Ultrasonic Level Meter

SLM600 Plus Series

(User's Manual)

IS Technologies Co., Ltd.

July 2003 Edition

WARRANTY AND LIABILITY

IS Technologies Co., Ltd. guarantees for a period of 1 year from the date of delivery that it will either exchange or repair any part of this product returned to IS Technologies Co., Ltd. if it is found to be defective in material or workmanship, subject to the defect not being due to unfair wear and tear, misuse, modification or alteration, accident, misapplication or negligence.

DISCLAIMER

IS Technologies neither gives nor implies any process guarantee for this product, and shall have no liability in respect of any loss, injury or damage whatsoever arising out of the application or use of any product or circuit described herein.

Every effort has been made to ensure accuracy of this documentation, but IS Technologies cannot be held liable for any errors.

TECHNICAL ENQUIRIES

Please contact IS Technologies Co., Ltd. for technical support.

COMMENTS AND SUGGESTIONS

If you have any comments or suggestions about this product, then please contact:

IS Technologies Co., Ltd.

203/504 Buchon Techno Park, 192

Yakdae Dong, Wonmi Gu

Buchon City, Kyungki Do, Korea

Tel: 82-32-621 2606

Fax: 82-32-621 2612

Web Site: http://www.sondar.com

e-mail: sales@sondar.com

Contents

Chapter 1 Start Here…

Congratulations on your purchase of a Sondar Ultrasonic Level Meter 600 Series. This quality system has been developed over many years and represents the latest in high technology ultrasonic level measurement and control.

It has been designed to give you years of trouble-free performance, and a few minutes spent reading this operating manual will ensure that your installation is as simple as possible.

About this Manual

It is important that this manual is referred to for correct installation and operation. There are various parts of the manual that offer additional help or information as shown:

Tips

At various parts of this manual you will find tips to help you.

Additional Information

Additional Information
At various parts of the manual, you will find sections like this that explain specific items in more detail.

About the SLM600 Series

Functional Description

The Sondar SLM600 Series is a highly developed ultrasonic level measurement system which provides non-contacting level measurement for a wide variety of applications in both liquids and solids.

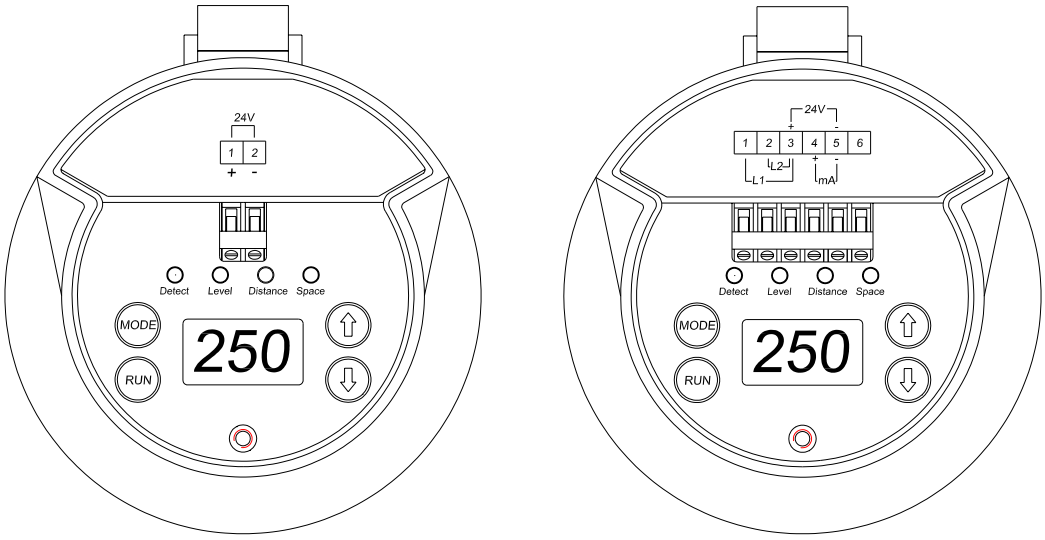
Easy calibration and maintenance free “fit and forget” performance mean that you can install the SLM600 Series rapidly and with confidence. Two Switched outputs NPN open collector, with fully programmable setpoints are provided in the 3 wire version, together with fault condition being indicated by the mA output on both the 2 and 3 wire versions.

