

- 1 Press DOWN  
 DIAGNOSTIC RATE is displayed on lines 1 and 2.  
 FAST = off 100mSec, on 300 mSec.  
 SLOW = off 250mSec, on 750mSec.  
 We will accept the FAST rate.  
  
 Alarm indication rates apply to light, display and beeper. Alarms are: unacknowledged diagnostics, high or low process and deviation conditions, and input quality
- 2 Press NXT  
 DIAGNOSTIC FLASH is OFF.  
 OFF = flashing is disabled.  
 ENABLE = flash display (LED always flashes for diagnostic).
- 3 Press NXT.  
 DIAGNOSTIC BEEP is OFF  
 OFF = beeping is disabled.  
 ENABLE = beep for diagnostic.
- 4 Press NXT
- 5 Set MINIMUM LOW PRI to 5 and press ENT. All process alarms with priority  $\geq$  this value (2 - 255) are considered LOW priority for display purposes.
- 6 Press NXT  
 HIGH PRI RATE is FAST.  
 FAST = off 100mSec, on 300 mSec  
 SLOW = off 250mSec, on 750mSec
- 7 Press NXT
- 8 Set HIGH PRI FLASH to ENABLE and press ENT  
 OFF = flashing is disabled  
 ENABLE = flash display on alarm

Figure 3 .13.



**Single Loop Template Lab**

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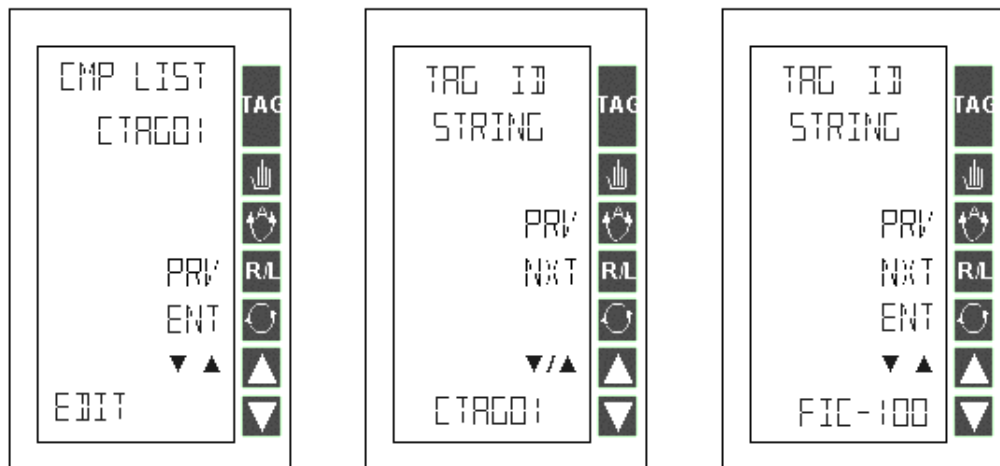
9	Press NXT	HIGH PRI BEEP is OFF. OFF = beeping is disabled ENABLE = beep on alarm
10	Press NXT	LOW PRI RATE is SLOW. FAST = off 100mSec, on 300 mSec SLOW = off 250mSec, on 750mSec
11	Press NXT	LOW PRI FLASH is OFF
12	Press NXT	LOW PRI BEEP is OFF.
13	Press NXT	SYSTEM appears on line 1; Lines 2 and 6 are blank
14	Press UP	End of SYSTEM ALARMS
15	Press NXT	End of SYSTEM functions.
16	Press UP	Return to System List
17	Press NXT	EMP LIST [TRG] is displayed on lines 1 and 2. LIST is displayed on Line 6.

### 3.3.8 Single Loop PID control template setup:

When you loaded defaults, you automatically created a “blank” loop tag which was given the name CTAG01. We will now edit this loop.

