

# LLC

## LIQUID LEVEL CONTROLLER



### GENERAL DESCRIPTION

The Liquid Level Controller (LLC) is designed to control the liquid level in a container by controlling one or two pumps.

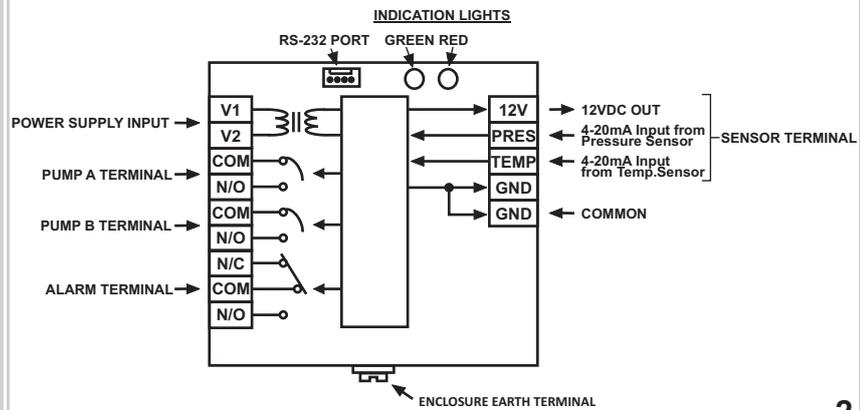
The level sensing is done via a 4-20mA pressure sensor. The NIST Pressure Sensor also has a 4-20mA temperature output. This adds the benefit of measuring and displaying the temperature of the liquid.

The LLC has a built in display and user friendly interface for changing operational parameters on site. Amongst others, these parameters include the type of controller (filling or emptying), pump options (use only pump A, use only pump B or use both pumps A and B) as well as various control levels and alarm settings.

The LLC also has an alarm relay (N/C) which could be used activate a siren or strobe-light when certain error conditions occur.

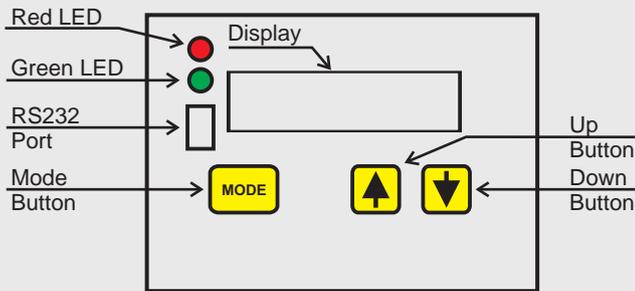
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### Liquid Level Controller



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### THE USER INTERFACE



#### How to use the User Interface:

The Liquid Level Controller has 15 different MODES in its Calibration Menu. To go to a specific mode, press and hold **MODE**, then press **▲** or **▼** until the desired mode number (M00 to M14) is displayed.

To change a specific value, go to the desired MODE, release **MODE** then press **▲** or **▼**.

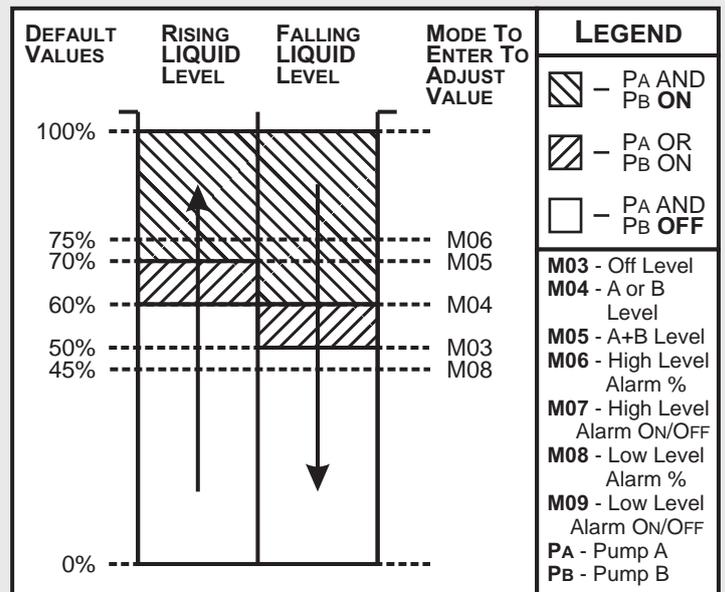
To Exit WITHOUT saving any changes, go to M14 and don't press any buttons. After 10 seconds, the normal screen (indicating the Level % and Temperature °C) will be displayed.

