Lasermeter Model SL1

Instruction Manual

SIStec

Specialised Industrial Systems

TABLE OF CONTENTS

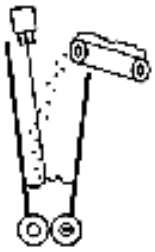
1. INTRODUCTION

What is a LASERMETER?
The LASERMETER is a laser-based distance-measuring instrument used in process control systems.

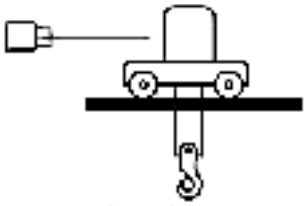
How does a LASERMETER work?
The LASERMETER measures the time it takes for a laser pulse to travel from the instrument to a target and back. The distance to the target is calculated from this time.

What can a LASERMETER do?

- **Level Control:**
  The LASERMETER can be used to measure the height of material in silos and bins.

 **Levels in bins and silos**	 **Level control in crushers**	 **Blockage detection in ore passes**	 **Proximity sensing for stackers and reclaimers**

- **Positioning:**
  The LASERMETER can be used for positioning or anti-collision of any short-range machinery.


Overhead crane positioning


Railcar positioning

Why use a LASERMETER?

- Narrow Beam
- Rapid response rate
- Measure off oblique angles
- Rugged and robust
- Easy to use
- Locally designed and manufactured

2. Model SL1

2.1 Features:

Corrosion-resistant, narrow beam, immune to cone angle, rapid response.

2.2 Ordering Information

Model P1/24Vdc/4-20mA

. 3. SPECIFICATIONS

3.1 Performance Specifications

- **MODEL SL1**

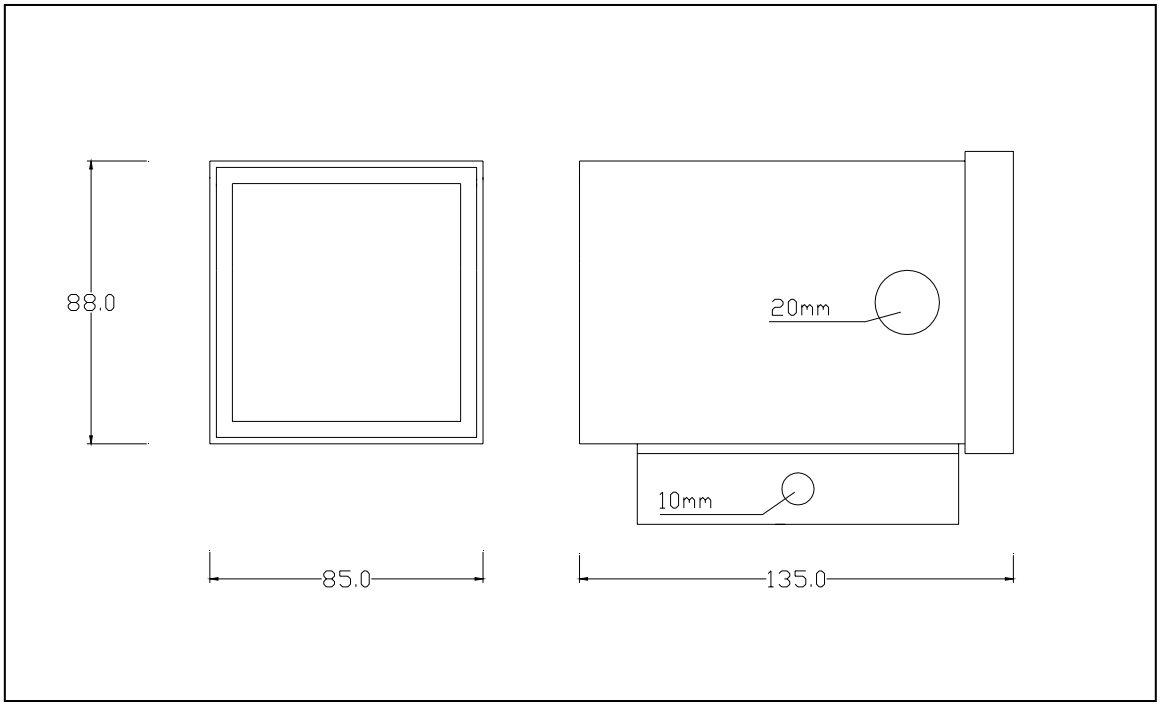
Resolution:	10mm
Update rate:	1 x per second in Normal program
	1 x per 2 seconds in Dust program
	3 x per second in Fast program

