V 3.1

USM FLOW METER

INSTRUCTION MANUAL

1 Lon Cae Darbi
Cibyn Industrial Estate
Llanberis Rd, Caernarfon
Gwynedd, LL55 2BD

Tel : +44 (0)1422 363462
E :Enquiries@smartstormgroup.com
Web : www.smartstormgroup.com

1. Contents

2. SPECIFICATIONS 6
3. GENERAL INFORMATION. 7
3.1. Safety information. 7
3.2. Use of hazard information. 8
3.3. Precautionary labels. 8
3.4. Wiring and Handling Precautions. 9
4. GETTING STARTED. 10
4.1. USM Connections. 10
4.2. Power Up. 12
5. USM Display Screens. 13
5.1. Home Screen. 14
5.2. Measurement Screens 15
5.3. 4-20mA Screen 16
5.4. Relay Screens 17
5.4.1. Flow, Distance and Level. 17
5.4.2. Sampler Relay. 18
5.4.3. Daily Totaliser. 19
5.4.4. Lost Comms. 19
5.5. Device Parameters 20
5.6. Sensor Set Up 20
5.7. Calc Parameters 21
5.8. Comms Set Up. 22
5.9. Report Screens 23
5.10. Trend Graph 23
5.11. Totaliser Screen. 24
5.12. Additional Screens. 24
5.12.1. GPRS Comms and SMS Texts 24
5.12.2. About USM 24
5.12.3. Smart Storm Logo 24
6. Configuring the USM. 25
7. Configuring the FLOW Parameters. 28
7.1. Device Set Up. 28

7.1.1. V-Notch Weir....29
7.1.2. Max Flow Height. 29
7.1.3. Rectangular Weirs and Flumes. 30
7.1.4. Parshall Flume and Palmer Bowlus. 31
7.1.5. HS/H/HL Flumes. 32
7.1.6. Log Equation 33
7.1.7. Flow Table. 37
7.1.8. Flow Equation. 38
7.1.9. Manning Formula. 41
7.2. No Flow Distance. 44
7.3. System Units. 45
7.4. Chart Scale. 46
7.5. Exit/Save. 46
8. Configuring the Display Set Up. 47
9. Configuring the Logger. 49
9.1. Log Interval....49
9.2. Date Format. 49
9.3. Date and Time Set Up. 50
9.4. Connect to USB. 50
9.5. Exit/Save. 50
10. Configuring the Sensor. 51
11. Configuring The Relays. 52
11.1. Relay Mode 53
11.1.1. DISTANCE RELAY 53
11.1.2. LEVEL RELAY 53
11.1.3. FLOW RELAY 53
11.1.4. SAMPLER RELAY 54
11.1.5. DAILY TOTAL RELAY....55
11.1.6. LOST COMMS RELAY 55
11.2. Trigger Type. 56
11.2.1. Single Point Trigger. 56
11.2.2. Range Trigger. 57
11.3. Exit/Save. 59
12. Configuring the 4-20mA Set Up. 60

12.1. Status. 60
12.2. Mode. 60
12.3. Current Set Points. 60
12.4. Save/Exit. 61
13. Configuring the Comms Parameters. 62
13.1. BMS Set Up 62
13.1.1. Status. 63
13.1.2. Baud. 63
13.1.3. Config. 63
13.1.4. Mode. 64
13.1.5. Address. 64
13.1.6. Save/Exit. 65
13.2. GPRS Set Up and Test 65
13.3. Robustel Configuration. 66
14. Relay Test. 66
15. 4-20mA Test. 67
16. Simulation Test 68
16.1. Sweep Mode. 68
16.2. Fixed Mode. 68
16.3. Entering and Exiting Test Mode 69
17. Change Password. 69
18. Echo Profile. 70
18.1. Select the Scale. 70
18.2. Select the Blanking. 71
19. Sleep Timer. 72
20. Engineering Menu. 72
21. Configuration File. 72
22. ModBus Communications. 73
22.1. ModBus RTU. 73
22.1.1. Relay Status. 74
22.1.2. Status. 74
22.2. ASCII Modbus. 75
22.3. Terminal ASCII 76
23. Log Files. 77

23.1. Data Folder. 78
23.1.1. Inquisitor File 79
23.1.2. CSV File 81
23.2. SET UP Folder. 81
23.2.1. Log Folders. 82
23.2.2. Configurations Files. 83
24. Remote Monitoring. 84
25. Fault Finding 85
26. Appendix 86
26.1. Sensor Mounting 86
26.2. Unit Conversion 88

2. SPECIFICATIONS

Specifications	Universal Smart Meter – Level Meter
Input	DIGISENS UltraSonic Sensor
Temperature Range	-5 - 50 °C
Display	Graphic LCD 124x64 dots Negative Blue
Relays	3 SPDT, 5A
Current Output	4 – 20 mA galvanic isolated
Mains Supply	100 – 240 VAC 50/60Hz. Switched-mode power supply
Power Consumption	5VA
Weight	450 grams, Wall Mount Version
Enclosure Dimensions	160 mm x 130 mm x 60 mm
Mounting Dimensions (including cable glands, etc.)	185 mm x 155 mm x 60 mm

Table 2.1 Device Specifications

3. GENERAL INFORMATION.

The information contained in this manual has been carefully checked and is believed to be accurate. However, Smart Storm assumes no responsibility for any inaccuracies that may be contained in this manual. In no event will Smart Storm be liable for direct, indirect, special, incidental, or consequential damages resulting from any defect or omission in this manual, even if advised of the possibility of such damages. In the interest of continued product development, Smart Storm reserves the right to make improvements in this manual and the products it describes at any time, without notice or obligation. Revised editions may be found on Smart Storm's website www.smartstormgroup.com.

3.1. Safety information.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger, warning and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment. Make sure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

DANGER

Smart Storm products are designed for outdoor use and are provided with a high level of ingress protection against liquids and dust (see specification for rating). If these products are connected to a mains electricity socket by means of a cable and plug rather than by fixed wiring, the level of ingress protection of the plug and socket connection against liquids and dust is considerably lower. It is the responsibility of the operator to protect the plug and socket connection in such a manner that the connection has an adequate level of ingress protection against liquids and dust and complies with the local safety regulations. When the instrument is used outdoors, it should be connected only to a suitable socket with at least IP44 rating (protection against water sprayed from all directions).

3.2. Use of hazard information.

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.
WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.
NOTICE
Indicates a situation that, if not avoided, could result in damage to the instrument. It also indicates information that requires special notice.

3.3. Precautionary labels.

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not fully observed.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.

3.4. Wiring and Handling Precautions.

⚠ DANGER

Electrocution Hazard. Always disconnect mains supply before removing covers and connecting any external wiring.
Only qualified Electricians should install this product. IET BS7671:2008 wiring regulations must be adhered to when installing the product.

NOTICE

Delicate internal electronic components can be damaged by static electricity, resulting in indeterminate instrument performance or eventual failure. Smart Storm recommends taking the following steps to prevent ESD damage to your instrument:

- Before touching any instrument electronic components (such as printed circuit cards and the components on them) discharge static electricity from your body. The user can accomplish this by touching an **earth - grounded** metal surface for 3 seconds such as the chassis of an instrument, or a metal conduit or pipe.
- To reduce static build-up, avoid excessive movement. Transport static-sensitive components in anti-static containers or packaging.
- To discharge static electricity from your body and keep it discharged, wear a wrist strap connected by a wire to earth ground, especially when handling circuit boards.
- Handle all static - sensitive components in a static - safe area. If possible, use anti-static floor pads and work bench pads.

⚠ DANGER

Electrocution hazard. Always install a ground fault interrupt circuit (GFIC)/ residual current circuit breaker (RCCB) with a maximum trigger current of 30 mA. If installed outside, provide overvoltage protection through a MCB rated not greater than 5 Amps.

⚠ DANGER

With fixed wiring, a disconnecting device (local interruption) must be integrated into the power supply line. The disconnecting device must meet BS7671:2008 standards and regulations. It must be installed near the device, be able to be reached easily by the operator and labelled as a disconnecting device.
If the connection is established using a mains connection cable that is permanently connected to the power supply, the plug of the mains connection cable can serve as local interruption.

⚠ DANGER

Ensure the relays are not subjected to loads great than 5 Amps as this will cause internal damage and possible product destruction.

4. GETTING STARTED.

The instrument is configured to measure Flow using a DIGISENS Sensor. The DIGISENS sensor is an intelligent sensor which measures time of flight of an ultrasonic echo and communicates to the USM using RS422.

The USM can interface with other instruments (e.g. Data Logger) through a galvanic isolated 4-20mA output.

Three configurable relays are provided for control, alarm and monitoring.

4.1. USM Connections.

The connection terminals are accessible by lifting the side flaps on the USM and removing the four screws. All connections should be made through appropriate cable glands to maintain the IP rating of the unit.

The unit is factory built to either 100 – 240 Vac input or 12/24Vdc input.

The DIGISENS Sensor is supplied with clearly paired wires and should be connected as follows.

Green	TX+
Black (with green)	TX-

White	RX+
Black (with white)	RX-

Red	15V
Black (with red)	GND

Some DIGISENS Sensors are supplied with an additional pair of wires which should be connected as follows:

Blue	15V
Black (with blue)	GND

Relays can be connected as COM & NO (connection made when relay ON) or COM & NC (connection made when relay OFF).

.

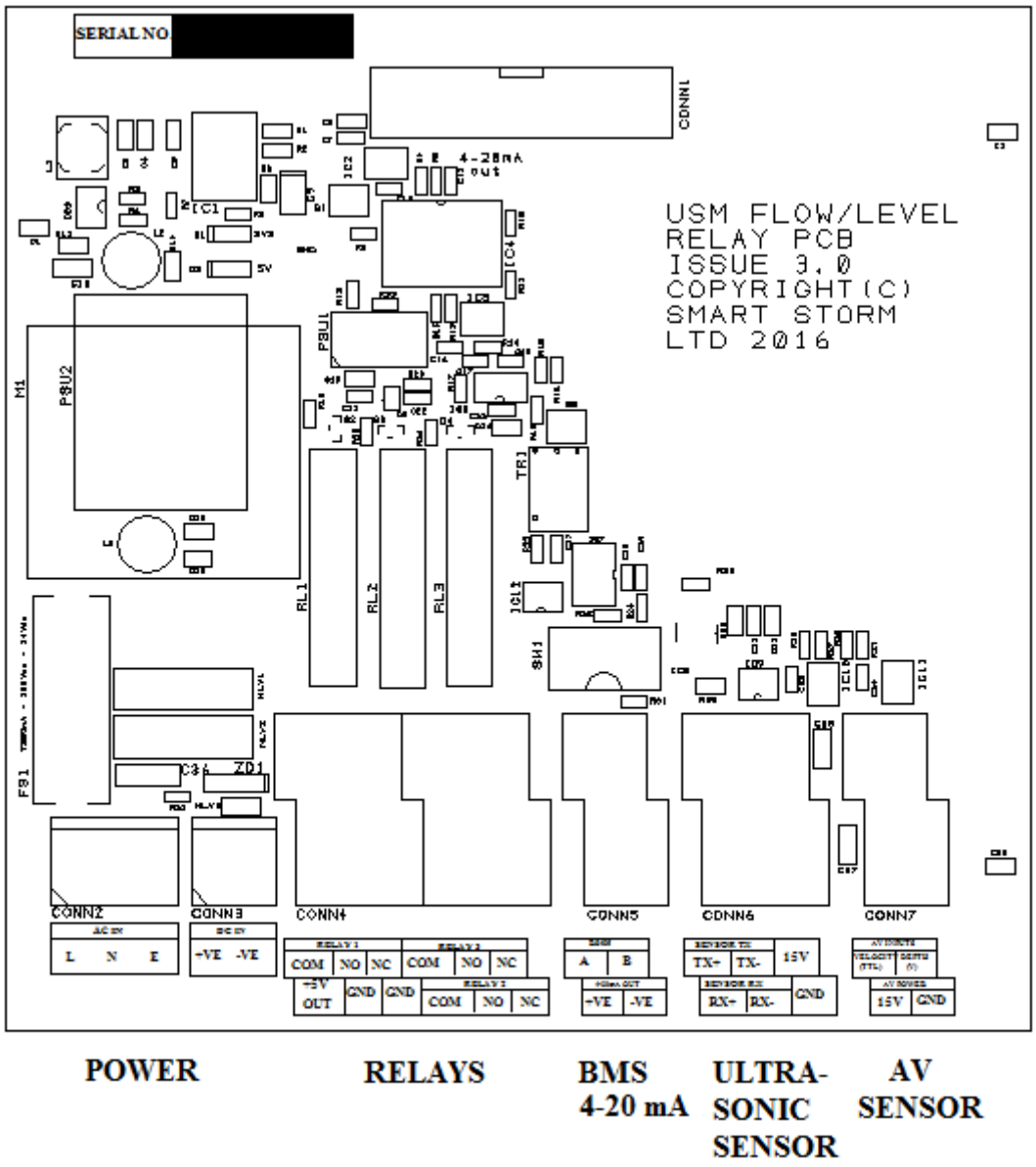


Figure 4.1 RELAY BOARD CONNECTIONS.

4.2. Power Up.

When the unit is turned on a splash screen (Figure 3.2) will be shown detailing the contact details of Smart Storm.

Figure 4.2 Smart Storm Screen

This will be followed automatically by the Home Screen (Figure 4.3).

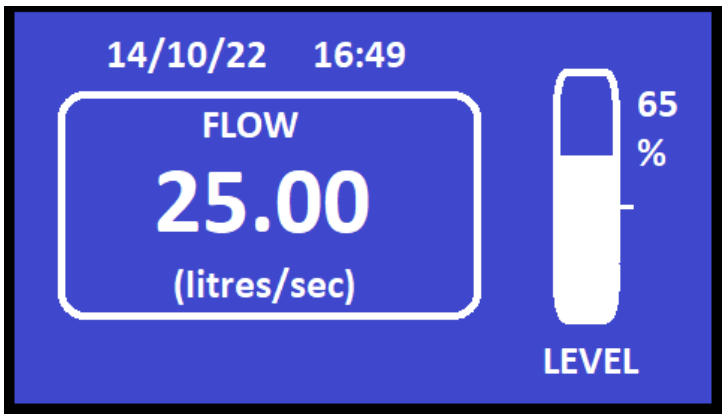


Figure 4.3 Home Screen

The Home Screen shows the selected Main Display Parameter (in the selected units) with a bar graph and percentage indicating either the Level or Distance. When the USM is first turned on the display will be inaccurate as flow device parameters will not have been set. Further display options are outlined in Section 5. The red LED at the side of the display will flash at a rate of 2Hz. This indicates data is being received from the Ultrasonic Sensor Head.

Pressing the Home Button  will return the Display to the Home Screen from all other display screens.

5. USM Display Screens.

Display Screens on the USM enable information to be viewed without accessing the configuration Menu.

Screens are accessed using the ⬆ and ⬇ buttons. The 🏠 Button returns the display to the Home Screen from any other screen.

The following available:

HOME ⬇

MEASUREMENT SCREEN 1	SMS COMMS
MEASUREMENT SCREEN 2	ABOUT USM
4-20mA SCREEN	SMART STORM LOGO
RELAY SCREEN 1	REPORT -3 DAYS
RELAY SCREEN 2	REPORT -2 DAY
DEVICE PARAMETER	REPORT -1 DAY
SENSOR SET UP	REPORT TODAY
CALC PARAMETERS	TREND GRAPH
COMMS SET UP	TOTALISER
GPRS COMMS	HOME ⬆

Table 5.1 Display Screens

5.1. Home Screen.

Figure 5.1 Home Screen

The Home Screen shows the current Flow alongside a configurable Bar Graph. The units of flow are selectable in the Flow Set Up Menu and the Bar Graph measurement in the Display Set Up Menu.

An optional Date and Time can be displayed and is selectable from Logger Set Up Menu.

The Ultrasonic Sensor has a maximum range over which it checks for return Echoes. If no Echo is detected for 5 consecutive transmissions (5 seconds) the screen will alternate between LOST and ECHO – this indicates that the USM is still receiving data from the sensor, but the sensor is not seeing a Return Echo.

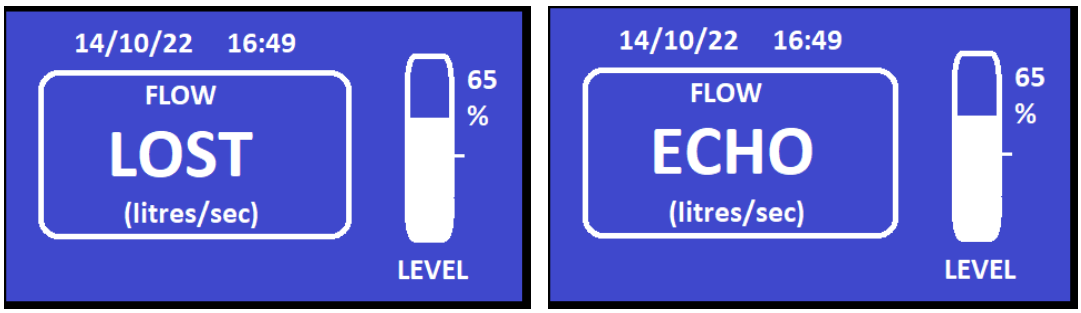


Figure 5.2 LOST ECHO indication.

If the USM receives no data from the sensor for 10 seconds, the display will alternate between LOST and COMMS.

5.2. Measurement Screens

There are two Measurement Screens which can be configured to show any two measurements in the Display Set Up Menu.

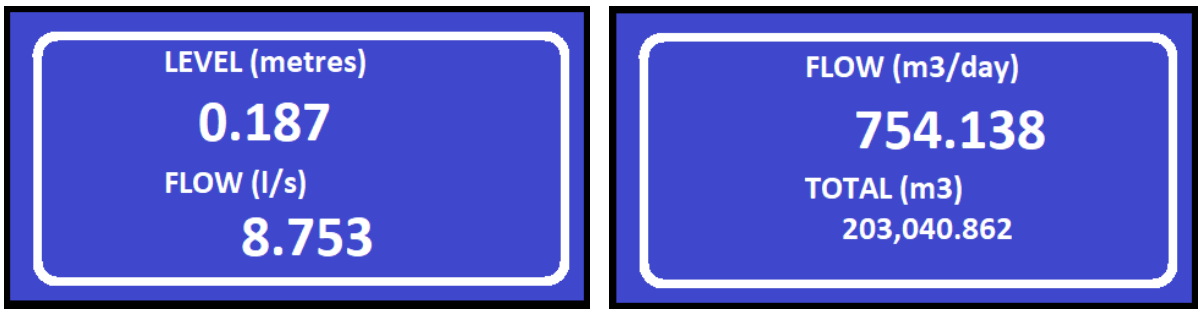


Figure 5.3 Measurement Page Example.

This allows the customer to display the measurements must suitable or comply with any industry requirements.

Under Fault conditions LOST ECHO or LOST COMMS will be displayed

Figure 5.4 Measurement Page with Fault.

5.3. 4-20mA Screen

The USM 4-20mA screen shows the Set Up of the 4-20mA along with the current value (CUR) of the selected measurement and the mA output for the value of that measurement.

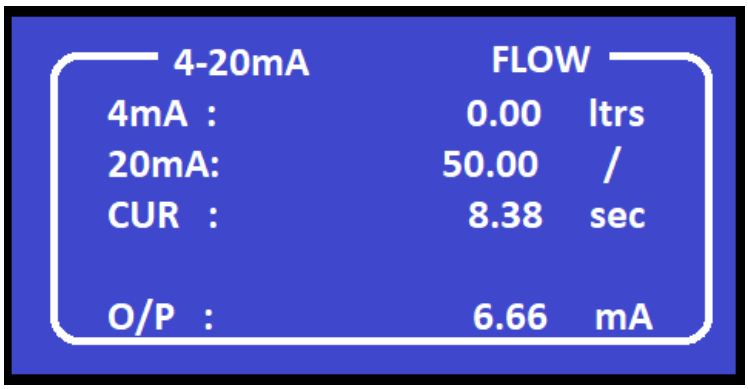


Figure 5.5 4-20mA Screen.

If the 4-20mA Channel is Disabled, the measurement (FLOW in Fig 21.5) will show DISABLED and the screen will be blank.

If there is a lost echo or lost comms an error measure will replace the CUR value will be replaced by LOST ECHO and the output will go to 0mA.

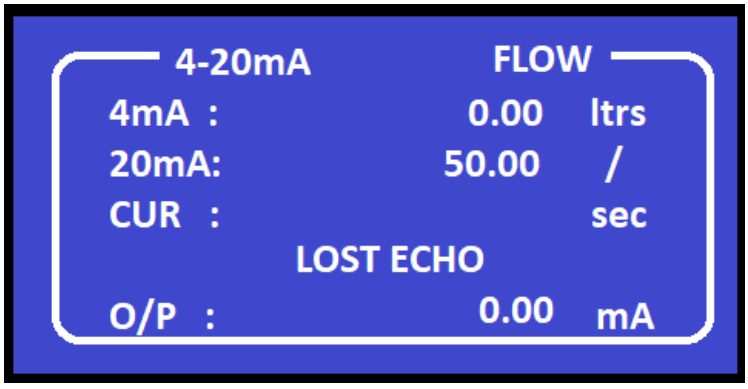
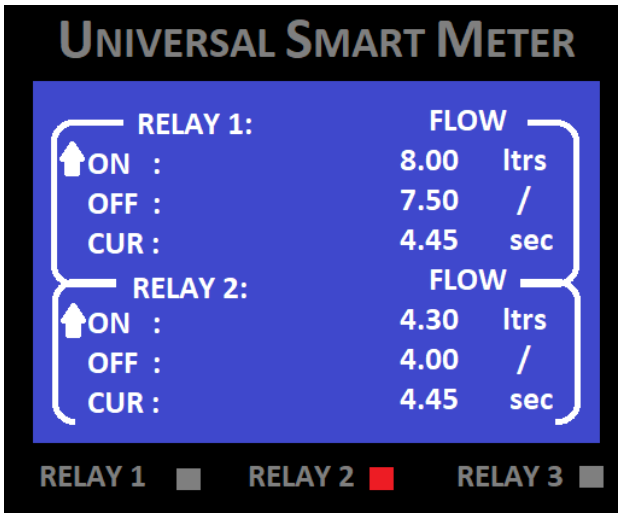


Figure 5.6 4-20mA Screen with Lost Echo/Comms.

5.4. Relay Screens

5.4.1. Flow, Distance and Level.

Relay Screen 1 shows the settings for Relay 1 and Relay 2. Both Relays are set to Flow and have the ON value above the OFF value. The Relays will turn ON when the Flow is above the ON value and this is indicated by the UP arrow alongside the ON value.

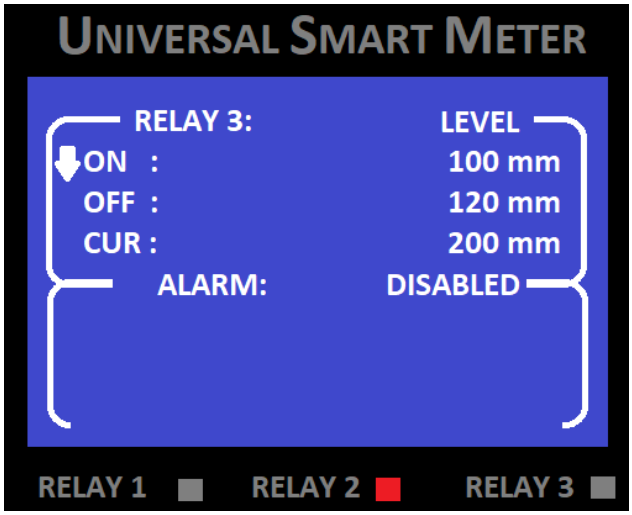


The ON Value of Relay 1 is higher than the current Flow, Relay 1 is therefore OFF. The Relay will turn ON when the Flow is above 8.00 l/s.

The ON Value of Relay 2 is higher than the current Flow, Relay 2 is therefore ON. The Relay will turn OFF when the Flow is below 4.00 l/s.

Figure 5.7 Relay Screen 1.

Relay Screen 2 shows the settings for Relay 3 and the Alarm Relay. Relay 3 is set to Level and the ON value is below the OFF value. The Relay will Turn ON when the Level is below the ON value and this is indicated by the DOWN arrow alongside the ON value.



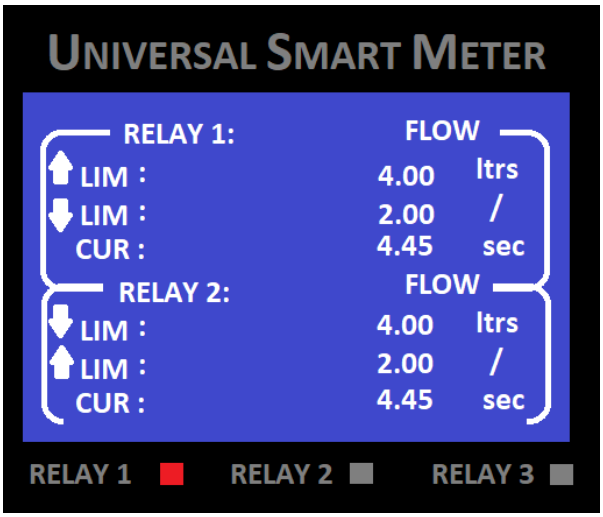
The current Flow is higher than the ON Value of Relay 3, Relay 3 is therefore OFF. The Relay will turn ON when the Level is below 100 mm.