- 1 Press UP arrow twice to select EDIT on line 6 and press ENT TAG ID STRING on lines 1 and 2. CTAG01 on line 6.
- 2 Press UP arrow to change tag characters. While display is flashing, press UP until F is displayed DO NOT PRESS ENTER
- 3 Press NXT
- 4 Press DOWN until the I is displayed as the second character
- 5 Press NXT
- 6 Use the arrow keys to make the third character display a C.
- 7 Press NXT

Figure 3 .14.



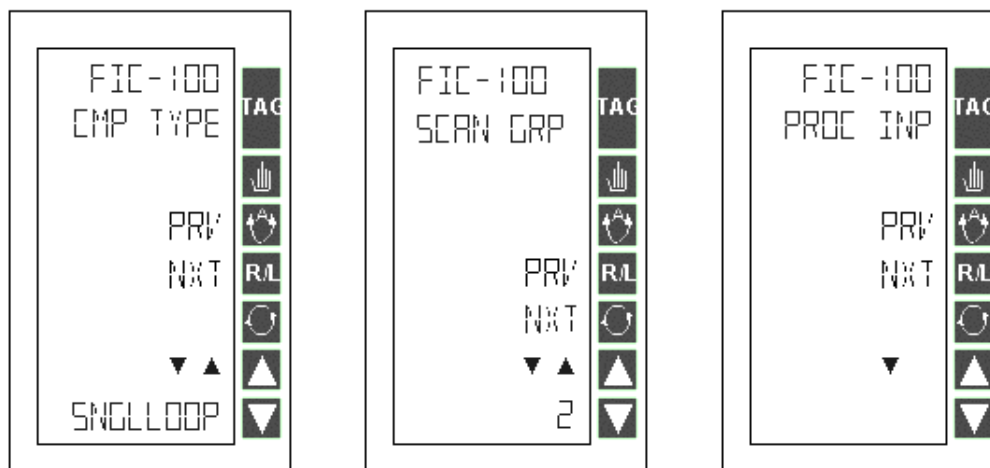
- 8 Continue on with this sequence until you have FIC-100 displayed, then press ENT. Pressing ENT will enter the new tag name in the database
- 9 Press NXT FIC-100 is displayed on line 1. SINGLELOOP is displayed on line 6. We will accept SINGLELOOP as our controller type for this lab.
- 10 Press NXT SCAN GRP 1 will be displayed on lines 2 and 6. This is the scan group to which this loop will be assigned.

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- 11 Press the UP key, then ENT to change loop to Scan Group 2

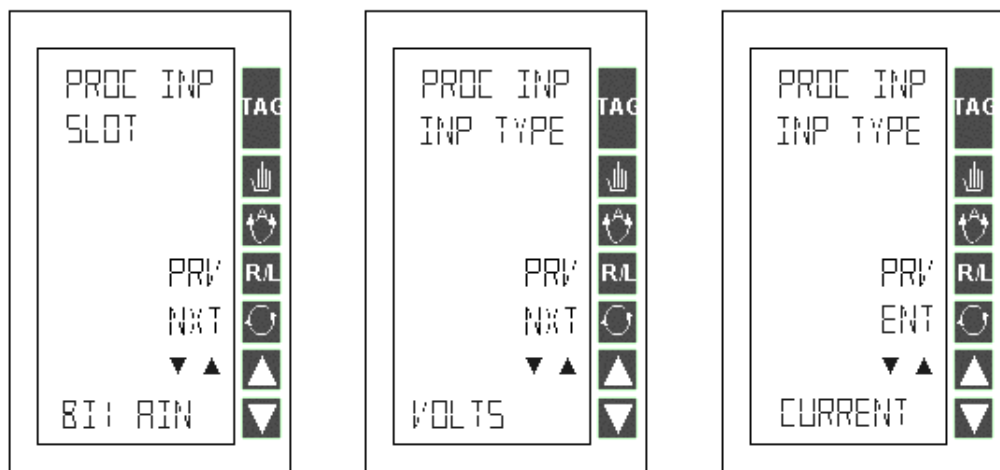
Figure 3 .15.



