SONDAR

Ultrasonic Level Meter

300C/ 800C/ 990C Plus Series

INSTRUCTION MANUAL

(July, 2008)

ISTEC

International Standard Technologies

SLM300C/ 800C/ 990C Plus Series
July, 2008

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Chapter 1 Specification

Physical

Dimensions	Overall	SLM300C+: 120 (dia). x 251 (height) mm
		SLM800C/990C+: 120 (dia) x 260 (height) mm
	Electronics housing	120 (dia). x 124 (height) mm
	Transducer housing	SLM300C +: 59 (dia) x 127 (height) mm
		SLM800C/990C +: 67 (dia) x 136 (height) mm
	Mounting	2 1/2"NPT
Weight		Nominal 3.4 kg
Case material/description		PP

Environmental

IP Rating (electronics housing)	IP67, NEMA 4X
Max. & Min. temperature (electronics)	-20 ºC to +70 ºC (-4 ~ 158°F)
Pressure	up to 2 Bar
Explosion Proof	EEX d m II B T6

Performance

Accuracy	0.25% of the measured range
Resolution	1mm
Max. range	Liquids 3 meters/ 8 meters / 9.9 meters
Min. range	0.25 meters / 0.35 meters
Beam Angle	4° at -3dB
Damping Rate	Adjustable from 0.1m/min to 100m/min
Temperature Compensation	Fully compensated via integral temperature sensor over entire operational span

Outputs

Analogue output	4-20mA into Max 750Ω (user adjustable)
	Fault condition Alarm 3.8mA / Hold / 21mA user selectable.
Display	4 Digit LCD Display

Programming

On-board programming	via 4 tactile push button keys

Supply

Power supply	DC 20 - 30V
Current Consumption	Less than 0.022A

Chapter 2 Installation

Power Supply Requirements

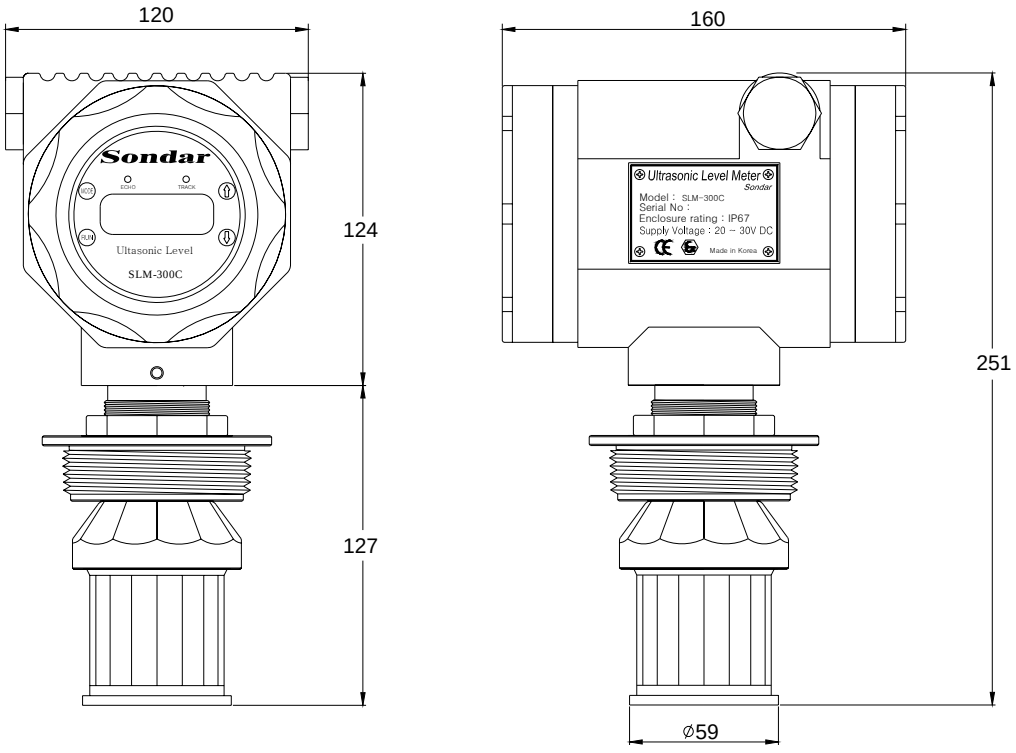
The SLM300C/800C/990C operates from a DC supply of 20 –30V and will typically draw less than 0.021A.
All electronic products are susceptible to electrostatic shock, so follow proper grounding procedures during installation.
The compact one-piece construction of the SLM300C/800C/990C can be mounted easily using the integral nose thread (2 1/2"NPT).