The ALARM is Disabled. This is used to send an SMS from a GPRS unit.

Smart Storm recommends the use of a Robustel GPRS system which supersedes this function. It is still available in consultation with Smart Storm.

Figure 5.8 Relay Screen 2.

The Relays can be configured to operate inside or outside a Range. The figure below shows Relay 1 configured as a Not In Range Relay and Relay2 as an In Range Relay as indicated by the UP and Down Arrows.



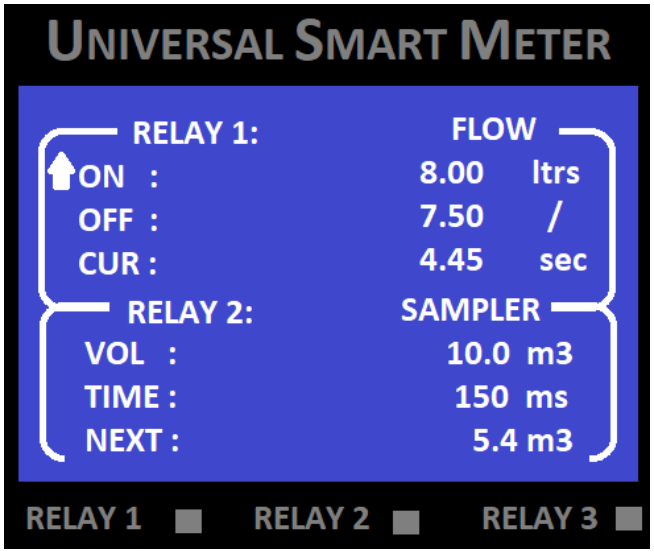
The current Flow is outside the Range 2.00- 4.00 l/s, so Relay 1 is ON.

The current Flow is not inside the Range 2.00- 4.00 l/s, so Relay 2 is OFF.

Figure 5.9 Relays Set to Range.

5.4.2. Sampler Relay.

The Relay can be configured to drive the input of a Composite Sampler.



The Volume Shows the amount of flow required to trigger the Relay and the Time shows the duration for which the relay will remain closed.

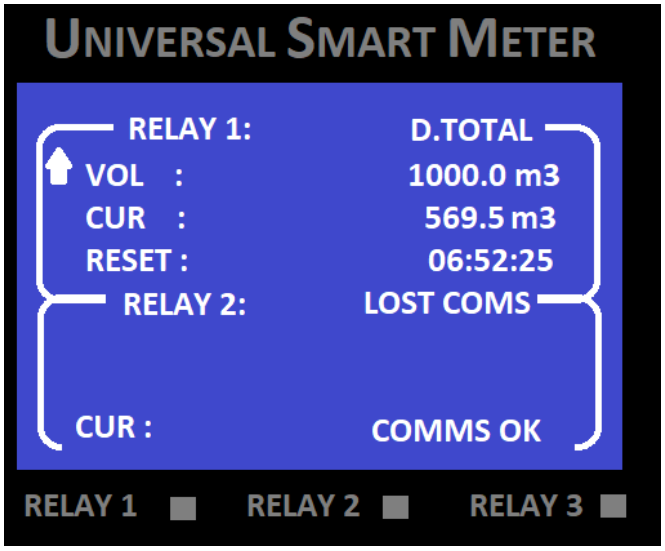
After the Relay has been triggered the Volume resets and a further 10m³ will be required for the next trigger.

Next shows the volume remaining until the next trigger

Figure 5.10 Sampler Relay.

5.4.3. Daily Totaliser.

The Relay can be configured to trigger when the Daily Totaliser passes a specified Volume.



In the figure opposite the Volume has been set to 1000m³. The Daily Total is shown next to CUR, and when this value exceeds the set Volume the Relay will trigger and remain ON until midnight when the Daily Total is reset to zero.

The time until midnight is shown next to RESET in HH:MM:SS format.

The LED will turn on for 1 sec when the Relay is triggered.

Figure 5.11 Daily Totaliser Relay.

5.4.4. Lost Comms.

The Relay can be configured to turn ON when either Lost Comms (no communication between the USM and the Ultrasonic Sensor) or Lost Echo (the Ultrasonic Sensor does not detect a return Echo).

Both Conditions are shown below.

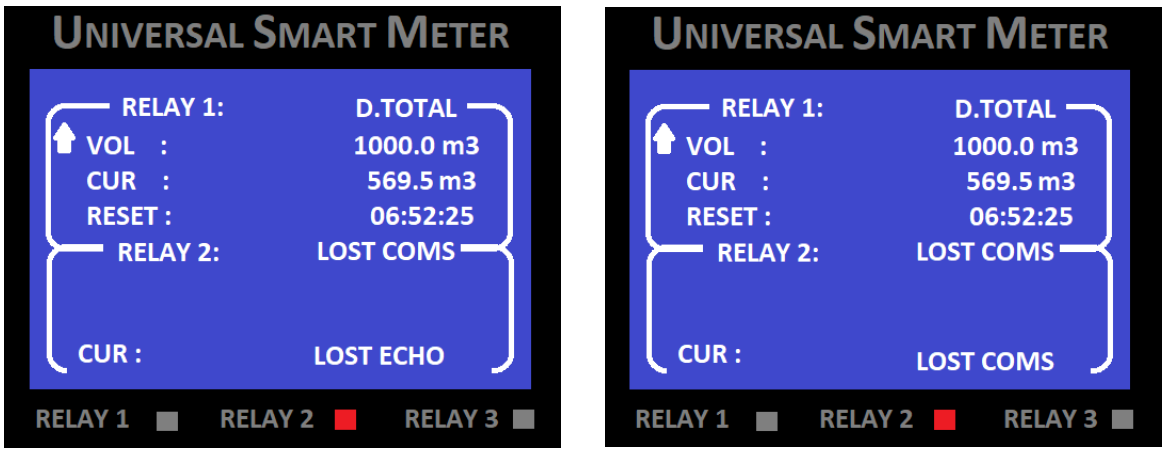


Figure 5.12 Lost Comms Relay.

5.5. Device Parameters

The Device Parameter Screen shows the details of the Weir or Flume being used to measure the Flow.

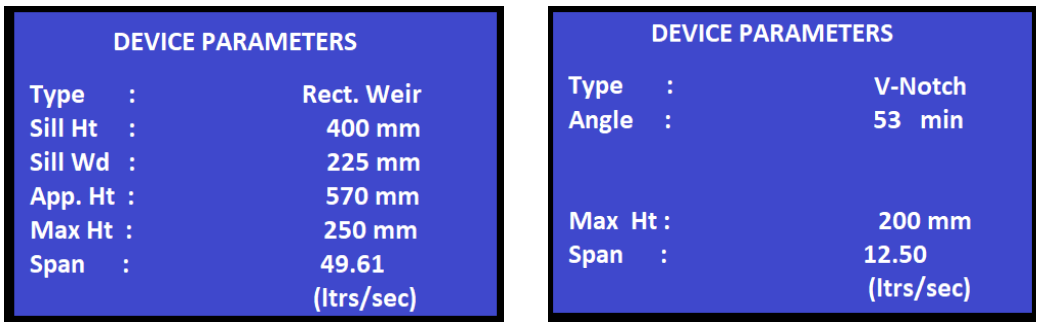


Figure 5.13 Device Parameters Screen.

The Dimensions and Span are shown in the SYSTEM UNITS selected in FLOW SET UP.

5.6. Sensor Set Up

The Sensor Set Up Screen shows the Ultrasonic Sensor set up. The Detection Threshold (Det Thres) and Blanking Distance are configurable from the Sensor Set Up Menu, other settings are only configurable from the Engineering Menu.

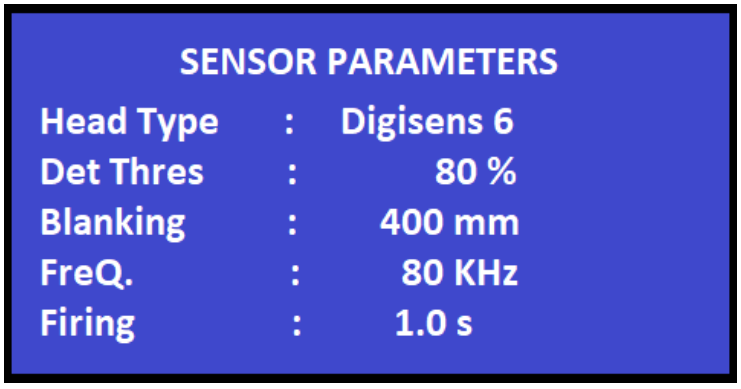


Figure 5.14 Sensor Set Up Screen.

The Ultra Sonic Sensors are factory tuned to give the best performance around the nominal frequency and will generally not need reconfiguration.

The Digisens 6 sensor gives 6 metres of Echo Detection and is used in most Flow applications.

5.7. Calc Parameters

The Calc Parameters show the information used by the USM to calculate the Level of the Flow.

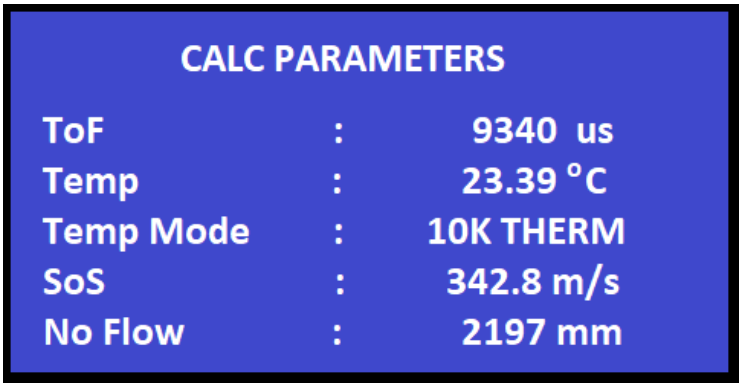


Figure 5.15 Calc Parameters Screen.

The Ultrasonic Sensor returns a Time of Flight (ToF). This is the time (in µseconds) from the Ultrasonic Pulse being transmitted from the Sensor, hitting the surface of the Flow and returning to the sensor.

The ToF is used to calculate the Distance between the Ultrasonic Sensor and the level of the Flow. This requires the SoS (Speed of Sound) to be known which is dependent on the Temperature of the air through which the Ultrasonic beam is travelling.

The Air Temperature is measured on the Ultrasonic Sensor using the device indicated in Temp Mode. This is usually a 10K thermistor, although other devices are occasionally used.

The Level of Flow is calculated by subtracting the Distance from the No Flow and converted to a Flow, dependent on the Flow Device (Weir or Flume).

Distance and Level are available to be displayed on the Measurement Screens.

The Calc Parameters screen is updated every 5 seconds and if a fault occurs the ToF, Temp and SoS will be replaced with LOST ECHO/LOST COMMS.

5.8. Comms Set Up.

The Comms Set Up Screen details the settings for MODBUS slave communication with the USM.

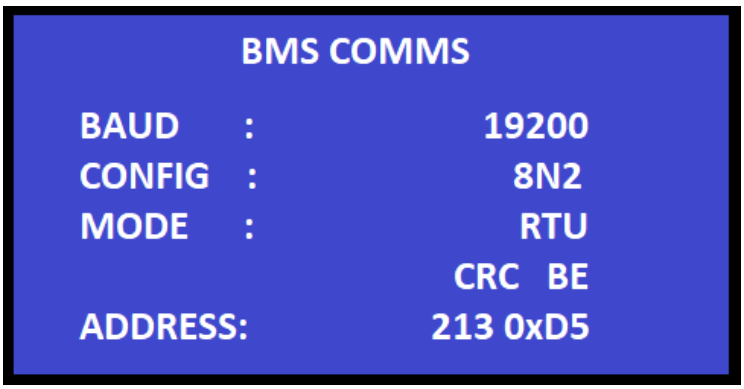


Figure 5.16 **Comms Set Up Screen.**

The above figure shows the configuration for connection to a Robustel GPRS unit.

Two flashing indicators are occasionally displayed in the top left-hand corner of the Display.

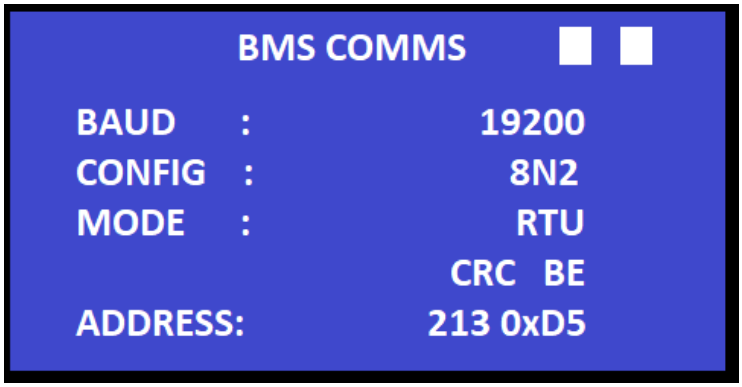


Figure 5.17 **Comms Activity Indicators.**

There are two possible indications.

Left-Hand Indicator only: Activity on RS485 Bus, Address set for different Device.

Both Indicators: Activity on RS485 Bus, Address set for this USM.

Details of the ModBus registers are shown in Section XX.

5.9. Report Screens

The USM has four report screens –

The details of the Flow today since midnight.

The Flow for last three days the unit has been switched on.

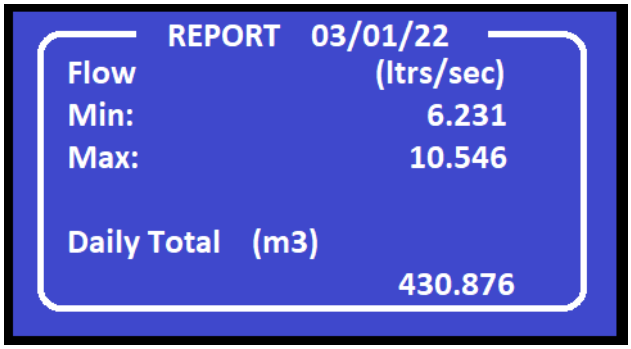


Figure 5.18 **Report Screen**

The units of the measurements are as defined in System Units in Flow Set Up.

5.10. Trend Graph

The Trend graph displays the Flow over the previous 2 hours. It is updated every minute and shows the average Flow over the minute. The current Flow is shown on the left-hand side of the Graph. The Scale of the Graph can be sets in the Flow Set Up menu.

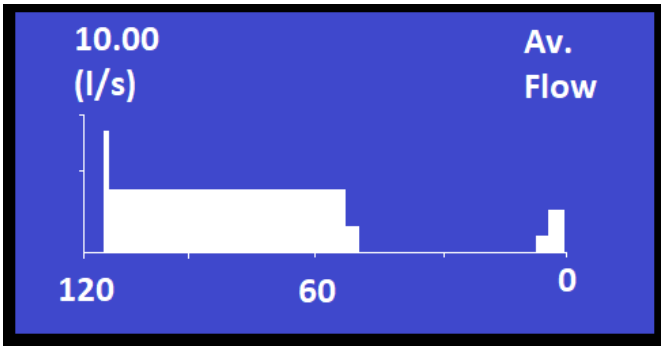


Figure 5.19 Trend Graph.

It should be noted that the screen is intended to show the trend of the flow and should not be used for accurate measurement.

N.B. if the unit is turned off all Trend Graph data is lost.

5.11. Totaliser Screen.

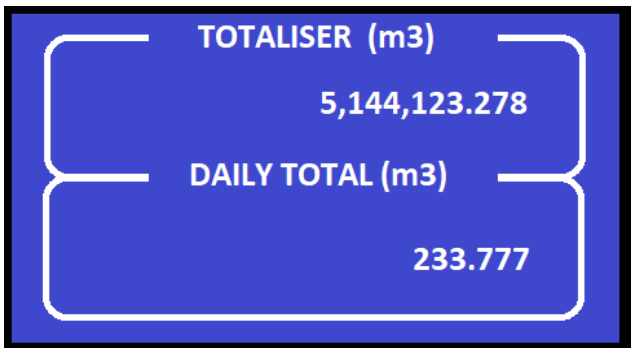


Figure 5.20 Trend Graph.

The Totaliser Screen gives both the Daily Total and the Total since the USM was first turned on (or Totaliser RESET in the Engineering Menu).

The units can be changed between m3 and cubic feet in Flow Set Up (system units).

For details of resetting the Totaliser contact Smart Storm.

5.12. Additional Screens.

They are additional self-explanatory and legacy Software Screens on the USM.

5.12.1. GPRS Comms and SMS Texts

These Screens are used to show the Configuration and Comms Status when the USM is used with an alternate GPRS unit (typically the Cinterion BGS 2T). Smart Storm no longer recommends the use of this module. Should you require further information, please contact Smart Storm directly.

5.12.2. About USM

The About USM Screen details the **DEVICE TYPE, SOFTWARE VERSION** and **SERIAL NUMBER.**

5.12.3. Smart Storm Logo

The Splash Screen shows the Company Logo and contact details.

6. Configuring the USM.

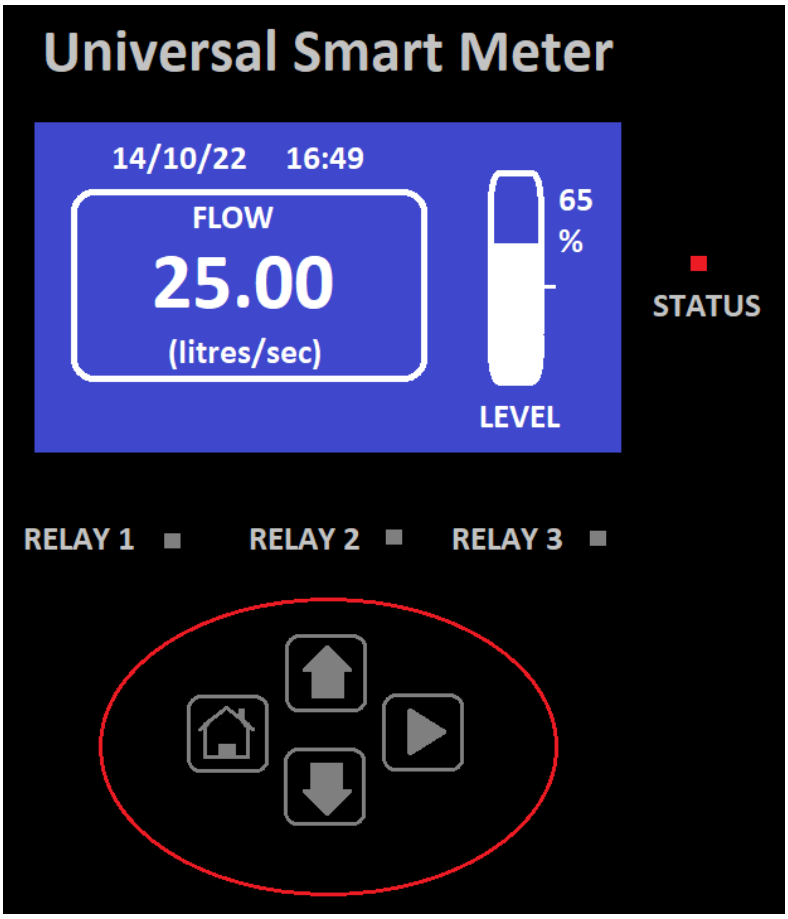


Figure 6.1 USM Set Up

The USM is configured using the four push buttons.

Button	Action
	Scroll Right or Enter
	Scroll up, Increment Numbers
	Scroll down, Decrement Numbers
	Return to previous menu level or to Home Screen and Abort

Table 6.1 – Keys' Functionalities

The unit is configured through the MENU page which is password protected. From the Home Screen, press button to access the PASSWORD page.

Figure 6.2 Password Screen

Use and buttons to select the desired digit at each location and press button to select the next digit. If a digit is entered incorrectly press to return to the Home Screen.

The factory set password to access the configuration menu is '0000'. This can be changed.

If an incorrect password is entered 3 times the USM will lock the menu for 5 minutes.

If PASSWORD is correct, access to The Configuration MENU page is granted.

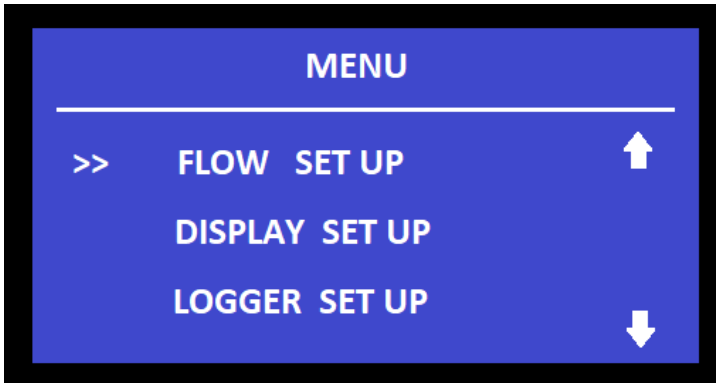


Figure 6.3 Configuration Menu Screen

There are 15 sub menus to the Configuration menu:

1. FLOW SET UP
2. DISPLAY SET UP
3. LOGGER SET UP

4. SENSOR SET UP
5. RELAY SET UP
6. 4 – 20 mA SET UP

7. COMMS SET UP
8. RELAY TEST
9. 4-20mA TEST

10. SIMUL. TEST
11. CHANGE PASSWORD
12. ECHO PROFILE

13. SLEEP TIMER
14. ENGINEERING MENU
15. CONFIG FILE

16. EXIT

Table 6.1 Main Menu

Use  and  buttons to align the cursor with required sub menu and press  button to select. The  key will return the USM to the Home Screen.

The ENGINEERING menu contains settings which should only be changed by Smart Storm Engineers and requires an additional password. For further information contact Smart Storm.

N.B. When the Configuration Menu is entered, the status of the relays and the 4-20mA output are not updated.

if No key is pressed for 5 minutes the USM will exit the Configuration Menu and return to the Home Screen without saving any changes.

7. Configuring the FLOW Parameters.

Select **FLOW SET UP** on the MENU page and press ▶ button. The following Sub-menu will be accessed.

Figure 7.1 Device Set Up Menu

7.1. Device Set Up.

Select **Device Set Up** on the MENU page and press ▶ button.

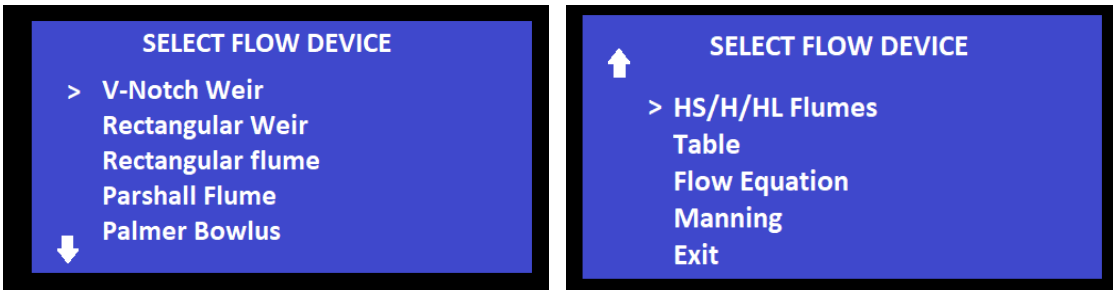


Figure 7.2 Select Flow Device Screens

There are nine options for flow devices available on the USM level Meter, including the programmable Flow Table which can be used for any device. Other devices are available on request from Smart Storm.

Move the cursor using the ↑ and ↓ buttons and press ▶ to select the required Flow Device.

7.1.1. V-Notch Weir

Move the Cursor to V-Notch Weir and press the ▶ button.

Use the ↑ or ↓ to select the required V-Notch Angle.

Available V-Notch Angles are:

22° 30’
28° 4’
45°
53° 8’
60°
90°

Figure 7.3 V-Notch Angle Screen

Press the ▶ button to access the Max Flow Height Screen.

7.1.2. Max Flow Height.

The Max Flow Height is required on all Flow Devices. It is used to calculate the span of the device (maximum Flow Rate). Should the Level exceed the Maximum Height, the Level will be clamped at the Maximum Height.

Figure 7.4 Maximum Flow Height Screen

Use the ↑ or ↓ to change the value to the maximum height and press the ▶ button. A display screen will then show you the span of the device, a further key press will return you to the **FLOW SETUP** menu.

N.B. The values are not saved until Exit/Save is selected from the FLOW SETUP Menu.

7.1.3. Rectangular Weirs and Flumes.

The Parameters for Rectangular Flumes and rectangular Weirs and entered in the same way as the Max flow Height. After pressing the ▶ button you will be passed automatically to the next parameter.