Temperature rating: 0º to + 50º C

3.2 Mechanical Specifications

- **Model SL1**
  Dimensions: 130 x 150 x 120
  Environmental: IP65
  Casing: Mild Steel powder coated

  Weight: 2.0 kg



3.3 Electrical Specifications

- **Model P1**
  Input Voltage: 24V DC (16-32V DC)

  Input Current: 300mA at 24V DC on startup
  100mA at 24V DC running normal

  Analogue Output: Non-isolated 4-20mA DC output

- **Wiring Connections:**

		-	+
+24V	-24V	4/20 mA	4/20 mA

- 24V and –4/20mA are common

NOTE: RS232 via D9 connector.

3.4 Optical Specifications

- **Model SL1**
  The SL1 uses a pulsed laser. This instrument will operate in dark and daylight conditions.

CAUTION!
DO NOT POINT THE LASERMETER DIRECTLY AT THE SUN.

Optical Aperture:	70mm
Laser Beam Diameter:	10mm
Receiver Beam Diameter:	50mm
Divergence:	<0.2 degrees
Optical Power:	15 Watts Peak
Wavelength:	905nm
Eye Safety:	Class 1 EYE SAFE (BSI BS7192: 1989 ANSI Z136.1-1986)

4. INSTALLATION

4.1 Unpacking

The product is supplied in a cardboard container with internal shock absorbing packaging. Always transport the instrument in the packaging supplied to reduce the chance of damage.

4.2 Handling

The product is designed to withstand many industrial environmental conditions. However, a few handling precautions will ensure reliable operation of the unit for extended periods of time.

- ***DO NOT DROP THE INSTRUMENT***
- Remove dirt from glass window with a clean, damp cloth only. Avoid oily rags.
- Do not install with the power on.
- Do not point the instrument at the sun.
- Store in a cool dry place.

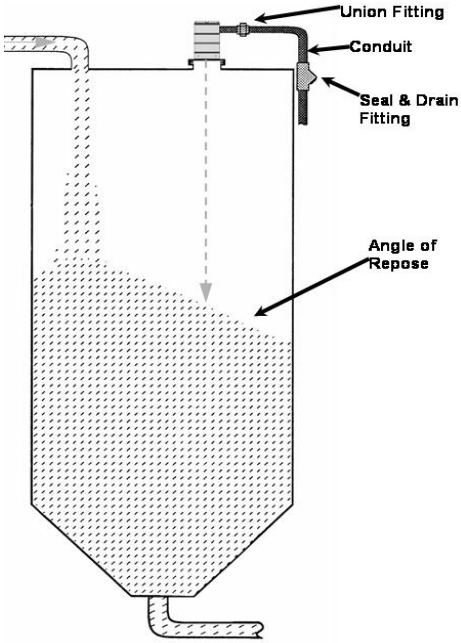
4.3 Mounting

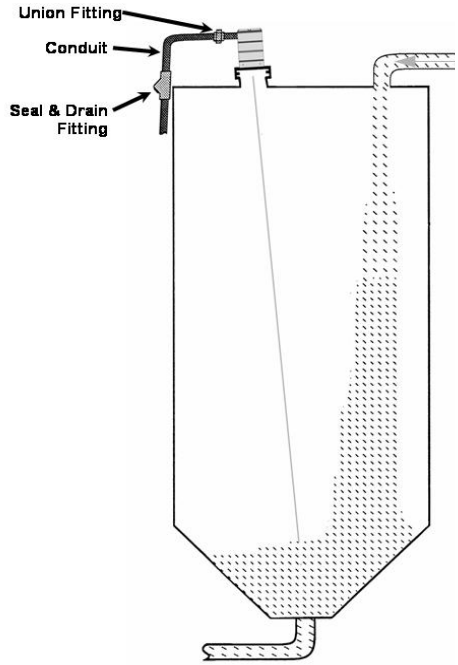
The LASERMETER produces a narrow, straight laser beam. It should be mounted facing directly towards the spot to be measured; with no obstacles directly in the beam path.