The Sondar SLM600 Series operates on the principle of timing the echo received from a measured pulse of sound transmitted in air and utilise “state of the art” echo extraction technology.

It can measure distances from 0.35m to 6m from the face of the transducer to the surface being monitored, dependent on the material being measured.

The SLM600 Series can show **level**, **space, distance**, on the display. The switched outputs can be programmed to give an ‘ON’ and ‘OFF’ point for external control. There is a 4-20 mA output that can be connected to a remote chart recorder or PLC, to monitor level, space or distance, dependant on the measurement mode selected, and provides a ‘fault condition’ alarm of either 3.8mA or 21mA.

The Sondar SLM600 Series has an IP65 lid covering an integral LCD display and 4 buttons used for programming purposes, together with 4 LED’s which provide status information whilst in RUN and PROGRAM Mode.



Product Specification

Physical

Dimensions	**overall**	105 (dia). x 248.5 (height) mm
	electronics housing	105 (dia). x 172 (height) mm
	transducer housing	55 (dia) x 76.5 (height) mm
	mounting	2" NPT
Weight		Nominal 1 kg
Case material/description		Polypropylene
Cable entry detail		1 x PG11 at rear (fitted with gland)

Environmental

IP Rating (electronics housing)	IP65
Max. & Min. temperature (electronics)	-20 ºC to +70 ºC (-4 ~ 158°F)
Pressure	up to 2 Bar
CE approval	EMC approval to BS EN 55011:1991 (Class A),.
	BS EN50082-2: 1995 BS EN61000-4-2:1995
	BS ENV50140:1993 BS ENV50141:1993
	BS ENV50204:1995 BS EN61000-4-4:1995

Performance

Accuracy	0.25% of the measured range or 3 mm (whichever is greater)
Resolution	0.03% of full scale or 1mm (whichever is greater)
Max. range	Liquids 6m(256 inches)
Beam Angle	8^{o} at -3dB.
Damping Rate	Adjustable 0.1m/min to 10m/min
Temperature Compensation	Fully compensated via integral temperature sensor over entire operational span

Outputs

Analogue output	4-20 mA into max 750Ω (user adjustable) Fault condition Alarm 3.8mA or 21mA user selectable.
NPN Open Collector switched output	2 Switched outputs, user programmable setpoints.
Display	3 Digit LCD Display

Programming

On-board programming	via 4 tactile push button keys

Supply

Power supply	DC 20 - 30V
Current Consumption	Less than 0.08A

Chapter 2 Installation

Power Supply Requirements

The SLM600 operates from a DC supply of 20 –30V and will typically draw less than 0.08A.

> *All electronic products are susceptible to electrostatic shock, so follow proper grounding procedures during installation.*

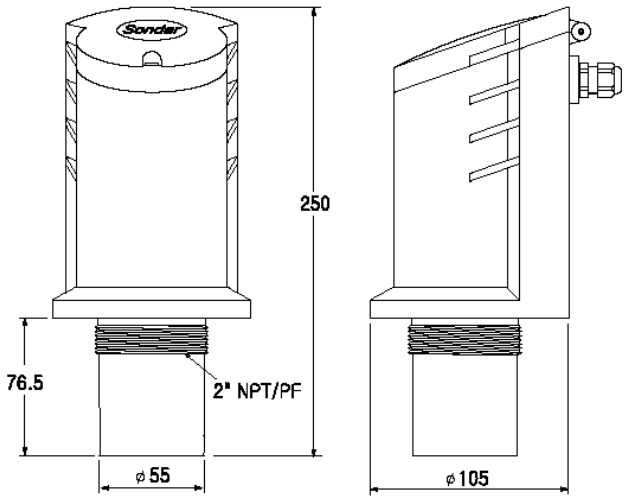
The compact one-piece construction of the SLM600 can be mounted easily using the integral nose thread (2”NPT).