The input parameters are:

Rectangular Weir –

Sill Height
Sill Width
Approach Width
Max Height

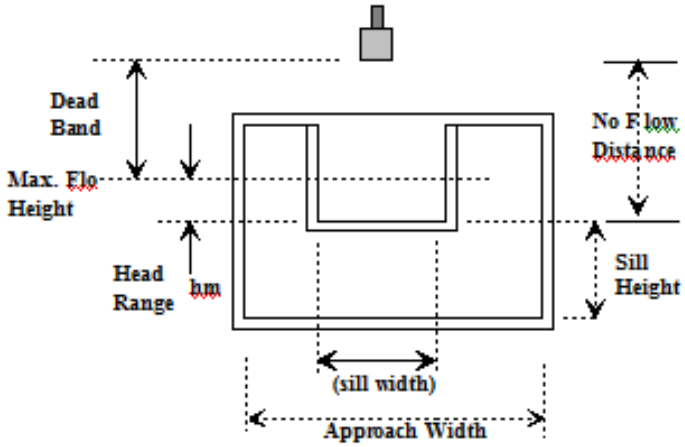


Figure 7.5 Rectangular Weir Parameters

Rectangular Flume –

Channel Width
Throat Width
Throat Length
Max Height

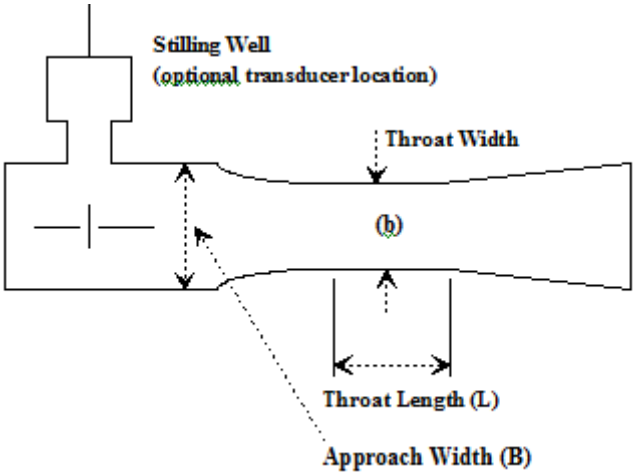


Figure 7.6 Rectangular Weir Parameters

7.1.4. Parshall Flume and Palmer Bowlus.

The required Parshall or Palmer Bowlus Flume can be selected from a rotating list using the ⬆ and ⬇ Buttons.

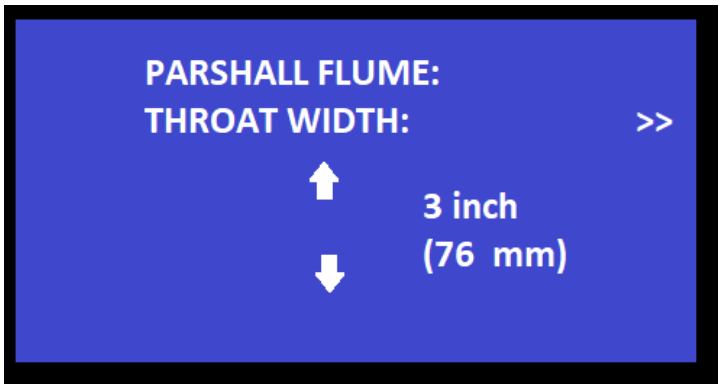


Figure 7.7 Rectangular Weir Parameters

The default types of Parshall Flume are:

3 inch (74 mm)	2 feet (610 mm)
6 inch (152 mm)	3 feet (914 mm)
9 inch (229 mm)	4 feet (1220 mm)
1 foot (305 mm)	5 feet (1520 mm)
1.5 feet (457 mm)	6 feet (1830 mm)

The default types of Palmer Bowlus Flume are:

4 inch (102 mm)	18 inch (457 mm)
6 inch (152 mm)	21 inch (533 mm)
8 inch (203 mm)	24 inch (610 mm)
10 inch (254 mm)	27 inch (686 mm)
12 inch (305 mm)	30inch (762 mm)
15 inch (381 mm)	

For other types contact Smart Storm.

7.1.5. HS/H/HL Flumes.

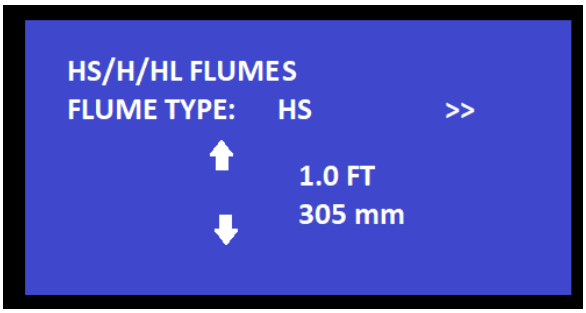


Figure 7.8 Select H Flume.

Use the and Buttons to cycle through the Flume Types. Press the button to select the Flume. The key will leave the Menu without saving.

The available Flume Types are:

0.4 Foot HS FLUME	0.5 Foot H FLUME
0.6 Foot HS FLUME	0.75 Foot H FLUME
0.8 Foot HS FLUME	1.0 Foot H FLUME
1.0 Foot HS FLUME	1.5 Foot H FLUME
	2.0 Foot H FLUME
3.0 Foot HL FLUME	2.5 Foot H FLUME
4.0 Foot HL FLUME	3.0 Foot H FLUME
	4.5 Foot H FLUME

After selecting the Flume type Select the Equation Type to be used:

LOG EQUATION: Log(Flow) = A + Blog(ht) + C(log(ht))^2

CO-EFFICIENT EQUATION: Flow = A + Bht^x + Cht^y + Dht^z

Where A, B, C and D are constants and ht is the level in metres and the flow is calculated in l/s.

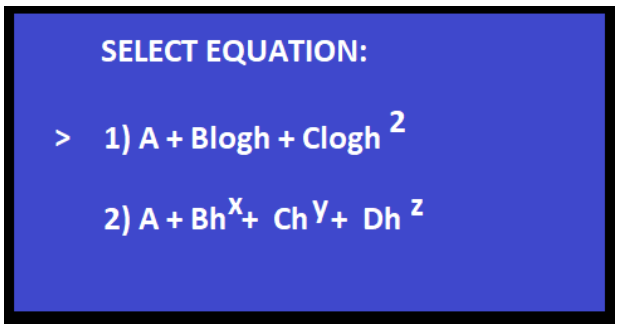


Figure 7.9 Select H Flume Equation.

7.1.6. Log Equation

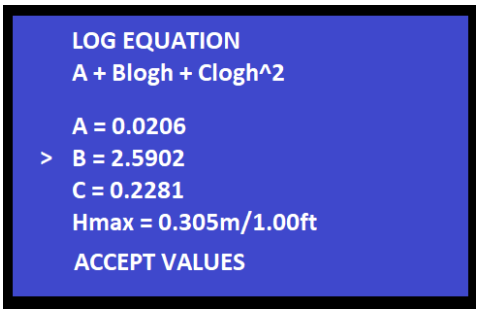


Figure 7.10 Log Equation for 1.0ft H FLUME.

When the Log Equation is selected the default values for the Flume are displayed.

e.g., for a 1.0-foot H flume the equation is:

log(Flow) = 0.0206 + 2.5902*log(ht) + 0.2281*(log(ht))^2.

Should you require to change the values, select the value to be changed with ⬆ and ⬇ Buttons and use the ▶ button to select. The USM will enter the Log Co-efficient screen.

Use the ▶ button to move to the digits you wish to change, as indicated by the arrow below. The value can then be changed with ⬆ and ⬇ Buttons.

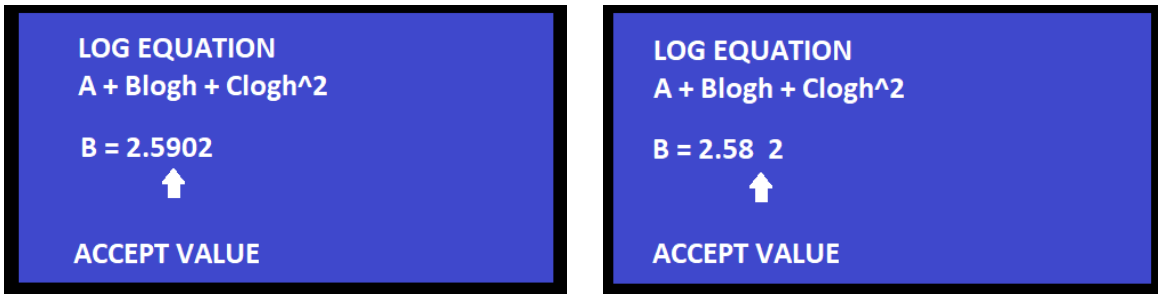
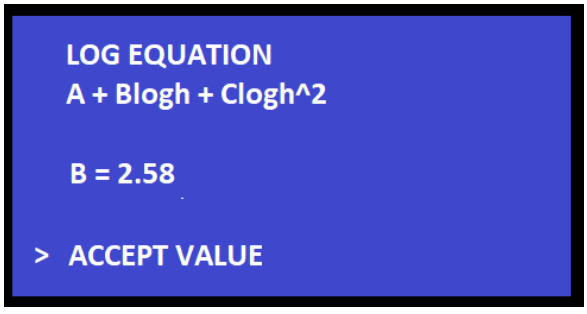


Figure 7.11 Changing a Co-efficient.



The value can be entered by moving the cursor to the end of the number or by entering a space as the current character.

Move The cursor to Accept Value and Press the ▶ Button to update the value. Pressing the 🏠 Button will quit the page and restore the previous value.

Figure 7.12 Accepting a Co-efficient.

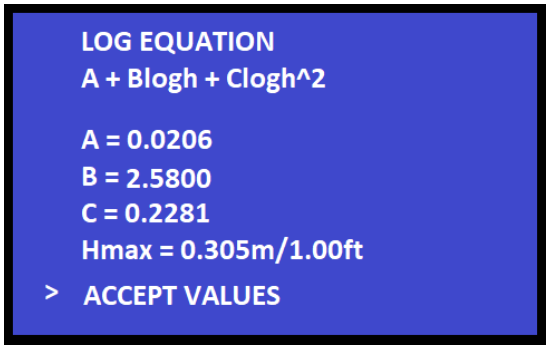


Figure 7.13 Accepting a Co-efficient.

When all values are correct, accept the values. The USM will show the SPAN (maximum flow) of the Flume.

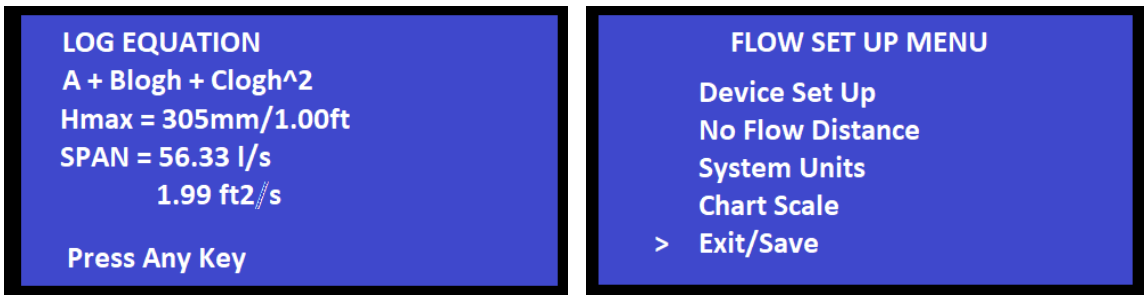


Figure 7.14 Accepting all Values.

N.B. The values will not be saved until the FLOW SET UP MENU is exited via EXIT/SAVE and Save selected.

7.1.6.1. Co-Efficient Equation.

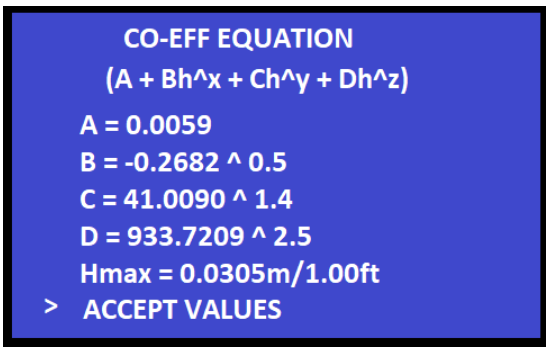


Figure 7.15 Co-eff Equation for 1.0ft FLUME.

When the Co-eff Equation is selected the default values for the Flume are displayed.

e.g., for a 1.0-foot H flume the equation is:

Flow = 0.0059 – 0.2682*(ht^0.5) +41.0090 *(ht^1.4) + 933.7209*(ht^2.5).

N.B. The values shown are truncated, the full value can be seen by accessing the individual value (the full value for D is 933.7209182 and this is the value used in calculations).

Should you require to change the values, select the value to be changed with ⬆ and ⬇ Buttons and use the ▶ button to select. The USM will enter the Co-efficient screen.

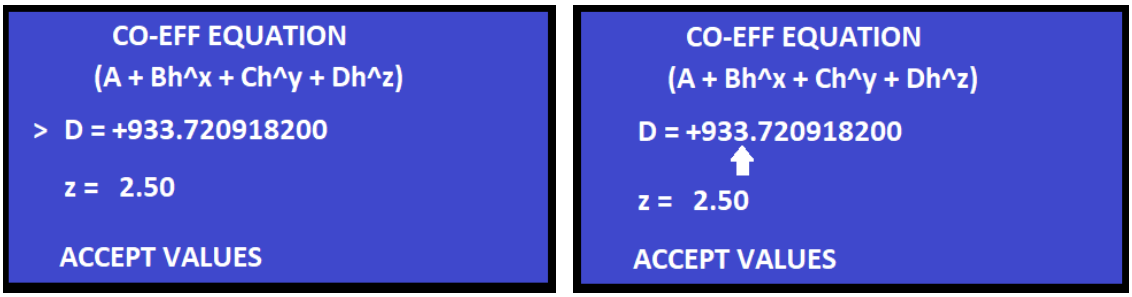


Figure 7.16 Change Co-efficient Equation Screen.

Select the value to be changed (co-efficient or exponent). Use the ▶ button to move to the digits you wish to change, as indicated by the arrow below. The value can then be changed with ⬆ and ⬇ Buttons.

Fig. 5.20 shows the decimal point being moved to change the integer from 933 to 93.

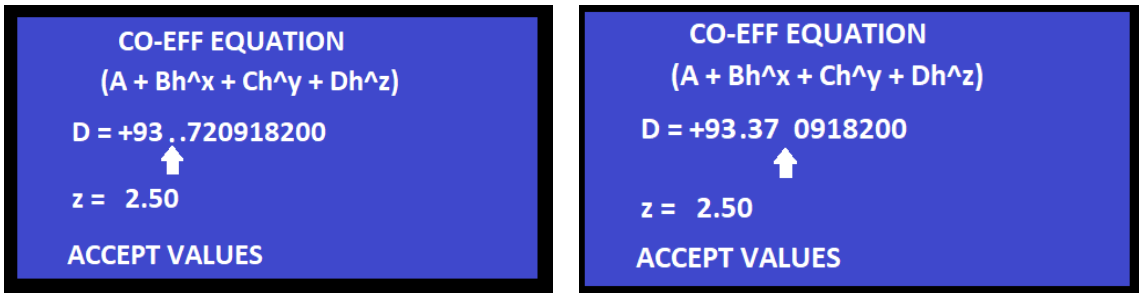


Figure 7.17 Change Co-efficient Equation Screen.

The value is entered by moving the cursor to the end of the number or by entering a space for the current character.

The exponent number (z) is a fixed format with the number between 0 and 9.99 to 2 decimal places. The decimal point cannot be moved.

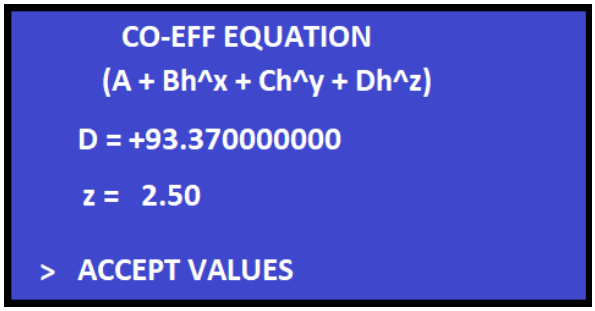


Figure 7.18 Accepting a Co-efficient.

Move The cursor to Accept Value and Press the ▶ Button to update the value. Pressing the ⌂ Button will quit the page and restore the previous value.

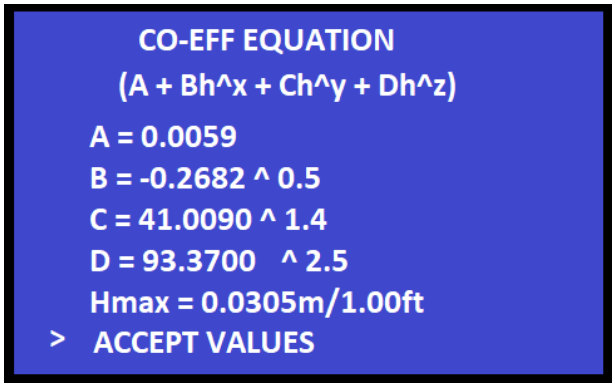


Figure 7.19 Accepting all Values.

When all values are correct, accept the values. The USM will show the SPAN (maximum flow) of the Flume.

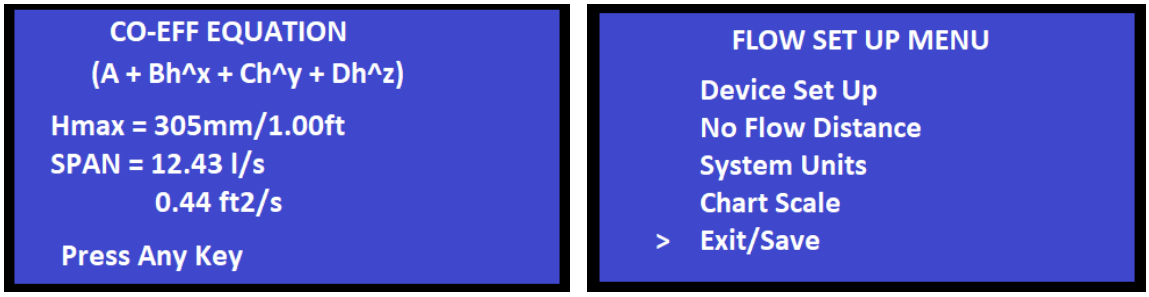


Figure 7.20 Accepting all Values.

N.B. The values will not be saved until the FLOW SET UP MENU is exited via EXIT/SAVE and Save selected.

7.1.7. Flow Table.

Non-uniform devices can be used by Table entry into a 16-point table. The first point is automatically set to 0mm level and 0.00 l/s flow.

Further points are entered in order, the Level followed by the Flow.

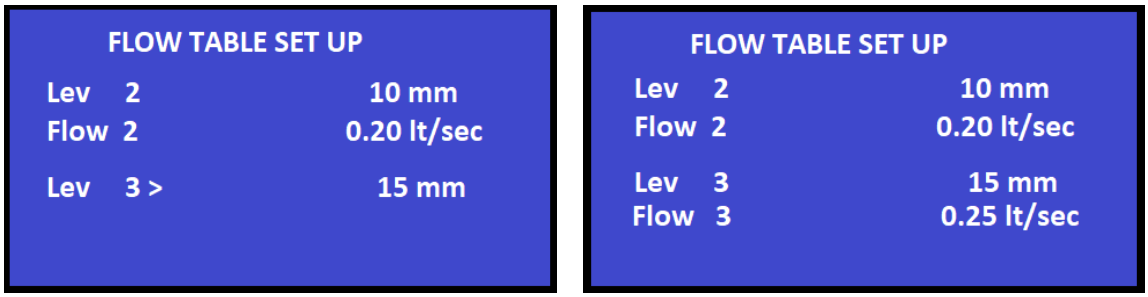


Figure 7.21 Table Parameters.

The level is entered in mm (inches in imperial) and the flow is entered in litres per second (gallons per second in imperial). Other units must be converted before entry.

The level and flow of successive points must be greater than the level and flow of the previous point. If not, then an error message is displayed and the value must be re-entered.

If the table is less than 16 points, entry can be terminated by entering a value of 0 into the level field. The USM will return to the FLOW SET UP MENU.

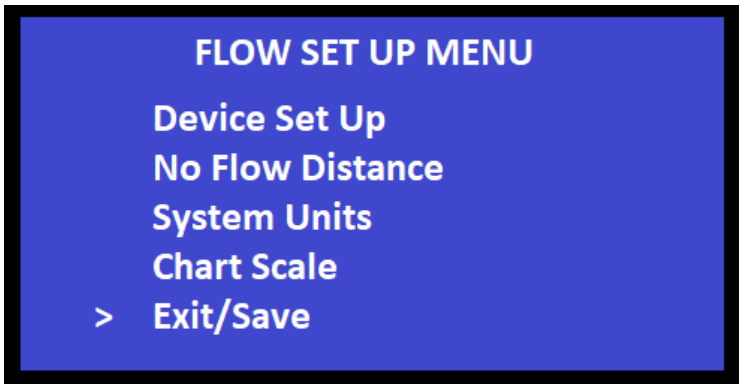


Figure 7.22 Saving the Settings.

N.B. The values will not be saved until the FLOW SET UP MENU is exited via EXIT/SAVE and Save selected.

7.1.8. Flow Equation.

The Flow Equation can be used as an approximation to represent the relationship between Flow and height.

This equation of the form: FLOW = A x ht ^ x where ht is the level of the flow.

The Co-efficients of the Equation are dependent on the units of the variable (level) and the result (flow) and these must be selected to match the Co-efficients.

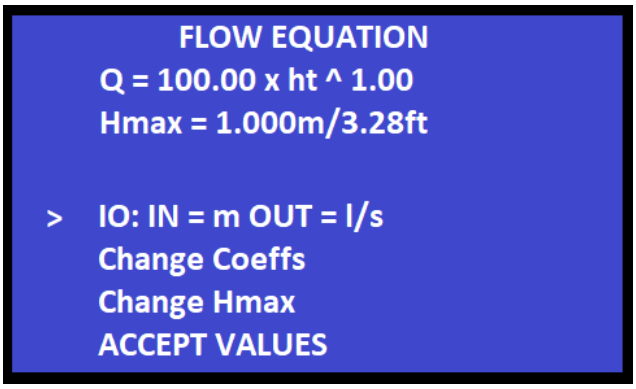


Figure 7.23 Select INPUT/OUTPUT Units.

Press the ▶ Button to cycle through the available Units. The options are:

INPUT	OUTPUT
Metres	l/s
Metres	m3/hr
Feet	CFS
Feet	GPM
Feet	MGD

Move the Cursor to Change Coeffs and press the ▶ Button.

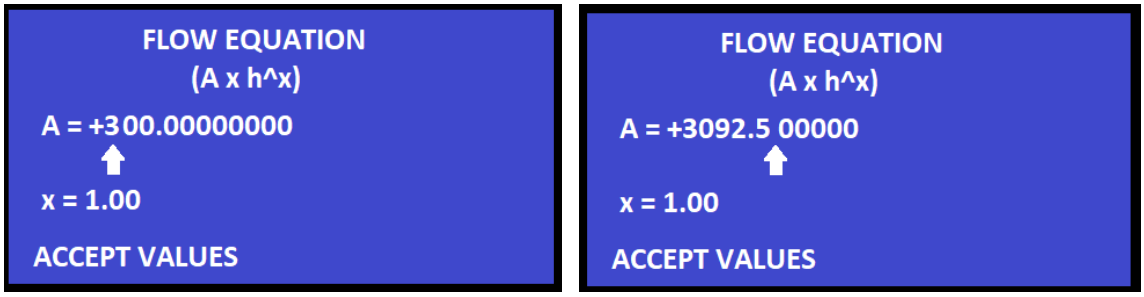
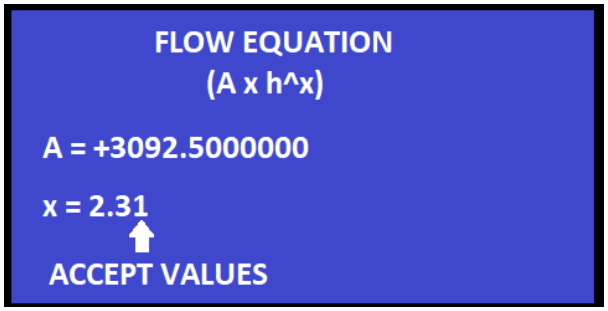


Figure 7.24 Entering Flow Equation Co-Efficients.

Select the value to be changed (co-efficient or exponent). Use the ▶ button to move to the digits you wish to change, as indicated by the arrow below. The value can then be changed with ↑ and ↓ Buttons.

The value is entered by moving the cursor to the end of the number or by entering a space for the current character.