The LASERMETER has a single mounting hole on the case bottom. This allows vertical alignment.The instrument can then be mounted directly onto an L-section to providing for horizontal alignment.

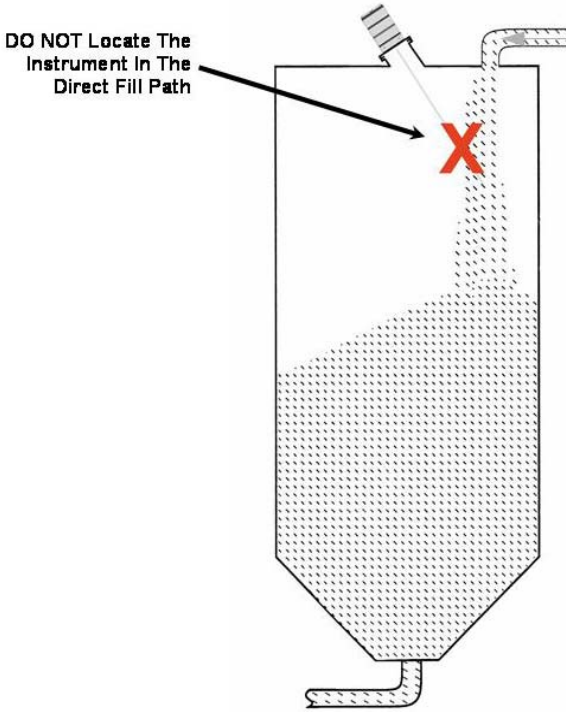
Where possible check the LASERMETER operation over the full range of distances or levels to be measured.

- **Suggested mounting arrangements - Solids**

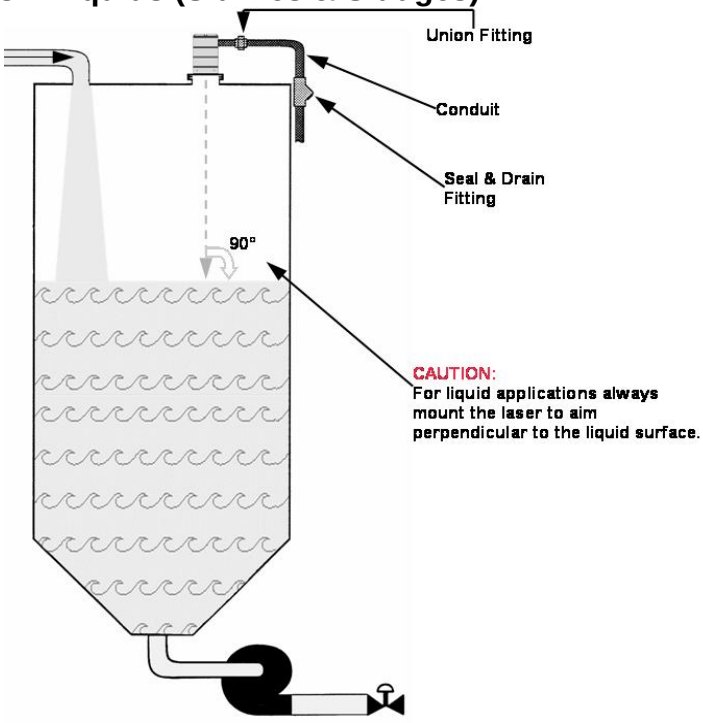




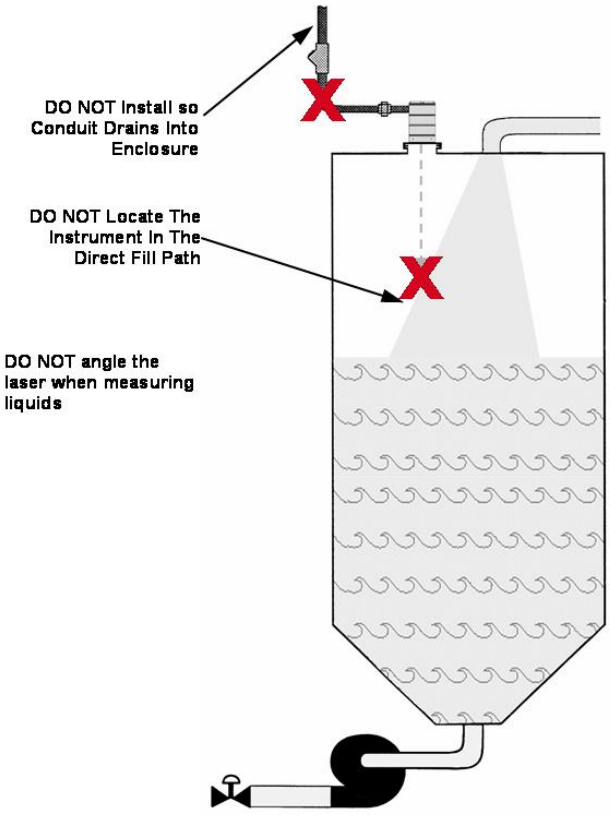
- **Mounting Arrangements <u>TO AVOID</u> - Solids**



