



USM AV FLOW METER INSTRUCTION MANUAL



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4. SPECIFICATIONS

Specifications	Universal Smart Meter – Level Meter
Input	Dual-Wave Doppler AV Sensor.
Maximum Depth Measurement	10 metres
Maximum Velocity Measurement	10 m/s
Logging	20 years – every 2 minutes
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 3.1 Device Specifications

5. 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 the 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 the Smart Storm's web site www.smartstormgroup.com.

5.1. 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.








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).

5.2. 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.	

5.3. 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.

5.4. 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.

6. GETTING STARTED.

6.1. General Product Information

The instrument measures Flow using a Dual-Wave Doppler AV Sensor. The sensor measures the Velocity and Depth of the fluid. The area of the fluid can then be determined from the depth and entered profile of the channel/pipe and the volume of flow calculated.

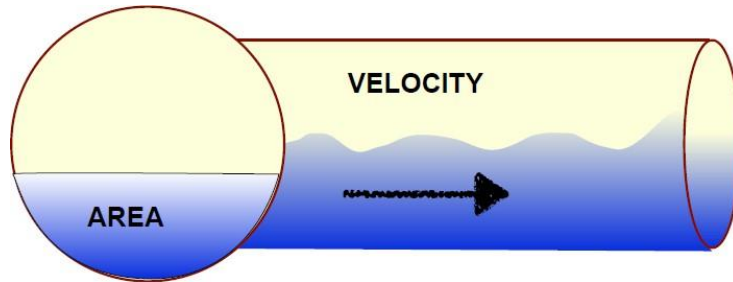


Figure 6-1 Flow Measurement.

Using acoustic technology, the sensor measures the velocity using the Doppler effect. Ultrasonic energy is continuously transmitted under water into the flow stream. The sound waves are reflected from tiny solid matter in the flow stream and the transmitted frequency compared to particle bounce frequency. Thousands of velocity return signals are averaged to produce a representative average velocity which is a function of sample time and echo reduction parameters. The velocity is output as a TTL UART signal which is transmitted directly to the USM.

A highly sensitive and accurate pressure depth sensor is incorporated into the AV sensor. The depth is output as a Voltage in the range 0 – 5V.

All calculations are then performed by the USM to convert the inputs from the sensor into velocity, depth and flow.

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

Remote Monitoring (IOT) is available via a GPRS unit.

Three configurable relays are provided for control, alarm and monitoring. Relays can be connected as COM & NO (connection made when relay ON) or COM & NC (connection made when relay OFF).

6.2. Connections

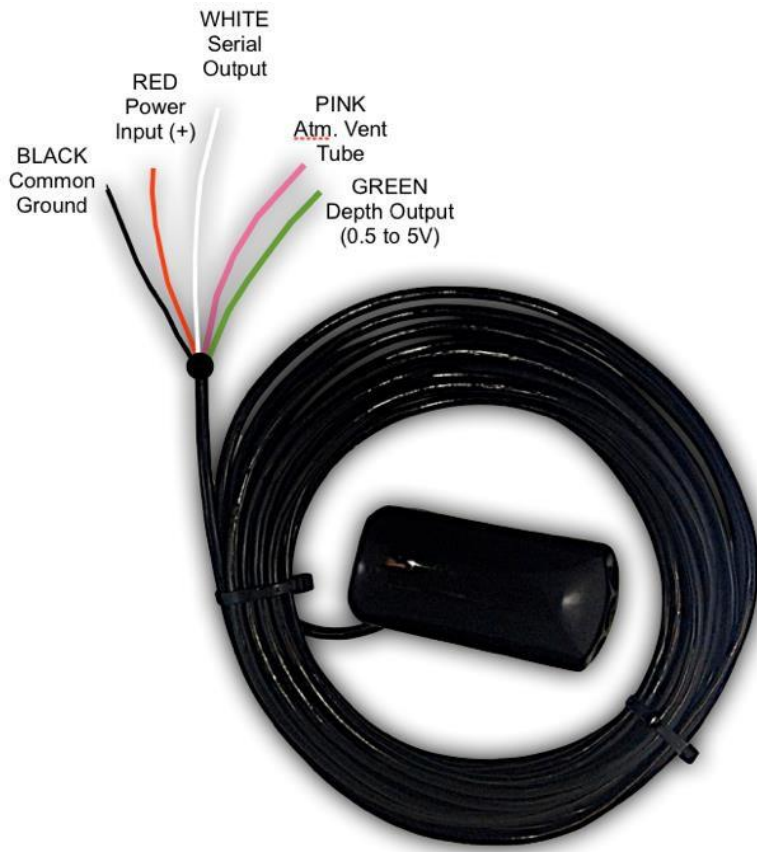
The connection terminals are accessible by removing the cover of the USM. All connections should be made through appropriate cable glands to maintain the IP rating of the unit.

The unit is factory built to either 100 – 240 Vac input or 9-24Vdc input.

The AV Sensor is supplied with clearly labelled wires and should be connected as follows. Connections are made to CONN7.

COLOUR	CONNECTION	VALUE	USI CONNECTION
RED	POWER IN	6-16V DC	15V
BLACK	GROUND	GROUND	GND
WHITE	VELOCITY OUT	4800 UART TTL	VELOCITY (TTL)
GREEN	DEPTH OUT	0.5 – 5V DC	DEPTH (V)

Table 5.1 – AV Sensor Connections



NOTE ** DO NOT BEND OR KINK THE PINK VENT TUBE FOUND IN THE CABLE

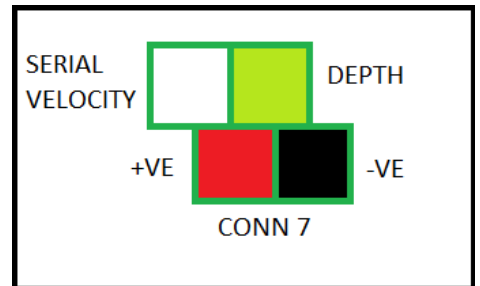


Figure 6-2 The AV Sensor.

6.3. 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 6-4 Smart Storm Screen.

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

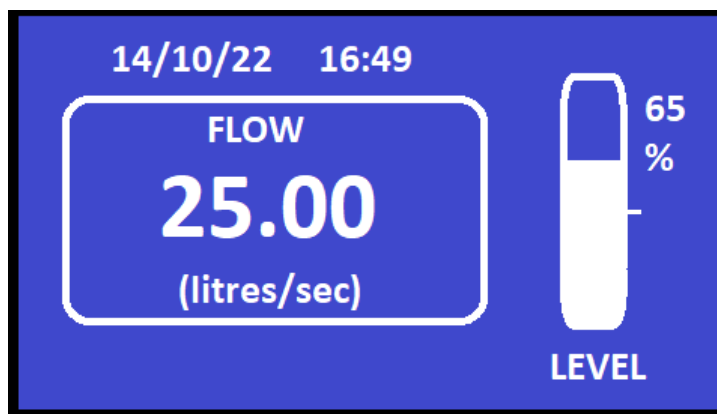






Figure 6-5 Home Screen.

The Home Screen shows the current flow (in the selected units) with a bar graph to show the current measured. 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.

7. 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 !\[\]\(8bbc1f1299a246c196d33c27b686a2d7_img.jpg\)](#)

[MEASUREMENT SCREEN 1](#)

[SMART STORM DETAILS](#)

[MEASUREMENT SCREEN 2](#)

[REPORT -3 DAYS](#)

[4-20mA SCREEN](#)

[REPORT -2 DAY](#)

[RELAY SCREEN 1](#)

[REPORT -1 DAYS](#)

[RELAY SCREEN 2](#)

[REPORT TODAY](#)

[DEVICE PARAMETERS](#)

[TREND GRAPH](#)

[BMS COMMS SET UP](#)

[TOTALISER](#)

[ABOUT USM](#)

[HOME !\[\]\(d61bafe2803480346b5b766d190cab5c_img.jpg\)](#)

Table 6.1 Display Screens

7.1. Home Screen.

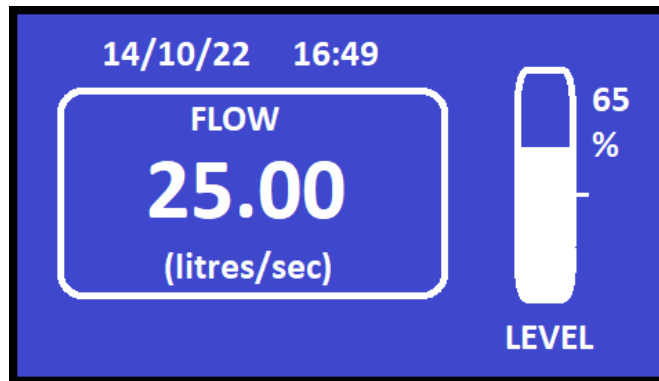


Figure 7-1 Home Screen

The Home Screen shows the current Flow alongside a Bar Graph showing the current Level as a percentage of the maximum Level.

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

If the USM lost communication with the AV sensor for 5 seconds, the screen will alternate between LOST and COMMS.

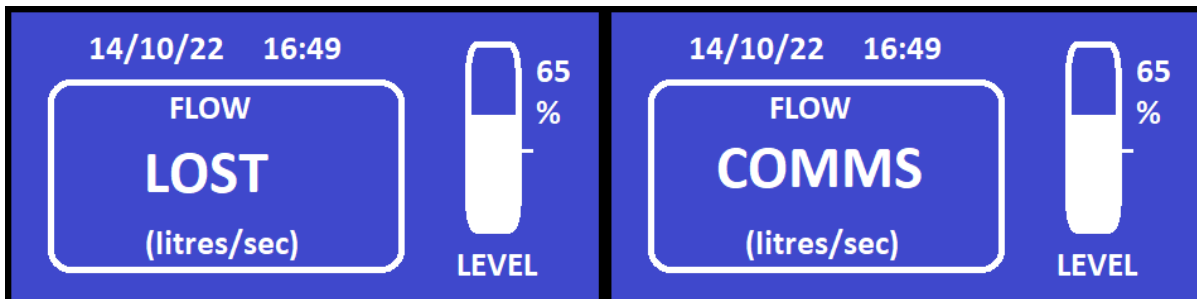


Figure 7-2 Lost Communications.

The USM will return to the normal display when communication with the AV sensor is re-established.

7.2. Measurement Screens

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

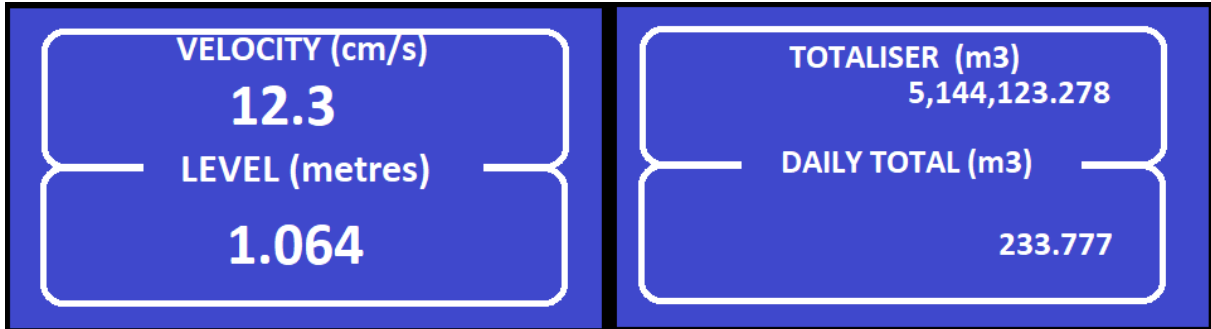


Figure 7-3 Measurement Pages.

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

If communication with the AV sensor is Lost, any measurement affected will alternatively show LOST and COMMS

7.3. 4-20mA Screen

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

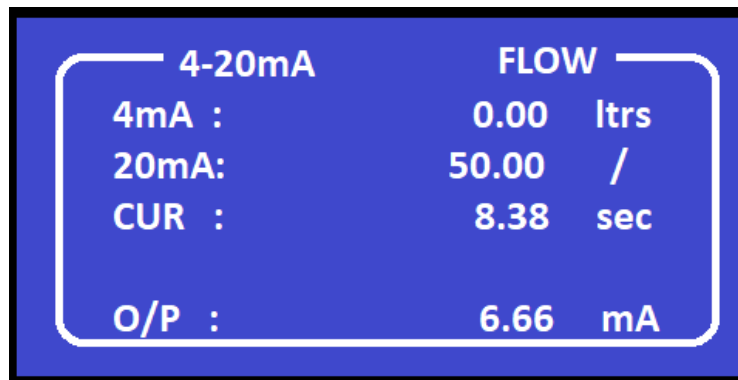


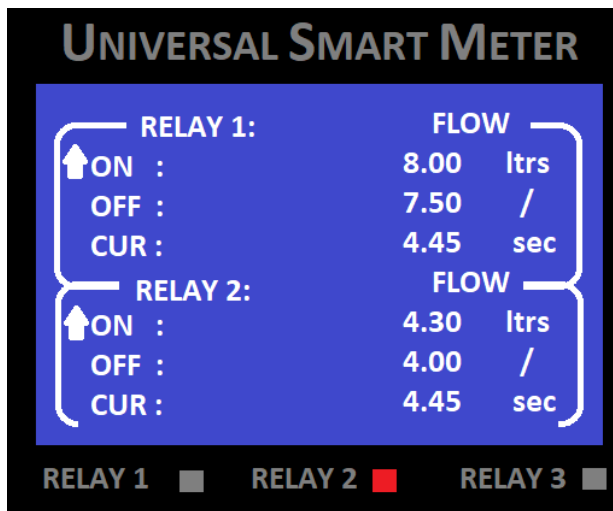
Figure 7-4 4-20mA Screen.