### 3.3.9 Process Input Setup

- |   |   |   |
|---|---|---|
| 1 | Press NXT   | PROC INP will be displayed on line 2. We are entering the process input setup for our PID control loop.                                   |
| 2 | Press DOWN  | This takes you into the process input definition menus. SLOT will be displayed on line 2.   |
| 3 | BI 1 AIN is the default input. We will accept this. | This is Built-In Analog Input 1. Inputs may be defined as NONE, BI AIN 1, BI AIN 2 or module slot S01- to S11- for input being configured |
| 4 | Press NXT   | INP TYPE will be displayed on line 2.   |

Figure 3 .16.



- |    |  |   |
|----|--|---|
| 5  | VOLTS is the default for the process input. Press UP and then ENT to change this to CURRENT. | Input types may be defined as: VOLTS, MVOLTS, CURRENT, RESIST, THRMOCPL<br>1 Slot: RTD2WIRE, CURRNT2W<br>2 Slots: RTD3WIRE, WIDERES<br>Built-in only: TC W/CJC, RTD |
| 6  | Press NXT until LO SIGNL is displayed on Line 2  |   |
| 7  | Press the DOWN arrow and FST/SLO keys to change the low signal range to 4                    | Built-in analog input 1 is wired to a pot in the demonstration unit which has a range of 0 to 6 Volts   |
| 8  | Press NXT  | HI SIGNL is displayed on line 2   |
| 9  | Use the UP and FST keys to change the high signal range to 20 and press ENT                  |   |
| 10 | Press NXT until HI ENGL is displayed on line 2   |   |
| 11 | Use the UP/DOWN keys and the FST   | Pressing the Up key, will cause the Least   |

Single Loop Template Lab

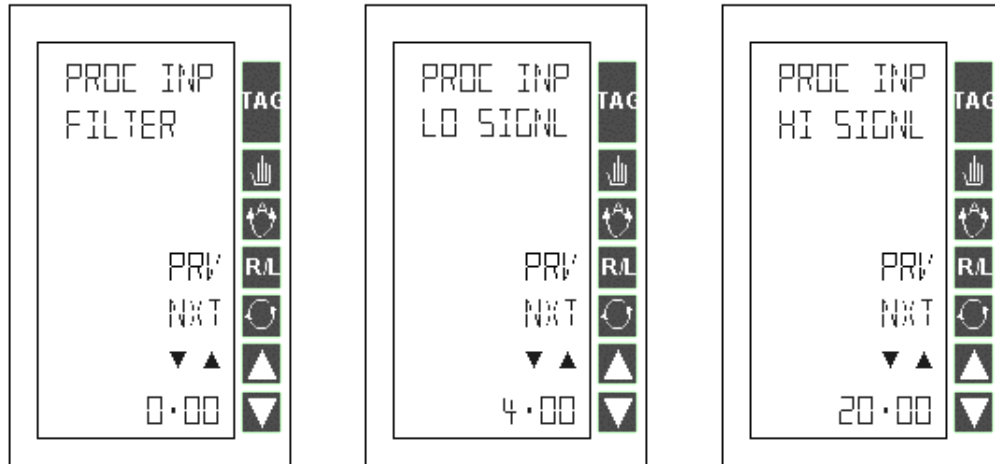
key to set the range at 200. Then press ENT

Significant Digit to flash, indicating you can change that digit. Each time you press the FST key the flash digit will move one digit to the left. Pressing one of the arrows will cause the flashing digit to ramp up or down.

12 Press NXT

EU LABEL will be displayed on line 2.

Figure 3 .17.