When choosing a location to mount the SLM300C/800C/990C, bear in mind the following:
For easy access to the LCD display and programming buttons mount it where it is easily accessible.
The ultrasonic signal path should be free of falling material and obstructions such as pipes, beams etc.
The SLM300C/800C/990C should be mounted at least 25/35cm above the maximum level of the material and be perpendicular to the surface.
The mounting surface should be vibration-free.
The ambient temperature is between -20ºC and 70ºC.
There should be no high voltage cables or electrical inverters close by.
Do not use any metal substances when installing
(Please use the PVC nut & flange supplied as option)

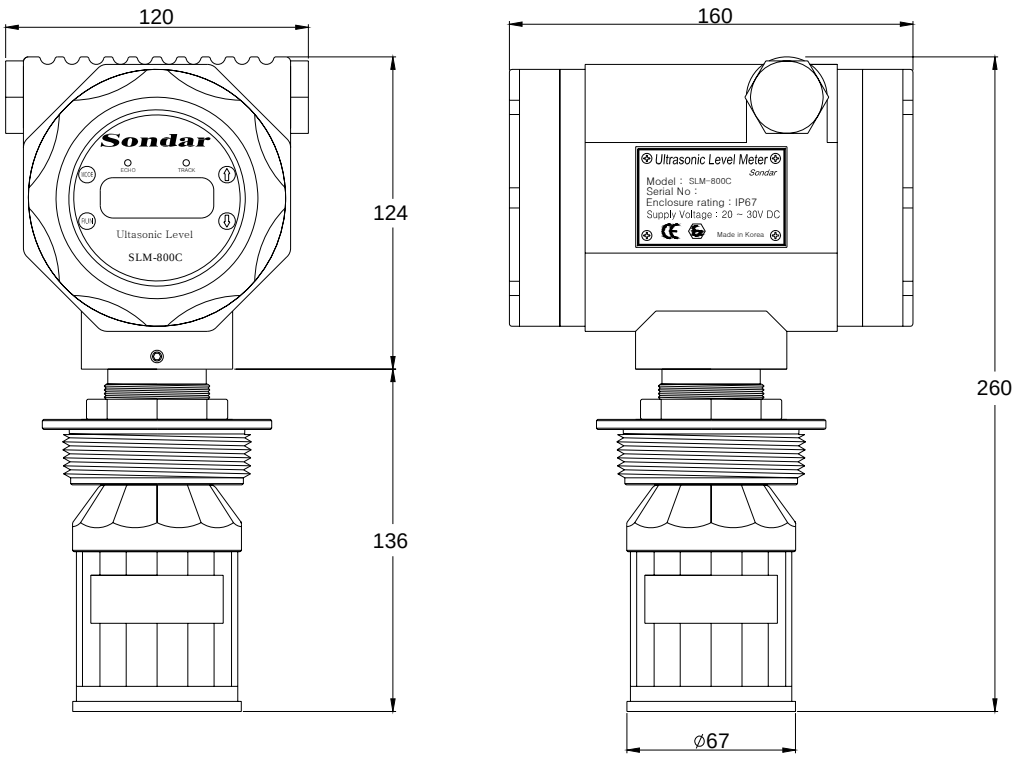
Dimensions

The dimensions of the SLM300C/800C/990C are as shown below

SLM300C

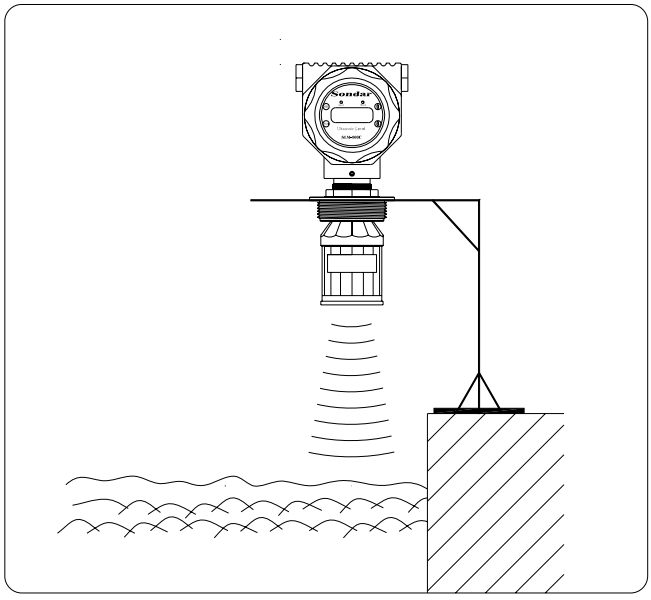


SLM800C/990C



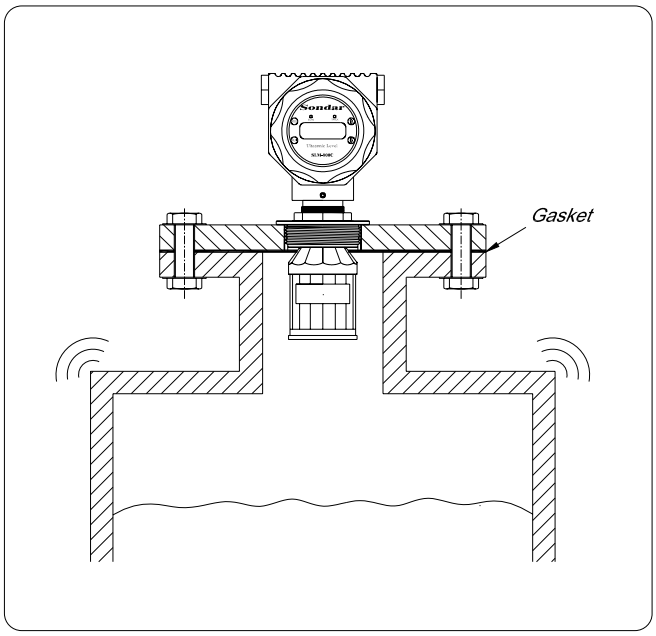
Outdoor and Open Vessel Installation

The SLM300C/800C/990C can be simply mounted on a bracket, suitable for the application and secured using the thread located at the top of the transducer (2 1/2" NPT).
Care should be taken to ensure that the SLM300C/800C/990C are not installed in direct sunlight, in order to avoid errors in the measurement of ambient temperature.
