Ultrasonic Level Meter SLM300C/800C

USER'S MANUAL

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TECHNICAL ENQUIRIES

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COMMENTS AND SUGGESTIONS

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Chapter 1 Specification

Physical

Dimensions	**Overall**	120 (dia). x 251 (height) mm = SLM300C 120 (dia) x 260 (height) mm = SLM800C
	Electronics housing	120 (dia). x 124 (height) mm
	Transducer housing	59 (dia) x 127 (height) mm = SLM300C 67 (dia) x 136 (height) mm = SLM800C
	Mounting	2 1/2"NPT
Weight		Nominal 3.2 kg
Case material/description		PP

Environmental

IP Rating (electronics housing)	IP67
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	0.2% of the measured range or 2 mm (whichever is greater) = SLM300C 0.25% of the measured range or 3 mm (whichever is greater) = SLM800C
Resolution	0.03% of full scale or 1mm (whichever is greater)
Max. range	Liquids 3 meters/ 8 meters
Min. range	0.25 meters / 0.35 meters
Beam Angle	12^{o} 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 or 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 0.021A

Chapter 2 Installation

Power Supply Requirements

The SLM300C/800C 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 can be mounted easily using the integral nose thread (2 1/2”NPT).

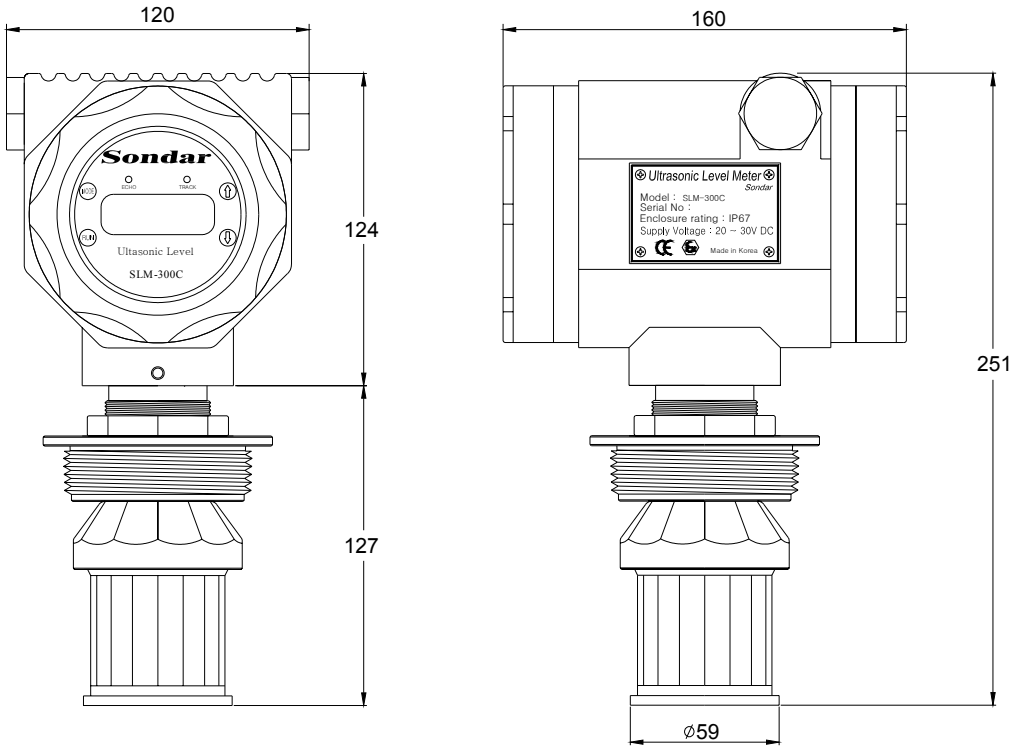
When choosing a location to mount the SLM300C/800C, bear in mind the following:

- 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 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)