If the 4-20mA Channel is Disabled, the measurement (FLOW in Fig 5-4) will show DISABLED and the screen will be blank.

7.4. Relay Screens

7.4.1. Flow, Velocity 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.

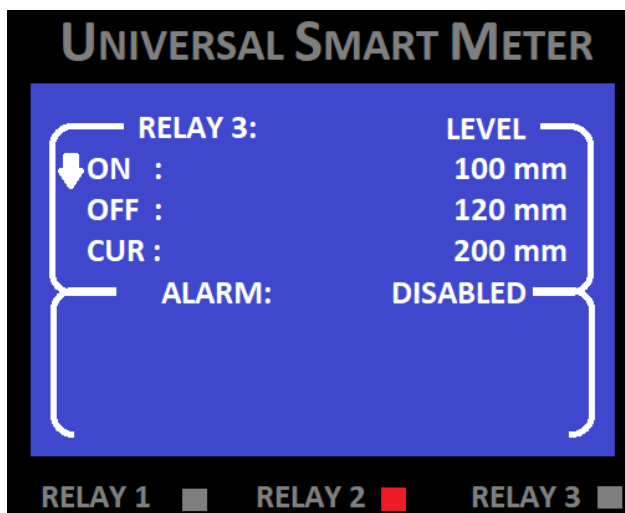


The ON Value of Relay 1 is higher than the current Flow, Relay 1 is therefore OFF. The Relay will turn ON when the Flow is above 8.00 l/s.

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 7-5 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.



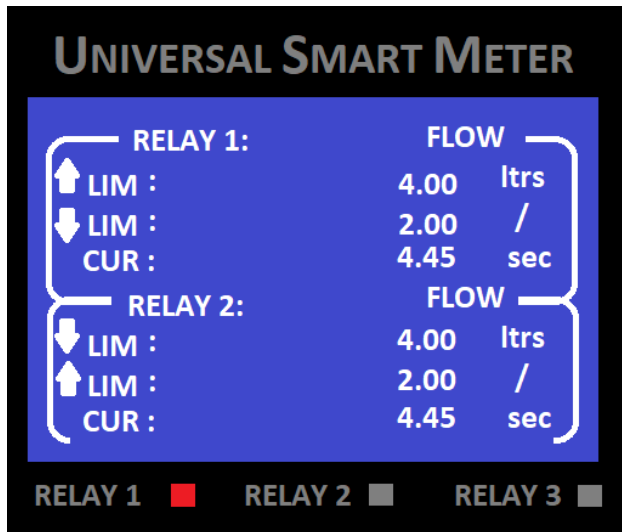
The current Flow is higher than the ON Value of Relay 3, Relay 3 is therefore OFF. The Relay will turn ON when the Level is below 100 mm.

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 7-6 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.



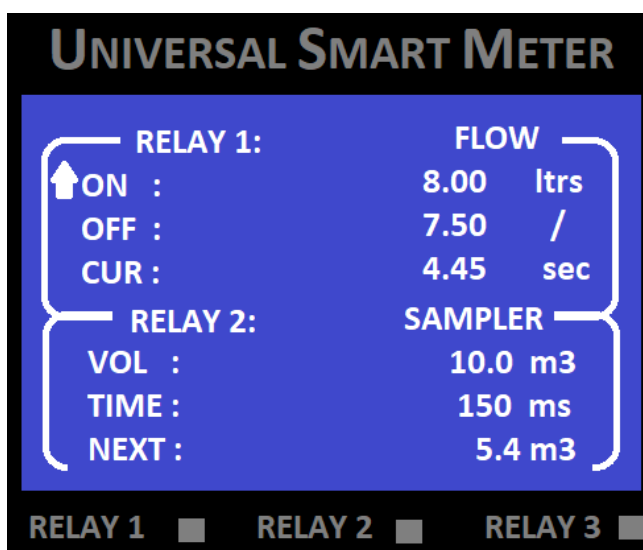
The current Flow is outside the Range 2.00- 4.00 l/s, so Relay 1 is ON.

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

Figure 7-7 Relays set to Range.

7.4.2. 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.

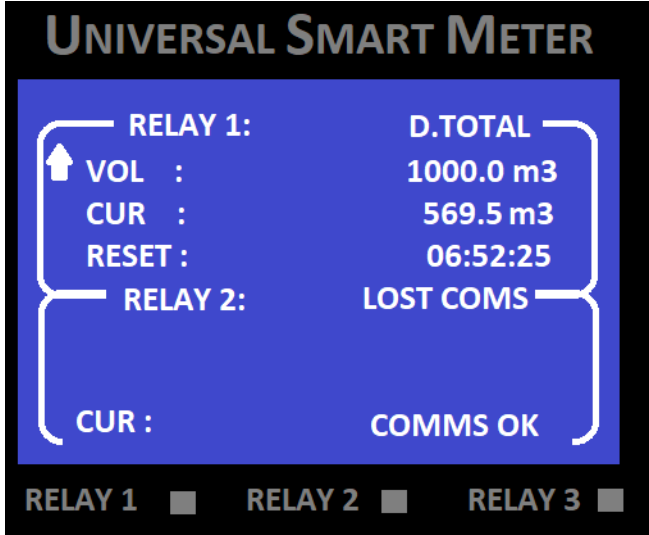
After the Relay has been triggered the Volume resets and a further 10m³ will be required for the next trigger.

Next shows the volume remaining until the next trigger

Figure 7-8 Sampler Relay.

7.4.3. 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 7-9 Daily Totaliser Relay.

7.4.4. Lost Comms.

The Relay can be configured to turn ON when communication to the AV sensor is lost

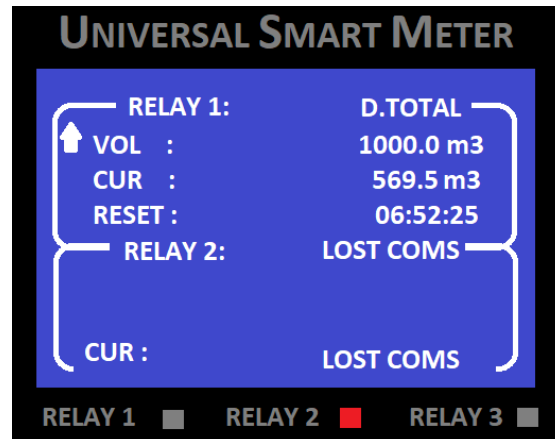


Figure 7-10 Lost Comms Relay.

7.5. Device Parameters

The Device Parameter Screen shows the details of the Device in which the AV Sensor is situated.

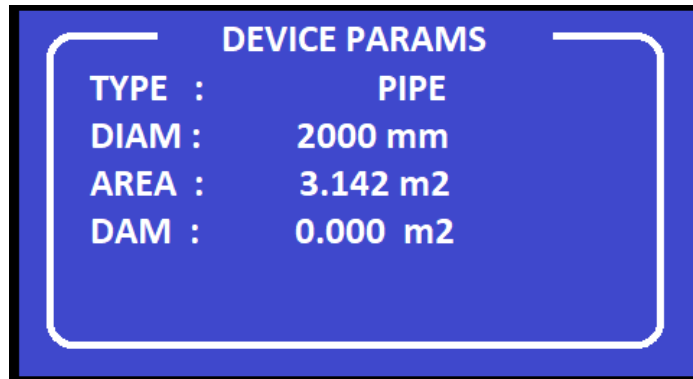


Figure 7-11 Device Parameters Screen

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

7.6. Comms Set Up.

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

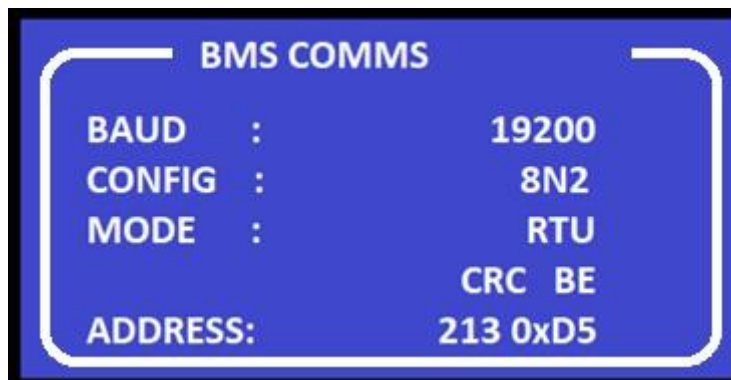


Figure 7-12 Comms Set UP Screen

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.

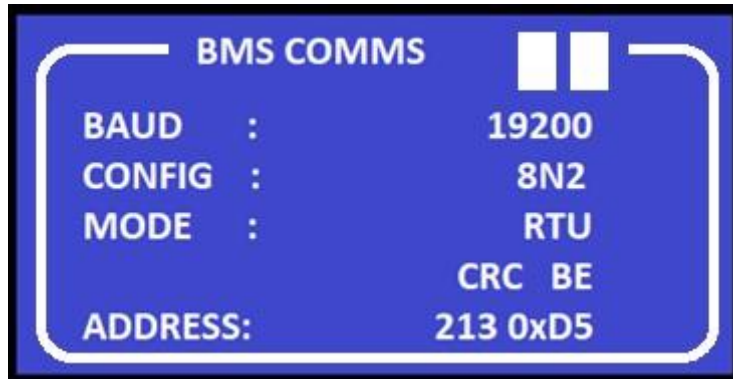


Figure 7-13 Comms Activity Indicators.

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.

7.7. 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.

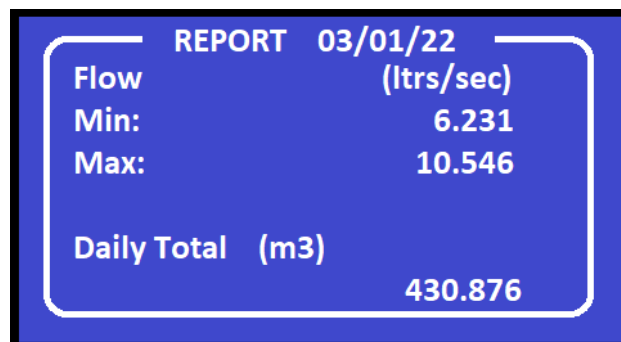


Figure 7-14 Report Screen.

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

7.8. 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 set in the Flow Set Up menu.

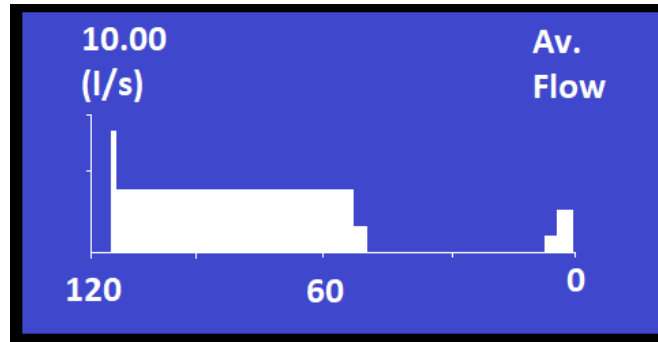


Figure 7-15 Trend Graph.

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.

7.9. Totaliser Screen.

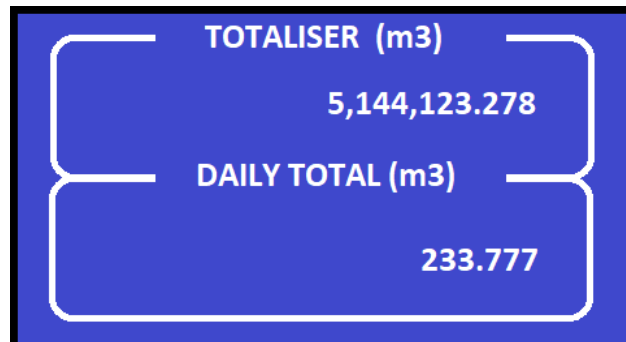


Figure 7-16 Trend Graph.