Attention should also be taken, when mounting the unit, to ensure that strong windy conditions are avoided, wherever possible, to prevent abnormal operation.



Closed Vessel Installation

The SLM300C/800C/990C can be simply screwed into a flange and secured using the thread located at the top of the transducer (2 1/2 ”NPT).
Where possible use a flange made of a synthetic material such as PVC, to avoid vibration
Place a rubber gasket between the flange and the connection to the vessel to avoid vibration.

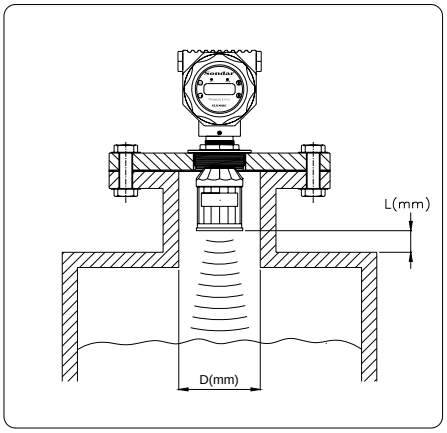


Stand Pipe Installation

When mounting the SLM300C/800C/990C to a standpipe care should be taken to ensure that the standpipe is of sufficient dia with reference to its length, see the table below for details:

When using a standpipe, fixed to the top of a vessel, ensure that the open end of the standpipe is clear of any obstructions such as weld seams, gaskets etc. in order to avoid unwanted signal returns.

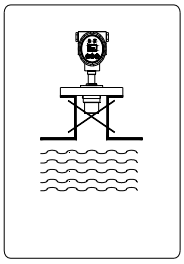
If using standpipes, which extend into the vessel, beyond the blanking distance, but not as far as the empty level, then the open end of the standpipe should be cut to an angle of 45o.