To SAVE the changes, go to M14 and press and hold **▲** and **▼** for more than 3 seconds.

To enter the Calibration Menu during normal operation, press **MODE** and hold for more than 3 seconds.

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### EMPTYING CONTROLLER



#### NOTES:

The pump status only changes when the level crosses over a programmed value.

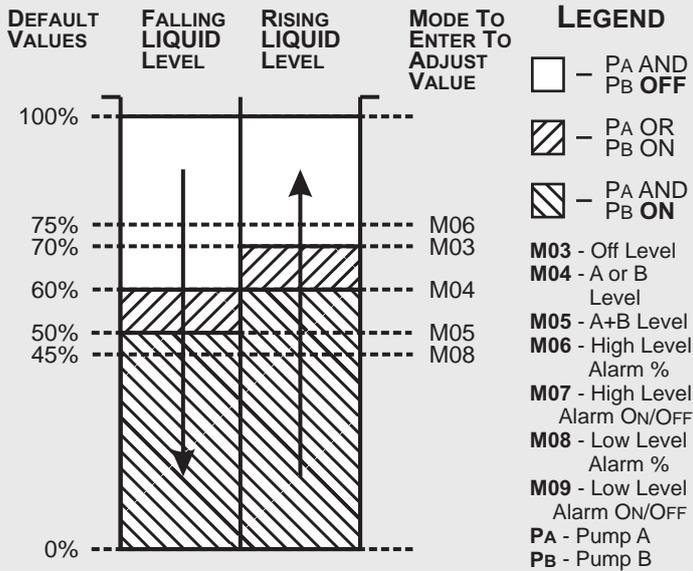
If M07 is programmed ON, the Alarm will go ON above M06.

If M09 is programmed ON, the Alarm will go ON below M08.

An hysteresis of 2% is programmed between the Alarm ON and Alarm OFF values to minimize Alarm oscillations.

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# FILLING CONTROLLER



## NOTES:

The pump status **only changes** when the level crosses **over a programmed** value.

If **M07** is programmed **ON**, the **Alarm** will go **ON** above **M06**.

If **M09** is programmed **ON**, the **Alarm** will go **ON** below **M08**.

An hysteresis of 2% is programmed between the **Alarm ON** and **Alarm OFF** values to minimize Alarm oscillations.

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# MODES OF THE CALIBRATION MENU

Now that a general idea is formed of the the **User Interface** and the method of operation, a description of each **MODE** is given below.

In the **DISPLAY** on the left, the **default value** of each **MODE** is indicated.

## DISPLAY

**M00: Controller Type = Emptying**

## DESCRIPTION

**Controller Type:** This menu item is only available during first time calibration. The user can choose whether the controller will be used to fill the container up or to empty it. Available options: Emptying or Filling.

**M01: Pump Options Use BOTH Pumps**

**Pump Options: Active Relay Selection** Here the user can choose which pump relays are enabled. Available options: Use BOTH Pumps, Use ONLY Pump A or Use ONLY Pump B.

**M01: Pump Options DelayOn=OFF**

**Pump Options: Delay-On Timer** Here the user can set the number of minutes a pump relay must remain OFF before it may be switched ON again. Range: 1-60 minutes (or OFF by pressing and holding UP and DOWN for more than 3 seconds).

**M02: Adjust % to Actual LVL(100%)**

**Level Calibration:** The user should adjust this value to correspond to the actual level of the liquid in the container at the time of calibration. Range: This value's 100% = 5% to 100% of the pressure sensor's range.

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## DISPLAY

## DESCRIPTION

**M03: OFF Level Value=50% :UorD**

**OFF Level:** This level is where both pumps are switched off. Range: The range is indicated on screen. U→ = UP ONLY, D← = DOWN ONLY, UorD = UP or DOWN.

**M04: AorB Level Value=60% :UorD**

**A or B Level:** Pumps A and B alternate (flip-flop) around this level. Range: The range is indicated on screen. U→ = UP ONLY, D← = DOWN ONLY, UorD = UP or DOWN.