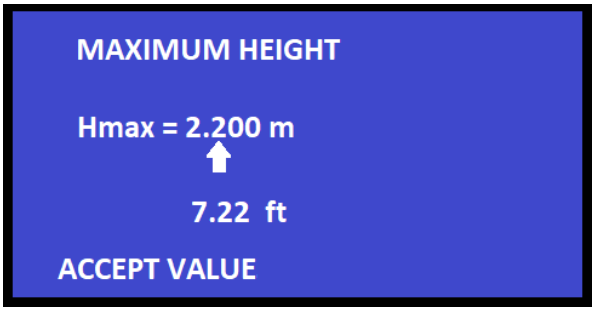


The exponent number (x) is a fixed format with the number between 0 and 9.99 to 2 decimal places.

Figure 7.25 Entering the Exponent.

When both co-efficients are correct move the cursor to ACCEPT VALUE and press the ▶ Button. Pressing the ⌂ Button key at any stage will quit the page and restore the initial value.

Move the Cursor to Change Hmax and press the ▶ Button. The Maximum Level of the Flow can be entered. This is used to calculate the Span (maximum Flow).



The Maximum Height that can be entered is 9.999m.

Enter the value and Select Accept Value to confirm.

Figure 7.26 Entering the Max Height.

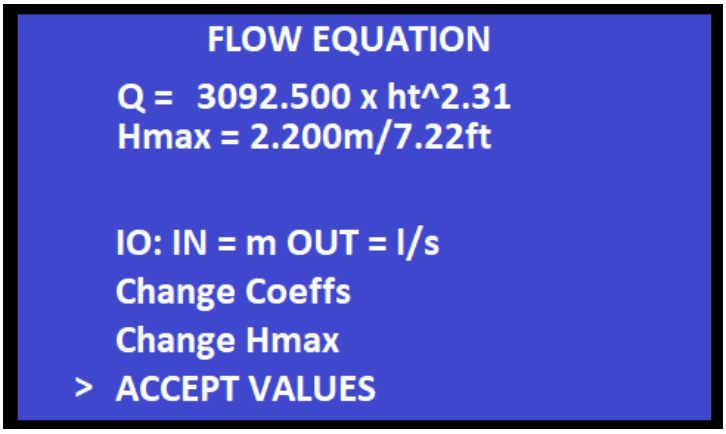


Figure 7.27 Accepting the Flow Equation Co-Efficients.

Move the cursor to ACCEPT VALUES and select with the ▶ button.

The USM will display the SPAN (maximum volume) of the Flume.

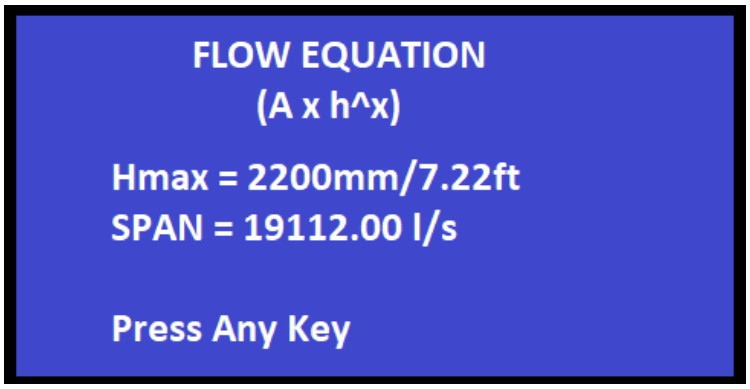


Figure 7.28 Display the Flow Equation Span.

The values will not be saved unit the FLOW SET UP MENU is exited via Exit/Save and Save selected.

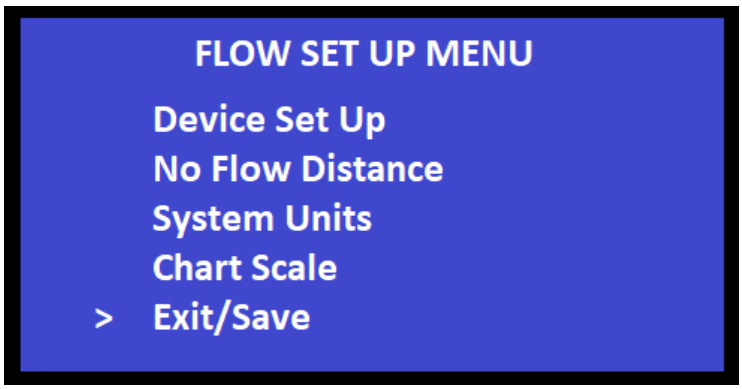


Figure 7.29 Saving the Settings.

7.1.9. Manning Formula.

The Manning Formula is used to calculate Flow in pipes and channels without a Weir or Flume. For best results the channel should be straight for at least 75 metres (preferably 300 metres) and be uniform in cross-section slope and roughness

The Manning Formula uses water surface slope, cross-sectional area and wetted perimeter to determine Flow Rate.

$$Q = \frac{K\,A\,R^{2/3}S^{1/2}}{n}$$

Q = flow rate
A = cross-sectional area of flow
R = hydraulic radius (cross-section area divided by wetted perimeter)
S = slope of the channel at the point of measurement
n = surface roughness (based upon channel material and condition)
K = constant dependent upon units

7.1.9.1. Device Set Up.

Select Device Set Up from the MANNING SET UP MENU using the ⬆ and ⬇ Buttons to move the cursor and the ▶ button to select.

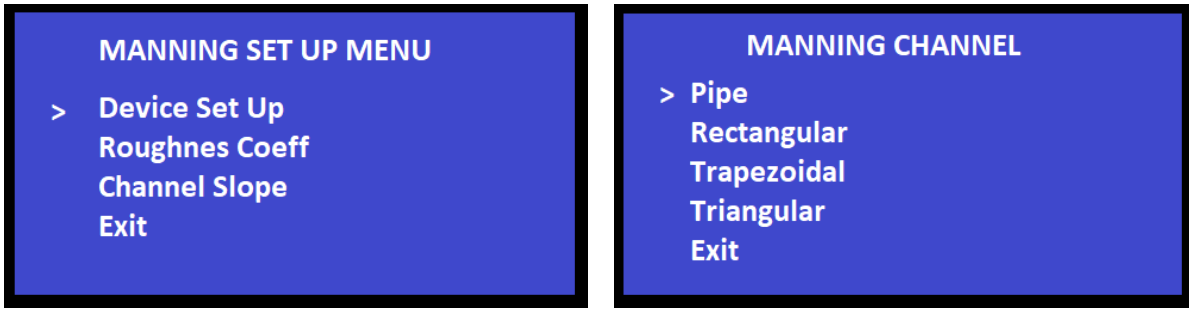


Figure 7.30 Select the Manning Device.

Select the required Channel from the list.

After the selecting the Device, the dimensions need to be entered. The following dimensions are required.

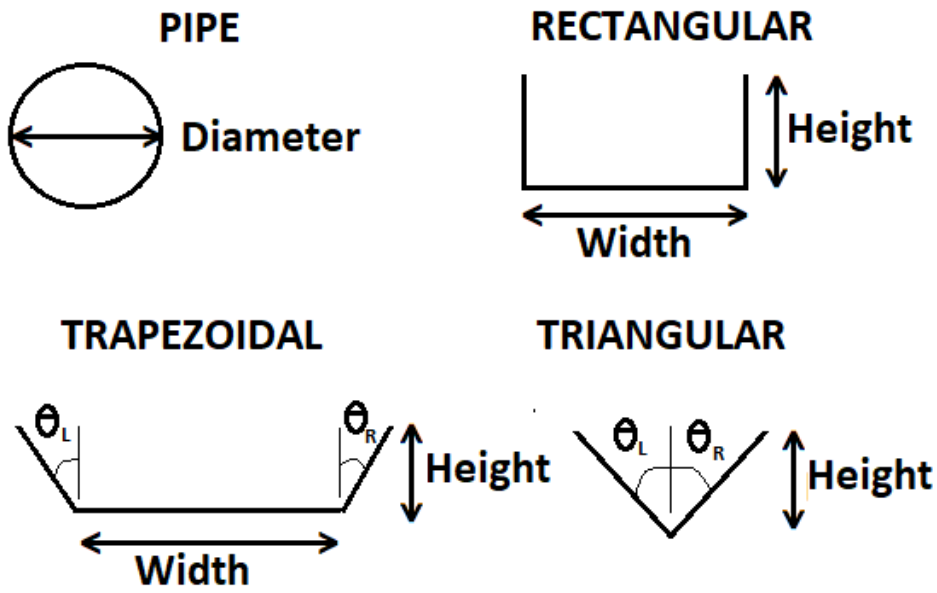


Figure 7.31 Manning Device Dimensions.

The Dimensions are added sequentially.

Use the ⬆ and ⬇ Buttons to change the Value and the ▶ button to enter the Value and move to the next Dimension.

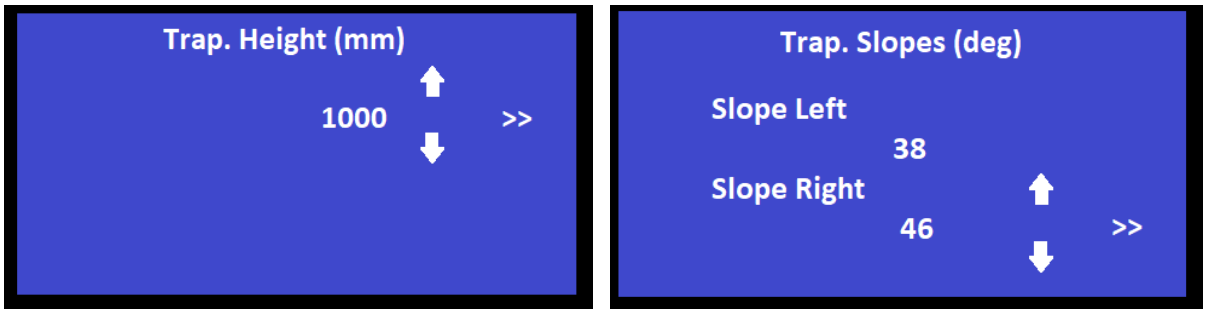


Figure 7.32 Manning Device Dimensions Entry.

The slope Values (ΘL and ΘR) are entered consecutively on the same Page.

When all Dimensions have been added the USM will return to the MANNING SET UP MENU.

7.1.9.2. Roughness Co-efficient.

Select Roughness Co-eff from the MANNING SET UP MENU.

Use the ⬆ and ⬇ Buttons to change the Value and the ▶ button to enter the Value and return to the MANNING SET UP MENU.

Figure 7.33 Manning Roughness co-efficient.

The acceptable values for the Roughness Co-efficient are 0.001 to 0.1. If a value of 0.00 is entered the value is ignored and the previous value retained.

7.1.9.3. Channel Slope.

Select Channel Slope from the MANNING SET UP MENU.

Use the ⬆ and ⬇ Buttons to change the Value and the ▶ button to enter the Value and return to the MANNING SET UP MENU.

Figure 7.34 Manning Channel Slope.

The acceptable values for the Channel Slope are 0.001 to 1.0. If a value of 0.00 is entered the value is ignored and the previous value retained.

7.1.9.4. Exit

The values will not be saved until the MANNING SET UP is exited via EXIT and YES selected on the SAVE SETTINGS? PAGE.

7.2. No Flow Distance.

The No Flow Distance is the distance measured by the USM when there is no flow. For accurate measurement, the flow through the device should be stopped and a reading of Distance taken from the USM. This Value can then be entered as the No Flow Value.

If it is not possible to stop the flow, the level of the flow from the bottom of the Weir or Flume should be measured and added to on the Distance Reading on the USM to obtain the No Flow Value.

The USM calculates the Level of the liquid through the device as the No Flow Distance minus the measured distance – So incorrect entry of the No Flow Distance will result in all subsequent readings being incorrect!

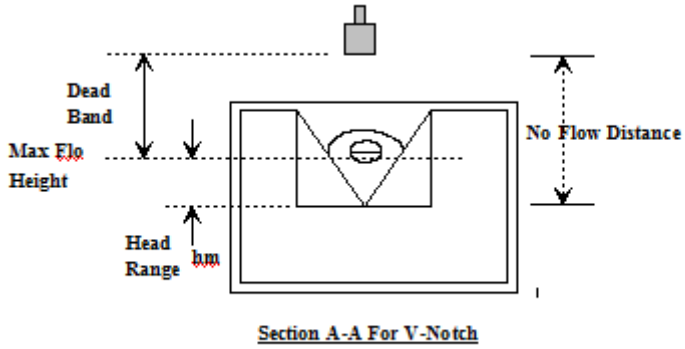


Figure 7.35 Measuring the No Flow.

The No Flow Distance parameter is accessed from the Flow SET Up Menu and entered using the ⬆ or ⬇ to change the value. Pressing the ▶ button will accept the value and return to the **FLOW SETUP** menu.

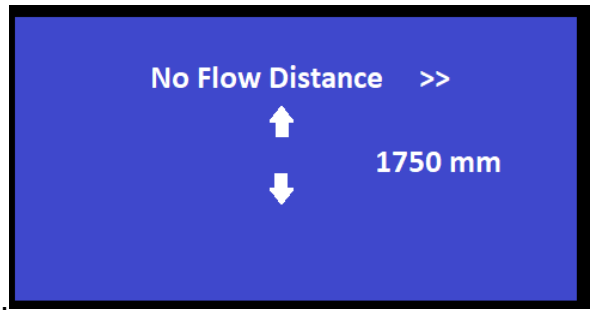


Figure 7.36 Setting the No Flow.

N.B. THE VALUES ENTERED WILL NOT BE SAVED UNTIL THE FLOW SET UP MENU IS EXITED AND SAVE SELECTED.

7.3. System Units.

This System Units allows the user to enter the units to be used for distance/length, flow and volume. These units are used on the display pages and as entry units when configuring the relays and 4-20mA.

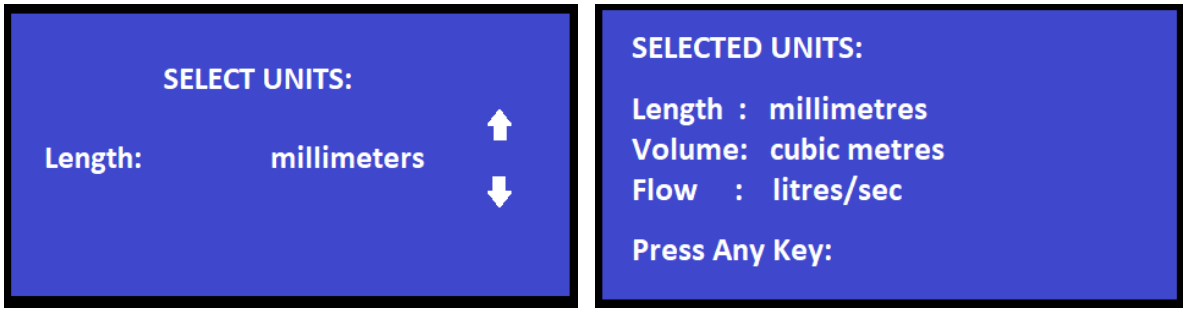


Figure 7.37 Setting the No Flow.

The units are selected from a rotating list. Use the ⬆ or ⬇ to move through the options and the ▶ button to select the units and move to the next measurement.

After the three units have been selected, the choices are displayed.

The available units are:

Length/Distance:

millimetres
metres
inches
feet
feet and inches

Volume:

cubic metres
cubic feet

Flow:

litres/sec
litres/min
cubic metres/sec
cubic metres/min
cubic metres/hour
cubic metres/day
US gals/sec
US gals/min
US kgals/hour
US kgals/hour

N.B. THE VALUES ENTERED WILL NOT BE SAVED UNTIL THE FLOW SET UP MENU IS EXITED AND SAVE SELECTED.

7.4. Chart Scale.

The USM has a chart recorder which shows the flow over the last 120 minutes.

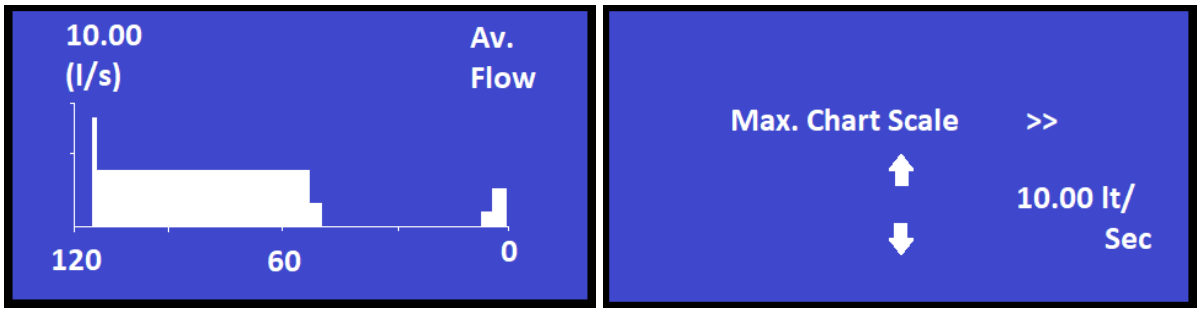


Figure 7.38 Chart Recorder.

The Chart Scale allows the vertical axis to be configured up to the Span of the device.

The Max Chart Scale can be changed using the ⬆ or ⬇ Buttons and entered using the ▶ button.

7.5. Exit/Save.

None of the Flow Set up parameters are saved until the menu is correctly exited and save selected from the Exit/Save option. If No is selected the previously saved values are restored.

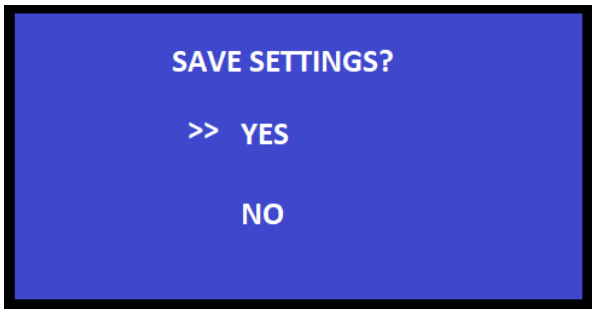


Figure 7.39 Save And Exit.

Use ⬆ or ⬇ Buttons to select YES or NO and the ▶ button to confirm the selection.

8. Configuring the Display Set Up.

The USM allows some display screens to be customised to show different measurements. These measurements are configured from the Display Set Up Menu.

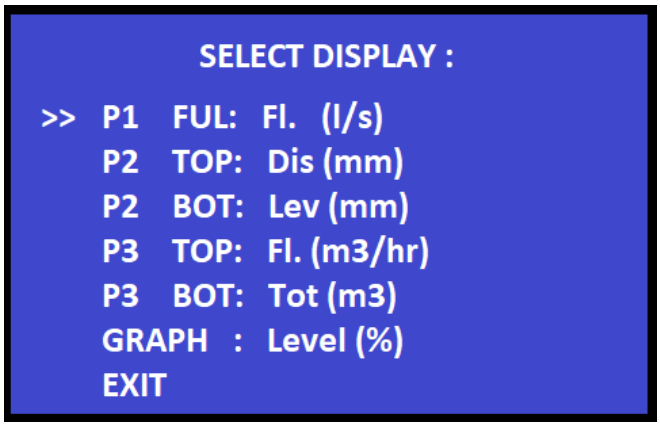


Figure 8.1 Display Set up Screen.

The displayed measurement to be changed is selected using the ⬆ ⬇ buttons. The ▶ button will then change the measurement in a rotating list. The above selection would result in the following screens:

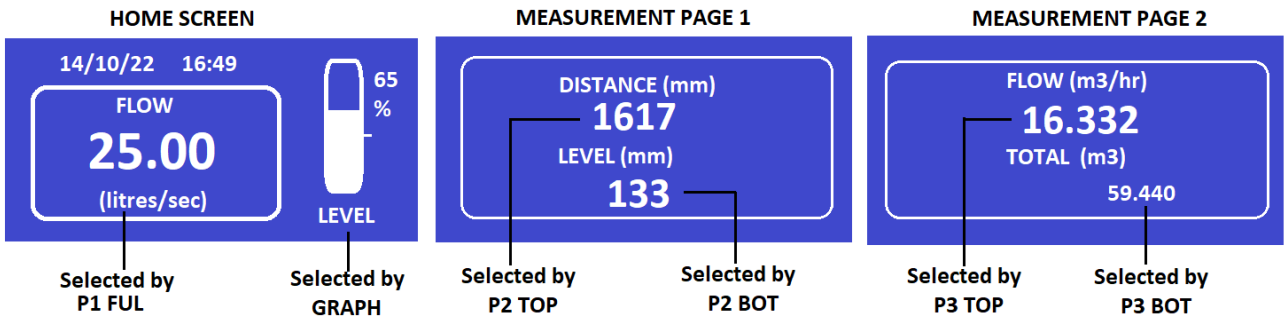


Figure 8.2 Display Screens.

The Home Screen is used to display the Flow. The available measurements for P1 FULL are:

Litres/sec	US gallons/sec
Litres/min	US gallons/min
m3/sec	US gallons/hour
m3/min	US gallons/day
m3/hour	
m3/day	

The GRAPH can be configured as

% Level % FLOW

%mA output (0% = 4mA, 100% =20mA)

The following measurements are available for P2 and P3

FLOW :

Litres/sec US gallons/sec

Litres/min US gallons/min

m3/sec US gallons/hour

m3/min US gallons/day

m3/hour

m3/day

LEVEL:

Level (mm) Level (inch)

Level (metre) Level (feet)

Level (feet and Inch)

DISTANCE:

Distance (mm) Distance (inch)

Distance (metre) Distance (feet)

Distance (feet and Inch)

Daily Total (m3) Daily Total (ft3)

Totaliser (m3) Totaliser (ft3) (only available on BOT position)

N.B. THE VALUES ENTERED WILL NOT BE SAVED UNTIL SELECT DISPLAY MENU IS EXITED AND SAVE SELECTED.

9. Configuring the Logger.

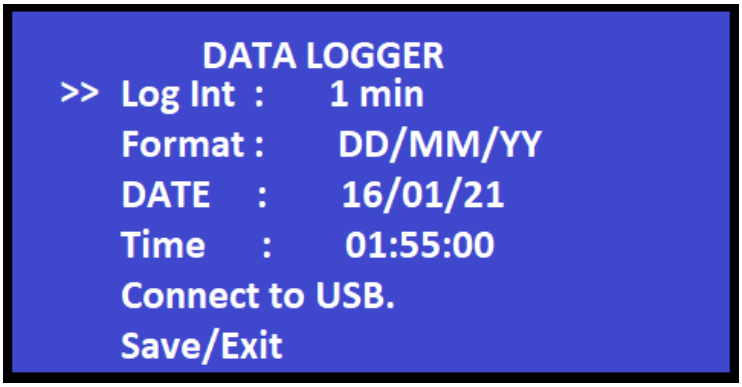


Figure 9.1 Data Logger Set Up.

The USM can be fitted with a Micro-SD card to give a Time Stamped record the main variables. These can then be displayed in text and graphical form using the Smart Storm INQUISTER software or as CSV files.

Use the ↑ or ↓ Buttons to move the cursor to the required Menu item.

9.1. Log Interval

Log Int. sets the interval at which the measurements are recorded and can be set to:

OFF	1 minute	2 minutes
5 minutes	10 minutes	30 minutes

The Log interval changes when the using the ▶ button is pressed.

The CSV file will record the Maximum and Minimum Values during the logging interval as well as the Average value.

9.2. Date Format.

Format is used to select the date format on the Home Screen and can be set to:

OFF	DD/MM/YY	MM/DD/YY (US format)

The Format changes when the using the ▶ button is pressed.

9.3. Date and Time Set Up.

Date and **Time** are used to set the date and time both for the home screen display and the record Time Stamp.

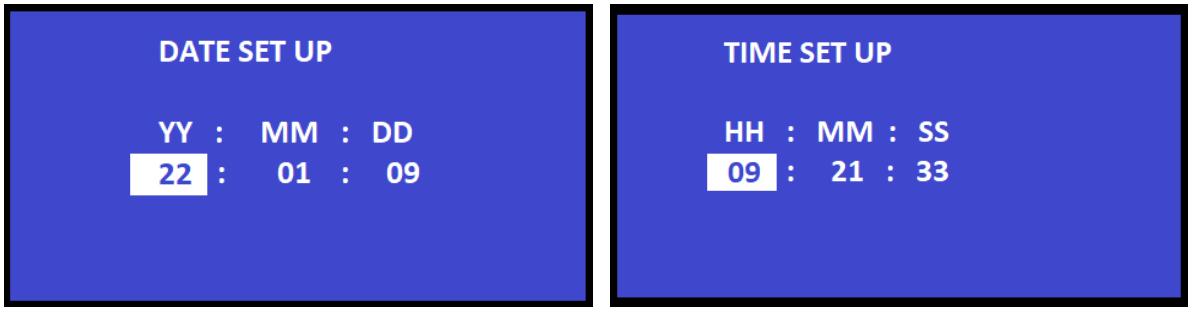


Figure 9.2 Date Set Up.