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.

7.10. Additional Screens.

They are additional self-explanatory Screens on the USM.

7.10.1. About USM

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

7.10.2. Smart Storm Logo

The Splash Screen shows the Company Logo and contact details.

8. Configuring the USM.

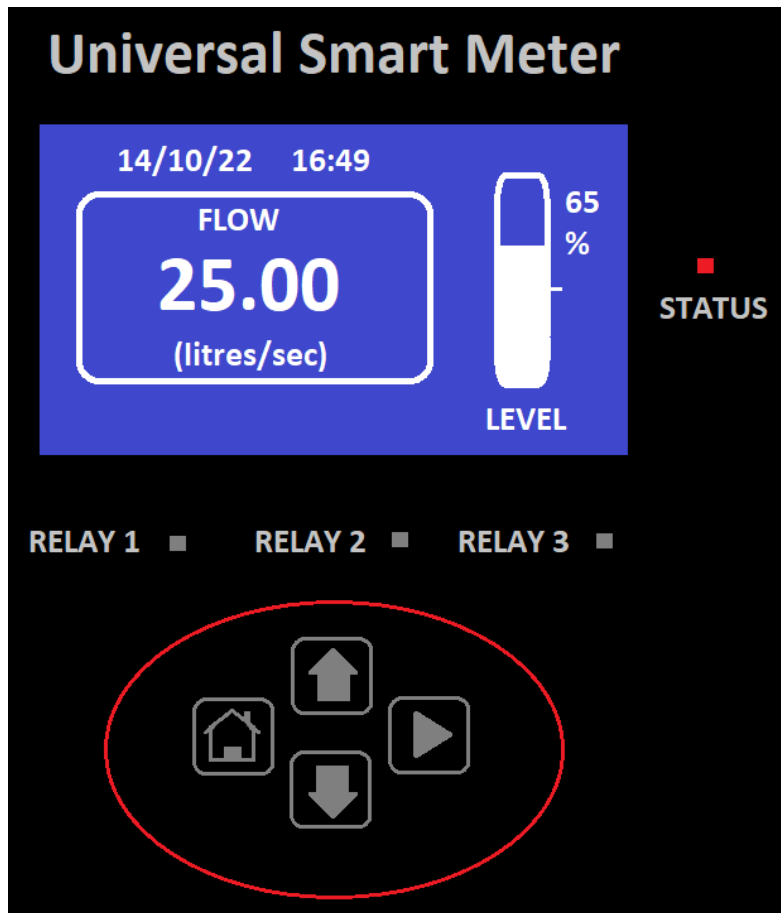


Figure 8-1 USM Set Up.

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 7.1 – Key Functionality






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



Figure 8-2 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 8-3 Configuration Menu

There are 13 sub menus to the Configuration menu:

1. [FLOW SET UP](#)
2. DISPLAY SET UP
3. LOGGER SET UP





4. MBUS BMS SET UP
5. 4 – 20 mA SET UP
6. 4 – 20 mA TEST O/P

7. RELAY SET UP
8. RELAY TEST
9. CONFIG FILES

10. CHANGE PASSWORD
11. SCREEN OFF TIME
12. ENGINEERING MENU

13. SIMUL. TEST
14. EXIT

Table 7.2 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.

9. Configuring the FLOW Parameters.

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

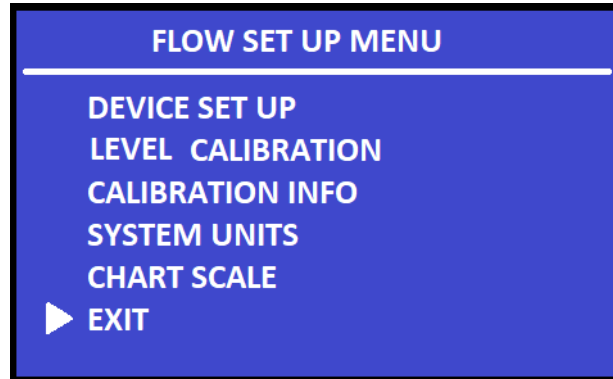


Figure 9-1 Flow Set Up Menu

9.1. Device Set Up.

Select **Device Set Up** on the FLOW SET UP MENU page and press  button.

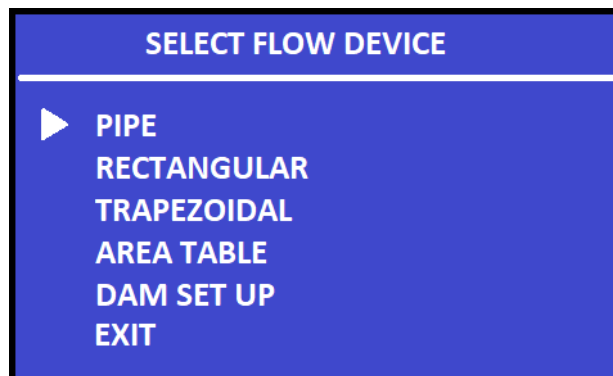


Figure 9-2 Select Flow Device


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

An option to configure a restriction (DAM SET UP) is also available.


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




If imperial units are selected in SYSTEM UNITS the values are entered in inches, if metric is selected the value is entered in millimetres.

After entering the values, confirm they are to be saved on the Save Screen.

If the  Button (Cancel) is pressed or No selected on the Save Screen, the entered value will be discarded and the previous value restored.

9.1.1. Pipe

Move the Cursor to Pipe and press the  button.

Use the  or  to change the diameter value and press the  button to accept the value.

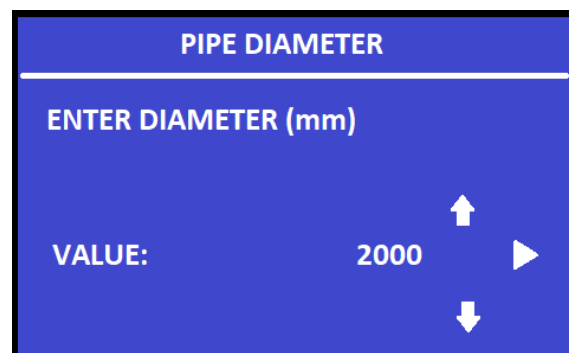


Figure 9-3 Enter Pipe Diameter.

9.1.2. Rectangular

Move the Cursor to Rectangular and press the  button.

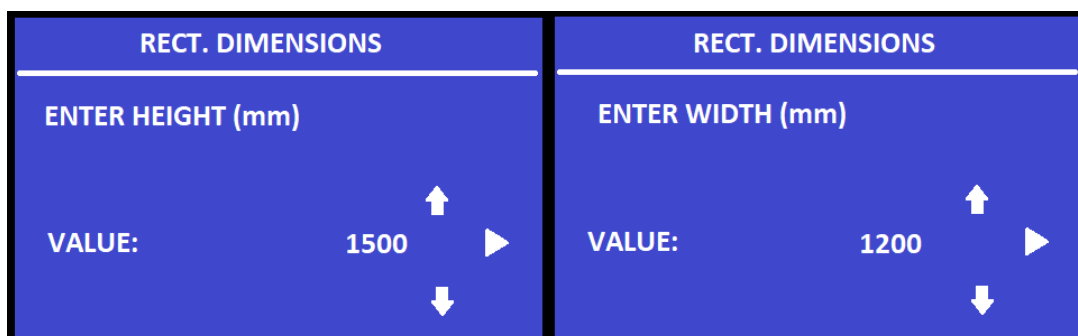





Figure 9-4 Enter Rectangular Dimensions

Use the  or  to change the diameter value and press the  button to accept the value.

After entering the Height, the screen will change to allow the Width to be entered.

9.1.3. Trapezoidal

A Trapezoidal Channel is defined by Four dimensions.

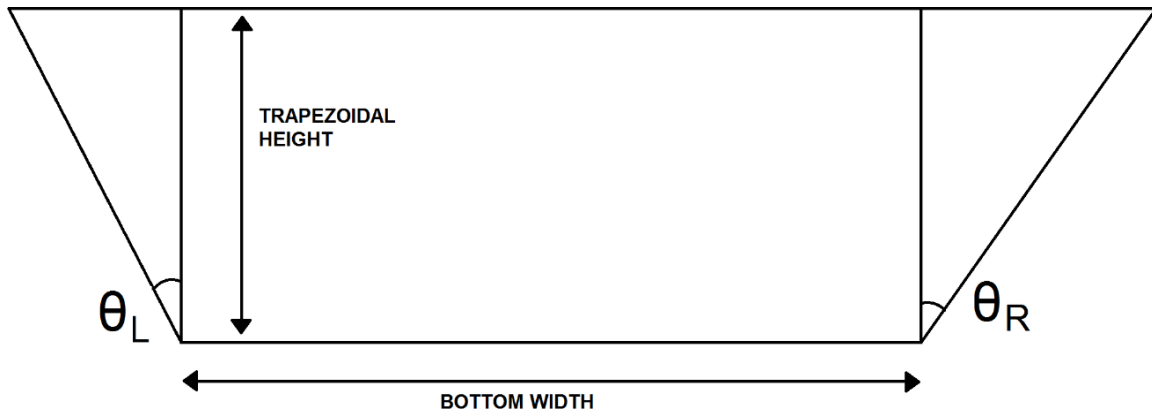


Figure 9-5 Trapezoidal Dimensions

Move the Cursor to Trapezoidal and press the  button.

Enter the Height and Bottom Width in the same way as Rectangular Dimensions.

Enter the Left- and Right-Hand Slopes.

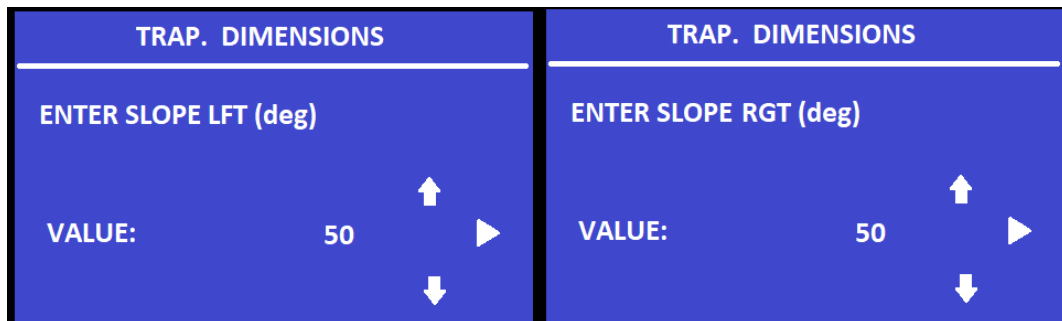


Figure 9-6 Enter Trapezoidal Slopes

9.1.4. Area Table.

Non-uniform devices can be used by Table entry into a 16-point table.

The Level is entered in mm (inches in imperial) and the Area is entered in cubic meters (cubic feet in imperial).

The first point is automatically set to 0mm/inches level and 0.00 m²/ft² Area.

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

If the table is less than 16 points, entry can be terminated by entering a value of 0 into the depth field.

The change of area between points is assumed to be linear.

AREA TABLE SET UP		AREA TABLE SET UP	
LEV 0	0 mm	LEV 0	0 mm
AREA0	0.00 m ²	AREA0	0.00 m ²
LEV 1 ▶	10 mm	LEV 1	10 mm
		AREA1 ▶	0.12 m ²

Figure 9-7 Enter Area Table Dimensions

The level is entered in mm (inches in imperial) and the Area is entered in m² (ft² in imperial).

The Level and AREA of successive points must be greater than the level and flow of the previous point. If not, an error message is displayed and the value must be changed.

AREA TABLE SET UP	
LEV 1	10 mm
AREA1	0.12 m ²
LEV 2 ▶	9 mm
LEVEL 2 LESS THAN LEVEL 1	

Figure 9-8 Area Table Error Message

If the table is less than 16 points, entry can be terminated by entering a value of 0 into the level field.

9.1.5. Dam Set Up

Certain Applications may require the AV sensor to be continually submerged and this can be achieved by installing a Dam to build up the Fluid.

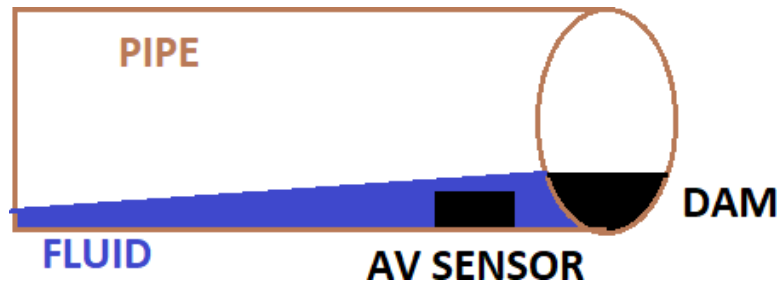





Figure 9-9 Use of a Dam

The Height of the Dam can be entered to calculate the actual Area of the restricted discharge.