13 Using the UP/DOWN keys and NXT key, spell out GPM Then press ENT

Up to a 4 character label to appear after process input value. First character entered becomes leftmost character

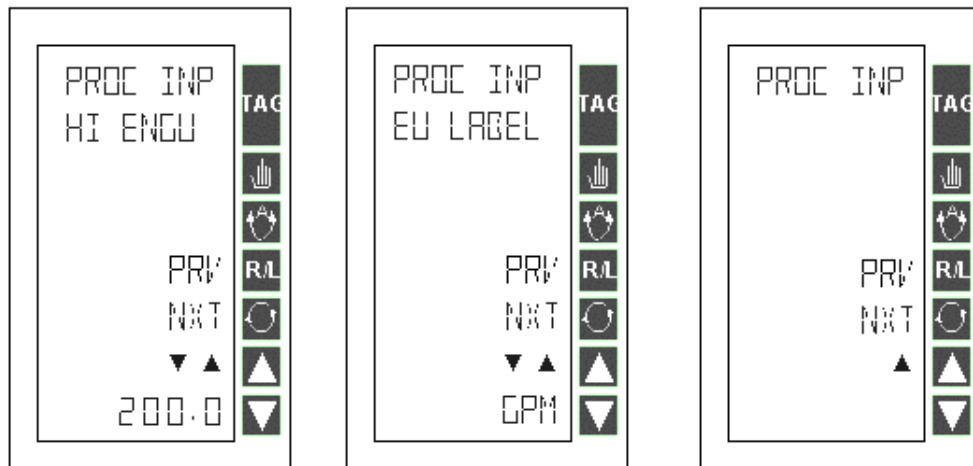
14 Press NXT

LO QUAL is displayed on line 2

15 Using the UP/DOWN keys enter -20 0 as low quality limit. Then press ENT

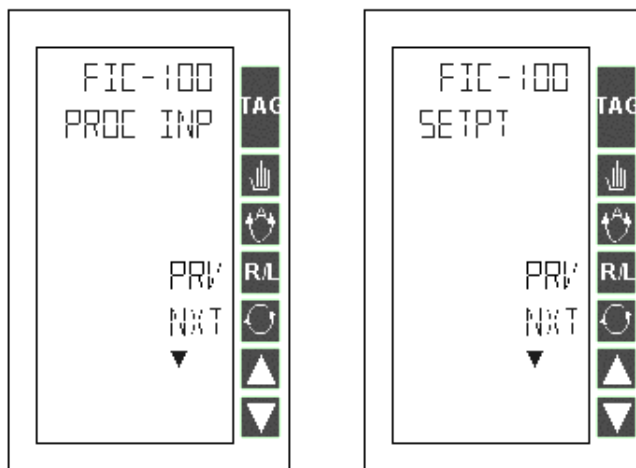
Result is set **BAD** if it goes below this value.

Figure 3 .18.



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- 16 Press NXT HI QUAL is displayed on line 2. Result is set **BAD** if it goes above this value. High quality must be higher than the low quality value
- 17 Set line 6 at 220. Then press ENT
- 18 Press NXT until line 2 and 6 are blank and only the up arrow is on
- 19 Press UP
- 20 Press NXT This completes the Process Input section. SETPT will be displayed on line 2.