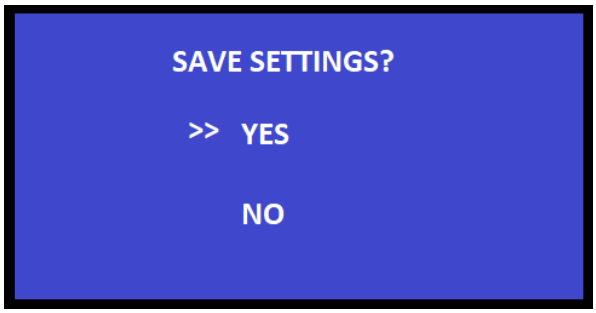
Use the ↑ or ↓ Buttons to change the selected value (indicated by the white box) and the ▶ button to move to the next value.

THE USM IS SUPPLIED WITH THE BATTERY DISCONNECTED FROM THE REAL TIME CLOCK. BEFORE USING THE LOGGER ENSURE THAT THE LINK (CONN4) ON THE CPU IS FITTED.

9.4. Connect to USB.

Connect to USB is selected when records are to be downloaded. This is detailed in Section XXXX.

9.5. Exit/Save.



The Data Logger parameters are only saved when the menu is correctly exited and save selected from the Exit/Save option. If No is selected the previously saved values are restored.

Figure 9.3 Save And Exit.

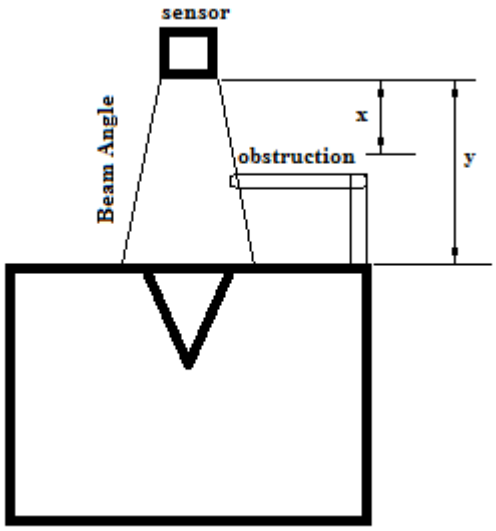
Use ↑ or ↓ Buttons to select YES or NO and the ▶ button to confirm the selection.

10. Configuring the Sensor.

The Sensor Set Up Menu allows the Threshold (level at which the device triggers) and blanking period (distance from the sensor at which readings begin to be taken) of the DIGISENS sensor to be changed.

The return echo under normal circumstances is returned at a level of 100%. This can be checked using the Echo Profile (see section 4.12). If the return echo is poor the threshold can be lowered to prolong the life of the sensor. The factory setting is 80%.

The Blanking period can be used to make the sensor 'blind' to objects between the sensor and the effluent.



In figure 9.1 there is a potential obstruction which may cause a false echo. If the Blanking Distance is set to x the sensor could report this false echo as the height of the effluent.

Setting the Blanking Distance to y will make the head ignore the return echo from the obstruction and return the 2nd echo from the effluent. In most cases the Blanking Distance can be set to the distance from the sensor to the Max Height.

Figure 10.1 Blanking Distance.

The Detection Threshold and Blanking Distance and entered consecutively and are written to the Ultrasonic head when YES is selected on the SAVE SETTINGS? Screen.

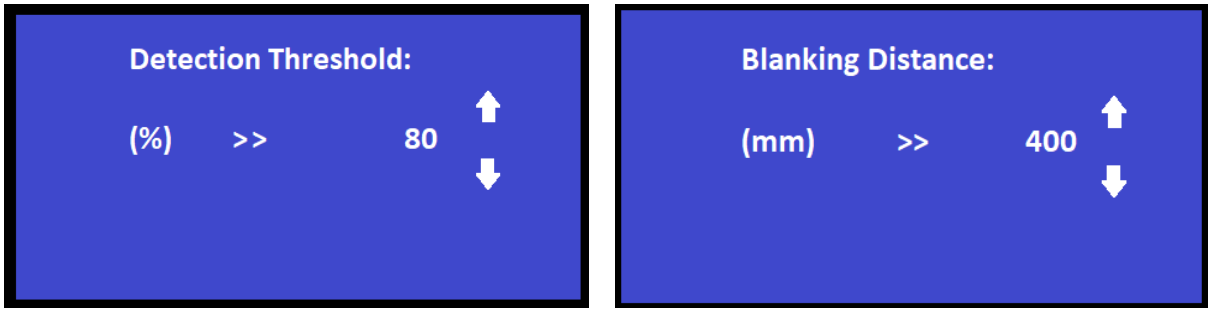


Figure 10.2 Parameter Entry.

Use ↑ or ↓ Buttons to change the value and the ▶ button to accept the value and move to the next value or Save Screen.

11. Configuring The Relays.

The USM has three programmable Relays which can be wired as Normally Open (NO) or Normally Closed (NC).

A TEXT RELAY is also available when the USM is used with a GPRS module.

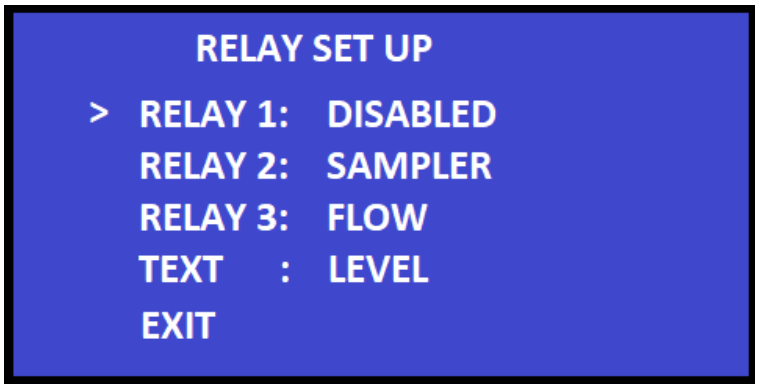


Fig 11.1 Relay Selection Screen.

Use ↑ or ↓ Buttons to Select the RELAY to be configured and the ▶ button to confirm the selection. Exit or the ⌂ Button can be used to return to the Main Menu.

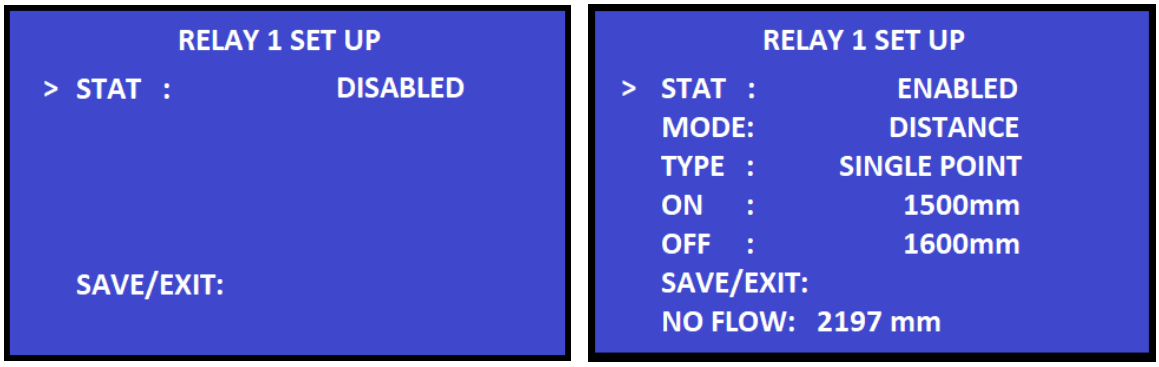


Fig 11.2 Relay Set Up Screen.

When the Status field is selected pressing the ▶ button toggles the selection between ENABLED and DISABLED. When ENABLED is selected, the additional configurable parameters are shown.

Use ↑ or ↓ Buttons to Select the required parameter to be changed.

11.1. Relay Mode

The Mode Parameter changes when the ▶ button is pressed.

11.1.1. DISTANCE RELAY

Triggers on the Distance measured by the Ultrasonic Head.

Minimum Distance 0mm, Maximum distance Range of Ultrasonic Head.

Distance Relays can be set with Single Point, In Range or Not in Range Trigger Types.

The NO FLOW is shown for Reference.

11.1.2. LEVEL RELAY

Triggers on the Level of the FLOW.

Minimum Distance 0mm, Maximum distance Max Height of the Flume or Weir.

Level Relays can be set with Single Point, In Range or Not in Range Trigger Types.

Flume or Weir Max Height is shown for Reference.

11.1.3. FLOW RELAY

Triggers on the FLOW rate.

Minimum Flow 0 l/s, Maximum Flow is Span of the Flume or Weir.

Flow Relays can be set with Single Point, In Range or Not in Range Trigger Types.

Span of Flume or Weir is shown for Reference.

11.1.4. SAMPLER RELAY

The Sampler Relay is used to trigger a Composite Sampler. The relay triggers when programmed Volume has been recorded by the USM. The Volume is then reset to 0m3 and re-triggers when the volume is again reached.

There are two parameters to set on the Sampler Relay:

VOLUME - The Volume of Flow (m3) at which the Relay triggers. The Minimum Volume is 0m3 and the Maximum Volume is 10m3.

TIME - The Length of Time (ms) the relay closes before opening. The required minimum Time the relay needs to close is dependent on the model of the Sampler. The Minimum Time is 0ms and the Maximum Type is 5000ms.

Fig 11.3 Sampler Relay Set Up.

Use ↑ and ↓ Buttons to Select the required parameter to be changed and confirm with the → button. The Cursor will move to show the Parameter can now be changed using the ↑ and ↓ Buttons. When the parameter Value is set press the → button to enter the value.

Although the Values can be set to 0m3 and 0ms these values should not be used. The TIME would normally be set to around150ms.

The Volume is normally calculated by considering the number of samples required to fill the Sampler Bottle. The Volume can then be determined by dividing the typically Maximum Daily Discharge by the number of samples taken so the Bottle is filled over a 24 Hour period.

11.1.5. DAILY TOTAL RELAY

The D.Total Relay, triggers when the Daily Totaliser exceeds the programmed Volume. The Relay will reset when the Daily Totaliser resets to 0m3 at Midnight.

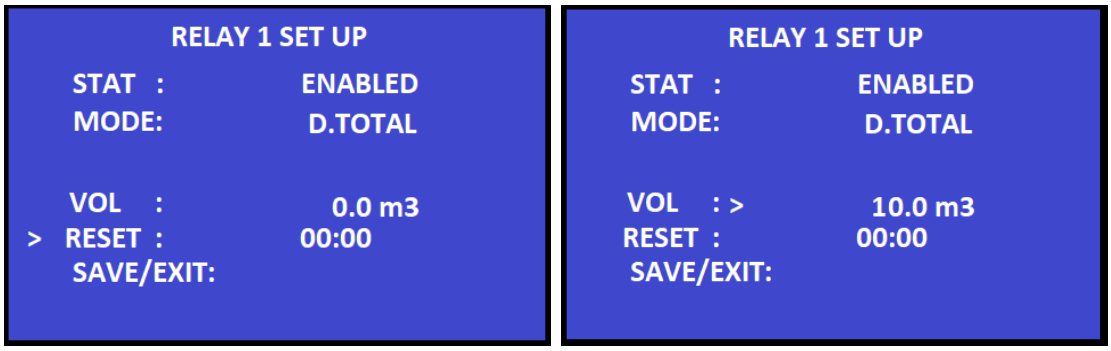


Fig 11.4 Daily Totaliser Relay Set Up.

Use ⬆ and ⬇ Buttons to Select either VOL or RESET and confirm with the ▶ button. The Cursor will move to show the Volume can now be changed using the ⬆ and ⬇ Buttons. When the VOL Value is set press the ▶ button to enter the value.

The RESET time cannot be changed and is provided for information only.

11.1.6. LOST COMMS RELAY

The Lost Communications Relay will trigger if the USM loses communication with the Ultrasonic Sensor for longer than 5 seconds. It resets when communication is restored.

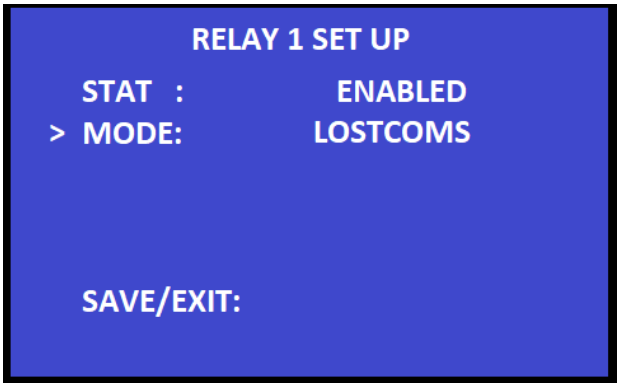


Fig 11.5 Lost Comms Relay.

11.2. Trigger Type.

The Trigger Type is changed by using the ⬆ and ⬇ Buttons to move the Cursor to TYPE and pressing the ▶ button.

11.2.1. Single Point Trigger.

The Single Point trigger is used when the Value is required to change a single Value.

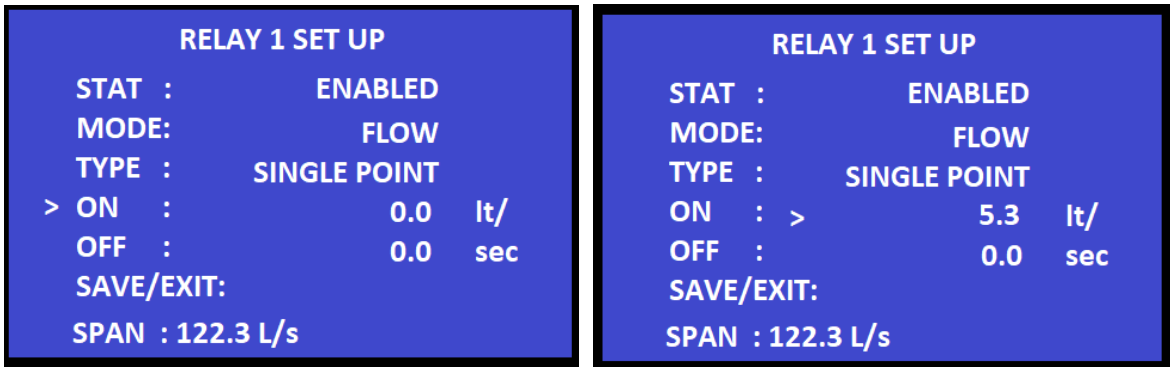
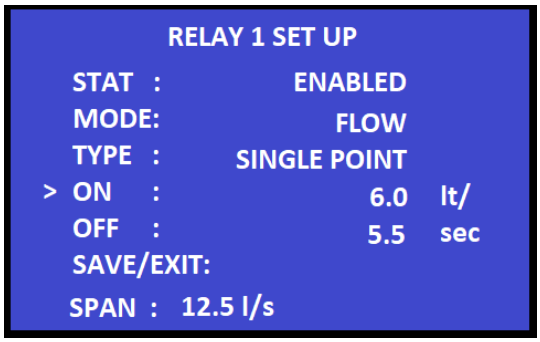
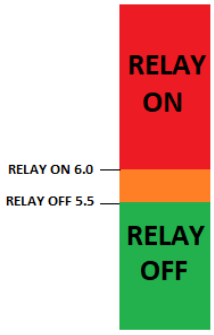


Fig 11.6 Single Point Flow Relay.

Use ⬆ and ⬇ Buttons to Select the ON or OFF value and confirm with the ▶ button. The Cursor will move to show the Parameter can now be changed using the ⬆ and ⬇ Buttons. When the Value is set press the ▶ button to enter the value.

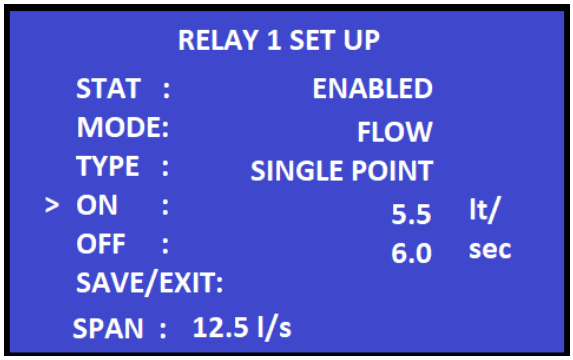
The ON and OFF Values should be set to different Values to provide Hysteresis and prevent chatter on the Relay.

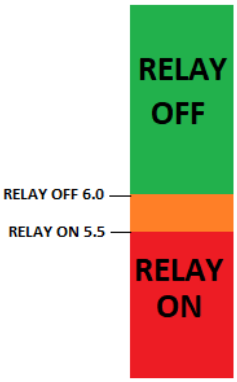




If the On Value is greater than the OFF Value, the Relay will be ON at values above the ON Value and OFF at values below the OFF Value.

Fig 11.7 Single Point ON Greater.





If the On Value is less than the OFF Value, the Relay will be ON at values below the ON Value and OFF at values above the ON Value

Fig 11.8 Single Point OFF Greater.

In Both incidences the value will remain in its previous state between the ON and OFF values.

11.2.2. Range Trigger.

The Limits of the Range are entered by using  and  Buttons to move the cursor to LIM1or LIM2 and pressing the  button.

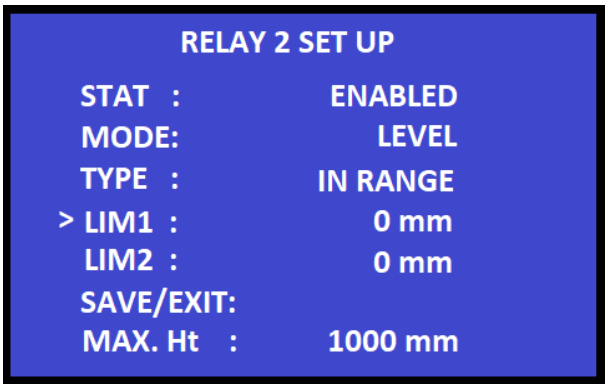


Fig 11.9 Inputting the Range Values.

The Limits are entered in order from the top Limit to the Bottom Limit:

	IN RANGE	**NOT IN RANGE**
1	UPPER LIMIT OFF	UPPER LIMIT ON
2	UPPER LIMIT ON	UPPER LIMIT OFF
3	LOWER LIMIT ON	LOWER LIMIT OFF
4	LOWER LIMIT OFF	LOWER LIMIT ON

When the ▶ button is pressed the cursor will move and the Value can be entered using ↑ and ↓ Buttons. The Value being entered is shown in the TYPE line above the Limits.

The two Upper Limits are entered as LIM1. Pressing the ▶ button moves to the next Value. The Maximum Value that can be entered is the Value of the previous entry.

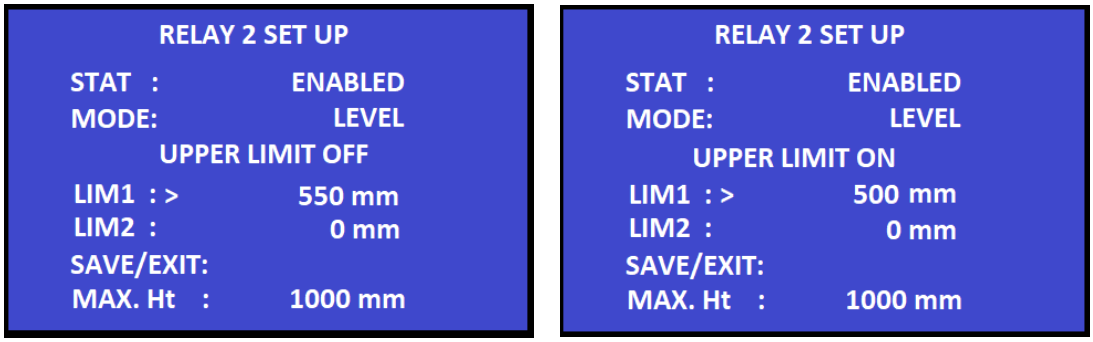


Fig 11.10 Inputting the Upper Limits.

The two Lower Limits are entered as LIM2.

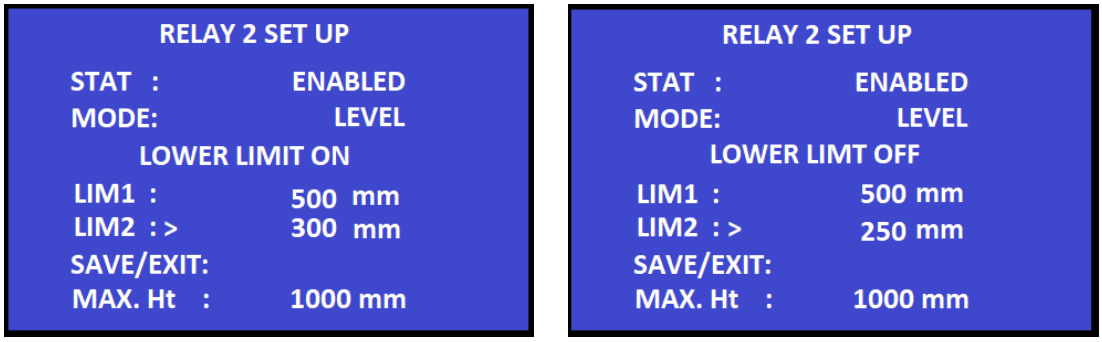
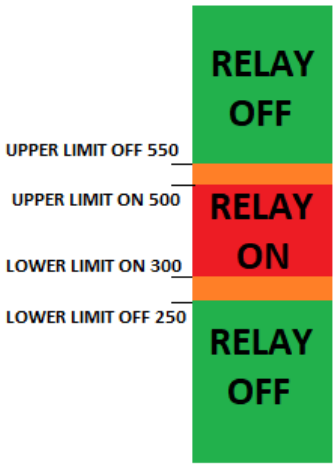


Fig 11.11 Inputting the Lower Limits.



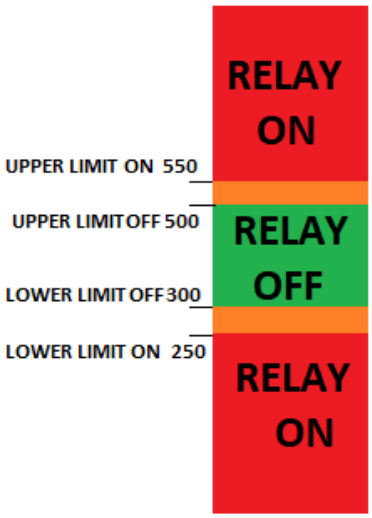
The settings shown above would result in the behaviour shown opposite.

The Relay will be OFF below the LOWER LIMIT OFF Value **or** above the UPPER LIMIT OFF Value.

The Relay will be ON when the Value is Above the LOWER LIMIT ON Value **and** below the UPPER LIMIT ON Value.

The Relay will remain in its current State between the 2 Upper limits and 2 Lower Limits.

Fig 10.11 In Range Relay Behaviour.



With the same entries and the relay set as NOT IN RANGE, the relay would behave as shown opposite.

The Relay will be ON below the LOWER LIMIT ON Value **or** above the UPPER LIMIT ON Value.

The Relay will be OFF when the Value is Above the LOWER LIMIT OFF Value **and** below the UPPER LIMIT OFF Value.

The Relay will remain in its current State between the 2 Upper limits and 2 Lower Limits.

Fig 11.12 Not In Range Relay Behaviour.

11.3. Exit/Save.

The Relay Settings are only saved when the menu is correctly exited and save selected from the Exit/Save option. If No is selected the previously saved values are restored.

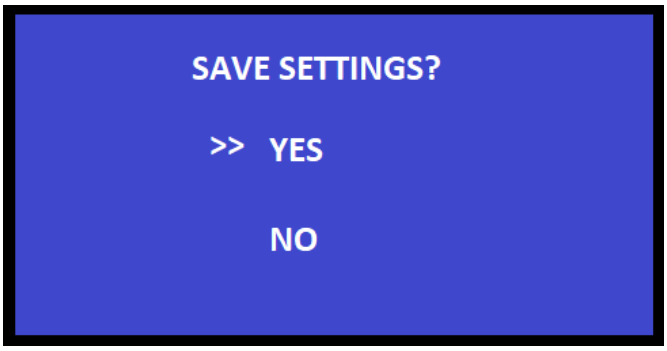


Figure 11.13 Save And Exit.

Use ⬆ or ⬇ Buttons to select YES or NO and the ▶ button to confirm the selection.

12. Configuring the 4-20mA Set Up.

The USM has a 4-20mA output which will provide an isolated current output proportional to the selected Measurement.

Use ⬆ or ⬇ Buttons to select the required Parameter.

Figure 12.1 4-20mA Setup Screen.

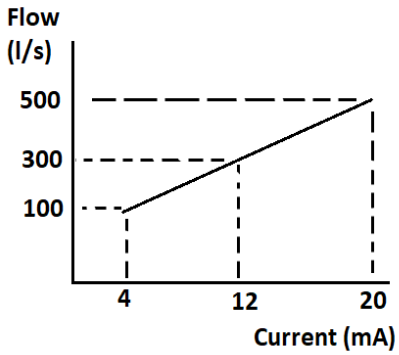
12.1. Status.

With the cursor on STAT: the ▶ button will toggle the 4-20mA between Enabled and Disabled. When the channel is disabled, the output is set at 0mA.