Move the Cursor to DAM SET UP and press the  button.

Use the  or  to change the HEIGHT value and press the  button to accept the value.

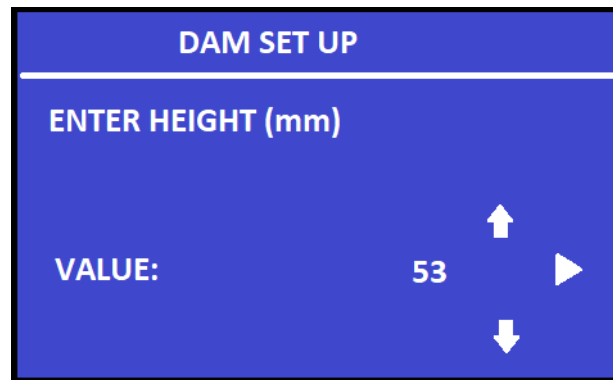


Figure 9-10 Enter Dam Height

9.1.6. Area Display

After the Dimensions have been saved, a screen displays the Maximum Cross-Sectional Area and the Dam Area of the Device.

9.2. Level Calibration

The AV sensor uses a two-point calibration for the level. The sensor outputs 500mV when not submersed and 5 V at the maximum depth (3 or 1m).

Select **LEVEL CALIBRATE** on the FLOW SET UP MENU page and press  button.

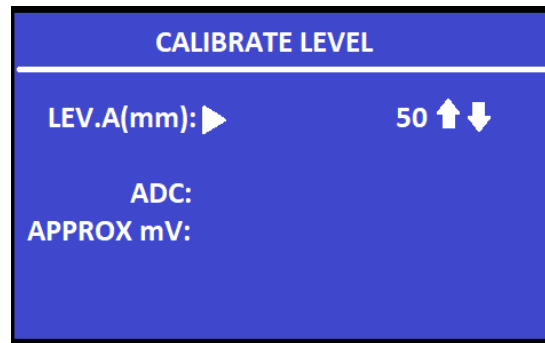





Figure 9-11 Calibrate Level Point 1a.

Submerge the Sensor in a known Level of Fluid.

Use the  or  to change the Level value and press the  button to accept the value.

The Value of the ADC will be displayed along with the approximate mV reading.

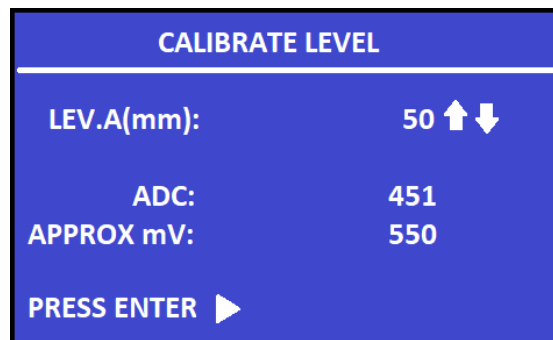



Figure 9-12 Level Calibration Point 1b.

Wait until the ADC reading has settled and press the  button to accept the value.

Pressing the  key at any stage will quit the calibration and return to the Flow Menu.

Repeat for a second level of Fluid.

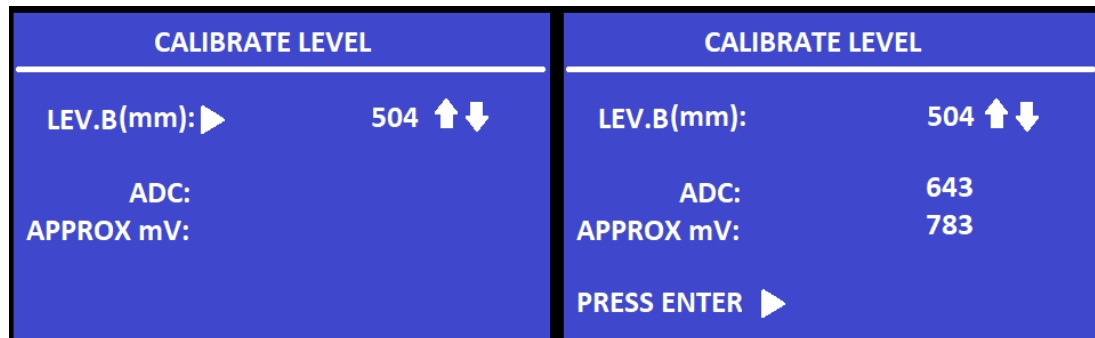


Figure 9-13 Level Calibration Point 2

The USM will display the Slope and Offset alongside typical values (slope is for 10m/3m versions). Press any Key and save the Calibration.

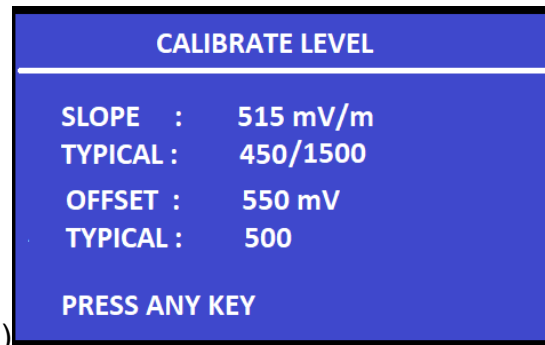


Figure 9-14 Calibration Slope and Offset

9.3. Calibration Information Screen

Shows the Calibration Set Up alongside the current value. This can be used to confirm the USM Level is functioning correctly. The CUR Value (current) will change in real time.

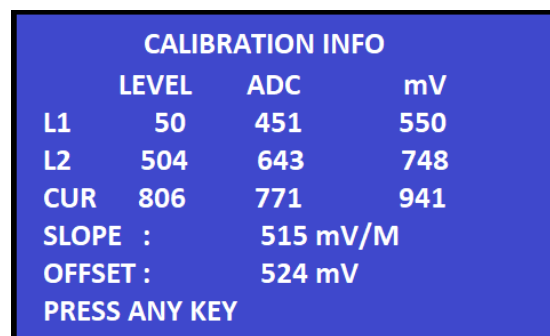


Figure 9-15 Calibration Information

9.4. System Units.

Used to change the Units between Imperial and Metric.

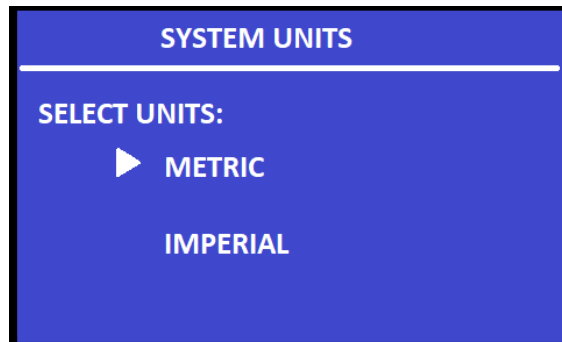


Figure 9-16 System Units

Use the  or  Buttons to choose Metric or Imperial and confirm using the  button.

9.5. Chart Scale.

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

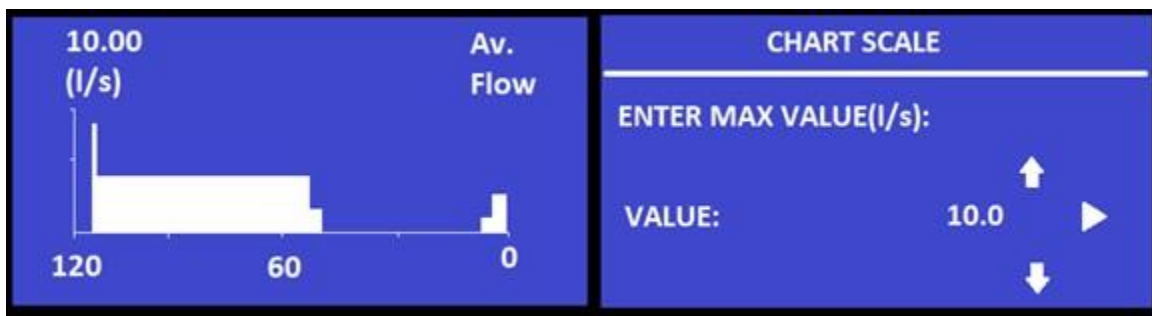





Figure 9-17 Flow Chart Scale Set Up

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.

9.6. Exit.

Select EXIT to return to the MAIN MENU.

10. 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.

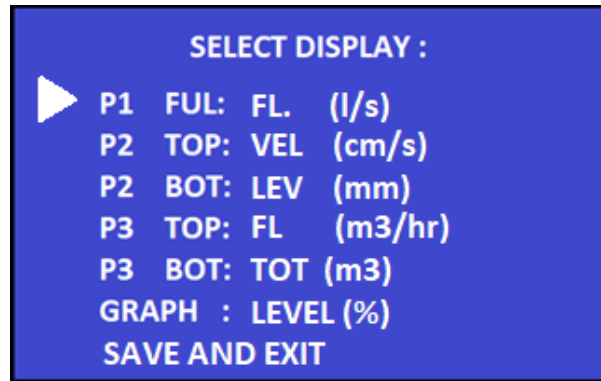


Figure 10-1 Display Set Up Screen

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:

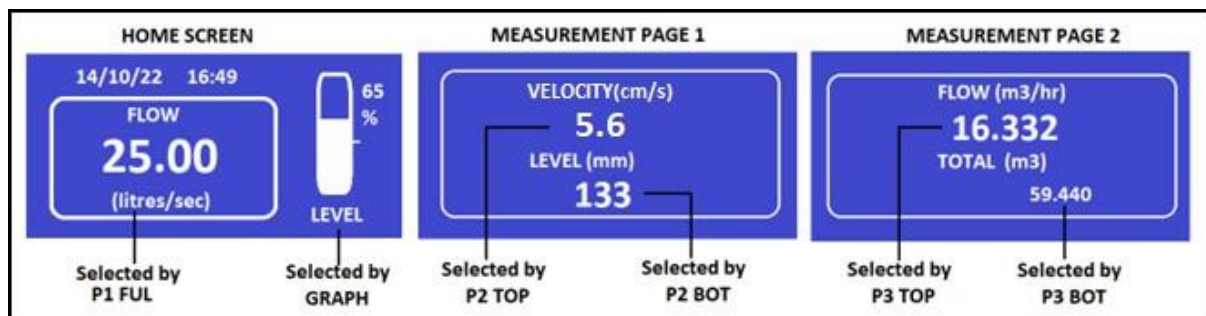


Figure 10-2 Display Screens

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	

11. Configuring the Logger.

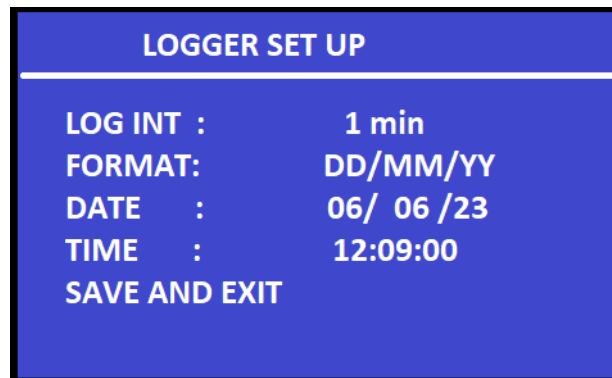




Figure 11-1 Logger Set Up Menu

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.

11.1. 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.

11.2. 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.

11.3. 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 11-2 Date and Time 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.

11.4. Save and Exit.

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


12. ModBus BMS Set Up (Comms UART)




Figure 12-1 Modbus BMS Set Up

Use  or  Buttons to select the required Parameter.

12.1. Status.

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

12.2. Baud.

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

12.3. 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.

12.4. 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.