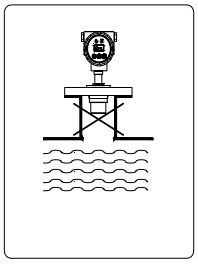
D [mm]	Length［mm]	
	SLM300C	SLM800C/990C
80	380	350
100	475	440
150	713	660
200	950	880

Incorrect Installation

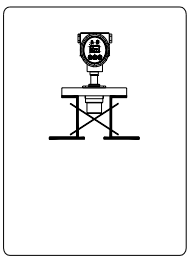
The maximum level (100% of Span) is inside the Blanking Distance



- Pipe should be free of obstructions as weld seams

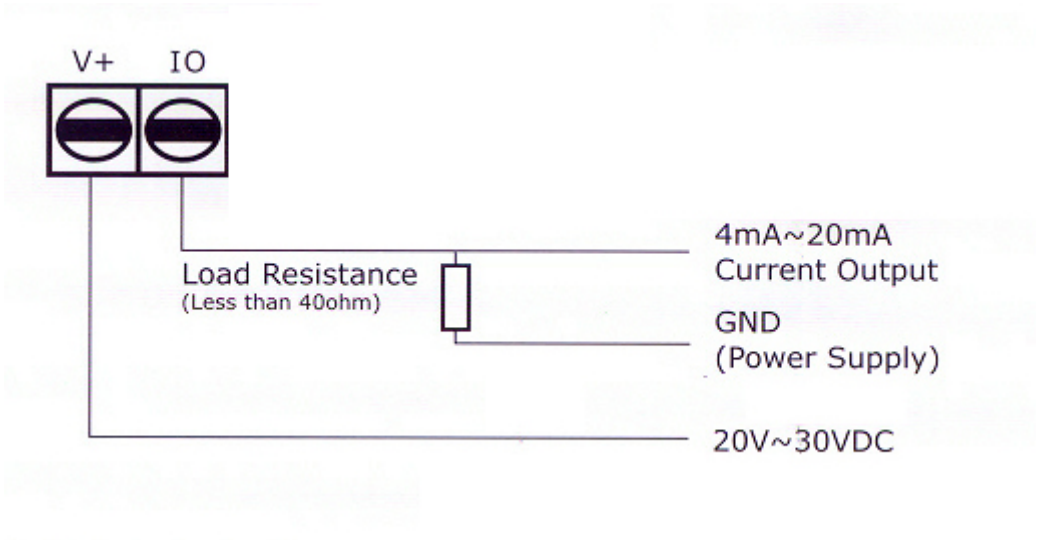


- Incorrect Standpipe size



Terminal Connection

The connection part of SLM series is at the back of level meter. Open the cover at the backside for wiring.
- The flexible tube adapter and 1/2" nipple can be used for fixing cable and waterproof.



Function

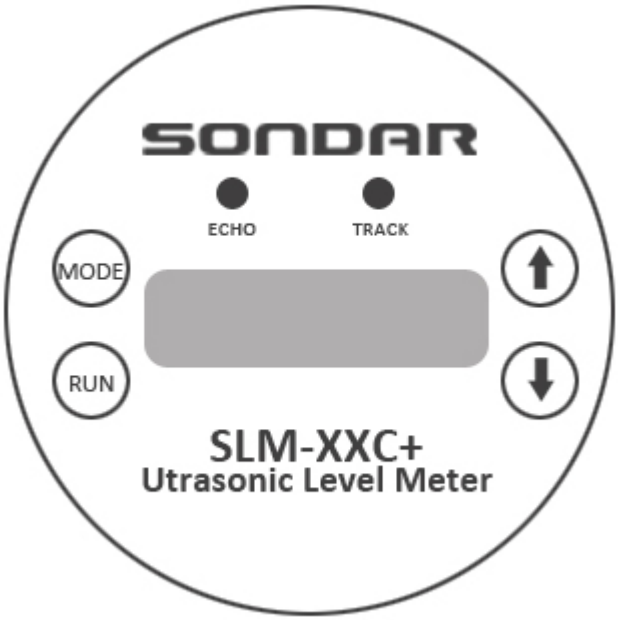
Terminal	Function	Note
V+	Direct current Input	DC 20 ~ 30V
Io	Current output	4mA ~ 20mA
COM	Ground	for repair
DET	Reflection Signal Checking	for repair
TR	Threshold Voltage Checking	for repair

Chapter 3 How to use SLM300C/800C/990C

Operating the Controller

Display

Whilst in the Run Mode, the 4-digit LCD display will show the current level reading in centimeter/feet, it will also display a flashing “0” when a fault condition (Loss Of Echo) is detected. When in the Program Mode the display is used to read information on the Menu Options and the values entered.
There are two operating modes for your SLM300C/800C/990C, Run Mode and Program Mode.



Run Mode

This mode is used once the SLM300C/800C/990C have been set up in program mode. It is also the default mode that the unit reverts to when it resumes operation after a power failure.

When the SLM300C/800C/990C are switched on for the first time, it will display, in centimeter/feet, the distance from the transducer face to the target.