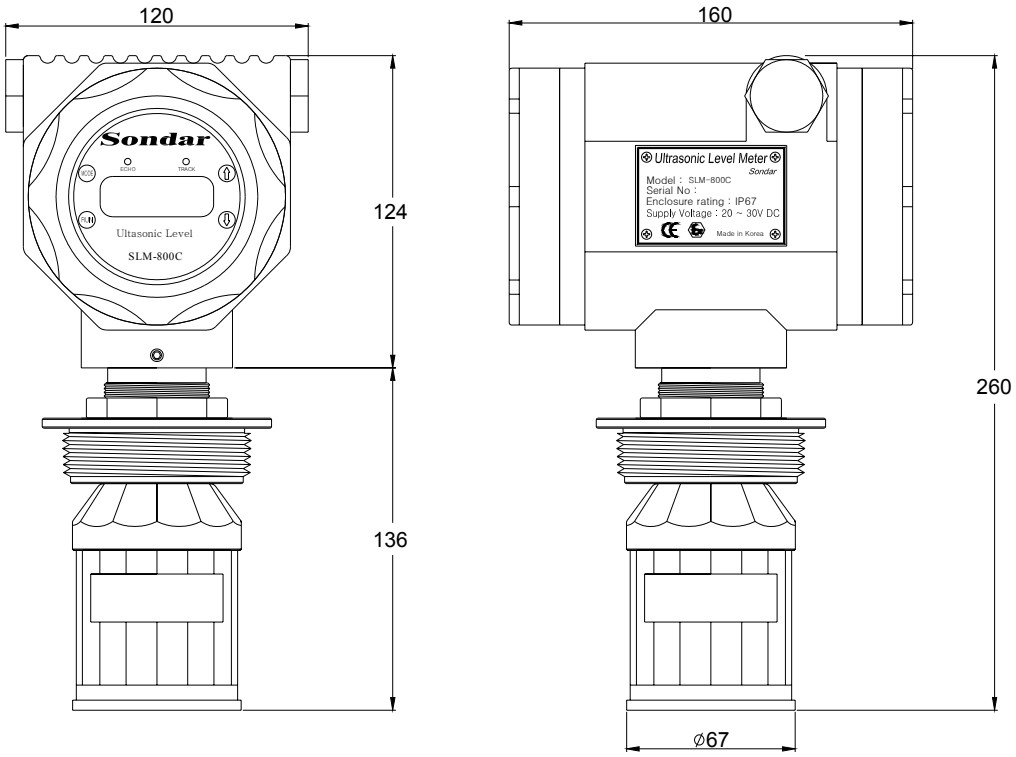
Dimensions

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

SLM300C



SLM800C

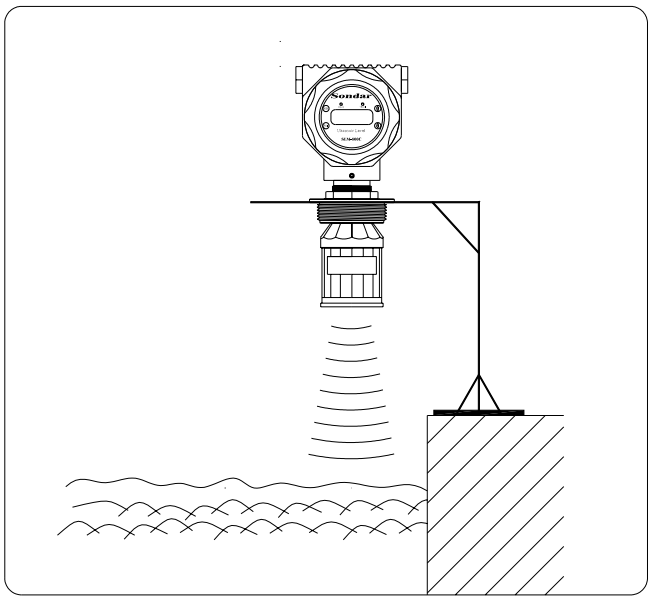


Outdoor and Open Vessel Installation

The SLM300C/800C 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 are not installed in direct sunlight, in order to avoid errors in the measurement of ambient temperature.