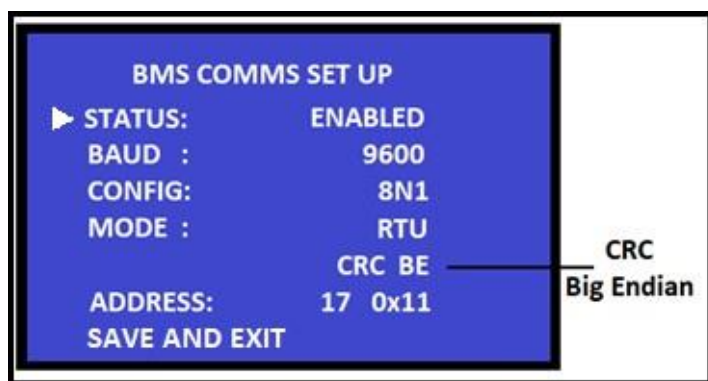


Figure 12-2 Setting the Endian on RTU

12.5. Address.

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

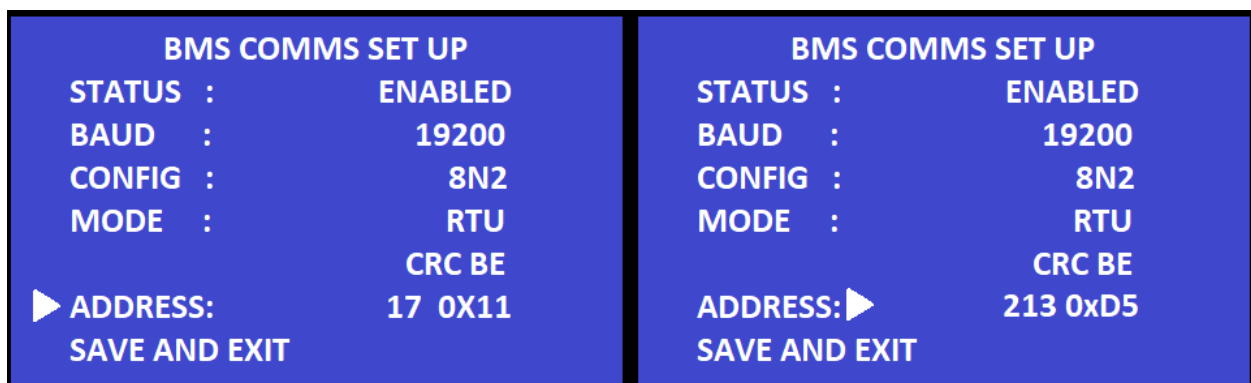









Figure 12-3 Change the Modbus Address

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.

12.6. Save and Exit.

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

12.7. IOT Settings (Robustel GPRS)

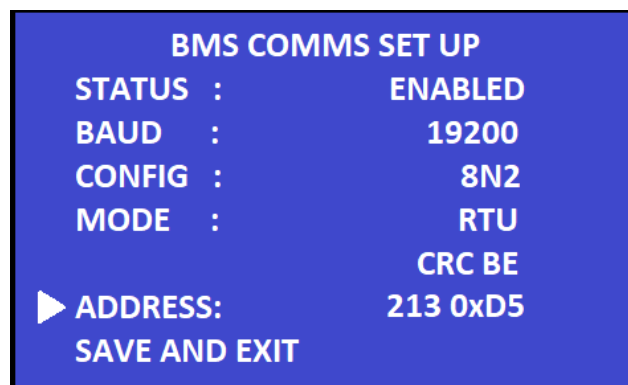



Figure 12-4 Modbus IOT Settings

The BMS comport is used to interface to the GPRS unit for the IOT webpage.

Figure 11-4 shows the required settings for comms. If a 2nd USM is connected to the GPRS unit, the Modbus address should be changed to 214 (0xD6).

13. 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.

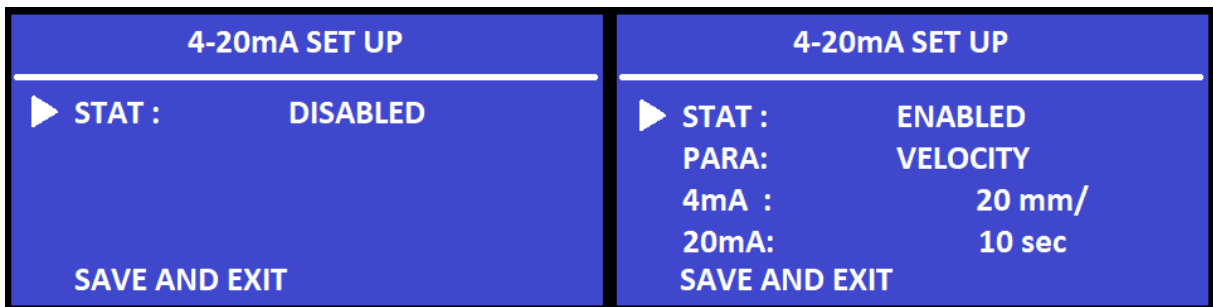




Figure 13-1 4-20mA Set Up

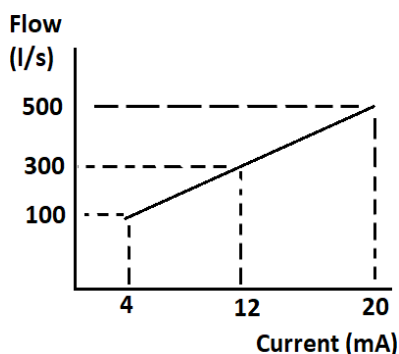
13.1. Status.

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.

13.2. Mode.

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


13.3. 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 13-2 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.




4-20mA SET UP		4-20mA SET UP	
STAT :	ENABLED	STAT :	ENABLED
PARA:	VELOCITY	PARA:	VELOCITY
4mA :	20 mm/	4mA :	20 mm/
 20mA:	10 sec	20mA: 	10 sec
SAVE AND EXIT		SAVE AND EXIT	

Figure 13-3 Enter 4-20mA Points




Press the  button to accept the Value.

The maximum Velocity is 10,000 mm/s.

The maximum Flow is set by the Area Span of the Device multiplied by the maximum Velocity.

The maximum Level is the Maximum Height of the Device.

13.4. Save and Exit.

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

14. 4-20mA Test.

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



TEST 4-20mA OUTPUT	TEST 4-20mA OUTPUT
 O/P(mA): 4.0	O/P(mA):  11.4

Figure 14-1 4-20mA Test

Press  and use  or  Buttons to change the value (the output will not change).

Press  to select the value and change the output.

15. Configuring The Relays.

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

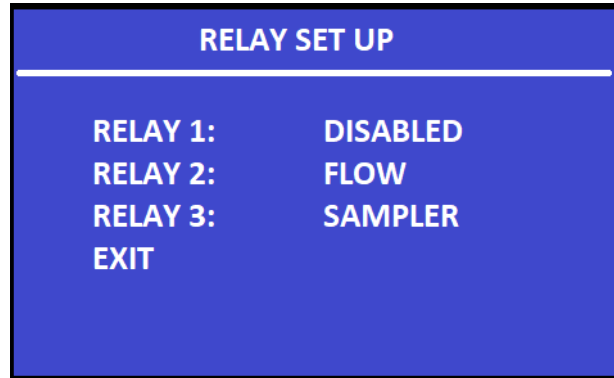


Figure 15-1 Relay Selection

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.

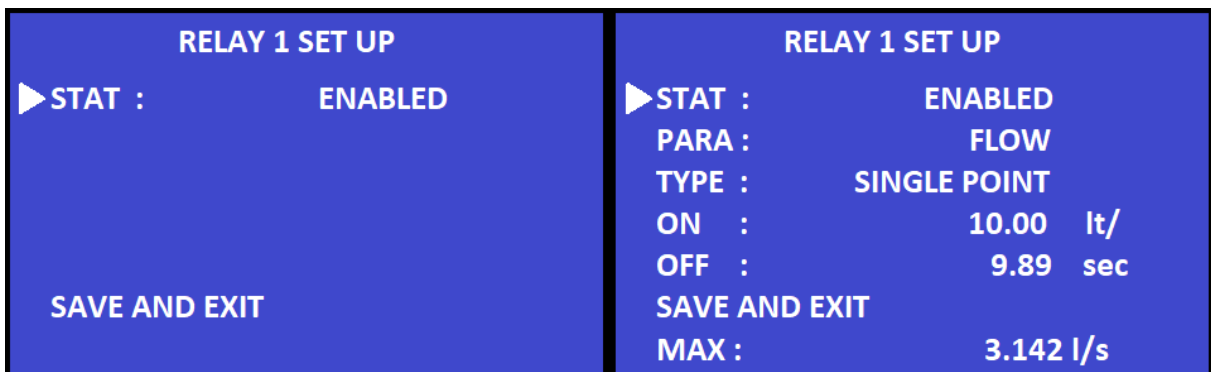






Figure 15-2 Relay Set Up

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.

15.1. Relay Parameter

The Relay Parameter changes when the  button is pressed.

15.1.1. Velocity RELAY

Triggers on the Velocity measured by the AV Sensor.

Minimum Velocity 0mm/s, Maximum Velocity 10,000 mm/s.

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

The Max Velocity is shown for Reference.

15.1.2. LEVEL RELAY

Triggers on the Level of the FLOW.

Minimum Distance 0mm, Maximum distance Max Height of the Device.

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

The Max Height of the Device is shown for Reference.

15.1.3. FLOW RELAY

Triggers on the FLOW rate.

Minimum Flow 0 l/s, Maximum Flow is Span of the Device multiplied by the maximum Velocity (10 m/s).

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.

15.1.4. 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.

RELAY 1 SET UP		RELAY 1 SET UP	
STAT :	ENABLED	STAT :	ENABLED
PARA :	SAMPLER	PARA :	SAMPLER
▶ VOL :	10.40 m ³	VOL : ▶	11.53 m ³
TIME :	150 ms	TIME :	150 ms
SAVE AND EXIT		SAVE AND EXIT	

Figure 15-3 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 around 150ms.

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.

15.1.5. DAILY TOTAL RELAY

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



Figure 15-4 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.

15.1.6. LOST COMMS RELAY

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

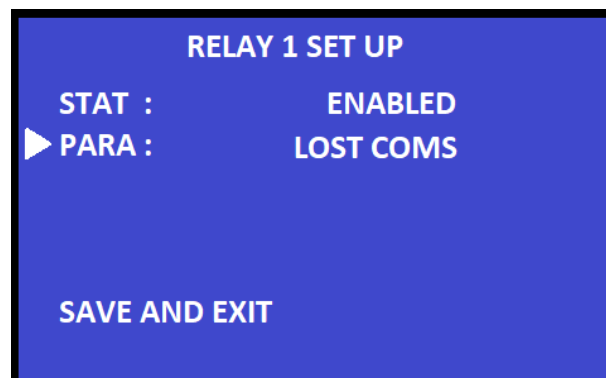


Figure 15-5 Lost Comms Relay

15.2. Trigger Type.







The Trigger Type is changed by using the  and  Buttons to move the cursor to TYPE and pressing the  button.

15.2.1. Single Point Trigger.

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

RELAY 1 SET UP		RELAY 1 SET UP	
STAT :	ENABLED	STAT :	ENABLED
PARA :	FLOW	PARA :	FLOW
TYPE :	SINGLE POINT	TYPE :	SINGLE POINT
▶ ON :	10.00 lt/	ON : ▶	10.00 lt/
OFF :	9.89 sec	OFF :	9.89 sec
SAVE AND EXIT		SAVE AND EXIT	
MAX :	3.142 l/s	MAX :	3.142 l/s

Figure 15-6 Single Point Triggering

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.

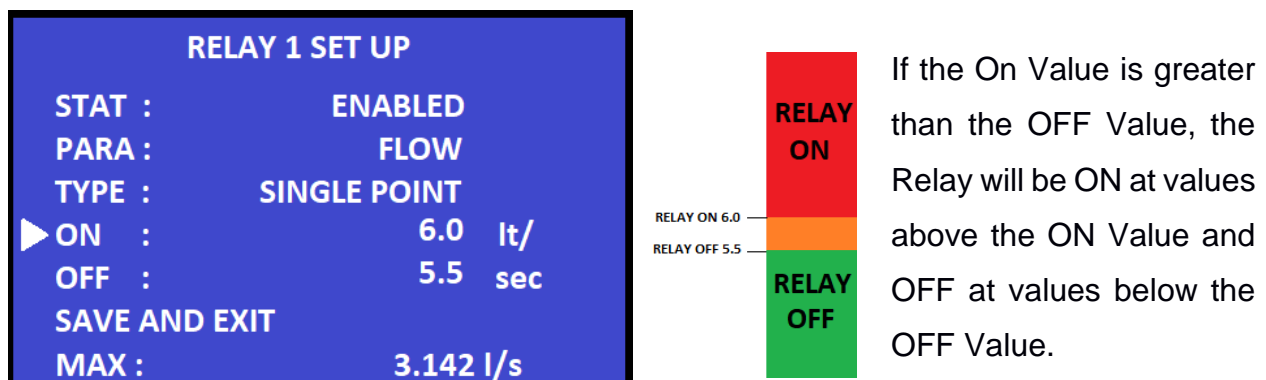


Figure 15-7 Single Point - On Higher

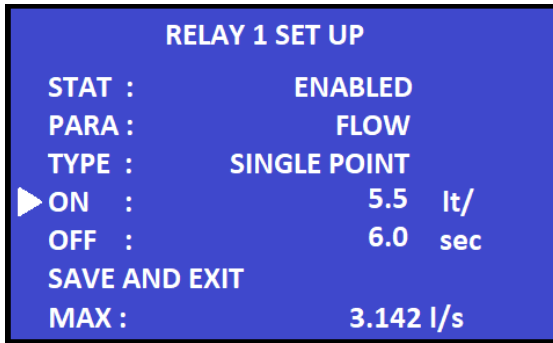
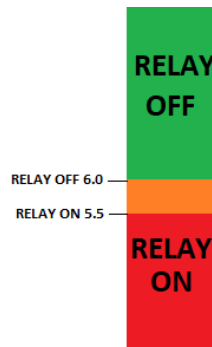


Figure 15-8 Single Point - On Lower



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

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

15.2.2. Range Trigger.

The Limits of the Range are entered by using and Buttons to move the cursor to LIM1 or LIM2 and pressing the button.