- **Suggested mounting arrangements – Liquids (Slurries & Sludges)**



- **Mounting arrangements <u>TO AVOID</u> – Liquids**



4.4 Alignment

The LASERMETER is simple to install and align.

Because the LASERMETER has a very narrow and direct beam, there is no interference from surrounding objects. The only consideration required when aligning the instrument is a clear line of sight.

It will also measure off a very oblique surface. There is no need to align the instrument perpendicular to the material as it will not be affected by the cone up or down of the material. However for liquid applications as far as possible mount the laser perpendicular to the surface.

4.5 Connections

The external power and signal cable may be connected to the LASERMETER either before or after the instrument is mounted in position. Ensure that the power is **OFF** before connecting the cables to the Lasermeter.

It is recommended that screened cable is used to prevent any interference from stray current.

4.6 Diagnostic Checks

Once the LASERMETER has been connected, the operation and performance may be tested.

TURN THE POWER OFF!

- Connect a Palm or PC running Windows 95, 98, NT or XP to the LASERMETER (refer to the “Programming” section of this manual for details of the communication protocols)
- To the D9 connector in the terminal box.
- Turn the power ON.
- Check the 4-20mA signal with a multimeter (DC current test). The 4-20mA signal can be manually driven to confirm that the output will read over the whole range. (See “Programming, 4/20mA Settings” section of this manual)
- Confirm the LASERMETER is reading distance correctly by running the instrument while measuring a range of distances.
- Turn the power off.
- Remove the RS232 cable.
- Turn the power on. The LED will always flash when the unit is running.

If the programming of set points and operating span is required then refer to the “Programming” section of this manual.

5. PROGRAMMING

5.1 Introduction

The Model SL1 can be programmed to optimize the performance in different applications. This is done via a communication adapter box connected to a handheld programmer or PC. The 4-20mA, fill and empty rates, alarm level, anti mirror, program mode and measuring units can be programmed. The programming menus can be used to change the set points, configuration and to do checks on the instrument.
(Refer to the programmer / PC manual for setup)

5.2 Hyperterminal

Ensure that Hyperterminal is installed on the PC. Open Hyperterminal. Select **File, Properties**. Choose a comm port and click **Configure**.
The settings should be as follows.

Bits per second	**: 9600**
Data bits	**: 8**
Parity	**: None**
Stop bits	**: 2**
Flow control	**: Xon / Xoff**

Click **OK**.

Click on the title block displaying **Settings.**
Ensure that the settings are as follows.

Terminal keys and **Ctrl+H** must be selected.

Emulation	**: Auto detect**
Telnet terminal	**: ANSI**
Backscroll buffer lines	**: 500**

Click on **ASCII Setup.**
Ensure that the settings are as follows.

Send line ends with line feeds, Append line feeds to incoming line ends and **Wrap lines that exceed terminal width** must be selected.