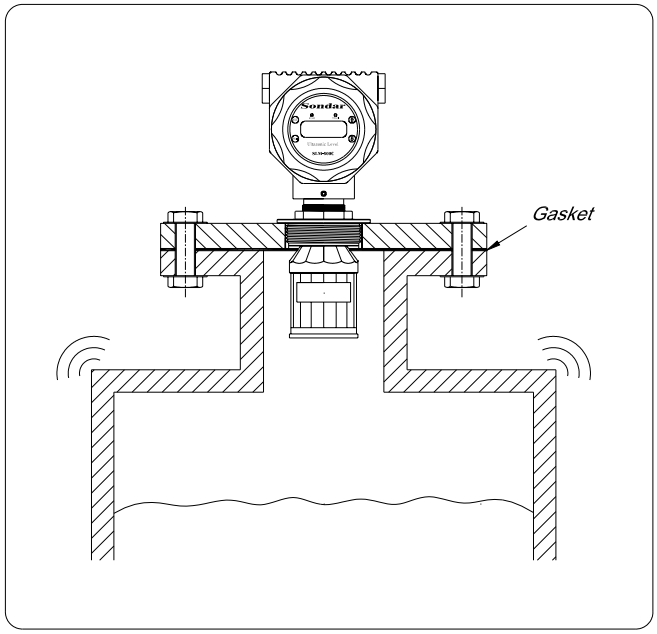
Attention should also be taken, when mounting the unit, to ensure that strong windy conditions are avoided, wherever possible, to prevent abnormal operation.



Closed Vessel Installation

The SLM300C/800C 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.

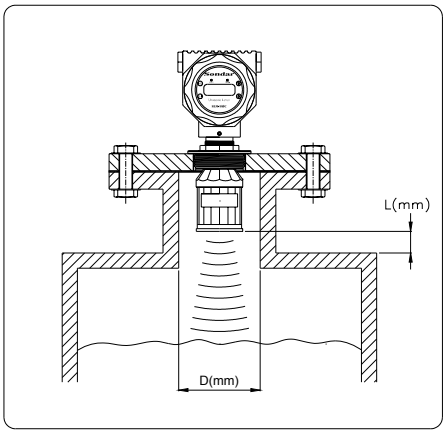


Stand Pipe Installation

When mounting the SLM300C/800C 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.

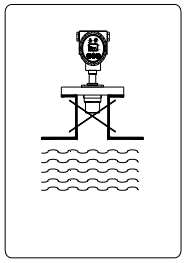
If using standpipes, which extend into the vessel, beyond the blanking distance, but not as far as the empty level, then the open end of the standpipe should be cut to an angle of 45^{o}.



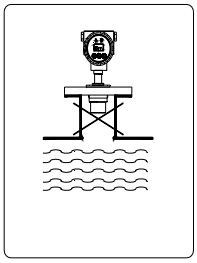
D [mm]	Length ［mm]	
	SLM300C	SLM800C
80	380	350
100	475	440
150	713	660
200	950	880

Incorrect Installation

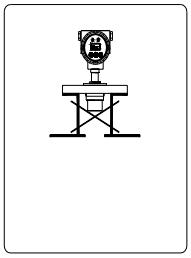
- The maximum level (100% of Span) is inside the Blanking Distance