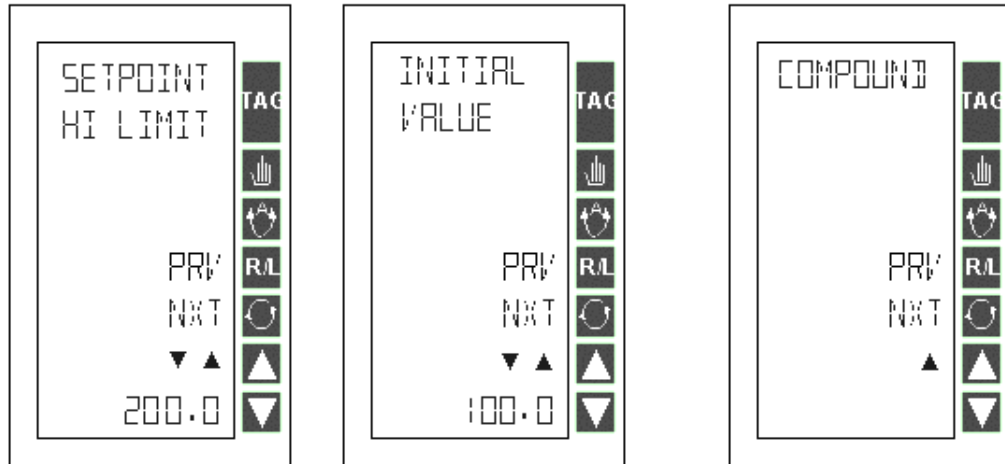
**Figure 3 .19.**

Single Loop Template Lab

### 3.3.10 SETPOINT Setup

- |   |  |  |
|---|--|--|
| 1 | Press DOWN to enter setpoint section.                                |  |
| 2 | Press NXT until SETPOINT HI LIMIT is displayed on lines 1 and 2.     | Setpoint values to the PID algorithm are limited to this number or below       |
| 3 | Set the high limit at 200. Then press ENT.                           |  |
| 4 | Press NXT until INITIAL VALUE is displayed.                          |  |
| 5 | Set the value at 100.0. Then press ENT.                              | Setpoint value when configuration is complete.                                 |
| 6 | Press NXT until lines 2 and 6 are blank and only the up arrow is on. | COMPOUND will be displayed on Line 1   |
| 7 | Press UP   | This completes the Setpoint section  |
| 8 | Press NXT  | This takes you to the top of the Control section. Line 2 will display CONTROL. |

Figure 3 .20.



### 3.3.11 CONTROL Setup

- |  |   |   |
|--|---|---|
| <p>1 Press DOWN to enter control section.</p> <p>2 ALGO TYP is displayed on line 1.</p> <p>What is the ALGO TYPE ?</p> | <p>This takes you down into the Control menus</p> <p>Gain (1st Character):</p> <p>Reset (2nd Character):</p> <p>Pre-Act (3rd Character):</p> <p>Manual Reset (4th Character):</p> | <p>O = Off<br/>P = On Process<br/>E = On Error</p> <p>O = Off<br/>S = Standard<br/>M = Micro-Scan</p> <p>O = Off<br/>P = On Process<br/>E = On Error</p> <p>O = Off<br/>E = Enabled</p> |
|--|---|---|

Figure 3 .21.