**M05: AorB Level Value=70% :UorD**

**A+B Level:** This menu item is only available when "Use BOTH Pumps" was selected in M01. At this level, BOTH pumps are switched ON. Range: The range is indicated on

**M06: High LVL AL ON=75% :UorD**

**High Level Alarm %:** Above this value, the ALARM will be switched ON (if M07 is ENABLED) and only the RED LED will glow. Range: The range is indicated on screen.

**M07: Sound alarm on HIGH level? Y**

**High Level Alarm On/Off:** Here the user can enable / disable the activated alarm for a HIGH level warning. Range: Y - Yes or N - No.

**M08: Low LVL AL ON=45% :UorD**

**Low Level Alarm %:** Below this value, the ALARM will be switched ON (if M09 is ENABLED) and only the RED LED will glow. Range: The range is indicated on screen. U→ = UP ONLY, D← = DOWN ONLY,

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## DISPLAY

## DESCRIPTION

**M09: Sound alarm on LOW level? Y**

**Low Level Alarm On/Off:** Here the user can enable / disable the activated alarm for a LOW level warning. Range: Y - Yes or N - No.

**M10: High Temp AL ON=40°C :UorD**

**High Temperature Alarm °C:** Above this value, the ALARM will be switched ON (if M11 is ENABLED) or only the RED LED will glow. Range: The range is indicated on screen. U→ = UP ONLY, D← = DOWN ONLY, UorD = UP or DOWN.

**M11: Alarm on HIGH temp? Y**

**High Temperature Alarm On/Off:** Here the user can enable / disable the activated alarm for a HIGH temperature warning. Range: Y - Yes or N - No.

**M12: Low Temp AL ON=40°C :UorD**

**Low Temperature Alarm °C:** Below this value, the ALARM will be switched ON (if M13 is ENABLED) and only the RED LED will glow. Range: The range is indicated on screen. U→ = UP ONLY, D← = DOWN ONLY, UorD = UP or DOWN.

**M13: Alarm on LOW temp? Y**

**Low Temperature Alarm On/Off:** Here the user can enable / disable the activated alarm for a LOW temperature warning. Range: Y - Yes or N - No.

**M14: Exit from Calibration Menu**

**Exit from Calibration Menu:** From here the user can Exit the Calibration menu in one of two methods:  
- Save and Exit: This is done by pressing **▲** & **▼** together for more than 3 sec.  
- Exit WITHOUT saving: This is done by pressing NO buttons for more than 10 sec.

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# FIRST TIME CALIBRATION

## STEP 1: Switch the Power ON

Unit NOT Cal Yet  
Entering Menu...

When the power is switched on for the first time, the controller is not calibrated yet. Therefore it enters into the Calibration Menu straight-away.

## STEP 2: Select the Controller Type

M00: Controller  
Type = Emptying

The LLC uses one of two main control methods, namely: Emptying or Filling. In this first MODE (M00) the user must choose which one of the two control methods are applicable to the system where this specific LLC is being installed. Thus if the goal of the system is to keep the liquid level in the container below a certain level, then the controller type is Emptying. On the other hand, if the goal of the system is to keep the liquid level in container above a certain level, then the controller type is Filling. Change the Controller Type by pressing **▲** or **▼**. To go to the next calibration step, press and hold **MODE** then also press **▲**.

## STEP 3: Configure the Pump Relays

M01: Pump Options  
Use BOTH Pumps

The LLC has two relay outputs. The one is to be connected to Pump A and the other is to be connected to Pump B. However,

if the system makes use of ONLY ONE PUMP, then the user should choose here which one of the Pump Relays is actually connected to the pump (i.e. Use ONLY Pump A or Use ONLY Pump B). Scroll through the options by pressing **▲** or **▼**. To go to the next calibration step, press and hold **MODE** then also press **▲**.

## STEP 4: Configure the Delay On Function

M01: Pump Options  
DelayOn=OFF

The Delay-On functionality enables the user to set the minimum number of minutes a pump relay must remain switched OFF

before it can be switched on again. This acts as basic motor overheating protection. To disable this feature at a later stage, press and hold **▲** and **▼** for more than 3 seconds. To go to the next calibration step, press and hold **MODE** then also press **▲**.