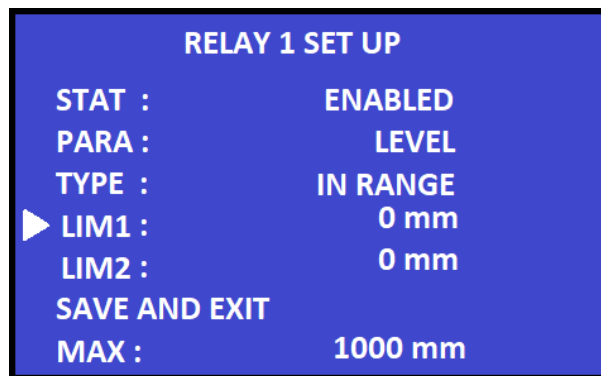





Figure 15-9 Inputting the Range Values

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.



Figure 15-10 Inputting the Upper Limits

The two Lower Limits are entered as LIM2.



Figure 15-11 Inputting the Lower Limits

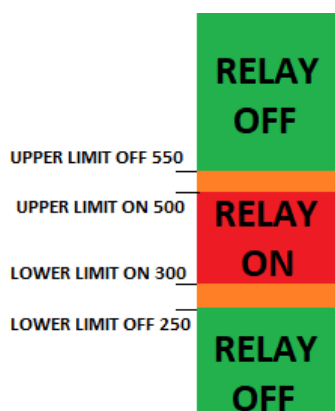


Figure 15-12 In Range Relay Behaviour

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.

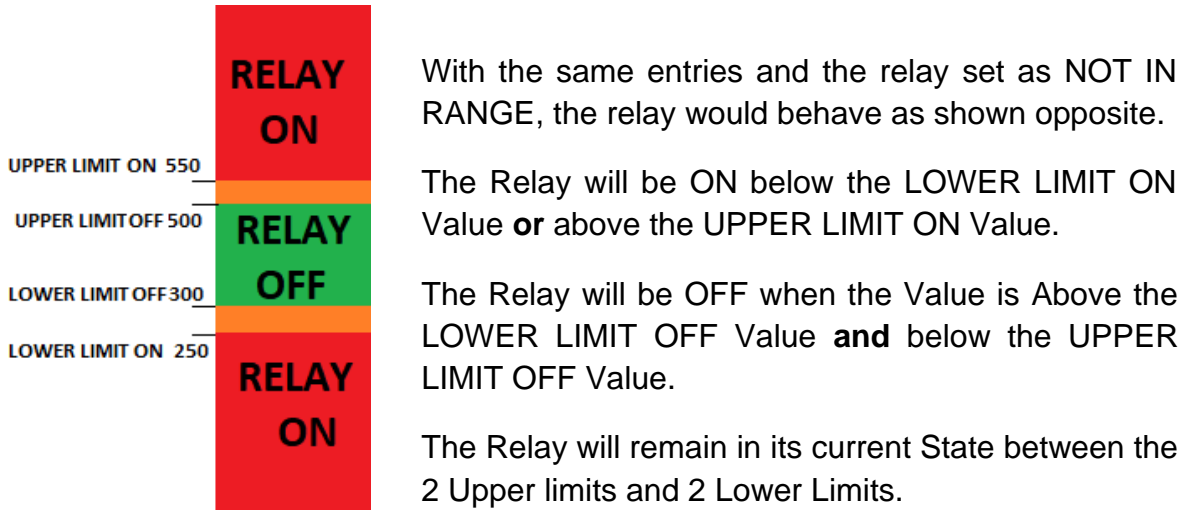


Figure 15-13 Not In Range Relay Behaviour

15.3. Save and Exit.

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

16. 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 16-1 Relay Test

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

17. Configuration Files.

The configuration of the USM, can be stored to the internal SD card and reloaded as required. This is particularly useful 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.

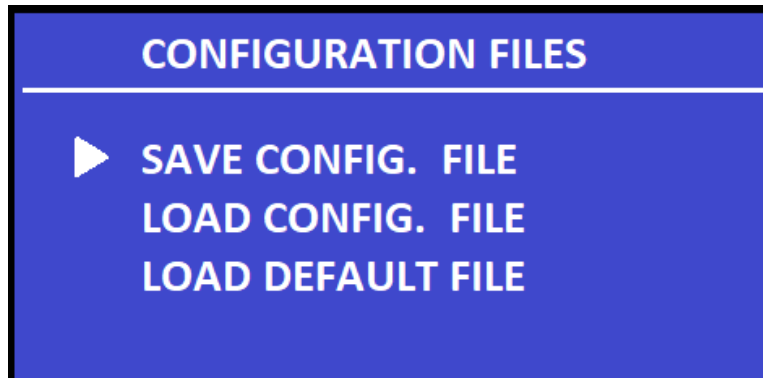





Figure 17-1 Configuration files.

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

- SAVE CONFIG. FILE: Saves the current configuration to the SD card
- LOAD CONFIG FILE: Loads the last saved configuration from the SD card.
- LOAD DEFAULT FILE: Loads the factory default settings.

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

18. Change Password.

The default password can be changed from 0000. Select CHANGE PASSWORD from the Main Menu and enter the current Password.

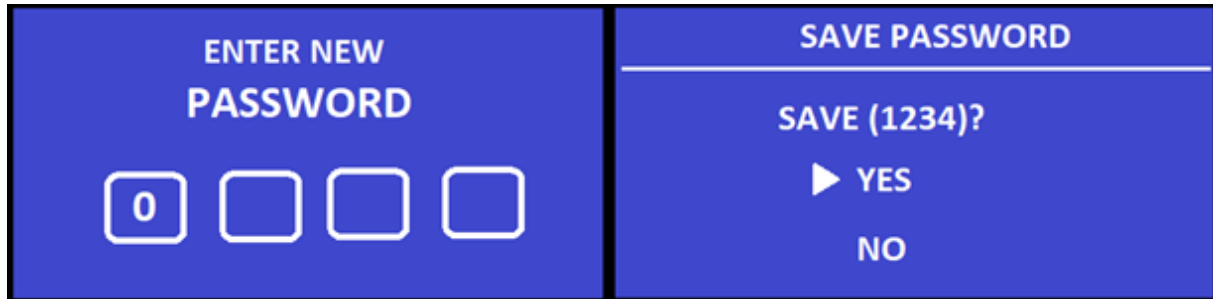






Figure 18-1 Enter New Password.

Use  and  buttons to change the selected digit at each location and press the  button to move to the next digit.

After the last digit is entered, confirm and save the password. If the  button is pressed at any stage, the previous password is restored.



19. Screen Off Time

The USM can be set to turn the LCD Off when no Buttons are pressed for a set time.



Figure 19-1 Screen Off Time

With the Cursor on TIME, press the  button to scroll through the available times.

Use  and  buttons to change between TIME and SAVE and EXIT and save the setting.

21. Simulation Test

The USM Simulation Test can be used for testing the Relays and 4 – 20mA outputs.

If no Button is pressed, after 5 minutes the USM will return to Normal Mode.

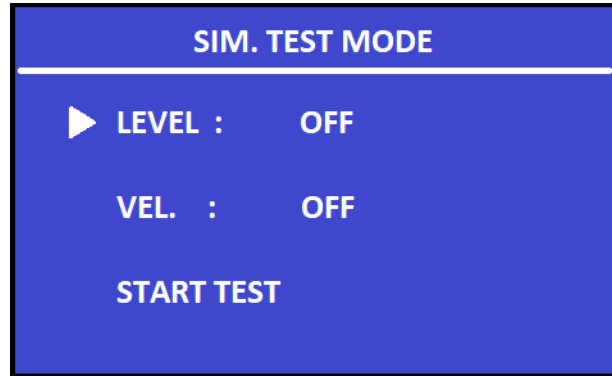


Figure 21-1 Simulation Test

Use  and  buttons to select the Parameter or Start Test.

Press the  button change the Setting or Start the Test

There are 3 settings available:

21.1. OFF

The parameter is not in Test Mode and uses the Real Measured values

21.2. FIXED

A single Value can be entered. This Value will be used on the Display of the USM and to drive the Relays and 4 -20mA output.

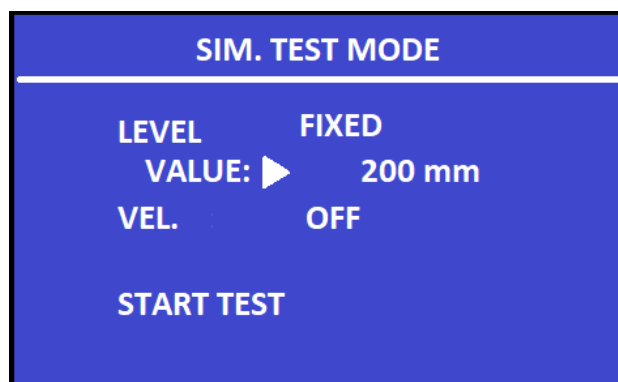





Figure 21-2 Fixed Simulation

When Fixed is selected an additional VALUE: entry Line will be visible.

Use  and  buttons to change Value and the  button to confirm the Value.

21.3. SWEEP

When selected:

The Level Value will Sweep Up and Down

The Velocity Value Will Sweep between 0 mm/s and 5000 mm/s

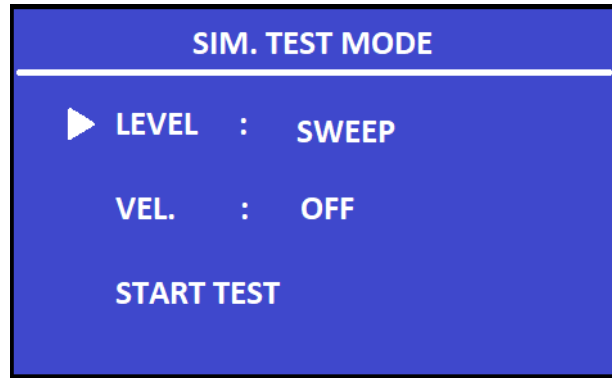


Figure 21-3 Sweep Simulation

21.4. Entering and Exiting Test Mode

Mover the Cursor to START TEST and press the  button,

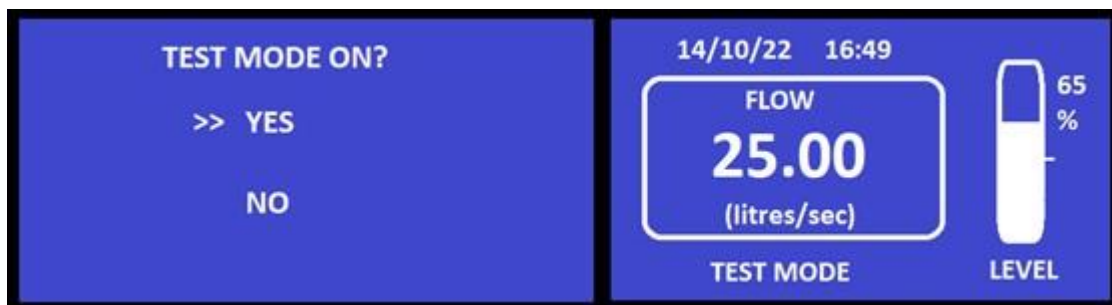



Figure 21-4 Enter Simulation Test Mode

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.

22. Engineering Menu.

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

23. ModBus Communications.

23.1. 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	VELOCITY (mm/s)	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.
0x020E	526	40527	RELAY STATUS	Int (16 bit) – 1 reg.
0X0210	528	40529	STATUS	Int (16 bit) – 1 reg.
0x0212	530	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	VELOCITY	596.96		
7		--		
8	TEMPERATURE	19.44		
9		--		
A	DAILY	2112.6		
B		--		
C	TOTAL	330696.305774811		
D		--		
E		--		
F		--		

Figure 23-1 Modbus Poll

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:

D5 04 02 02 02 C3 A7

Totaliser:

D5 04 02 0C 04 22 66

Relay Status:

D5 04 02 10 01 88 EE

	Name	0200
0		
1		
2	FLOW	23,8433
3		--
4		
5		
6		
7		
8		
9		
A		
B		
C		
D		
E		
F		

	Name	0200
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
A		
B		
C	TOTAL	330918.385457367
D		--
E		--
F		--

	Name	0210
0	RELAY STATUS	0x0010
1		
2		
3		
4		
5		
6		
7		
8		
9		
A		
B		
C		
D		
E		
F		

Figure 23-2 ModBus Poll Individual Registers.