- Pipe should be free of obstructions as weld seams

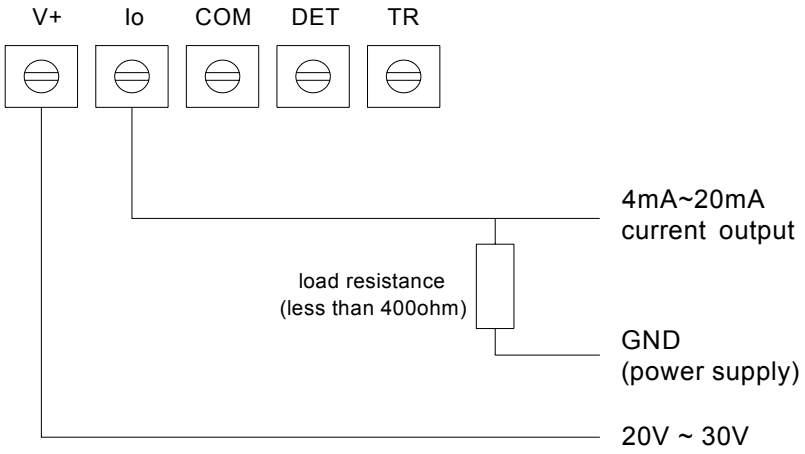


- Incorrect Standpipe size



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

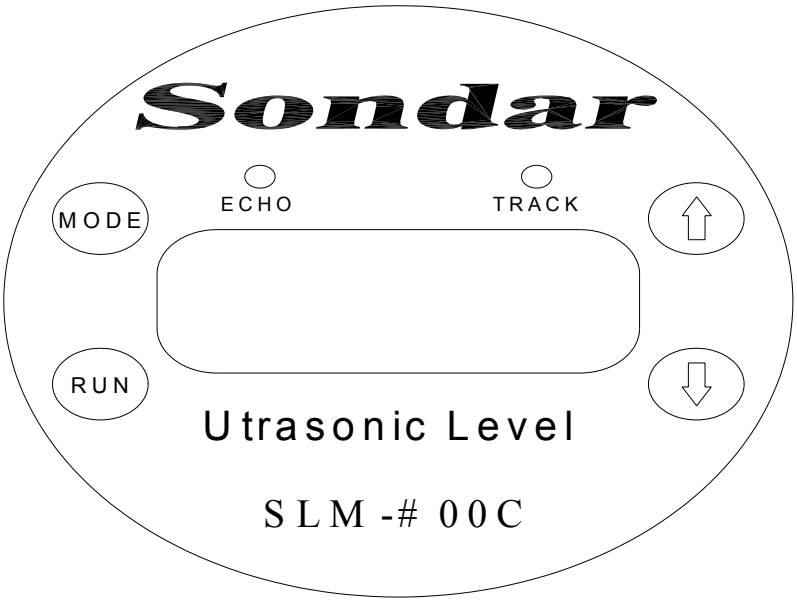
Terminal	Function	Note
V+	Direct current Input	DC 20 ~ 30V
Io	Current output	4mA ~ 20mA
COM	Ground	for repair
DET	Reflection Signal Checking	for repair
TR	Threshold Voltage Checking	for repair

Chapter 3 How To Use SLM300C/800C

Operating the Controller

Display

Whilst in the Run Mode, the 4-digit LCD display will show the current level reading in centimeters, 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, **Run Mode** and **Program Mode**.



Run Mode

This mode is used once the SLM300C/800C 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 are switched on for the first time, it will display, in centimetres, 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 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 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	Not used	Return SLM300C/800C to Run Mode
↑	Echo confidence(V). A measure of echo reliability. Normally above 2V is stable.	Increase Menu Option value
↓	Reads Current Temperature N.B. –20°C displayed as 020 +20°C	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

Menu Summary

No.of Menu	Function	Setting Range	Factory Setting
00	**PASSWORD**	0~4000	2000
01	**OPERATION MODE**	1,2,3	1
02	**DISPLAY UNIT**	1,2	1
03	**EMPTY LEVEL**	0~3.000m /0~8.000m	3.000/8.000m
04	**4mA SETPOINT**	0~3.000m /0~8.000m	0
05	**20mA SETPOINT**	0~3.000m /0~8.000m	3.000/8.000m
06	**BLANKING DISTANCE**	0.25~3.000m /0.35~8.000m	0.25/0.35m
07	**TRANSMIT POWER**	1,2,3,4	3
08	**DAMPING RATE**	1: 0.1m/min 2: 1m/min 3: 10m/min 4: 100m/min	2
09	**mA FAIL SAFE VALUE**	1,2	2
10	**mA FAIL SAFE TIME**	20~1800s	120s
11	**SOUND VELOCITY**	200.0~500.0m/s	331.5m/s
12	**VELOCITY TEMPERATURE FACTOR**	-200~200	60
13	**MATERIAL TEMPERATURE**	0~100.0℃	25.0℃
14	**REFLECTED TERMPERATURE RATIO**	0~100%	0%
15	**THRESHOLD VOLTAGE**	4~15	5

Application Menu Option

01 Operation 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 Display Unit

Factory Set = 1 Meter

This option is to choose unit in LCD.

Option	Description
1= Meter	Display unit is meter
2= Percentage	Display unit is percentage(%) of total range

03 Empty Level

Factory Set=13.3/27.9 feet

This option is to sets the maximum distance from the face of the transducer to the empty point, in feets.

04 4 mA Setpoint

Factory Set = 0

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)

05 20 mA Setpoint

Factory Set = Span

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 03) **minus Blanking Distance** (Option 06). Except for when **Operation Mode** (Option 01) = **Distance** in this case the **Span** is the **same** as the **Empty Level** (Option 03)

06 Blanking Distance

Factory Set = 0.25/0.35m

This option is the distance from the face of the transducer that is not capable of being measured, and is pre-set to 25/35cm. It should not be set to less than this figure, but can be increased if required.