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## STEP 5: Lower the sensor into the container

Lower sensor to  
tank floor → M+U →

Before the Level Calibration can start, the user is prompted (on screen) to lower the pressure sensor into the liquid and to the floor of the container (which level is to be controlled with the LLC). Once the pressure sensor has settled on the floor inside the liquid containing container, **MODE** and **▲** should be pressed together to initiate the Level Calibration process.

## STEP 6: OBSERVE

Please Wait:  
Busy Calibrating

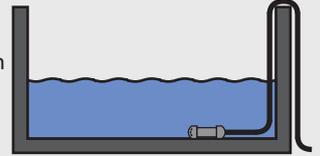
During this step, the LLC measures the pressure sensor's average output (4-20mA) over 3 sec.

## STEP 7: Actual level setting

M02: Adjust % to  
Actual LVL( \_\_% )

Since the LLC has no knowledge of the actual liquid level within the container which is to be controlled, the user should thus enter this

value into the LLC. Say for example that the system at this given moment, looks like this: A rough estimation of this given system is that the liquid level is now at 50%. Therefore, the value of M02 should be adjusted to 50% by pressing **▲** or **▼**. To go to the next calibration step, press and hold **MODE** then also press **▲**.



### LEVEL CALIBRATION HINT

When uncertain about the actual level of the liquid, it is always safer to set the value of M02 to a higher value. By doing this, the chances of the container overflowing due to incorrect calibration is eliminated. Example: The level is observed to be between 50% and 60%. To be safe, rather set M02 to 60%.

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### LEVEL CALIBRATION NOTE

When pressing and holding **▼**, at a given moment an error message will be displayed: **ERR:Value can't be set LOWER!** This indicates that the lowest value of M02 for the specific system was reached. If the LLC would have allowed the user to set M02 LOWER than this value, the pressure sensor's output would be HIGHER than 20mA if the liquid would reach a level of 100% in the container. Thus this helps to protect the SENSOR against over-pressure.

## STEP 8: Level Calibration Verification

M02: Is LVL 51%?  
Yes: M+U, No: UorD

The LLC will now present the user with real-time measurements of the liquid level. In the event that the LLC interpretation of the liquid

level is NOT correct, the user may alter it by pressing either **▲** or **▼**. As soon as the user is satisfied with the LLC interpretation of the liquid level, the user may press and hold **MODE** then also press **▲** to continue to the next calibration step.

## STEP 9: OFF Level value

M03: OFF Level  
Value=50% :UorD

The OFF Level is the level at which both Pumps are switched OFF. The default value of M03 for an Emptying Controller is 50% and for a

Filling Controller it is 80%. To change the value of the OFF Level, press **▲** or **▼**. To go to the next calibration, step press and hold **MODE** then also press **▲**.

## STEP 10: AorB Level value

M04: AorB Level  
Value=60% :UorD

The AorB Level is the level at which the flip-flop function of the LLC is implemented. The default value of M04 for an Emptying

Controller is 60% and for a Filling Controller it is 65%. To change the value of the AorB Level, press **▲** or **▼**. To go to the next calibration step, press and hold **MODE** then also press **▲**.

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## STEP 11: A+B Level value

M05: A+B Level  
Value=70% :UorD

The A+B Level is the level at which both Pumps are switched ON. This MODE is only available for changing if the value of M01 is "Use Both

Pumps". If M01 is set to "Use ONLY Pump A" or "Use ONLY Pump B", then the value of this MODE is set AUTOMATICALLY, since it's value makes no difference in the control of a single Pump. The default value of M05 for an Emptying Controller is 60% and for a Filling Controller it is 65%. To change the value of the A+B Level, press **▲** or **▼**. To go to the next calibration step, press and hold **MODE** then also press **▲**.

## STEP 12: Save and Exit

M14: Exit from  
Calibration Menu

The minimum settings for normal operation is now set. The user may thus SAVE these settings and EXIT from the Calibration Menu

by pressing and holding **▲** and **▼** for more than three seconds. However, should the user wish to customize other settings before exiting, it can be done by pressing and holding **MODE** then also pressing **▲**. Pages to of this manual is a guide for the viewing or changing of the other MODES.

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