When choosing a location to mount the SLM600, 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 SLM600 should be mounted at least 1.15feet 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 -20° to 70°c
- 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 SLM600 are as shown below

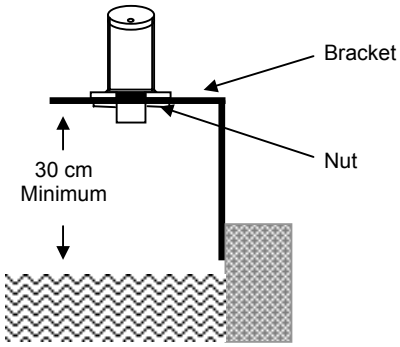


Outdoor and Open Vessel Installation

The SLM600 can be simply mounted on a bracket, suitable for the application and secured using the thread located at the top of the transducer (2”NPT).

Care should be taken to ensure that the SLM600 is 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.



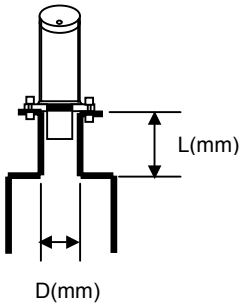
Closed Vessel Installation

The SLM600 can be simply screwed into a flange and secured using the thread located at the top of the transducer (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 of the Sondar and the connection to the vessel to avoid vibration.

Stand Pipe Installations

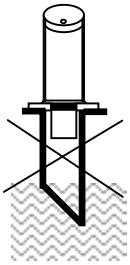
When mounting the SLM600 to a standpipe care should be taken to ensure that the standpipe is of sufficient dia with reference to its length, see the table below for details:



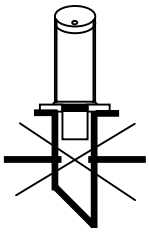
D(mm)	Length(mm)
80	224
100	280
150	420
200	560

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.

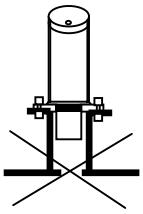
If using standpipes, which extend into the vessel, beyond the blanking distance, but not as far as the empty level, then the open end of the standpipe should be cut to an angle of 45^{o}.



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



Pipe should be free of obstructions such as weld seams



Incorrect Standpipe size

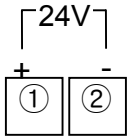
Cable Entry

The SLM600 Series has a single PG9 cable entry, fitted with a suitable gland, to ensure moisture protection is maintained.

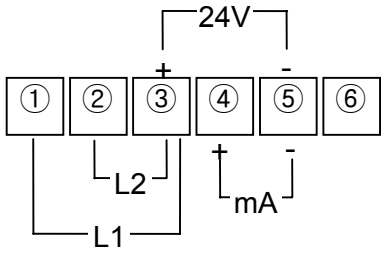
Terminal Connection Details

The SLM600 Series comes in both 2 wire and 3 wire versions the terminal connections for both are as detailed below. Wiring details are also given on the terminals under the access cover.

2 Wire



3 Wire



Terminal Connections

2 Wire(SLM600B)

① : Direct Current (DC) input terminal (20-30VDC)

② : Current Output terminal (4-20mA)

3 Wire(SLM600A)

① : Limit 1 Switched Output terminal (NPN Open Collector)

② : Limit 2 Switched Output terminal (NPN Open Collector)

③ : Direct Current (DC) input terminal (20-30VDC)

④ : Current Output terminal (4-20mA)

⑤ : DC COMMON input terminal, and also used as RETURN terminal for all OUTPUTS

⑥ : Service use only

Important Information
If the equipment is installed or used in a manner not specified in this manual, then the protection provided by the equipment may be impaired.

Preparation for Operation

Before switching on, check the following:

- ✓ The SLM600 is mounted correctly.
- ✓ The power supply is correctly installed.

Maintenance

There are no user serviceable parts inside your SLM600, if you experience any problems with the unit, then please contact IS Technologies Co., Ltd. for advice.

To clean the equipment, wipe with a damp cloth. Do not use any solvents on the enclosure.