Process Menu Options

07 Transmit Power

Factory Set = 3

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 = Minimum Power	For use on short range applications
2 = Low Power	For use on applications where obstructions such as pipes, beams etc. are present.
3 = Normal Power	For use in normal conditions
4 = High Power	For use in arduous applications where conditions are dusty, steamy or turbulent.

08 Damping Rate

Factory Set = 2 (1m/min).

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. 0.1 m/min
2 = 1m/min	Responds to changes to a max. 1 m/min
3 = 10m/min	Responds to changes to a max. 10 m/min
4 = 100m/min	Responds to changes to a max. 100 m/min

09 mA Fail-safe Value

Factory Set =2 (21mA)

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 = 21mA	Fault condition (LOE) indicated by 21mA

10 mA Fail-safe Time

Factory Set = 120 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).

Compensation Menu Options

11 Sound Velocity

Factory Set = 331.5 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 traveling in air at a temperature of 0°C.
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 0°C. 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

12 Velocity Temperature Factor

Factory Set = 60 cm/°C

The sound velocity in air increases or decreases at a uniform rate of 60cm/ °C, however in atmospheres other than air it will change at a different rate.
This option allows the rate of change in cm/°C to be set according to the present atmosphere and temperature. The level indicated, should be compared with the actual level, several times, then **Velocity Temperature Factor** adjusted accordingly, to obtain an accurately displayed reading.

13 Material Temperature

Factory Set = 25°C

The SLM300C/800C Series uses an internal temperature sensor, housed within the transducer nose cone and therefore the temperature used for compensation is that which is near the sensor. In applications where there is a large difference between the temperature near the sensor and that at the surface of the material being measured, errors in measurement may occur.
This option allows for the present temperature at the material surface to be entered and reduce any error in measurement. The temperature of the material should be entered in °C.

14 Reflected Temperature Ratio

Factory Set = 0

This option is used in conjunction with **Option 13, Material Temperature** and determines the effect the material temperature has on the air temperature in front of the transducer. Where the temperature of the material has no effect on the air temperature **Option 14** should be set to **0,** in which case **Option 13, Material Temperature** will be ignored. However in cases where the material temperature heavily influences the temperature at the transducer **Option 14** should be set to **100** and temperature compensation will be performed accordingly.

15 Threshold Voltage

Factory Set = 5

SONDAR SLM series measure reflected signal, which is bigger than the preset threshold voltage.
However when the application site has difficult surroundings such as strong wind, high voltage, high current or strong electronic wave noise, the level meter may detect and measure the noise instead of reflected signal.
To avoid measuring the noise, SLM300/800C can set its threshold voltage(from 4 to 15).
As the chart below, increasing one value is equivalent to raising 0.2V of threshold voltage.
When level meter detects reflected ultrasonic waves(TRACK and ECHO LED flicker at the same time), the reflected wave is indicated in LCD as voltage at the press of upper button.

Value	4	5	6	7	8	9	10	11	12	13	14	15
Threshold Voltage	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5

Note : The level meter may not detect reflected waves when the threshold voltage is bigger than reflected weak waves.

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 appear frozen on wrong reading and only the “ECHO” LED is flashing.	Check that the Response Rate (08) 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 (03) correctly entered.

Menu Option Record

SLM300C/800C

APPLICATION

Option Details		Entered Values					
No.	**Description**	**Factory Set**	1	2	3	4	5
01	Operating Mode	1 = Level					
02	Display Unit	1 = Meter					
03	Empty Level	0					
04	4mA setpoint	0					
05	20mA setpoint	Empty Distance					
06	Blanking Distance	0.25/0.35					

PROCESS

07	Output Power	3					
08	Damping Rate	2					
09	mA Fail Safe Value	2					
10	mA Fail Safe Time	120 sec					
11	Sound Velocity	331.5m/sec					

COMPENSATION

12	Vapour Temp. Comp.	60cm/^{o}C					
13	Material Temperature	25^{o}C					
14	Reflected Temp. Ratio	0					
15	Threshold Voltage	5					