12.2. Mode.

With the cursor on MODE: the ▶ button will switch the referenced Measurement for the 4-20mA Output between Distance, Level and Flow.

12.3. Current Set Points.



The 4mA and 20mA Set Points are used to define the relationship between the output current and the selected measurement.

The Graph opposite shows the linear relationship with 4mA set to 100 l/s and the 20mA set to 500 l/s. The current output at 300 l/s would be 12mA.

Figure 12.2 4-20mA Output.

With the cursor on 4mA or 20mA press the ▶ button. The cursor will move and the Value can be entered using ↑ and ↓ Buttons.

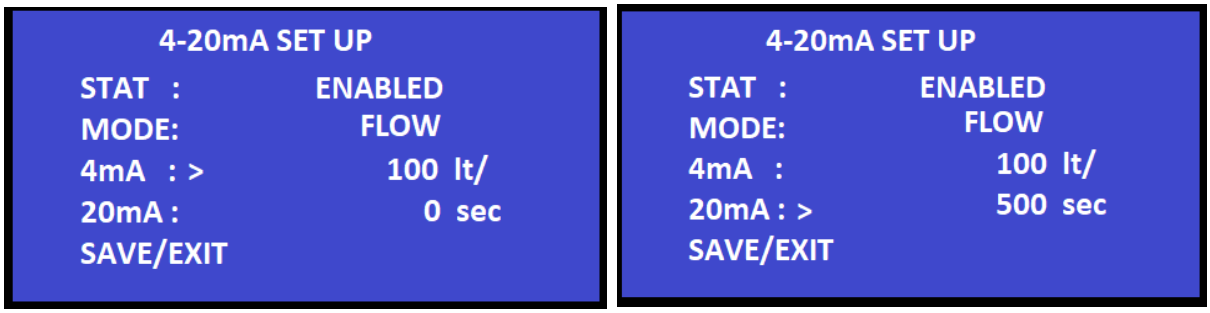


Figure 12.3 Enter 4-20mA Set Points.

Press the ▶ button to accept the Value.

The maximum Distance is set by the Digisens maximum distance (3000mm, 60000mm, 10000mm or 20000mm).

The maximum Flow is the Span of the Weir or Flume.

The maximum Level is the Maximum Height of the Weir or Flume.

12.4. Save/Exit.

The 4-20mA Settings are only saved when the menu is correctly exited and save selected from the Save/Exit option. If No is selected the previously saved values are restored.

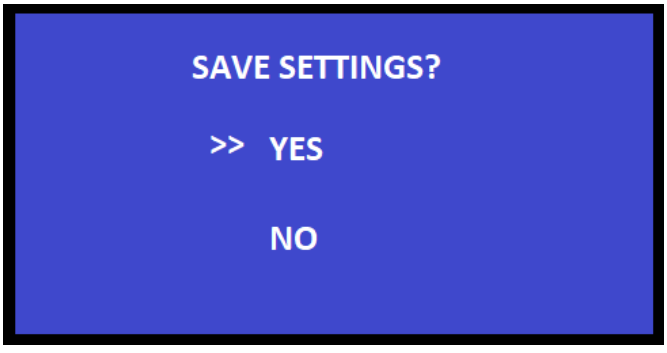


Figure 12.4 Save And Exit.

Use ↑ or ↓ Buttons to select YES or NO and the ▶ button to confirm the selection.

13. Configuring the Comms Parameters.

The USM Comms Port can be configured can be configured as a ModBus RS485 Slave port to respond to Building Management System (BMS) requests or as a Master port to control a GPRS unit.

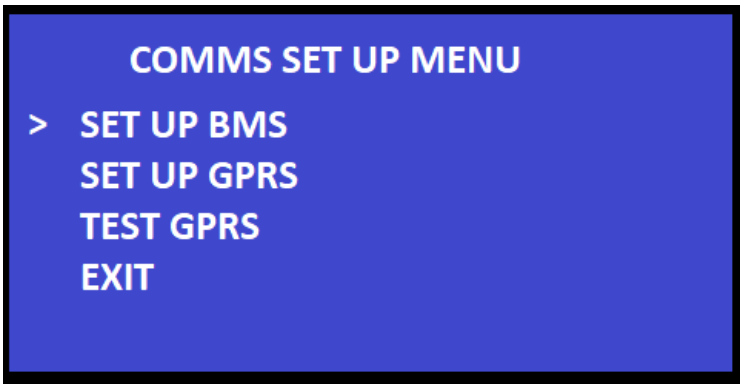


Figure 13.1 Comms Selection Screen.

Use ↑ and ↓ Buttons to Select the required Set Up and confirm with the ▶ button.

Use Exit or the ⌂ Button to return to the Main Menu.

13.1. BMS Set Up

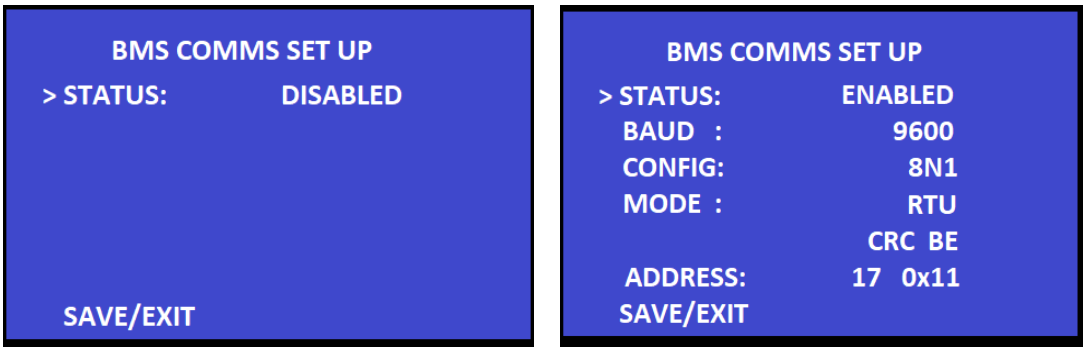


Figure 13.2 Comms BMS Setup Screen.

Use ↑ or ↓ Buttons to select the required Parameter.

13.1.1. Status.

With the cursor on STATUS: the ▶ button will toggle the COMMs between Enabled and Disabled.

13.1.2. Baud.

With the cursor on BAUD: the ▶ button will toggle the Baud Rate between 9600 and 19200.

13.1.3. Config.

The Config. is used to set the configuration of Comms Port Number of Bits, Number of Stop Bits and Parity.

With the cursor on CONFIG: the ▶ button will rotate through the available configurations:

7N1 – 7 bits, No Parity, 1 stop bit.

7E1 – 7 bits, Even Parity, 1 stop bit.

7O1 – 7 bits, Odd Parity, 1 stop bit.

7N2 – 7 bits, No Parity, 2 stop bits.

8N1 – 8 bits, No Parity, 1 stop bit.

8E1 – 8 bits, Even Parity, 1 stop bit.

8O1 – 8 bits, Odd Parity, 1 stop bit.

8N2 – 8 bits, No Parity, 2 stop bits.

The configuration is related to Mode (which also defines the number of bits). If the Mode is incompatible with the selected Configuration, the Mode will change automatically.

Ensure both Mode and Configuration are as required before saving the Set Up.

13.1.4. Mode.

The Mode is used to Define the Format of ModBus being used.

With the cursor on MODE: the ▶ button will rotate through the available standards:

ASCII-7 - 7-bit ASCII Format.

ASCII-8 - 8-bit ASCII Format.

RTU - ModBus RTU.

The ModBus RTE can be further defined with the CRC as Big Endian or Little Endian.

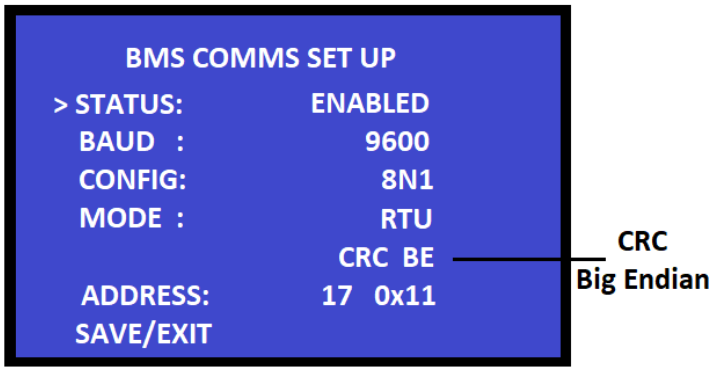


Figure 13.3 Endian Setting on RTU.

13.1.5. Address.

With the cursor on ADDRESS: press the ▶ button. The cursor will move to show that the Address Value can be changed,

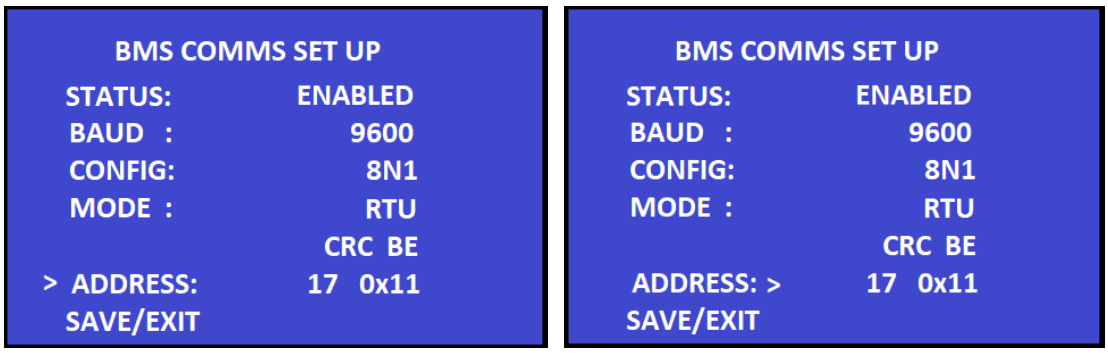


Figure 13.4 Changing the Address.

Use the and Buttons to change the Address. The Address can be set from 1 to 248 or OFF (equivalent of Address zero). The Address will pause when the value passes through OFF.

When the Address is set press the button to accept the Address. Use the Button to cancel and return to the previous Address.

13.1.6. Save/Exit.

The BMS Comms Settings are only saved when the menu is correctly exited and save selected from the Save/Exit option. If No is selected the previously saved values are restored.

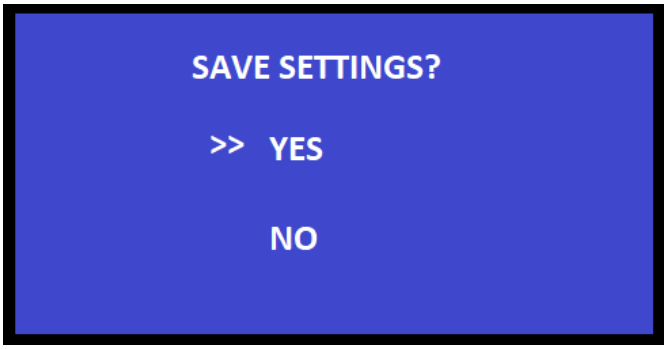


Figure 13.5 Save And Exit.

Use or Buttons to select YES or NO and the button to confirm the selection.

13.2. GPRS Set Up and Test

The use of the GPRS Set Up and Test has been superseded by the Use of a Robustel GPRS with the BMS Set Up.

Should you require to use a different GPRS unit, please contact Smart Storm.

13.3. Robustel Configuration.

The Robustel GPRS is pre-configured when supplied by Smart Storm. Use the following Set Up for Comms Parameters.

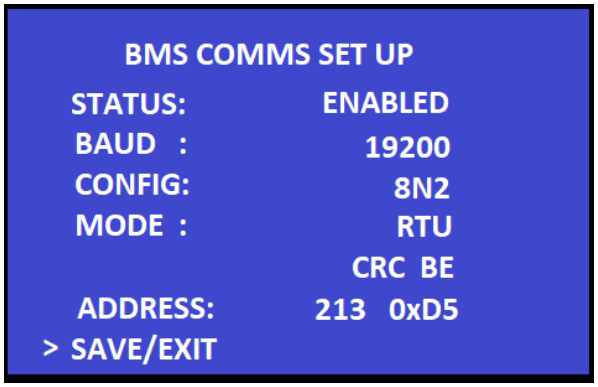


Figure 13.6 Robustel Configuration.

If a second USM is connected to the Robustel the address shous be set to 214 (0xD6).

14. Relay Test.

The USM Relay Test Screen can be used for testing the relays or for driving the connected equipment (e.g., testing a sampler will respond to a sample request or testing an alarm).

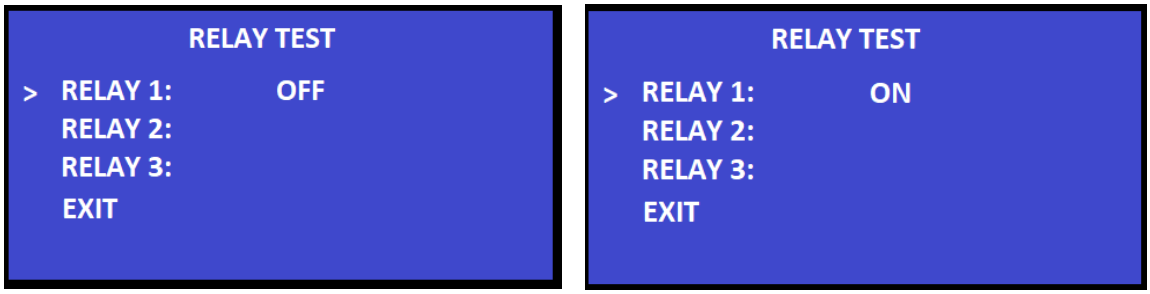


Figure 14.1 Relay Test.

Use the ↑ or ↓ Buttons to select the Relay. The ▶ button can be used to toggle the Relay state.

15. 4-20mA Test.

The USM 4 - 20mA Test Screen can be used for setting the current output for testing or for driving the connecting equipment.

The output value can be changed using the or buttons. Pressing or will exit to the Configuration MENU.

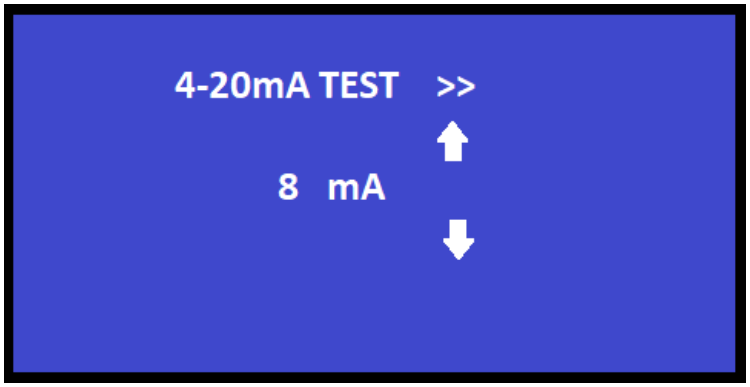


Figure 15.1 4-20mA Test Screen.

Use the and Buttons to change the Current Output Value. The Value can be set between 0mA and 20mA.

Use the Button or the Button to return to the Main Menu.

The output can be checked by measuring the voltage generated across a 100 ohm resistor on the output (current = voltage/100) or by direct measurement using the current input on a suitable multi-meter.

N.B. In both cases any other connections from the 4-20mA output circuit should be removed.

The 4-20mA test can be used for calibration to other equipment.

To integrate to a data logger, configure the 4mA output to 0.0 flow and the 20 mA to the span of the Flow Device.

In the 4-20mA Test, set the output to 4mA and enter 0.0 as the 4mA value on the data logger.

Set the output to 20mA and enter the Span as the 20mA value on the data logger.

This will calibrate the USM to the data logger. Refer to the data logger instruction manual for details of calibrating the values.

16. Simulation Test

The USM Simulation Test Screen can be used for testing the Relays and 4 – 20mA outputs. There are two test modes: SWEEP and FIXED.

Use the ⬆ and ⬇ Buttons to select SWEEP or FIXED and the ▶ Button to confirm the selection.

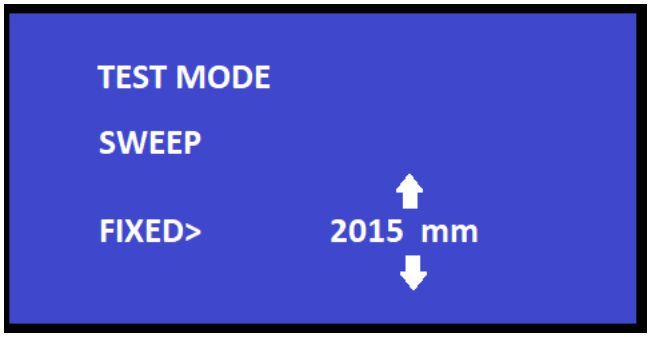
16.1. Sweep Mode.

When SWEEP Mode is selected and confirmed, the USM will return to the Home Screen and sweep the Distance (as normally recorded by the Ultrasonic Head) from the No Flow Distance to the Max height and Back to the No Flow Distance.

Figure 16.1 Simulation Test Screen.

This will cause the Level to sweep from 0mm to the Maximum height and back to 0mm.

16.2. Fixed Mode.



When Fixed Mode is selected, the cursor will move to allow a Distance to be entered using the ⬆ and ⬇ Buttons.

The distance is the distance normally recorded by the Ultrasonic Head.

Figure 16.2 Fixed Simulation Test.

The Level will be the No Flow Distance – the Distance set. The No flow Distance is the maximum distance that can be set.

16.3. Entering and Exiting Test Mode

After selecting the Test Mode, confirm that Test Mode is to be turned On.

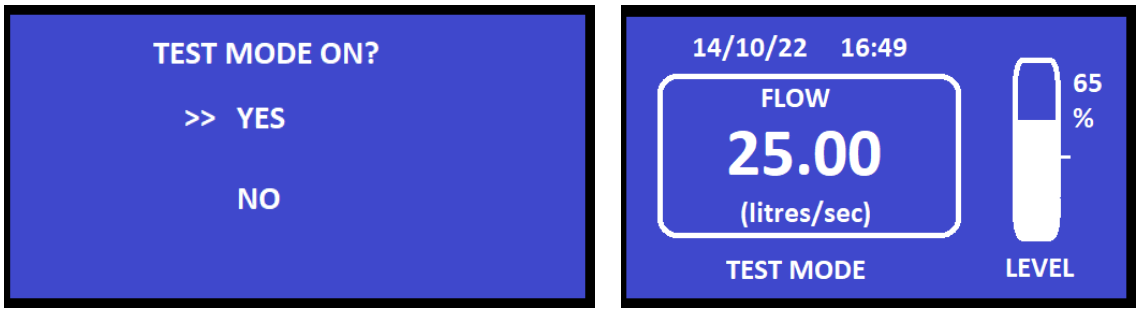


Figure 16.3 Entering Test Mode.

The USM will enter Test Mode and return to the Home Screen. The Home Screen will indicate that the USM is in Test Mode.

The USM will remain in Test Mode for a minimum of 5 minutes, then automatically return to Normal Mode. Pressing any Button will reset the Test mode duration to 5 minutes.

To exit Test Mode, Press the ▶ and enter the Password. Select SIMUL. TEST and at the TEST MODE OFF? Screen, select YES.

Whilst in Simulation Test flow values are not recorded as Daily Maximum and Minimum.

17. Change Password.

The default password can be changed from 0000. Select CHANGE PASSWORD from the Main Menu. Enter the Current Password and the New Password and Confirm the Password is to be changed.

Caution is advised, as the new password is saved immediately after the last digit is entered. The new password will be shown for 3 seconds after the change is confirmed.

18. Echo Profile.

The Echo Profile provides a real time representation of the Ultrasonic Echo received by the Ultrasonic Head. It can be used to ensure there are no obstructions causing false echoes and that the displayed distance is coming from a strong return echo.

18.1. Select the Scale.

The scale for the X axis is selectable and dependant on the sensor type.

Use the ↑ and ↓ Buttons to select required Scale and the → Button to confirm the selection.

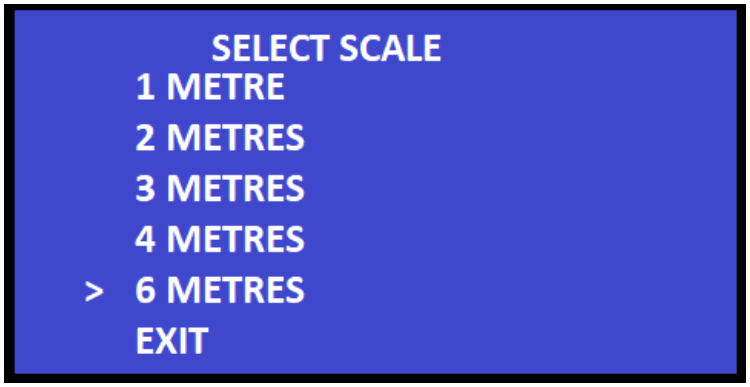


Figure 18.1 Scales for a Digisens 6 Sensor.

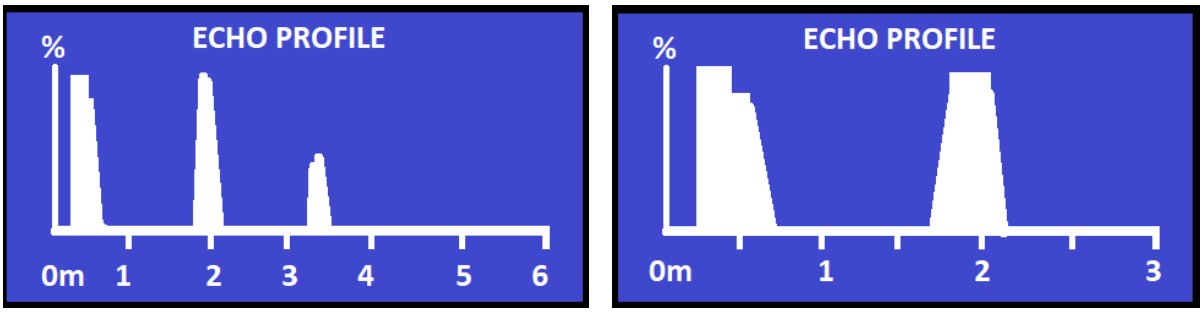


Figure 18.2 Effect of Scaling on Echo Profile.

Figure 17.2 the Echo Profile with 6 Metres and 3 Metres selected. Both show a strong return Echo at around 1.8 metres.

18.2. Select the Blanking.

The Echo Profile can be viewed with the Blanking ON or OFF.

After selecting the Scale, the Blanking Select Screen can be seen.

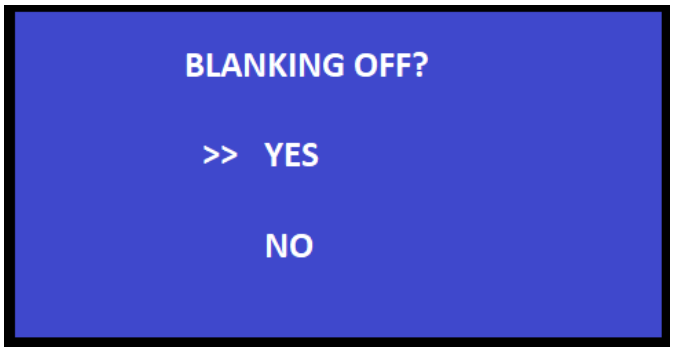


Figure 18.3 Selecting the Blanking.

Use the ⬆ and ⬇ Buttons to select required Scale and the ▶ Button to confirm the selection.

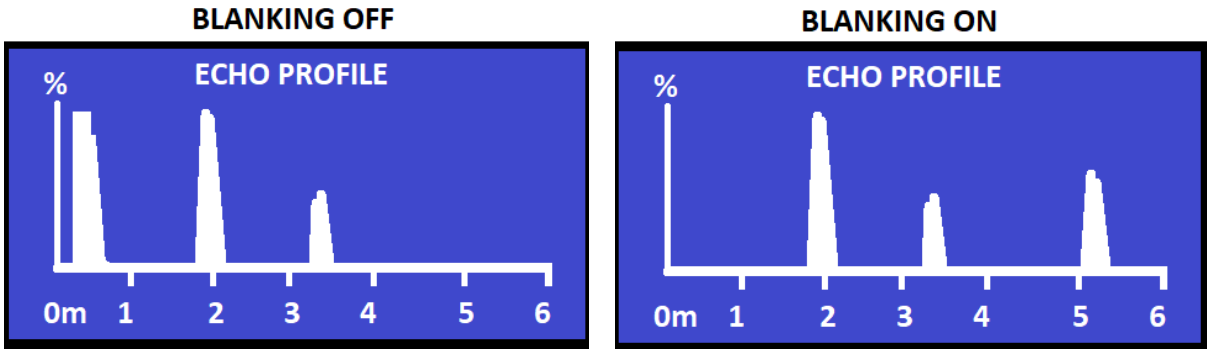


Figure 18.4 Effects the Blanking.

With Blanking On the Start of Echo Profile is ignored (this is due to effects within the Ultrasonic Head, known as the Dead Band). This allows more Bandwidth to see echoes at a greater distance.