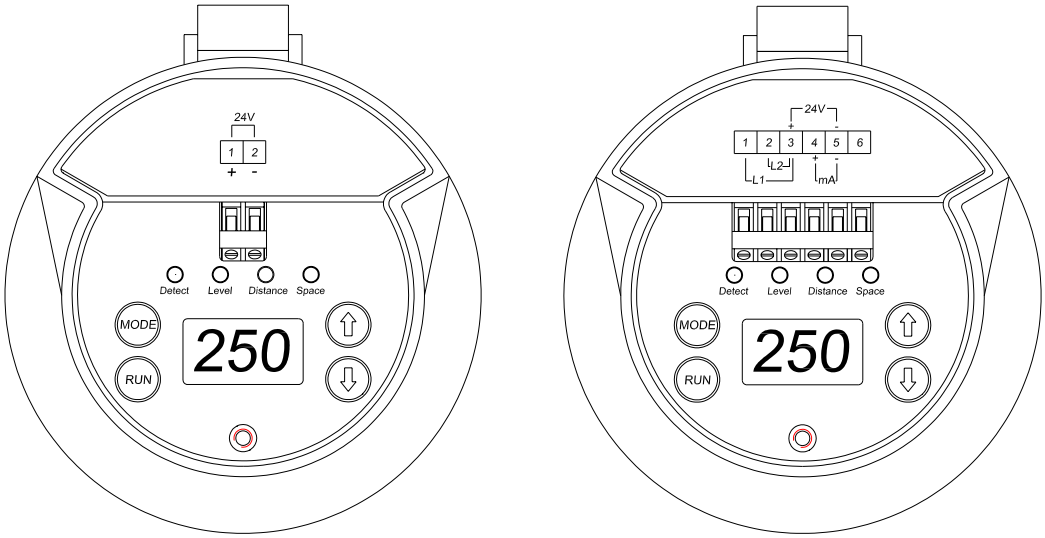
Chapter 3 How To Use SLM600 Series

Operating the Controls

Display

Whilst in the Run Mode, the 3-digit LCD display will show the current level reading in centimetres, 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 SLM600, **Run Mode** and **Program Mode**.



Run Mode

This mode is used once the SLM600 has 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 SLM600 is 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 Detect and Distance LED’s provide information on the status of the signal.

Program Mode

This mode is used to set up the SLM600 or change information already set, this is achieved by using the 4 push buttons located either side of the display.

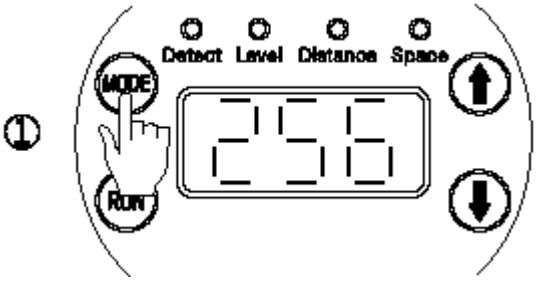
Entering a value for each of the menu options that are relevant to your application provides all the programming information.

How to use buttons

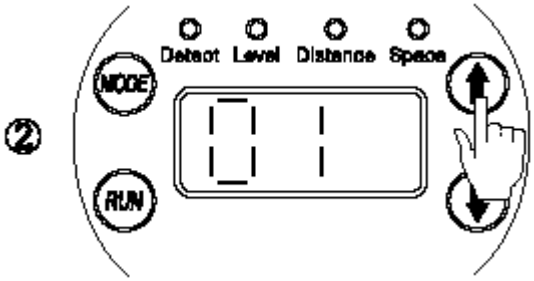
To access the Program Mode simply press the “Mode” button. Confirmation that you have entered the Program Mode will be given by the Detect and Mode (Level, Distance, Space) LED’s being extinguished, and the Software Version will also appear in the display. Each subsequent press of the Mode button will advance you through the options, 01 to 05. To access other group options, you have to press the Mode and Up/Down buttons.