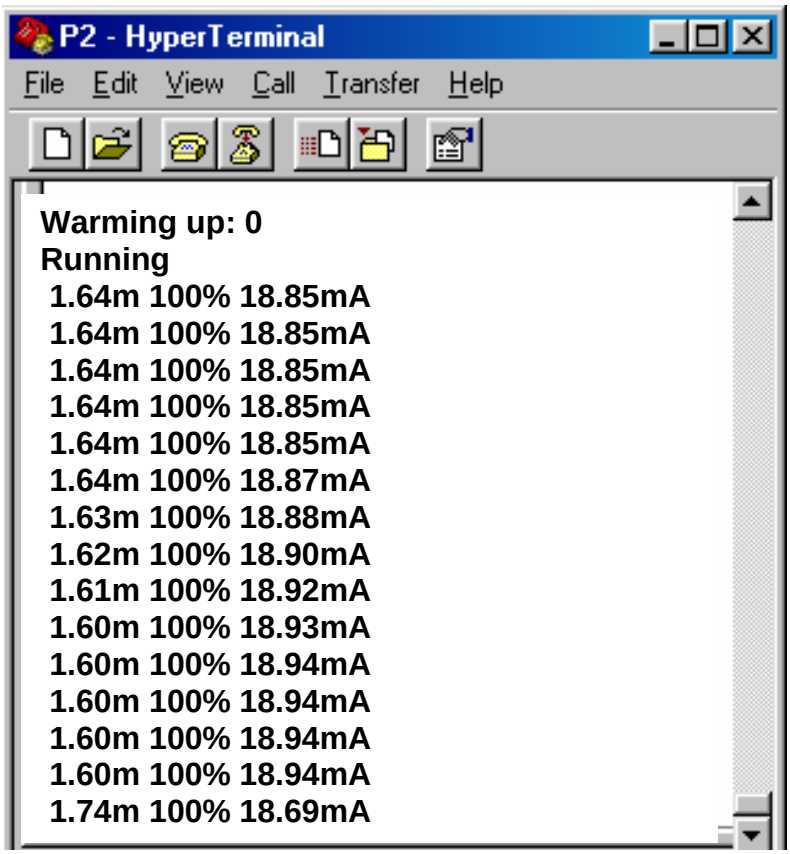
Line delay	**: 5 milliseconds**
Character delay	**: 5 milliseconds**

Click **OK** and **OK** again in the following screen.

5.3 Programming the Laser

When the LASERMETER is connected to the terminal software and the instrument is **ON,** it will be running. The distance in meters and the output in milli-Amps will update on the screen.

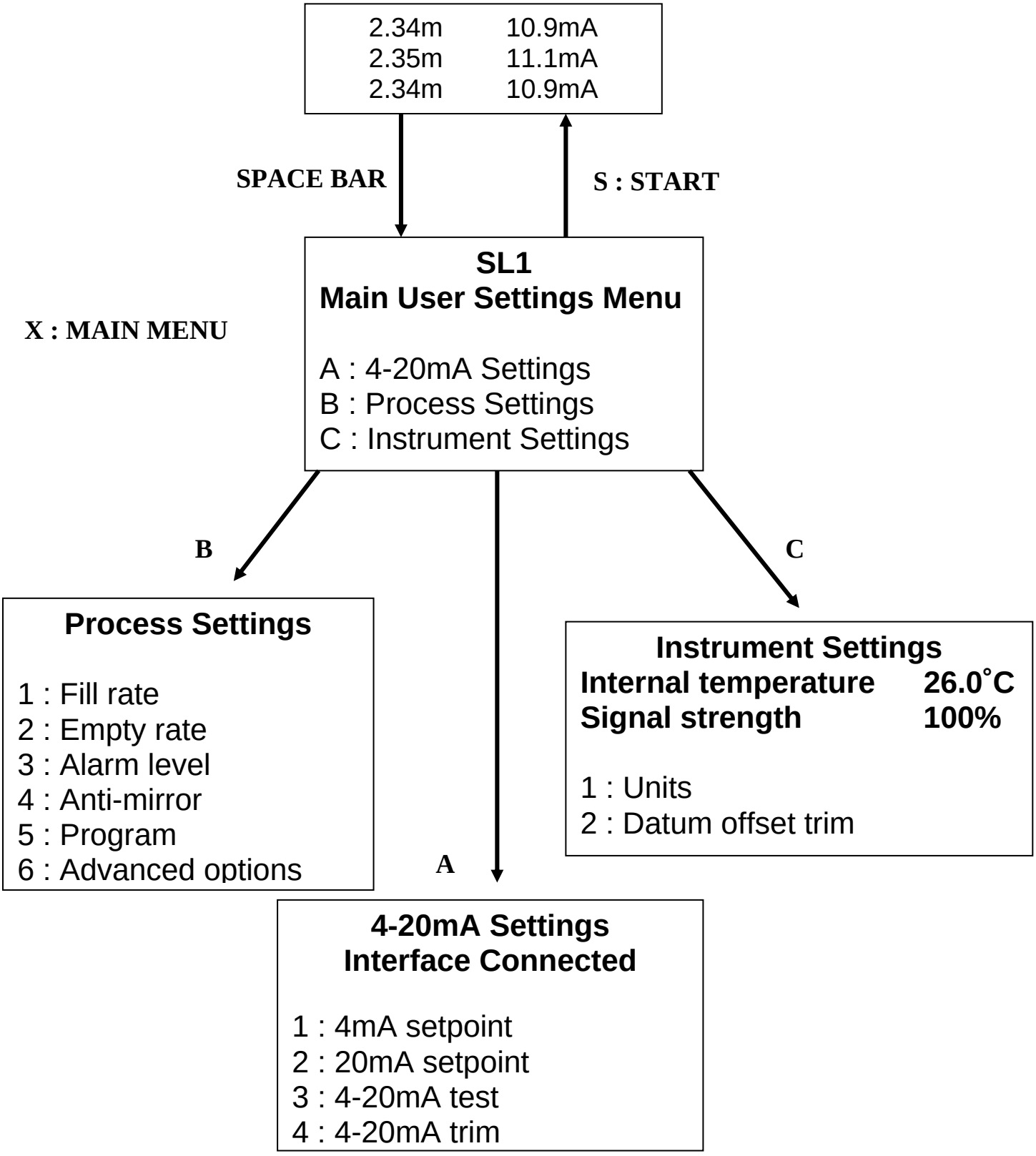
Example:



In order to stop the LASERMETER and display the main menu, press the **SPACE BAR** if using Hyperterminal or a Palm.

The options presented in the menus can be reached by pressing the corresponding key on your PC or Palm.

- **Programming menu flow chart**



I. MAIN MENU:

STARTING POINT TO ACCESS FEATURES AND OPTIMISE PERFORMANCE IN VARIOUS APPLICATIONS.

SL1
Main User Settings Menu

A : 4 – 20mA Settings
B : Process Settings
C : Instrument Settings

To restart the LASERMETER and return to normal operation, press the **S** key on the Palm or PC.

The options presented in this menu can be reached by pressing the corresponding keys, **A, B** or **C** on the Palm or PC. Either upper case or lower case characters may be used.

To return to the main menu from any one of these options press the **X** key on the Palm or PC. If any additional help is required press the **H** [help] key on the Palm or PC.

II. A = 4-20mA SETTINGS:

ALLOWS FOR ADJUSTMENT ON 4-20mA SETTINGS AND ALSO ALLOWS FOR TRIMMING AND TESTING OF THE 4-20mA OUTPUT.

4-20mA Settings
Interface Connected

1 : 4mA setpoint = 10.00m
2 : 20mA setpoint = 1.00m
3 : 4-20mA test = 12.00mA
4 : 4-20mA trim

To display the 4-20mA Settings menu press the **A** key when in the main menu. To return to the main menu press **X.** For additional help press the **H** [help] key.

1 : 4mA setting

The 4mA set point is 0.40m

This option allows for the 4mA set-point to be changed to either polarity with the 4mA representing vessel full or vessel empty. Enter a value and press the **ENTER** key.
For additional help press the **H** [help] key.

2 : 20mA setting

The 20mA set point is 5.00m

This option allows for the 20mA set-point to be changed to either polarity with the 20mA representing vessel full or vessel empty. Enter a value and press the **ENTER** key.
For additional help press the **H** [help] key.

3 : 4-20mA test

This option allows the user to manually drive the output current to 4, 12 and 20mA. This is a toggle option. By selecting the option number the output is changed.

3 : 4-20mA test = 20.00mA

When the option number is pressed the following display will appear.

Changing mA Output 4.00mA => 12.00mA Please wait . . . .

For additional help press the **H** [help] key in the 4 – 20mA Settings main menu.

4 : 4-20mA trim

```
Interface is connected.

Read values off
multimeter.

    4mA trim
Enter a new value:

    20mA trim
Enter a new value:
```

This option allows for adjustment to the end points of the current output loop to match the indicated display value on the user's meter or PLC. To restore the default setting, press the **D** key. For additional help press the **H** [help] key.