With Blanking OFF the Dead Band is visible. This can be important when deciding where to set the Blanking distance.

19. Sleep Timer.

The Sleep Timer is used to save power and dictates how long the screen remains on after any Button is pressed. This has no effect on the operation of the USM.

Figure 19.1 Sleep Timer Screen.

Use the ⬆ and ⬇ Buttons to Step through the available Sleep Times and the ▶ Button to enter the selection. The Sleep Time will be saved when confirmed on the Save Settings? Screen.

The Sleep Timer can be configured as: **OFF, 1 minute, 2 minutes, 5 minutes, 10 minutes and 30 minutes**.

The USM will come out of sleep mode when any button is pressed.

20. Engineering Menu.

The Engineer Menu is password protected and not available for general use. For further information contact Smart Storm.

21. Configuration File.

The configuration of the USM, can be stored to the internal SD card and reloaded as required. This is particularly usefully to reset the USM if there is a fault condition. The Configuration File should only be saved when it is known to be correct as it will overwrite the factory default settings.

Use the ⬆ and ⬇ Buttons to Select Save or Load and the ▶ Button to enter the selection.

The file will only be saved/loaded when confirmed at the next page.

22. ModBus Communications.

22.1. ModBus RTU.

The USM uses standard Modbus RTU protocol. The registers are outlined below:

REGISTER ADDRESS			REGISTER	FORMAT
HEX	**DEC**	**PLC**		TYPE (LEN.) – No. Regs
0x0200	512	40513	SERIAL NUMBER	Long Int (32 bit) – 2 reg.
0x0202	514	40515	FLOW (l/s)	Float (32 bit) – 2 reg.
0x0204	516	40517	LEVEL (mm)	Float (32 bit) – 2 reg.
0x0206	518	40519	DISTANCE (mm)	Float (32 bit) – 2 reg.
0x0208	520	40521	TEMPERATURE (°C)	Float (32 bit) – 2 reg.
0x020A	522	40523	DAILY TOTAL (m^3)	Float (32 bit) – 2 reg.
0x020C	524	40525	TOTALISER (m^3)	Double (64 bit) – 4 reg.
0X0210	528	40529	RELAY STATUS	Int (16 bit) – 1 reg.
0X0211	528	40530	STATUS	Int (16 bit) – 1 reg.
0X0212	528	40531	mA OUTPUT (mA)	Float (32 bit) – 2 reg.

Table 22.1 Modbus Registers.

All registers can be read with the Modbus Command:

D5 04 02 00 00 14 E3 A9 (where D5 is the Address of the USM and E3 A9 the CRC).

An example response on Modbus Poll is shown below.

	Name	0200	Name	0210
0	SERIAL	2111005	RELAY STATUS	0x0010
1		--	STATUS	0
2	FLOW	24.0532	mA OUT	11.759
3		--		--
4	LEVEL	153.04		
5		--		
6	DISTANCE	596.96		
7		--		
8	TEMPERATURE	19.44		
9		--		
A	DAILY	2112.6		
B		--		
C	TOTAL	330696.305774811		
D		--		
E		--		
F		--		

Figure 22.2 Modbus Poll All Registers.

To accommodate some Building Management Systems, if the CRC bytes are switched, the USM Comms Mode can be changed:

D5 04 02 00 00 14 **E3 A9** normal - RTU CRC BE.

D5 04 02 00 00 14 **A9 E3** switched - RTU CRC LE.

Individual Registers can also be read:

Flow:	Totaliser:	Relay Status:
D5 04 02 02 02 C3 A7	D5 04 02 0C 04 22 66	D5 04 02 10 01 88 EE

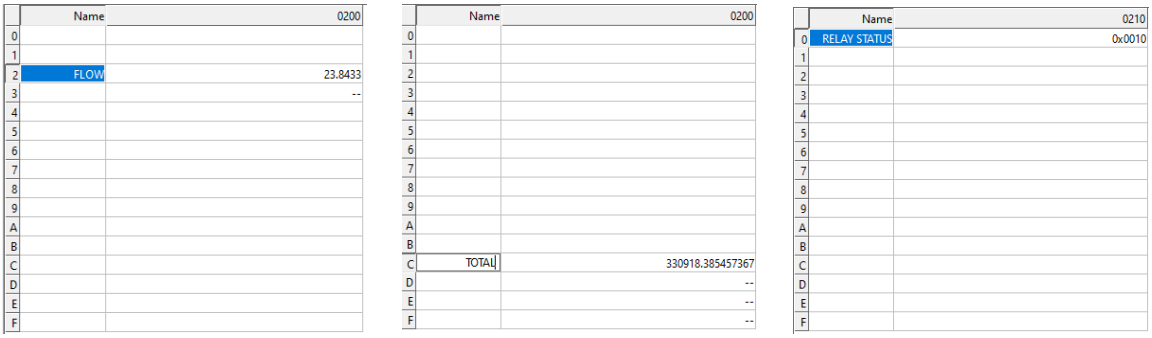


Figure 22.3 Modbus Poll Individual Registers.

22.1.1. Relay Status.

The status of the 4 relays is shown in the Relay Status Register. Each Relay is represented by 4 bits, a 1 shows the Relay is ON and a 0 shows the Relay is OFF.

ALARM	RELAY 3	RELAY 2	RELAY 1	
000X	000X	000X	000X	where X represents the Relay Status.

The above example 0x0010 shows Relay 2 is ON and the other 3 Relays are OFF.

22.1.2. Status.

The Status of the USM is shown in the Status Register.

0x0000 (Dec 0) – Normal Running

0x0001 (Dec 1) – Lost Comms

0x0002 (Dec 2) – Lost Echo

0x0003 (Dec 3) – In Menu

0x0004 (Dec 4) – Test Mode

22.2. ASCII Modbus.

The USM uses a simplified Modbus ASCII protocol. The registers are outlined below:

REGISTER ADDRESS		REGISTER	`
HEX	(DEC)		TYPE (LEN.) – No. Regs
0x0000	(0)	FLOW (l/s)	Float (32 bit) – 2 reg.
0x0004	(4)	LEVEL (mm)	Float (32 bit) – 2 reg.
0x0008	(8)	DISTANCE (mm)	Float (32 bit) – 2 reg.
0x000C	(12)	TEMPERATURE (°C)	Float (32 bit) – 2 reg.
0x0010	(16)	TOTALISER (m³)	Double (64 bit) – 4 reg.
0x0018	(24)	DAILY TOTAL (m³)	Float (32 bit) – 2 reg.
0x001C	(28)	RELAY STATUS	Int (16 bit) – 1 reg.
0x0020	(32)	STATUS	Int (16 bit) – 1 reg.
0x0024	(36)	mA OUTPUT (mA)	Float (32 bit) – 2 reg.
0x0028	(40)	SERIAL NUMBER	Long Int (32 bit) – 2 reg.

Table 22.2 ASCII Registers.

Registers can only be accessed individually. Examples of the Modbus Requests are shown below.

FLOW:

TX: 3A 44 35 30 33 30 30 30 30 30 30 30 32 32 36 0D OA

: D5 03 00 00 00 02 CRC CR LF

RX: 3A 44 35 30 33 30 34 34 31 43 30 36 43 46 43 42 42 0D OA

: D5 03 04 41 30 6C FC CRC CR LF

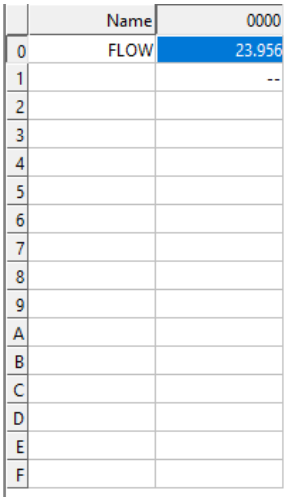


Figure 22.4

ASCII Flow Command.

TOTALISER:

TX: 3A 44 35 30 33 30 30 31 30 30 30 30 34 31 34 0D OA

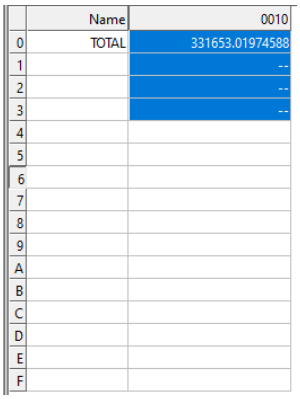
: D5 03 00 10 00 04 CRC CR LF

RX: 3A 44 35 30 33 30 38 34 31 31 34 33 45 31 34 31 34 33 38

: D5 03 08 41 14 3E 14 14 38

RX: 34 33 39 36 35 34 0D OA

43 96 CRC CR LF



	Name	0010
0	TOTAL	331653.01974588
1		--
2		--
3		--
4		
5		
6		
7		
8		
9		
A		
B		
C		
D		
E		
F		

Figure 22.5

ASCII Flow Command.

SERIAL NUMBER:

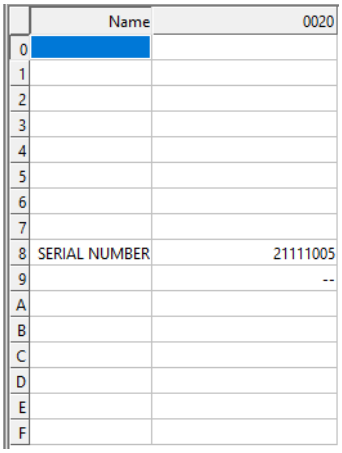
TX: 3A 44 35 30 33 30 30 32 38 30 30 30 32 46 45 0D OA

: D5 03 00 28 00 02 CRC CR LF

RX: 3A 44 35 30 33 30 34 30 31 34 32 32 30 44 44 42 31 0D OA

: D5 03 04 01 42 20 DD CRC CR LF

0x014220DD = 21111005(Decimal)



	Name	0020
0		
1		
2		
3		
4		
5		
6		
7		
8	SERIAL NUMBER	21111005
9		--
A		
B		
C		
D		
E		
F		

Figure 22.6

ASCII Serial Number Command.

Relay Status:

TX: 3A 44 35 30 33 30 30 31 43 30 30 30 31 30 42 0D 0A

: D5 03 00 1C 00 01 CRC CR LF

The Relay Status and Status are as shown for the RTU.

22.3. Terminal ASCII

A simpler form of ASCII Modbus communication is provided for use with a terminal application.

In this format the text can be written to the application which will send the string and attach the carriage return and line feed.

The format is as follows:

Colon USM address (hex) parameter. No LRC is used and the application should be configured to add the CR and LF.

Available parameters are flow, distance, level, temperature, daily total, totaliser.

An example using Tera Term is shown below. The text strings sent begin :C9 (the address of the USM) and the replies from the USM are below.

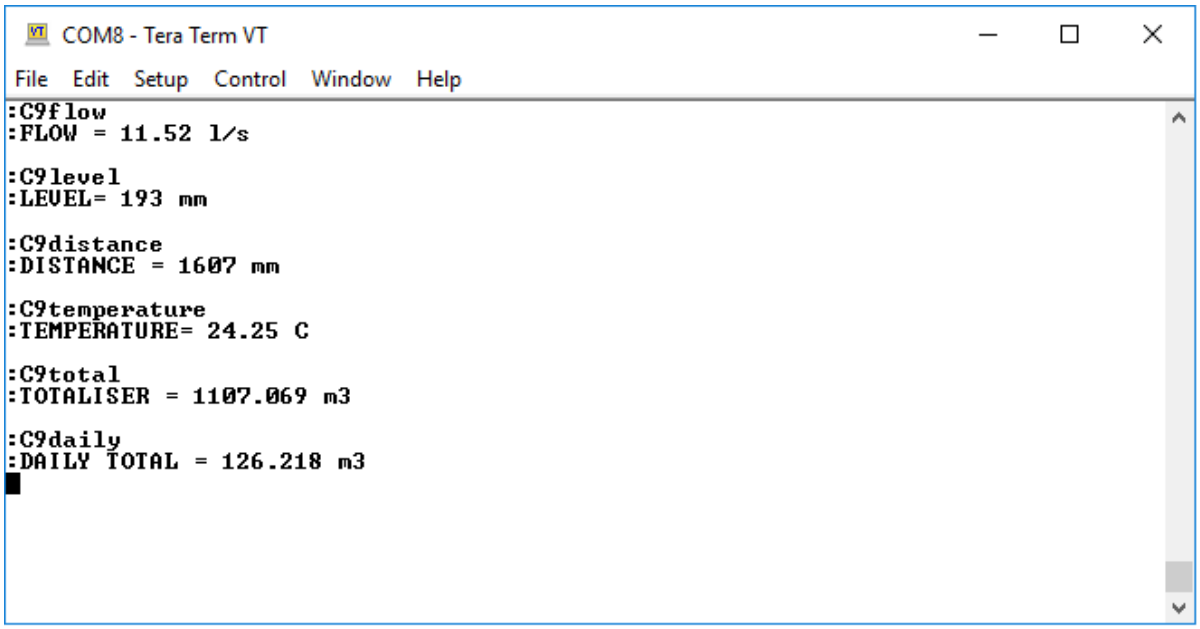


Figure 22.6 Terminal Commands on TerraTerm.

23. Log Files.

The Data from the USM is stored on an internal SD card. The SD card can be accessed by connecting a USB cable between the MINI B USB connector on the USM and a PC.

The files can then be accessed from the Logger Set Up Menu. From the Main Menu select LOGGER SET UP to access the DATA LOGGER MENU. Move the cursor to Connect to USB using the ⬆ and ⬇ Buttons and the ▶ button to select.

To Disconnect, remove the USB cable and return to Main Menu using the ⌂ Button.

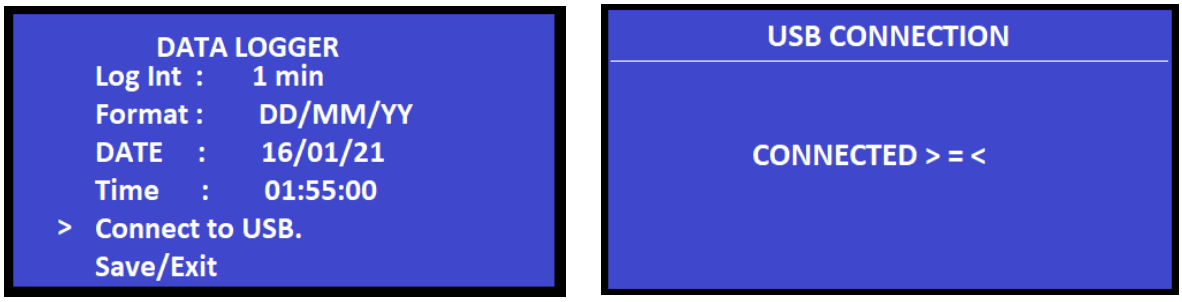


Figure 23.1 Accessing the Log Files.

The USM will show it is connected.

Open Windows Explorer and navigate to USB Drive (this may open automatically).

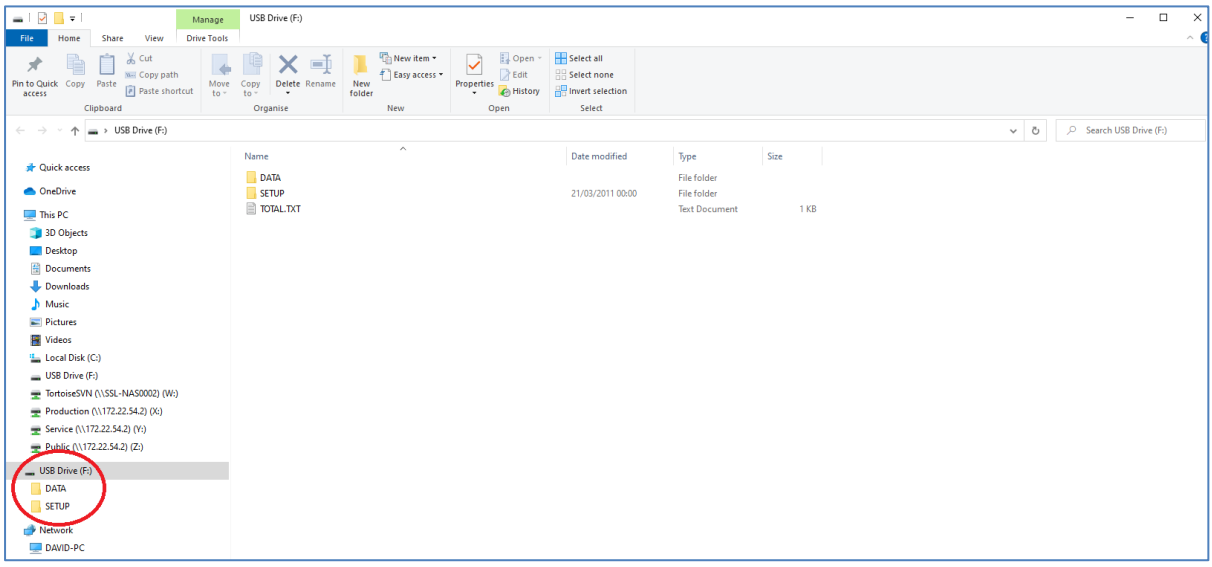


Figure 23.2 Windows Explorer.

Two Folders – DATA and SET UP should be visible alongside the TOTAL.TXT file which contains the Current Totaliser.

23.1. Data Folder.

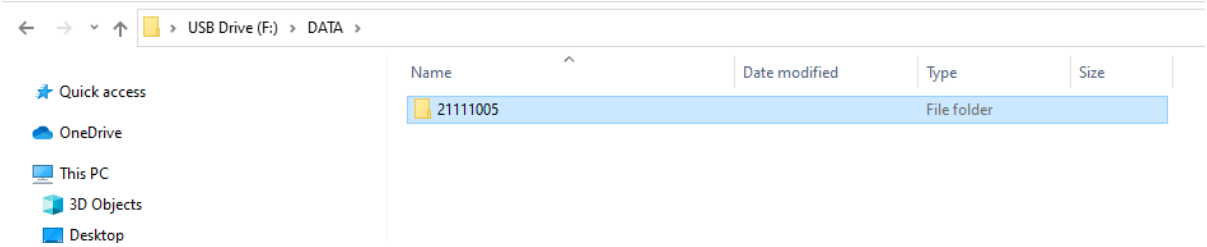


Figure 23.3 Data Structure.

The Data Folder contains the Data Log Files for the USM. These are grouped into Serial Number Folders. If the Serial Number has not been changed there should only be one Folder with the current Serial Number. It is possible that if the USM has been reset, a Folder called SN_FAULT has been created, and this will contain the data when no Serial Number was present.

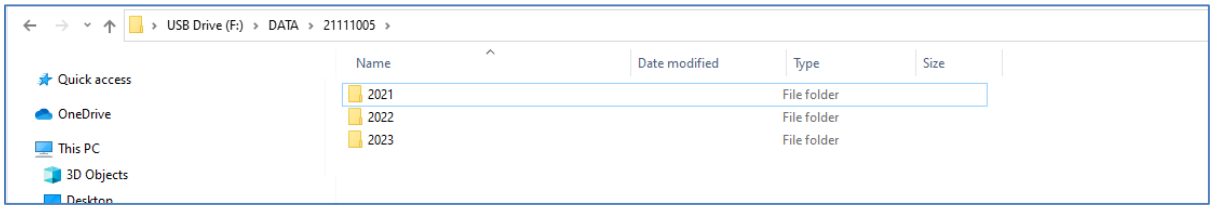


Figure 23.4 Serial Number Structure.

The Serial Number Folder is divided into the records from individual years containing monthly records. The name of the file consists of the last 4 digits of the Serial Number, the month of the record and the extension.

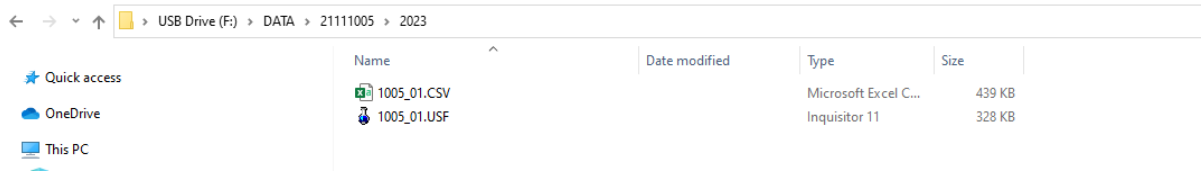


Figure 23.5 Monthly Records.

23.1.1. Inquisitor File

The .USF is an Inquisitor file and can only be opened using Smart Storm Inquisitor Software.

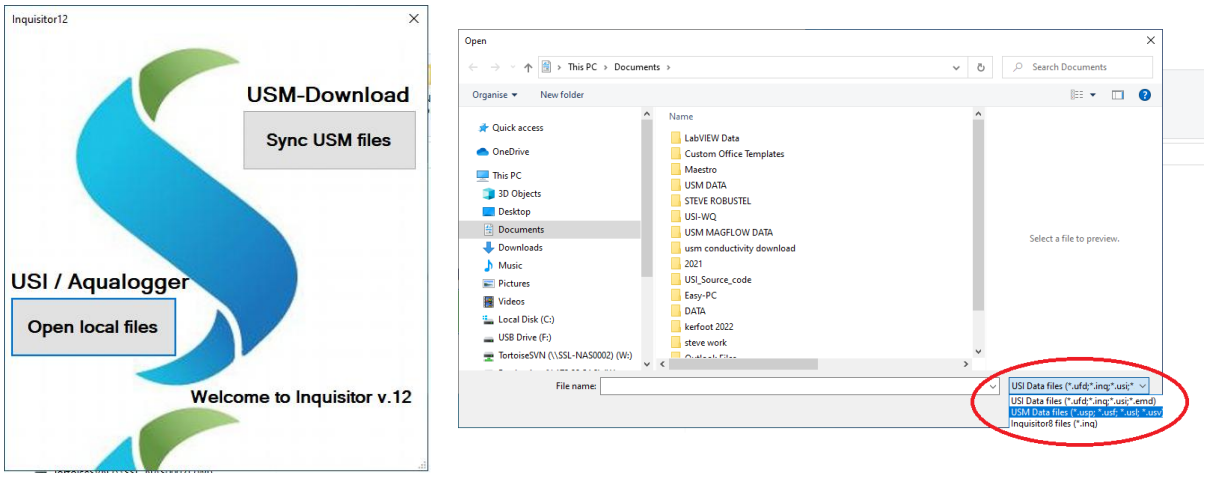
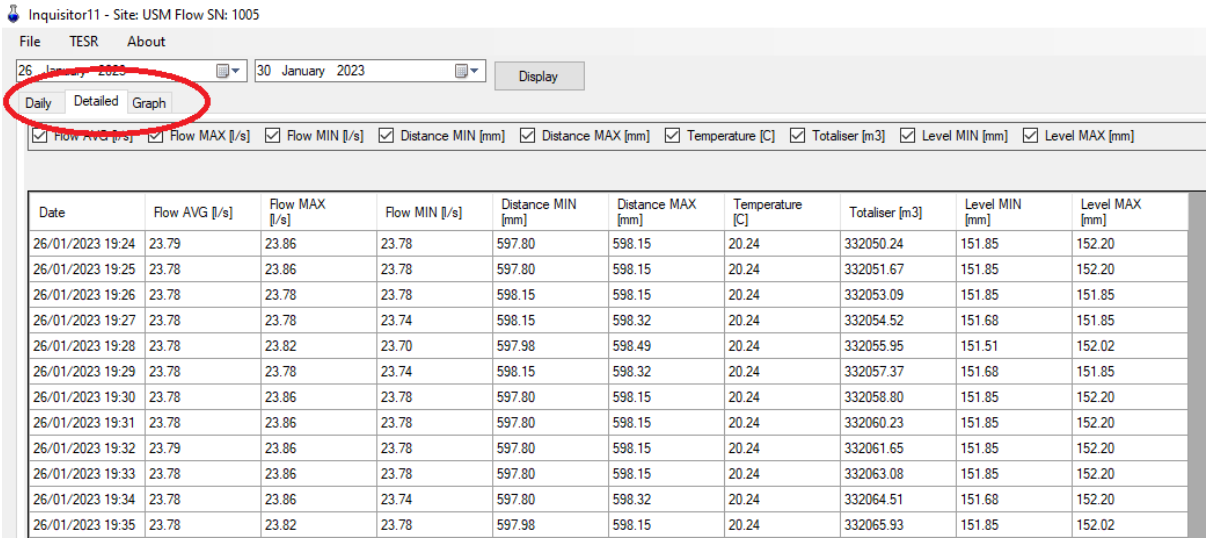


Figure 23.6 Inquisitor Front Screen.

With the USM connected to the PC, The Sync USM files can be used to upload the files from the USM.

Alternatively, the files can be copied to the PC and opened using Open local files. To see the USM files USM Data files must be selected as the File Type.