After programming is complete, any switched outputs that are set will operate when the level reaches the relevant setpoint. Whilst in Run Mode the ECHO and TRACK LED’s provide information on the status of the signal.

Program Mode

This mode is used to set up the SLM300C/800C/990C or change information already set, this is achieved by using the 4 push buttons located either side of the display.
Entering a value for each of the menu options that are relevant to your application provides all the programming information.

How to Access Program Mode

To access the Program Mode simply press the “Mode” button. Confirmation that you have entered the Program Mode will be given by the ECHO and TRACK LED’s being extinguished, and the Software Version will also appear in the display. Each subsequent press of the Mode button will advance you through the options, 01 to 15, values of which can be changed by using the Up and Down buttons. To return to the Run mode simply press the Run button, confirmation that the SLM300C/800C/990C has returned to Run successfully will be given by the LCD display indicating the level and the ECHO and TRACK LED flashing.

Button Functions

There are 4 push buttons, 2 located each side of the display their functions are as follows:

Button	Run Mode	Program Mode
Mode	Access Program Mode	Advance through Menu Options
Run	Echo confidence (V). A measure of echo reliability. Normally above 2V is stable.	Return SLM300C/800C/990C to Run Mode
↑	Not used	Increase Menu Option value
↓	Reads Current Temperature N.B. –20oC displayed as 020 +20oC displayed as 20	Decrease Menu Option value

LED Functions

There are 4 LED’s, located above the display their functions are as follows:

Normal operation: ECHO and TRACK LED flicker at the same time.

Abnormal operation: ECHO LED alone flicker

The reflected pulses are received but the previous output remains, at the same time the sensor tracks the actual level. The unit returns to the normal operation after 20 seconds.

- Cause
  - ☐ When the unit is just turned on.
  - ☐ When the surface level change is big and abrupt.(over 5cm/sec)
  - ☐ When an obstacle is detected in the ultrasonic path.

  (If an obstacle remains more than 20 seconds, the distance of the obstacle will be measured)

Error Sign: All LED is off and "0" flickers in LCD.

This happens when ultrasonic pulses are not received for the set time(lost echo). At this time, the error output 21mA or 3.8mA will be shown continuously.

- Cause
  - ☐ When the object is out of the measuring range.
  - ☐ When the reflected pulses can not be reached at the sensor because the sensor is not mounted exactly perpendicular to the liquid surface
  - ☐ When the environmental conditions (temperature, pressure) are out of its specifications.

Chapter 4 Menu Guide

This chapter describes all of the menu options in your SLM-300C,800C,990C, in numerical order.
To move other menus, please press the “mode” key + “↑”or”↓” key.
From menu 01 to menu14 you can move each menu with “mode” key.

Application Menu Options

01. Operating Mode
Factory Set = 1 Level
This option sets the mode of operation when in run mode, and can be set to one of the following:

Option	Description
1= Level	Display shows how full the vessel is with respect to the Empty (0% of Span)
2= Distance	Display shows the distance from the transducer face to the surface.
3= Space	Display shows how an empty vessel is with respect to Full (100% of Span) i.e. how much space is available in the vessel.

02. System Unit
Factory Set = 1
1 = m
2 = feet
This option is to choose the system unit between meter and feet.

03. Display
Factory Set = 1
This option sets the display unit of LCD display among cm(inch), mA, or %

04. Empty Level
Factory Set = 3.000 / 8.000 / 9.999

This option is to sets the maximum distance from the face of the transducer to the empty point, in cm (inch).

05. Blanking Distance
Factory Set = 0.300 (30cm)
This option is the distance from the face of the transducer that is not capable of being measured, and is pre-set to 30cm (14 inches). It should not be set to less than this figure, but can be increased if required.

Current Output Menu Options

11. 4 mA Setpoint
Factory Set = 0.000

This option sets the distance (or level or space, depending on the selected Operating Mode (Option 01) at which the 4mA output will occur. By default 4mA will represent Empty (0% of Span)

12. 20 mA Setpoint
Factory Set = 3.000 / 8.000/ 9.999
This option sets the distance (or level or space, depending on the selected Operating Mode (Option 01) at which the 20mA output will occur. By default 20mA will represent Full (100% of Span)

Important Information
The Span is the maximum working distance from Empty (0%) to Full (100%), and is automatically calculated as Empty Level (Option 02) minus Blanking Distance (Option 05). Except for when Operating Mode (Option 01) = Distance in this case the Span is the same as the Empty Level (Option 02)
*******.**DO NOT REMOVE THIS PARAGRAPH—

13. mA Fail-safe Value

Factory Set =2 (Hold)

If the SLM600 Series fails to receive a valid echo return from the target, then the mA output can be used to indicate a fault condition (Loss of Echo). This option determines the mA output value which will indicates such a condition.