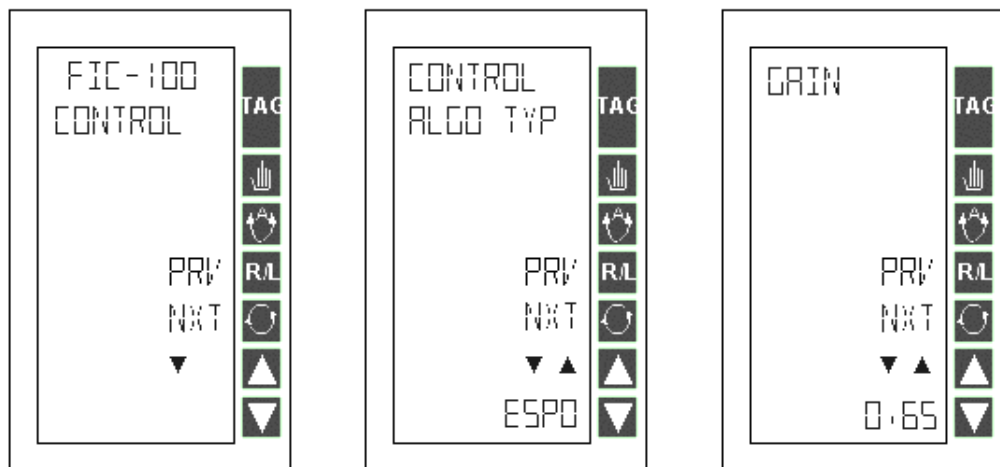
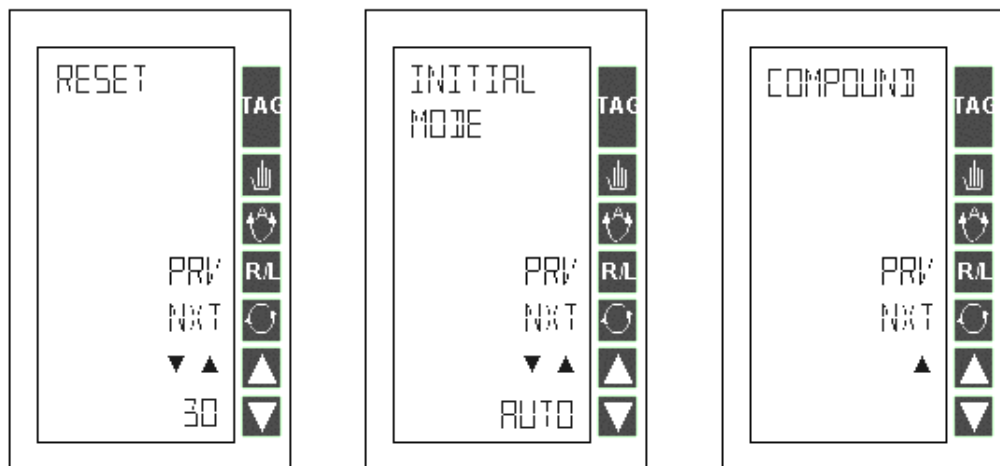


Figure 3 .22.



**Single Loop Template Lab**

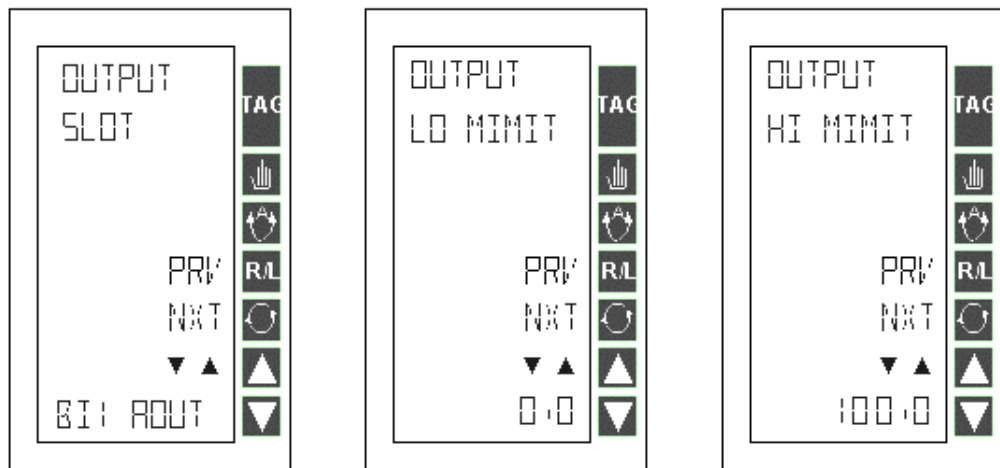
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- |   |  |  |
|---|--|--|
| 3 | Press NXT until "GAIN" is displayed on line 1. Set Gain at <u>0.65</u> . Then press ENT. | 0.01 to 125.0<br>Proportional response in a fixed gain controller.     |
| 4 | Press NXT, set Reset at <u>30.00</u> then press ENT                                      | 0.01 to 125.0<br>Reset in repeats per minute.                          |
| 5 | Press NXT until INITIAL MODE is displayed on lines 1 and 2.                              |  |
| 6 | Set Mode to <u>AUTO</u> . Then press ENT   |  |
| 7 | Press NXT until lines 2 and 6 are blank and only the up arrow is on.                     | [COMPOUND] will be displayed on Line 1                                 |
| 8 | Press UP.  | This completes the Control section                                     |
| 9 | Press NXT  | This takes you to the <u>OUTPUT</u> section of the configuration tree. |