- Access the Program Mode : [MODE]
- Move to other group option : [MODE] + [▲] / [▼]
- Move inside of each group option : [MODE]
- Change option value : [▲] / [▼]
- Return to Run Mode : [RUN]

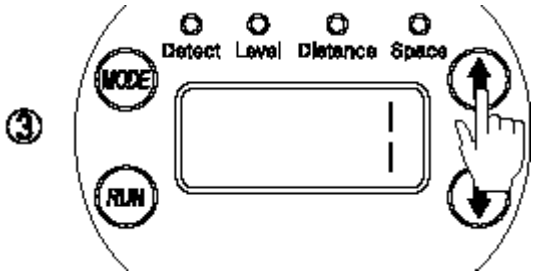
Example of using bottons



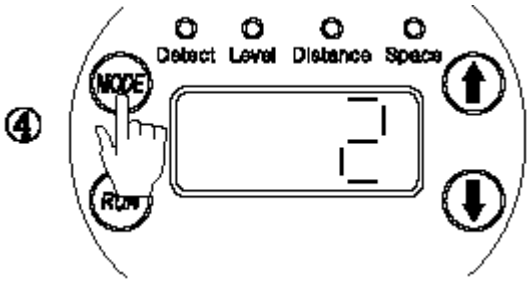
Press the Mode button to enter the program mode.



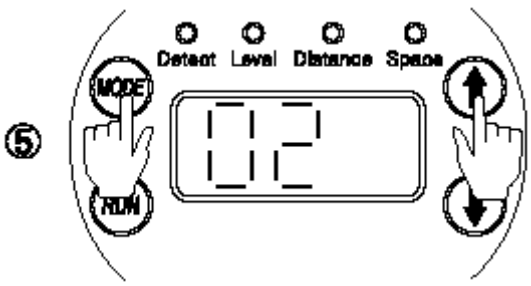
Option No. is displayed. To check the option value, press the Up button



The present value is displayed. Press the Up button to change the value

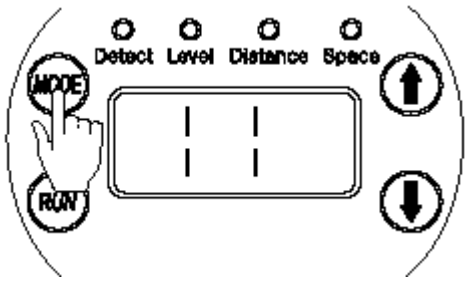


The value is changed. Press the Mode button to advance to next option



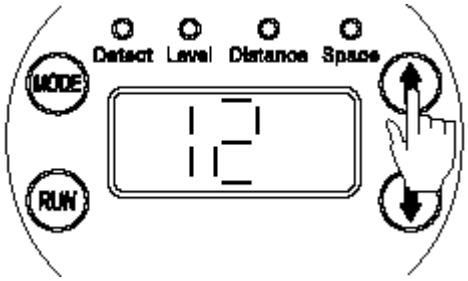
The next option No. is displayed. Press Mode and Up buttons simultaneously to move into next option group.

⑥



The option No. of next option group is displayed. Press Mode button to enter into next option

⑦



The option No. is displayed. Press Up button to check the option value

LED Functions

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

LED	Condition	Function
Detect & Level	Flashing together	Indicates Normal Operation Mode selected = Level
Detect & Distance	Flashing together	Indicates Normal Operation Mode selected = Distance
Detect & Space	Flashing together	Indicates Normal Operation Mode selected = Space
Detect	Flashing alone	Indicates that SLM600 is detecting an echo but checking if the value is correct.
None	All Off Display indicates flashing "E*"	Indicates that SLM600 has gone into Fail condition. E0 means there is no reflected echo received. E1 means transducer and electronic part is disconnected

What to Do First

When you first switch the SLM600 on, it will be reading the **distance** from the face of the transducer to the surface in **centimetre/feet**, as shown on the display.

TIP

In some applications it is simplest to empty the vessel, take a reading from the SLM600 for distance and then setup the empty level to this figure.

Once you are satisfied with the installation, and the SLM600 is reading what you would expect in terms of distance from the face of the transducer to the material level, then you can set up the options as detailed in **Chapter 4 Program.**.