Option	Description
1 = 3.8mA	Fault condition (LOE) indicated by 3.8mA
2 = Hold	The previous measured value outputs
3 = 22mA	Fault condition (LOE) indicated by 22mA

14. mA Fail-safe Time

Factory Set = 300 seconds

In the event of a fail-safe condition occurring (LOE) the fail safe timer determines the time before the mA output indicates a fault condition (LOE). The possible setting time range is 20-900seconds.

Compensation Menu Options

21. Damping Rate

Factory Set = 2

This option determines the maximum rate at which the unit will respond to an increase/decrease in level.

Option	Description
1 = 0.1m/min	Responds to changes to a max. 0.1m/min
2 = 0.5m/min	Responds to changes to a max. 0.5m/min
3 = 2m/min	Responds to changes to a max. 2m/min
4 = 10m/min	Responds to changes to a max. 10m/min

22. Detection Threshold Voltage

Factory Set = 8

This option determines detectable size of return echo. This is useful when the first return echo is needed in condition where small objects creating various kinds of return echoes exist. In case the set value is high, it can be stronger to the noise, but may not be able to detect small echoes. The 8 is equal to 0.8V. The table below shows the equivalent voltage to each value

23. Output Power

Factory Set = 2

This option is used to set the power output from the transducer to suit varying applications.. By reducing the power emitted the beam angle will be effectively reduced and can be applied as detailed below:

Option	Description
1 = Low Power	For use on short range applications
2 = Normal Power	For use in normal conditions
3 = High Power	For use in outdoor applications, long range measurement
4 = Maximum Power	For use in arduous applications where conditions are dusty, steamy or turbulent.

24. Sound Velocity

Factory Set = 331.6 m/sec

This option allows for the velocity of sound to be changed according to the atmosphere the transducer is operating in. By default the velocity is set for sound travelling in air at a temperature of 0oC.

The table below gives details of the velocity of sound in various gaseous atmospheres In all cases the velocity indicated is that in a 100% gaseous atmosphere at 0oC. In atmospheres less than 100% it may be necessary to check the level indicated at near empty and near full and compare with the actual level, several times, then adjust the Sound Velocity accordingly to obtain an accurately displayed reading.

Gas	Sound Velocity
Chlorine	206 m/sec
Carbon Dioxide.	259 m/sec
Argon	308 m/sec
Oxygen	316 m/sec
Air	331.5 m/sec
Ammonia	415 m/sec
Methane	430 m/sec
Helium	435 m/sec
Neon	965 m/sec

25. Vapour Temperature Compensation

Factory Set = 600 mm/℃

The sound velocity in air increases or decreases at a uniform rate of 60cm/℃, however in atmospheres other than air it will change at a different rate.

This option allows the rate of change in cm/℃ to be set according to the present atmosphere and temperature. The level indicated, should be compared with the actual level, several times, then Vapour Temperature Compensation adjusted accordingly, to obtain an accurately displayed reading.

26. Detection Algorithm

Factory Set = 1

This option determines the detection algorithm. The returned signal can be strong or weak according to field condition.

This option chooses what signal is effective.

1= Automatic, 2= Effective only for the latest signal

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Outputs Simulation Menu Options

These menu options are used when the SLM600 operates with other field instruments. Option No. 32,

31. Display value simulation
This option simulates display output value at user's need compulsory. The range of simulation values is empty.

Password Menu Option

41. Password
This option prevents malicious and unskilled user from changing option values.
Once this option is set, the password is required whenever entering into program mode.

Chapter 5 Troubleshooting

This section describes some problem symptoms, with suggestions as to what to do.

Symptom	What to Do
Display blank, transducer not firing.	Check power supply
Display shows flashing “0” and all LED’s are Off.	No valid echo being received and unit has gone into fault condition. Check material level is not out of range, sensor is perpendicular to material surface.
Displays appears frozen on wrong reading and only the “Detect” LED is flashing.	Check that the Response Rate (21) is appropriate for the application. Ensure that there are no obstacles in the ultrasonic signal path.
Material level is consistently incorrect by the same amount.	Check empty level (04) correctly entered.