III. B = PROCESS SETTINGS:

THIS MENU OFFERS SETTINGS THAT RELATE TO THE WAY THAT MATERIAL IS LOADED INTO AND REMOVED FROM THE VESSEL. IT INCLUDES PROCESS RATE SETTINGS AS WELL AS A LIMIT TO WARN OF OVER-FILLING.

To display the Process Settings Menu press the **B** key while in the main menu screen. To return to the main menu press **X.** For additional help press the **H** [help] key.

Palm: Choices requiring a letter or number can be made by using graffiti characters or the ABC and 123 keyboards.

Process Settings

```
1 : Fill rate      = 60.00m/min
2 : Empty rate     = 30.00m/min
3 : Alarm level    =   1.00m
4 : Anti-mirror    =   OFF
5 : Program        = Normal
6 : Advanced options
```

To change a value, select the option (i.e. 1 for Fill rate) then change the value by typing in the distance required with the numerical keyboard.

1 : Fill Rate

The fill rate is the expected speed at which material can fill a vessel and is a value entered in meters per minute.

Fill rate is 50.00m/min

To change this value enter a value and press the **ENTER** key or press the **O** [off] key to disable this function. For additional help press the **H** [help] key.

NOTE: An additional safety margin of 50% to 300% should be added to the actual fill rate.

2 : Empty Rate

The empty rate is the expected speed at which material can empty a vessel and is a value entered in meters per minute.

Empty rate is 40.00m/min

To change this value enter a value and press the **ENTER** key or press the **O** [off] key to disable this function. For additional help press the **H** [help] key.

NOTE: An additional safety margin of 50% to 300% should be added to the actual empty rate.

3 : Alarm Level

This setting is used as a warning of overfilling as well as the end default level in the event of a loss of signal or instrument failure.

Alarm level at 1.00m

To change this value enter a value and press the **ENTER** key or press the **O** [off] key to disable this function. For additional help press the **H** [help] key.

4: Anti-Mirror

This setting is used to prevent a possible lost signal off reflective materials or an empty stainless steel vessel.

Anti-mirror mode at 9.00m

To change this value enter a value and press the **ENTER** key or press the **O** [off] key to disable this function. For additional help press the **H** [help] key.

5 : Program
This option allows for the selection of a program for a specific application.
This is a toggle option. By selecting the option number the program is changed to **Normal, Dust** or **Fast.**

5 : Program = Normal

When the option number is pressed the following display will appear.

Changing Program normal => dust Please wait . . . .

Normal Program : 1 x per 1 second update rate.
Dust Program : 1 x per 2 seconds update rate.
Fast Program : 3 x per 1 second update rate.

For additional help press the **H** [help] key in the Process Settings main menu.

6 : Advanced
This option allows for advanced adjustment of selected programs. This option should only be used by persons that fully understand all the sub-menus.

Dust Program Options
1:Update rate = 2sec 2:Buffer = 3 3:Keep option = Auto 4:Keep number = 3 5:Integration = 1 6:Power level = Auto

For additional help press the **H** [help] key.

1 : Update Rate

This option allows for the adjustment of the update rate and can be set between 1 and 250 seconds, depending on the selected program.

1 : Update rate = 1sec

To change the value enter the value and press the **ENTER** key. To restore the default setting press the **D** key. For additional help press the **H** [help] key.

2 : Buffer

Sets the number of readings in the answer Buffer and can be set between 1 and 30. The new reading is added into the buffer while the oldest reading in the buffer is discarded. A Buffer of 1 produces an immediate output with no averaging.

For an erratic surface or slower, more stable response, use a high buffer.

Below are two examples of how the buffer setting affects the output:

Example 1:

Buffer = 1 (each reading produces an immediate output)

Distance = 560 cm	Output = 560 cm
Distance = 570 cm	Output = 570 cm
Distance = 580 cm	Output = 580 cm
Distance = 570 cm	Output = 570 cm
Distance = 560 cm	Output = 560 cm

Example 2:

Buffer = 3 (each distance is averaged with the previous 2 distances)
(When Keep number = Buffer)

Distance = 560 cm	Output = 560 cm
Distance = 570 cm	Output = 563 cm
Distance = 580 cm	Output = 570 cm
Distance = 570 cm	Output = 573 cm
Distance = 560 cm	Output = 570 cm

To change the value enter the value and press the **ENTER** key. To restore the default setting press the **D** key. For additional help press the **H** [help] key.