Date	Flow AVG [l/s]	Flow MAX [l/s]	Flow MIN [l/s]	Distance MIN [mm]	Distance MAX [mm]	Temperature [C]	Totaliser [m3]	Level MIN [mm]	Level MAX [mm]
26/01/2023 19:24	23.79	23.86	23.78	597.80	598.15	20.24	332050.24	151.85	152.20
26/01/2023 19:25	23.78	23.86	23.78	597.80	598.15	20.24	332051.67	151.85	152.20
26/01/2023 19:26	23.78	23.78	23.78	598.15	598.15	20.24	332053.09	151.85	151.85
26/01/2023 19:27	23.78	23.78	23.74	598.15	598.32	20.24	332054.52	151.68	151.85
26/01/2023 19:28	23.78	23.82	23.70	597.98	598.49	20.24	332055.95	151.51	152.02
26/01/2023 19:29	23.78	23.78	23.74	598.15	598.32	20.24	332057.37	151.68	151.85
26/01/2023 19:30	23.78	23.86	23.78	597.80	598.15	20.24	332058.80	151.85	152.20
26/01/2023 19:31	23.78	23.86	23.78	597.80	598.15	20.24	332060.23	151.85	152.20
26/01/2023 19:32	23.79	23.86	23.78	597.80	598.15	20.24	332061.65	151.85	152.20
26/01/2023 19:33	23.78	23.86	23.78	597.80	598.15	20.24	332063.08	151.85	152.20
26/01/2023 19:34	23.78	23.86	23.74	597.80	598.32	20.24	332064.51	151.68	152.20
26/01/2023 19:35	23.78	23.82	23.78	597.98	598.15	20.24	332065.93	151.85	152.02

Figure 23.7 Inquisitor Detailed Screen.

The logged data can be viewed in three ways:

Daily Report - showing the Max and Min values for the measurements over a 24-hour period, along with the Daily Total and Final total (value at midnight).

Detailed - Displays each record logged by the USM (shown above).

Graph - Graphical Representation shown below.

In each case the date range for the records can be selected and displayed by pressing the Display Button.

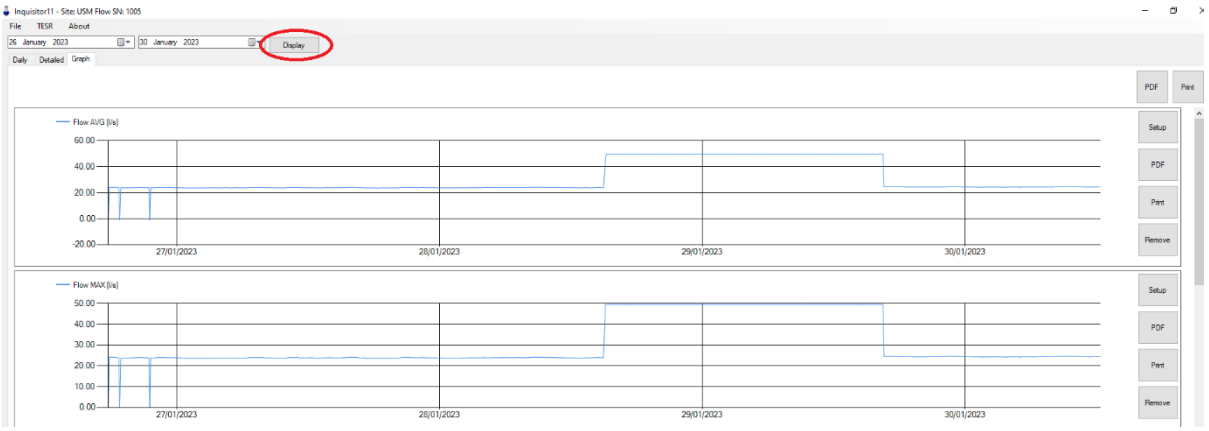
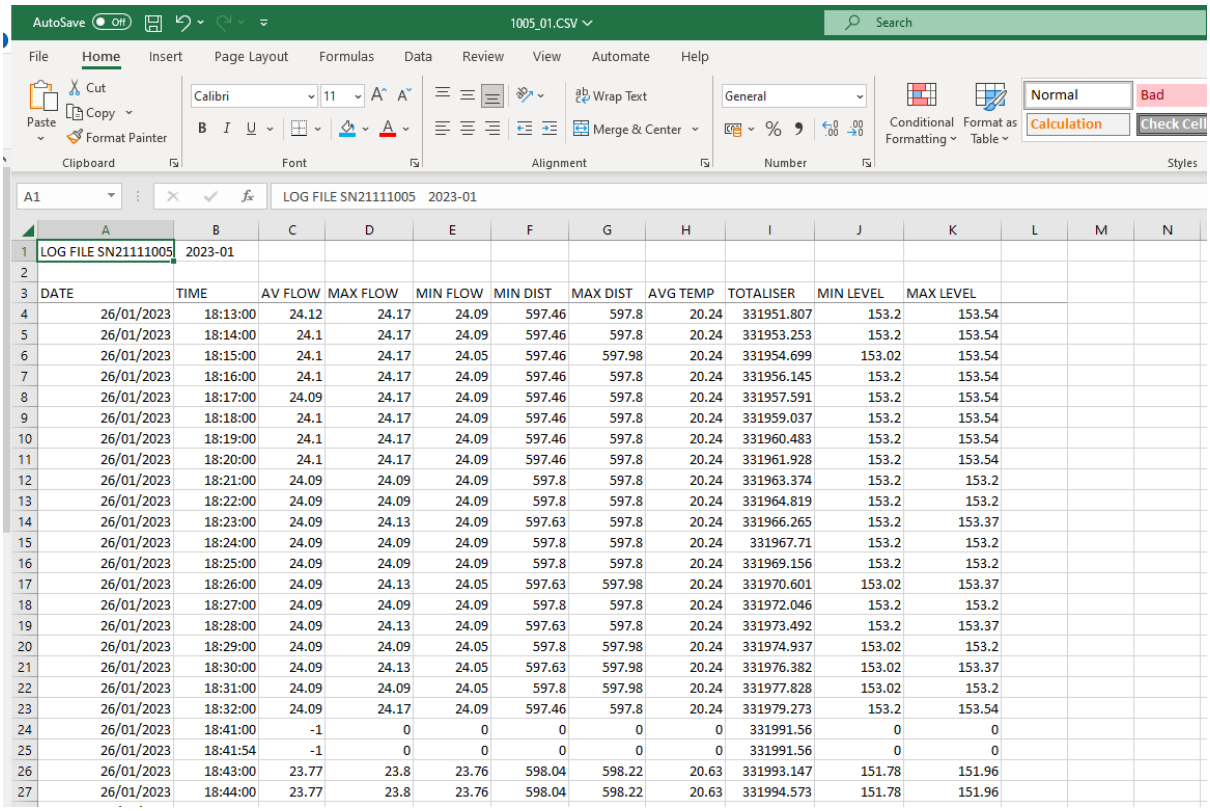


Figure 23.8 Inquisitor Graph Screen.

Further information can be found in the Smart Storm Inquisitor Guide.

23.1.2. CSV File

The data is also logged as a CSV file and can be opened with spreadsheet software.



	A	B	C	D	E	F	G	H	I	J	K
1	LOG FILE SN21111005	2023-01									
2											
3	DATE	TIME	AV FLOW	MAX FLOW	MIN FLOW	MIN DIST	MAX DIST	AVG TEMP	TOTALISER	MIN LEVEL	MAX LEVEL
4	26/01/2023	18:13:00	24.12	24.17	24.09	597.46	597.8	20.24	331951.807	153.2	153.54
5	26/01/2023	18:14:00	24.1	24.17	24.09	597.46	597.8	20.24	331953.253	153.2	153.54
6	26/01/2023	18:15:00	24.1	24.17	24.05	597.46	597.98	20.24	331954.699	153.02	153.54
7	26/01/2023	18:16:00	24.1	24.17	24.09	597.46	597.8	20.24	331956.145	153.2	153.54
8	26/01/2023	18:17:00	24.09	24.17	24.09	597.46	597.8	20.24	331957.591	153.2	153.54
9	26/01/2023	18:18:00	24.1	24.17	24.09	597.46	597.8	20.24	331959.037	153.2	153.54
10	26/01/2023	18:19:00	24.1	24.17	24.09	597.46	597.8	20.24	331960.483	153.2	153.54
11	26/01/2023	18:20:00	24.1	24.17	24.09	597.46	597.8	20.24	331961.928	153.2	153.54
12	26/01/2023	18:21:00	24.09	24.09	24.09	597.8	597.8	20.24	331963.374	153.2	153.2
13	26/01/2023	18:22:00	24.09	24.09	24.09	597.8	597.8	20.24	331964.819	153.2	153.2
14	26/01/2023	18:23:00	24.09	24.13	24.09	597.63	597.8	20.24	331966.265	153.2	153.37
15	26/01/2023	18:24:00	24.09	24.09	24.09	597.8	597.8	20.24	331967.71	153.2	153.2
16	26/01/2023	18:25:00	24.09	24.09	24.09	597.8	597.8	20.24	331969.156	153.2	153.2
17	26/01/2023	18:26:00	24.09	24.13	24.05	597.63	597.98	20.24	331970.601	153.02	153.37
18	26/01/2023	18:27:00	24.09	24.09	24.09	597.8	597.8	20.24	331972.046	153.2	153.2
19	26/01/2023	18:28:00	24.09	24.13	24.09	597.63	597.8	20.24	331973.492	153.2	153.37
20	26/01/2023	18:29:00	24.09	24.09	24.05	597.8	597.98	20.24	331974.937	153.02	153.2
21	26/01/2023	18:30:00	24.09	24.13	24.05	597.63	597.98	20.24	331976.382	153.02	153.37
22	26/01/2023	18:31:00	24.09	24.09	24.05	597.8	597.98	20.24	331977.828	153.02	153.2
23	26/01/2023	18:32:00	24.09	24.17	24.09	597.46	597.8	20.24	331979.273	153.2	153.54
24	26/01/2023	18:41:00	-1	0	0	0	0	0	331991.56	0	0
25	26/01/2023	18:41:54	-1	0	0	0	0	0	331991.56	0	0
26	26/01/2023	18:43:00	23.77	23.8	23.76	598.04	598.22	20.63	331993.147	151.78	151.96
27	26/01/2023	18:44:00	23.77	23.8	23.76	598.04	598.22	20.63	331994.573	151.78	151.96

Figure 23.9 CSV File.

If the USM is turned OFF dummy records are written to the CSV with the Flow at -1 and other values to zero to show the time the USM was turned OFF (last record written) and the time it was turned back ON.

23.2. SET UP Folder.

The Set-Up Folder stores the Configuration of the USM and a daily log of changes made to the Configuration and Menu Access.

These are grouped into Serial Number Folders. If the Serial Number has not been changed there should only be one Folder with the current Serial Number. It is possible that if the USM has been reset, a Folder called SN_FAULT has been created, and this will contain the information when no Serial Number was present.

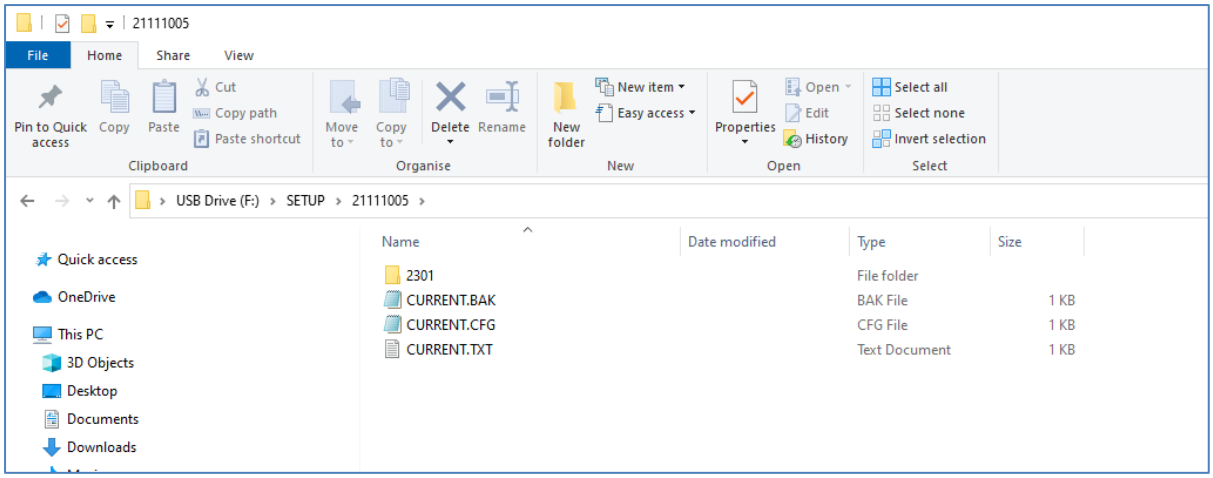


Figure 23.10 Set Up Files.

The Serial Number Folder contains Log Folders and Configuration Files.

23.2.1. Log Folders.

The Log Folders are named by Year and Month. 2301 refers to January 2023.

The folder will contain a Text File for each day the Configuration has been changed or the Menu accessed.

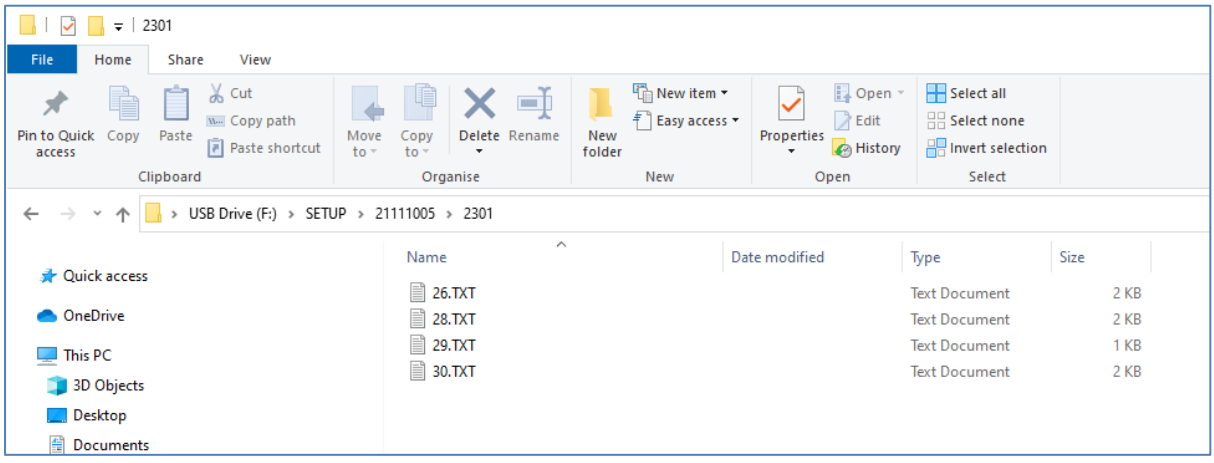


Figure 23.11 Log File Directories.

Each Log File contains the Configuration of the USM at the start of the day followed by the section that has been changed.

The change can be identified by comparing the section to the previous values.

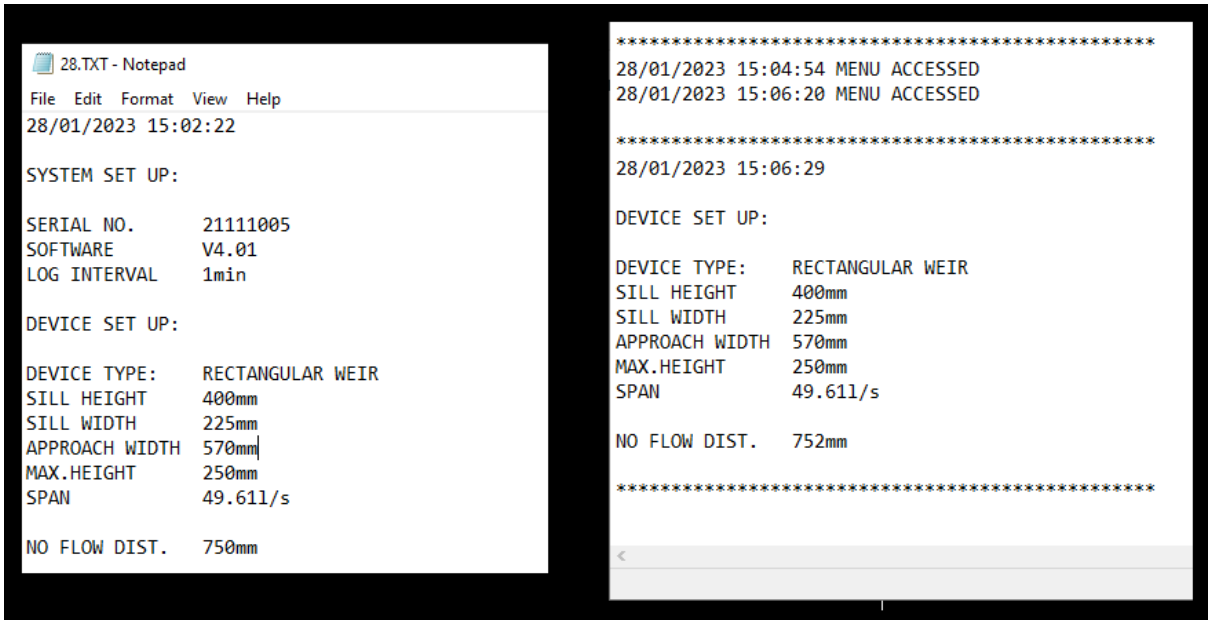


Figure 23.12 a & b Set Up File.

Figure 23.12 shows sections of the Log File. Fig 23.12a show the start of the file with the initial configuration. Fig 23.12b shows there was a change to the DEVICE SET UP at 15:06.

Comparing the two, it can be seen the NO FLOW DIST. was changed from 750mm to 752mm.

23.2.2. Configurations Files.

There are 3 Configurations Files stored on the SD card.

- **CURRENT.TXT -** The current USM Set Up in Text Format.
- **CURRENT.CFG -** The current USM Set Up in Hexadecimal Format (as stored in the Flash memory).
- **CURRENT.BAK -** The Saved USM Set Up in Hexadecimal Format (as stored in the Flash memory). This the file loaded that is saved by the SAVE CONFIG File Command and loaded by the LOAD CONFIG File Command.

24. Remote Monitoring.

The USM can be used with Robustel GPRS module to remotely monitor the unit.

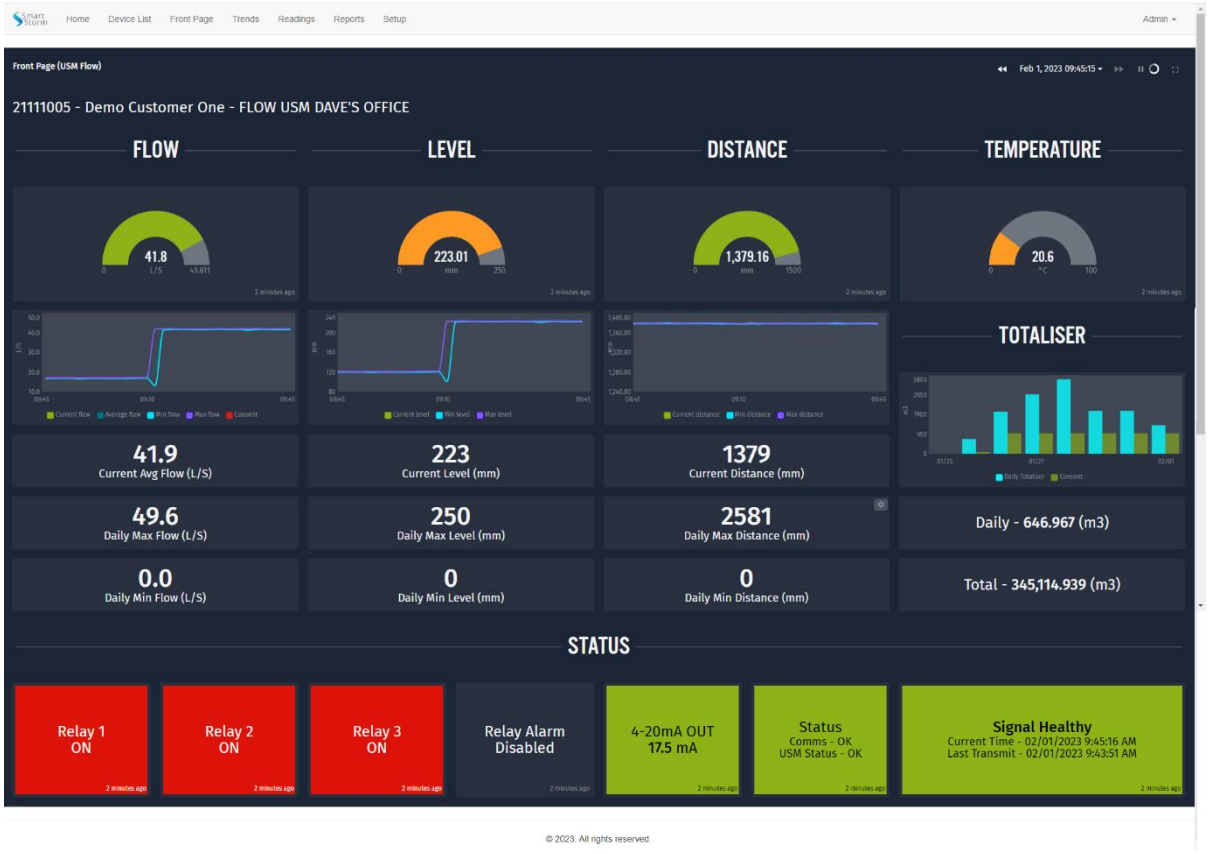


Figure 24.1 Remote Monitoring.

The Web Site shows the status of the USM (normally updated every 2 minutes) along with Trend Graphs which cover the last 3 days.

There are also Daily Reports with maximum and minimum measurements over 24 hours and a log of all records received.

Two configurable SMS alarms can be set from the website.

Further in information can be found in the Smart Storm Remote Monitoring User Manual.

25. Fault Finding

Fault	Possible Cause	Solution
No Display	Lost Power	Check external and internal fuses
No Display	Ribbon Cable disconnected from Main PCB	Carefully remove each end of enclosure. Separate top of enclosure from the bottom. Identify cable and carefully push back onto connector. Reassemble
Lost Comms	Sensor wiring incorrect	Check Wiring of the US sensor. Check Power to Senor is 15V
Flow reading not stable Or LOST ECHO displays continuously	US sensor incorrectly mounted	Check and ensure the US sensor is positioned correctly
No Current output on the 4 – 20 mA output	4 – 20 mA Setup not enabled. Setting enabled but set to zero. Incorrect wiring	Check Configuration. Ensure +ve and –ve terminals.are connected correctly.
Current mA Output read 24V	No load on 4-20mA output	Check the wiring of the 4-20mA output
Relay not triggering at set point	Relay_x is DISABLED. Set points not reached	Check the configuration of the relay

Table 6.1 Fault Finding

26. Appendix

26.1. Sensor Mounting

Mounting Over a V-Notch

Ultrasonic sensor must be positioned a distance 4-5h where h is the maximum level of liquid above the v-notch

Mounting Over a Flume.

Ultrasonic sensor must be positioned a distance 4-5h where h is the maximum depth of the flume.

26.2. Unit Conversion

The USM requires that some parameters be entered as L/s or g/s. Other units can be converted using the following tables.

Metric.

UNIT	Conversion Factor
L/mn (litres per minute)	0.0167
L/hr (litres per hour)	0.000278
m3/s (cubic metres per second)	1000
m3/mn (cubic metres per minute)	16.67
m3/hr (cubic metres per hour)	0.278
m3/day (cubic metres per day)	0.0116

I.E. To convert from a value in m3/day to L/s multiply the value by 0.0116.

Imperial.

UNIT	Conversion Factor
gal/mn(gallons per minute)	0.0167
gal/hr(gallons per hour)	0.000278
M gal/hr(Mega gallons per day)	11.574
ft3/s(cubic feet per second)	7.48052
ft3/mn(cubic feet per second)	0.24675
ft3/hr(cubic feet per second)	0.002078

27. Version Control.

V3.0	03/03/24	Original Version for Version 3.0 Software.
V3.1	12/06/24	Added PLC Modbus Registers.

28. Declaration of Conformity

We

Smart Storm Limited
1 Lon Cae Darbi
Cibyn Industrial Estate
Caernarfon, Gwynedd
LL55 2BD, UK

Declare under our sole responsibility that the products:

USI, Hydrocell, USM, Avocet 9000, Greasebuster, Neutralizer

are in conformity with the following directives where applicable:

- The Electromagnetic Compatibility (EMC) Directive 2014/30/EU
- The Low Voltage Directive 2014/35/EU
- RoHS2 Directive 2011/65/EU
- Machinery Directive 2006/42/EC
- S.I. 2016/1091 The Electrical Compatibility Regulations 2016 -UKCA
- S.I 2016/1101 The Electrical Equipment (Safety) Regulations 2016 -UKCA

We also declare that the products:

Named above

are of UK origin and are manufactured and tested to Smart Storm internal quality standards defined in the company's formal ISO9001:2015 quality manual and meet conformity assessment requirements for CE marking.

Dr John Duffy

Managing Director

30/06/2021

CERTIFIED ISO 9001:2015 COMPANY