23.1.1. 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.

23.1.2. Status.

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

0x0000 (Dec 0) – Normal Running

0x0003 (Dec 3) – In Menu

0x0001 (Dec 1) – Lost Comms

0x0004 (Dec 4) – Test Mode

0x0002 (Dec 2) – Lost Echo

23.2. ASCII Modbus.

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

REGISTER ADDRESS		REGISTER	TYPE (LEN.) – No. Regs
HEX	(DEC)		
0x0000	(0)	FLOW (l/s)	Float (32 bit) – 2 reg.
0x0004	(4)	LEVEL (mm)	Float (32 bit) – 2 reg.
0x0008	(8)	Velocity (mm/s)	Float (32 bit) – 2 reg.
0x000C	(12)	TEMPERATURE (°C)	Float (32 bit) – 2 reg.
0x0010	(16)	TOTALISER (m ³)	Double (64 bit) – 4 reg.
0x0018	(24)	DAILY TOTAL (m ³)	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 32 32 36 0D 0A

: 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 0D 0A

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

	Name	0000
0	FLOW	23.956
1		--
2		
3		
4		
5		
6		
7		
8		
9		
A		
B		
C		
D		
E		
F		

Figure 23-3ASCII Flow Command

TOTALISER:

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

: 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 0A

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 23-4 ASCII Totaliser Command

SERIAL NUMBER:

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

: 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 0A

: 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 23-5 ASCII Serial Number

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.

23.3. Terminal ASCII

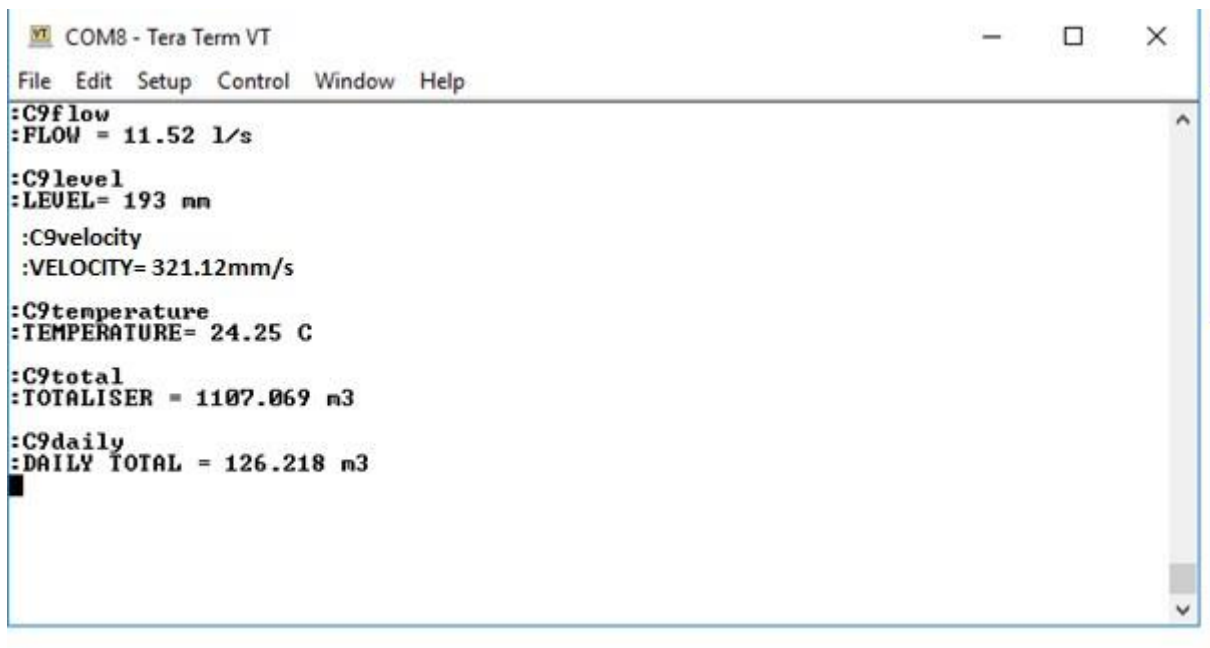
A simpler form of ASCII Modbus communication is provided for use with a terminal application. In this format the text can be written to the application which will send the string and attach the carriage return and line feed.

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.



```
COM8 - Tera Term VT
File Edit Setup Control Window Help
:C9flow
:FLOW = 11.52 l/s
:C9level
:LEVEL= 193 mm
:C9velocity
:VELOCITY= 321.12mm/s
:C9temperature
:TEMPERATURE= 24.25 C
:C9total
:TOTALISER = 1107.069 m3
:C9daily
:DAILY TOTAL = 126.218 m3
```

Figure 23-6 Terminal Commands on TerraTerm

24. Log Files and Configuration 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.

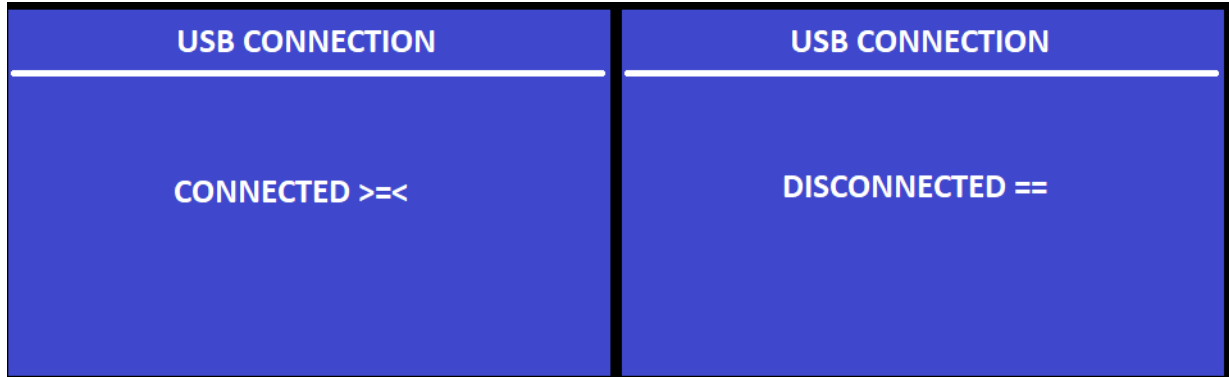


Figure 24-1 Connecting the USB

The USM will show it is CONNECTED and the USM will appear as a drive on Windows Explorer.

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

The USM will show it is DISCONNECTED.

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

N.B. Some Log and configuration Files below are shown for other USMs. The Format is the same.

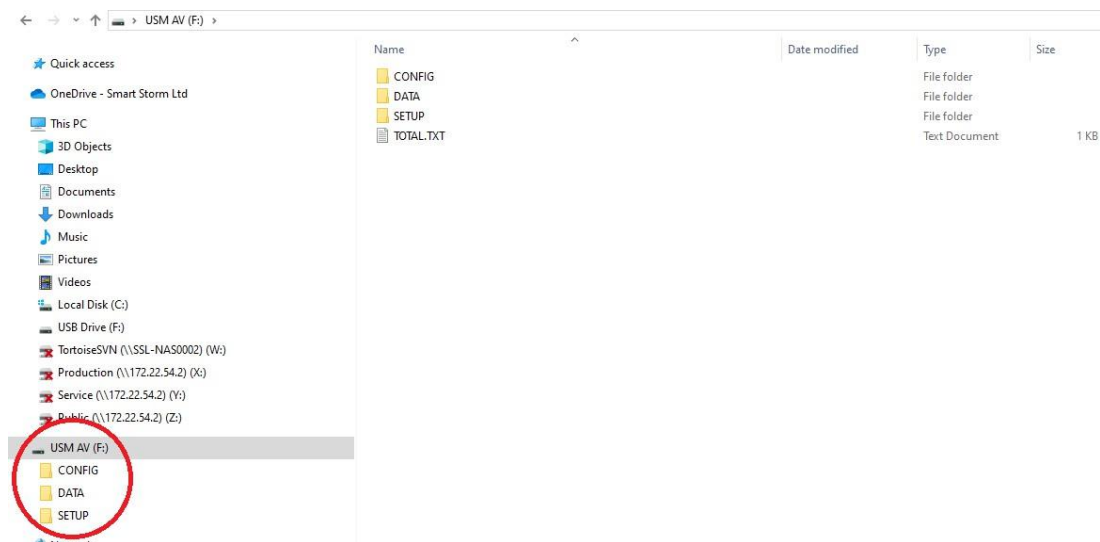


Figure 24-2 Windows Explorer.

The Drive can be renamed by right-clicking on the drive and using re-name. In this case it has been called USM AV.

Three Folders should be visible:

- CONFIG
- DATA
- SET UP

alongside the TOTAL.TXT file which contains the Current Totaliser.

24.1. Data Folder.

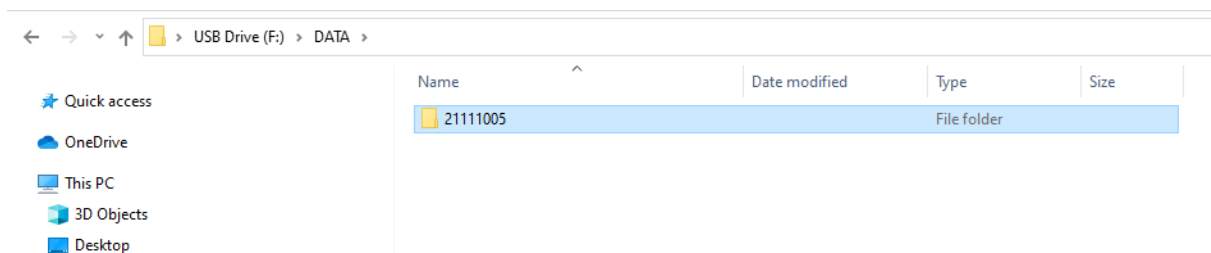


Figure 24-3 Data Structure

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.

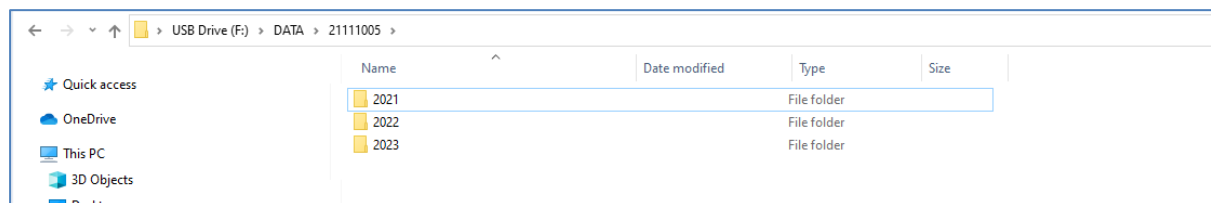


Figure 24-4 Year Structure

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.

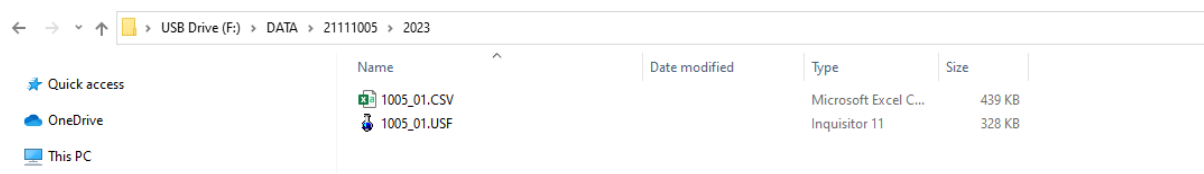


Figure 24-5 Monthly Records

24.1.1. Inquisitor File

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

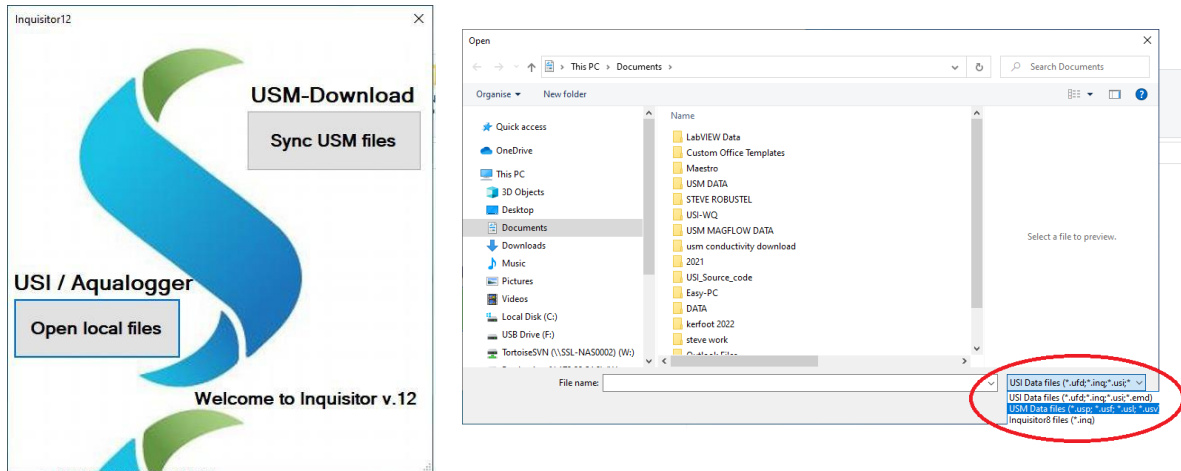


Figure 24-6 Inquisitor Front Screen

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.