3 : Keep Option

This option allows the unit to keep **Longest, Shortest** or **Best** readings.
This is a toggle option. By selecting the option number the Keep option is changed.

Longest **:** The unit keeps only the longest readings.
Shortest **:** The unit keeps only the shortest readings.
Best **:** The unit keeps only the best averaged readings.

3 : Keep option = Best

When the option number is pressed the following display will appear.

Changing Keep Option best => shortest   Please wait . . . .

For additional help press the **H** [help] key in the Advanced Settings main menu.

4 : Keep Number

The keep number can be set between 1 and 30. If the buffer is set on 8 and the keep number is set on 3, the 3 optimum readings within the rolling average of 8 will be kept.

Example 1:

Buffer = 3	Keep = 1	(The optimum reading is kept)
Distance = 560 cm		Output = 560 cm
Distance = 560 cm		Output = 560 cm
Distance = 120 cm		Output = 560 cm

To change the value enter the value and press the **ENTER** key. To restore the default setting press the **D** key. For additional help press the **H** [help] key.

5 : Integration

This option allows the unit to do more or less integrations per reading. This allows for increase in accuracy while speed is decreased, or for decrease in accuracy while speed is increased.

5 : Integration = 9

To change the value enter a value between 1 and 9 and press the **ENTER** key. To restore the default setting press the **D** key. For additional help press the **H** [help] key.

6 : Power Level

This option allows for the adjustment of the laser power level in intervals of 25%. The power level can be set to 25, 50, 75 or 100%. This is a toggle option. By selecting the option number the power level is changed.

6 : Power level = 100%

When the option number is pressed, the following display will appear.

Changing Power Level 100% => 75% Please wait . . . .

For additional help press the **H** [help] key in the Advanced Settings main menu.

IV. C = INSTRUMENT SETTINGS:

THIS MENU DISPLAYS OR MODIFIES INFORMATION SUCH AS UNITS AND MEASURING DATUM POINT.

To display the Instrument Settings Menu, press the **C** key in main menu. To return to the main menu press **X**. For additional help press the **H** [help] key.

Instrument Settings	
Internal temperature	**26.0˚C**
Signal strength	**100%**
1 : Units	= meters
2 : Datum offset trim	= +0.00m

This menu also shows the internal temperature of the unit and the signal strength of the last distance measured.

1 : Units

This option allows for the selection of measuring units in either Feet or Meters. This is a toggle option. By selecting the option number the units are changed.

1 : Units = meters

When the option number is pressed the following display will appear.

Changing Units meters => feet Please wait . . . .

For additional help press the **H** [help] key in the Instrument Settings main menu.

2 : Datum Offset Trim

Present offset = 0.00m

This option allows the instrument datum to be adjusted by up to +1m or –1m. To change the value enter the value that you want the instrument to read shorter or longer and press the **ENTER** key. To restore the default setting press the **D** key. For additional help press the **H** [help] key.

7. TROUBLE SHOOTING

SYMPTOM	FAULT	CORRECTION
Unit Dead	Not correctly connected	• Check connections • 24V DC +- 10% - check power input • Check polarity. • Check 4-20mA connection is dedicated to the laser instrument and no other instrument
Incorrect 4-20 mA DC output: **Correct reading on serial port**	***HINT:*** *check the distance readout using the RS232 serial output into a PC or Palm* Incorrect scaling of PLC or Instrument	• Check that the 4 and 20mA DC scales are the same on the instrument and the PLC
	Electric interference from closely laid power supply cables	• Re-route the cable or screen the cable
	Incorrect connection to PLC through isolator	• Check circuit diagram on the isolator
Incorrect reading on serial port	Dirt or obstruction on the glass window	• Check that the glass window is clean
	Dust or obstruction in application	• Check the application: can you see surface? • Check for correct settings for dusty environment
	Laser might not be aiming at target	• Check that laser is aiming at the target all the way.
Unit is erratic	Unit might not be aiming at target	• Check the instrument is aiming at the target.
	Electric interference from closely laid power supply cables	• Re-rout the cable or screen the cable
	Dust or obstruction in application	• Check the application: can you see surface? • Check for correct settings for dusty environment.
	Incorrectly programmed	• Check that the program is set up as smooth as possible.