Chapter 4 Program

This chapter describes all of the menu options in your SLM600, in numerical order.

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 Cm

This option is to choose the system unit between cm and inch.

03 Display

Factory Set = 1

This option sets the display unit of LCD display among cm(inch), mA, or %

04 Empty Level

Factory Set = 600(256)

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 = 30(12)

This option is the distance from the face of the transducer that is not capable of being measured, and is pre-set to 30cm(12 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

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 = 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 04) **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 04)

13 mA Fail-safe Value

Factory Set =3 (22mA)

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 sec

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

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 = 7

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 7 is equal to 0.7V. The table below shows the equivalent voltage to each value

No.	3	4	5	6	7	8	9	10	11	12	13	14	15
Voltage	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5

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 = 332 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 0^{o}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^{o}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

25 Vapour Temperature Compensation

Factory Set = 60 cm/^{o}C

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

This option allows the rate of change in cm/^{o}C 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 choose what signal is effective.

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

.

Outputs Simulation Menu Options

These menu options are used when the SLM600 operates with other field instruments. Option No. 32, 33 is only for 3 wire version.

31 Display value simulation

This option simulates display output value at user's need compulsory. The range of simulation values is empty value set at Option No.4

32 Limit 1 output simulation

Factory Set = 0

This option simulates the LIMIT1 switched output compulsory.

0 = No output , 1= Output

33 Limit 2 output simulation

Factory Set = 0

This option simulates the LIMIT2 switched output compulsory.

0 = No output , 1= Output

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.

Switched Outputs Menu Options

This option group displays only at 3 wire version

51 Limit 1 ON Setpoint

Factory Set = 100cm (39)

This option determines the "**ON**" point for L1 Switched Output (NPN Open Collector).

Setpoints are entered in centimetres measured from the Empty Level.

52 Limit 1 OFF Setpoint

Factory Set = 110cm(43)

This option determines the "**OFF**" point for L1 Switched Output (NPN Open Collector).

Setpoints are entered in centimetres measured from the Empty Level.

53 Limit 2 ON Setpoint

Factory Set = 490cm(197)

This option determines the "**ON**" point for L2 Switched Output (NPN Open Collector).

Setpoints are entered in centimetres measured from the Empty Level.

54 Limit 2 OFF Setpoint

Factory Set = 500cm(193)

This option determines the "**OFF**" point for L2 Switched Output (NPN Open Collector).

Setpoints are entered in centimetres measured from the Empty Level.

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 Damping Rate (07) is appropriate for the application. Ensure that there are no obstacles in the ultrasonic signal path.
Liquid level is consistently incorrect by the same amount.	Check empty level (02) correctly entered.

Menu Option Record

SLM600 Series (2 and 3 wire)

APPLICATION

Option Details		Entered Values					
No.	**Description**	**Factory Set**	1	2	3	4	5
01	Operating Mode	1 = Level					
02	System Unit	1 = cm					
03	Display	1 = cm(inch)					
04	Empty Level	Empty Dist.					
05	Blanking Distance	30cm(12 inches)					

CURRENT OUTPUT

11	4mA Setpoint	0					
12	20mA Setpoint	600					
13	mA Fail Safe Value	3 = 22mA					
14	Fail Safe Time	300 sec					

COMPENSATION

21	Damping Rate	2 = 0.5m/min					
22	Detection Threshold	7 = 0.7V					
23	Output Power	2					
24	Sound Velocity	332					
25	Vapour Temp. Comp.	60					
26	Detection Algorithm	1					

SIMULATION

31	Display Value						
32	Limit1 Output	0					
33	Limit2 Output	0					

PASSWORD

SLM600A (3 wire)

SWITCHED OUTPUTS

Option Details		Entered Values					
No.	**Description**	**Factory Set**	1	2	3	4	5
51	Limit 1 ‘On’ Setpoint	100(39)					
52	Limit 1 ‘Off’ Setpoint	110(43)					
53	Limit 2 ‘On’ Setpoint	490(197)					
54	Limit 2 ‘Off’ Setpoint	500(193)					