### 3.3.12 OUTPUT Setup

- |   |   |  |
|---|---|--|
| 1 | Press DOWN to enter output section                        |  |
| 2 | Leave the default value of <code>BI1 AOUT</code> in place | NONE, BI1 AOUT, BI2 AOUT, and S01 to S11. Only available outputs are listed. |
| 3 | Press NXT   | OUTPUT LO SIGNAL displayed. 0% of the output range.                          |
| 4 | Press NXT   | OUTPUT HI SIGNAL displayed. 100% of the output range                         |

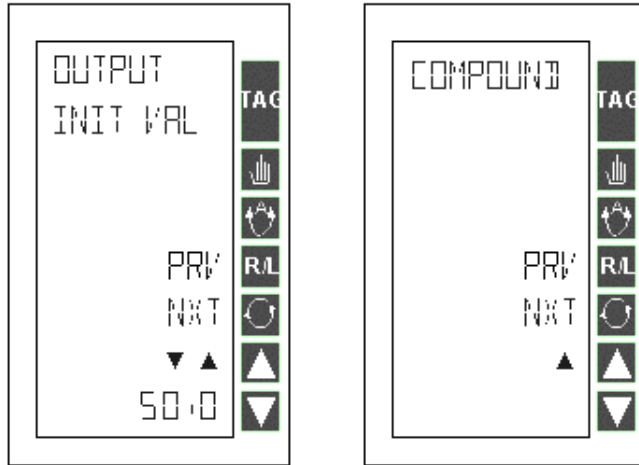
Figure 3 .23.



- |   |  |   |
|---|--|---|
| 5 | Press NXT until OUTPUT LO LIMIT displayed    | PID output limited to this number or above. |
| 6 | Set limit to <code>0.0</code> Then press ENT |   |
| 7 | Press NXT, OUTPUT HI LIMIT displayed         | PID output limited to this number or below. |

Single Loop Template Lab

Figure 3 .24.



- |    |   |   |
|----|---|---|
| 8  | Set limit to 100.0 and press ENT                  |   |
| 9  | Press NXT until Line 2 displays OUTPUT INIT VAL   | This is the initial value of the output on download   |
| 10 | Change the initial value to 50                    |   |
| 11 | Press NXT until [COMPOUND] is displayed on line 1 |   |
| 12 | Press UP  | This completes the output section.  |
| 13 | Press NXT   | This takes you to the ALARM section of the configuration tree. We will not setup any process alarm in this lab. |
| 14 | Press NXT   | [COMPOUND] is displayed on line 1 and LIST on line 2.   |

### 3.3.13 Install the edited template

- |   |  |   |
|---|--|---|
| 1 | Press UP   | CMP LIST FIC 100 is displayed on lines 1 and 2.   |
| 2 | Press NXT  | CMP LIST is displayed on line 1; lines 2 and 6 are blank  |
| 3 | Press UP   | EDIT TEMPLATE displayed on lines 1 and 2.   |
| 4 | Press NXT  | INSTALL TEMPLATE displayed  |
| 5 | Press DOWN. Select INITWARM  | INSTALL TYPE displayed.   |
| 6 | Press ENT  | This compiles your configuration and loads it into runtime memory.<br>You should now see the FIC-100 display. Line 2 will display the process variable and the EU (GPM). Line 6 will display the output (50%) |
| 7 | Press the SCROLL key to see the Setpoint at the bottom.  |   |
| 8 | Operate your PID loop by changing the output, setpoint and also by getting into TUNING mode and by changing the GAIN and RESET values. | Refer to the MOD 30ML Operation Lab 1 for more information on operating the PID loop.   |

Figure 3 .25.