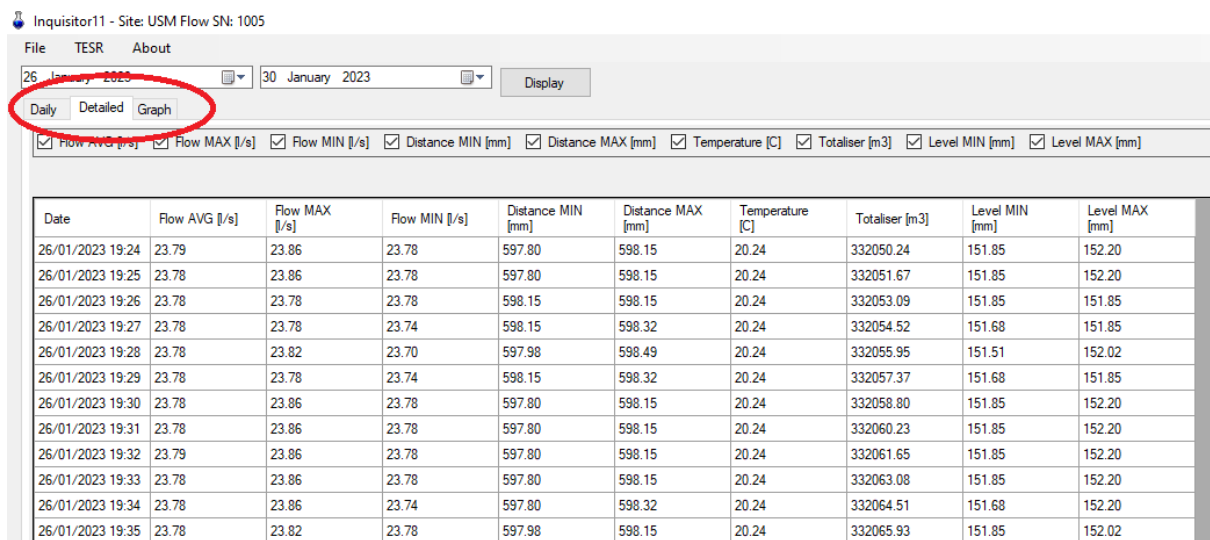


Figure 24-7 Inquisitor Detailed Screen

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 24-8 Inquisitor Graph Screen

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

24.1.2. CSV File

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

DATE	TIME	AV FLOW	MAX FLOW	MIN FLOW	MIN DIST	MAX DIST	AVG TEMP	TOTALISER	MIN LEVEL	MAX LEVEL
26/01/2023	18:13:00	24.12	24.17	24.09	597.46	597.8	20.24	331951.807	153.2	153.54
26/01/2023	18:14:00	24.1	24.17	24.09	597.46	597.8	20.24	331953.253	153.2	153.54
26/01/2023	18:15:00	24.1	24.17	24.05	597.46	597.98	20.24	331954.699	153.02	153.54
26/01/2023	18:16:00	24.1	24.17	24.09	597.46	597.8	20.24	331956.145	153.2	153.54
26/01/2023	18:17:00	24.09	24.17	24.09	597.46	597.8	20.24	331957.591	153.2	153.54
26/01/2023	18:18:00	24.1	24.17	24.09	597.46	597.8	20.24	331959.037	153.2	153.54
26/01/2023	18:19:00	24.1	24.17	24.09	597.46	597.8	20.24	331960.483	153.2	153.54
26/01/2023	18:20:00	24.1	24.17	24.09	597.46	597.8	20.24	331961.928	153.2	153.54
26/01/2023	18:21:00	24.09	24.09	24.09	597.8	597.8	20.24	331963.374	153.2	153.2
26/01/2023	18:22:00	24.09	24.09	24.09	597.8	597.8	20.24	331964.819	153.2	153.2
26/01/2023	18:23:00	24.09	24.13	24.09	597.63	597.8	20.24	331966.265	153.2	153.37
26/01/2023	18:24:00	24.09	24.09	24.09	597.8	597.8	20.24	331967.71	153.2	153.2
26/01/2023	18:25:00	24.09	24.09	24.09	597.8	597.8	20.24	331969.156	153.2	153.2
26/01/2023	18:26:00	24.09	24.13	24.05	597.63	597.98	20.24	331970.601	153.02	153.37
26/01/2023	18:27:00	24.09	24.09	24.09	597.8	597.8	20.24	331972.046	153.2	153.2
26/01/2023	18:28:00	24.09	24.13	24.09	597.63	597.8	20.24	331973.492	153.2	153.37
26/01/2023	18:29:00	24.09	24.09	24.05	597.8	597.98	20.24	331974.937	153.02	153.2
26/01/2023	18:30:00	24.09	24.13	24.05	597.63	597.98	20.24	331976.382	153.02	153.37
26/01/2023	18:31:00	24.09	24.09	24.05	597.8	597.98	20.24	331977.828	153.02	153.2
26/01/2023	18:32:00	24.09	24.17	24.09	597.46	597.8	20.24	331979.273	153.2	153.54
26/01/2023	18:41:00	-1	0	0	0	0	0	331991.56	0	0
26/01/2023	18:41:54	-1	0	0	0	0	0	331991.56	0	0
26/01/2023	18:43:00	23.77	23.8	23.76	598.04	598.22	20.63	331993.147	151.78	151.96
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 24-9 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.

24.2. 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.

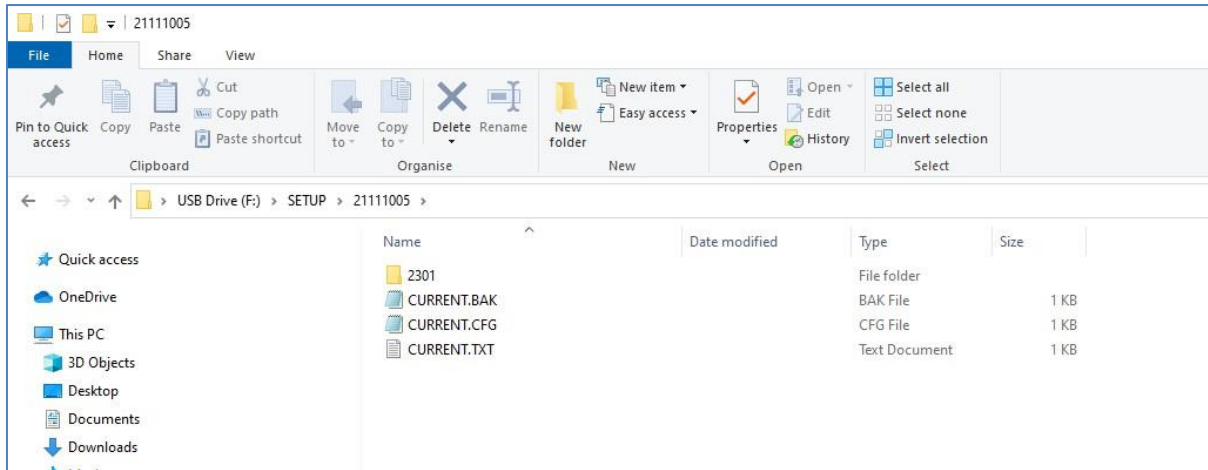


Figure 24-10 Set Up Files

The Serial Number Folder contains Log Folders and Configuration Files.

24.2.1. 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.

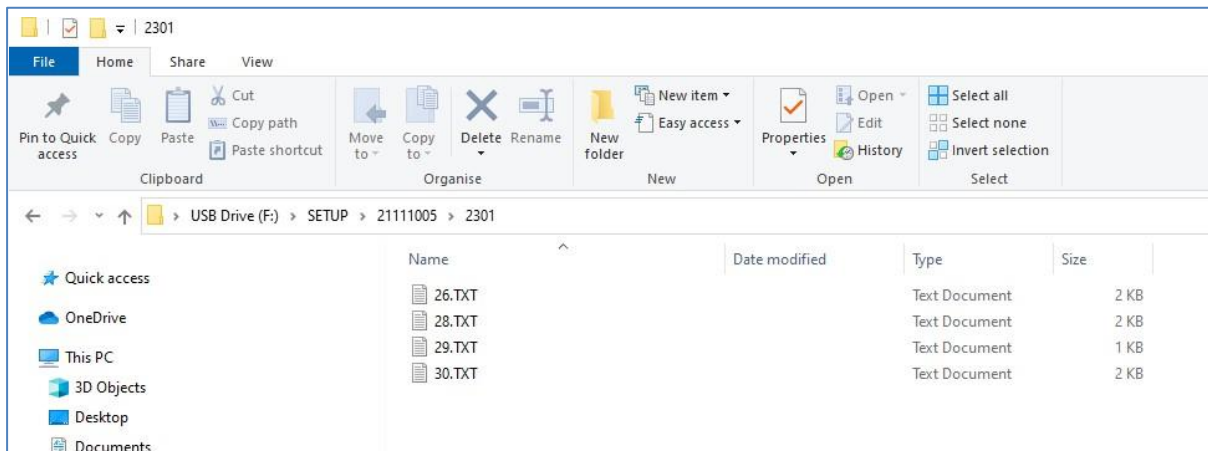


Figure 24-11 Log File Directories

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.

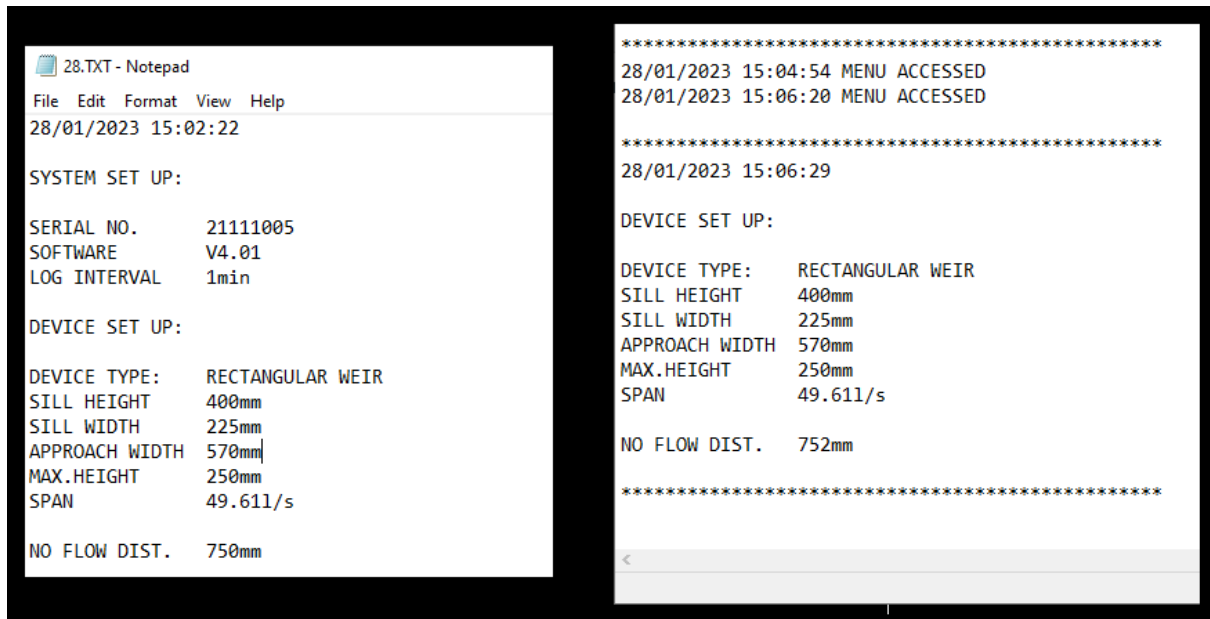


Figure 24-12 Set Up File

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.

24.2.2. 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.

25. Remote Monitoring.

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

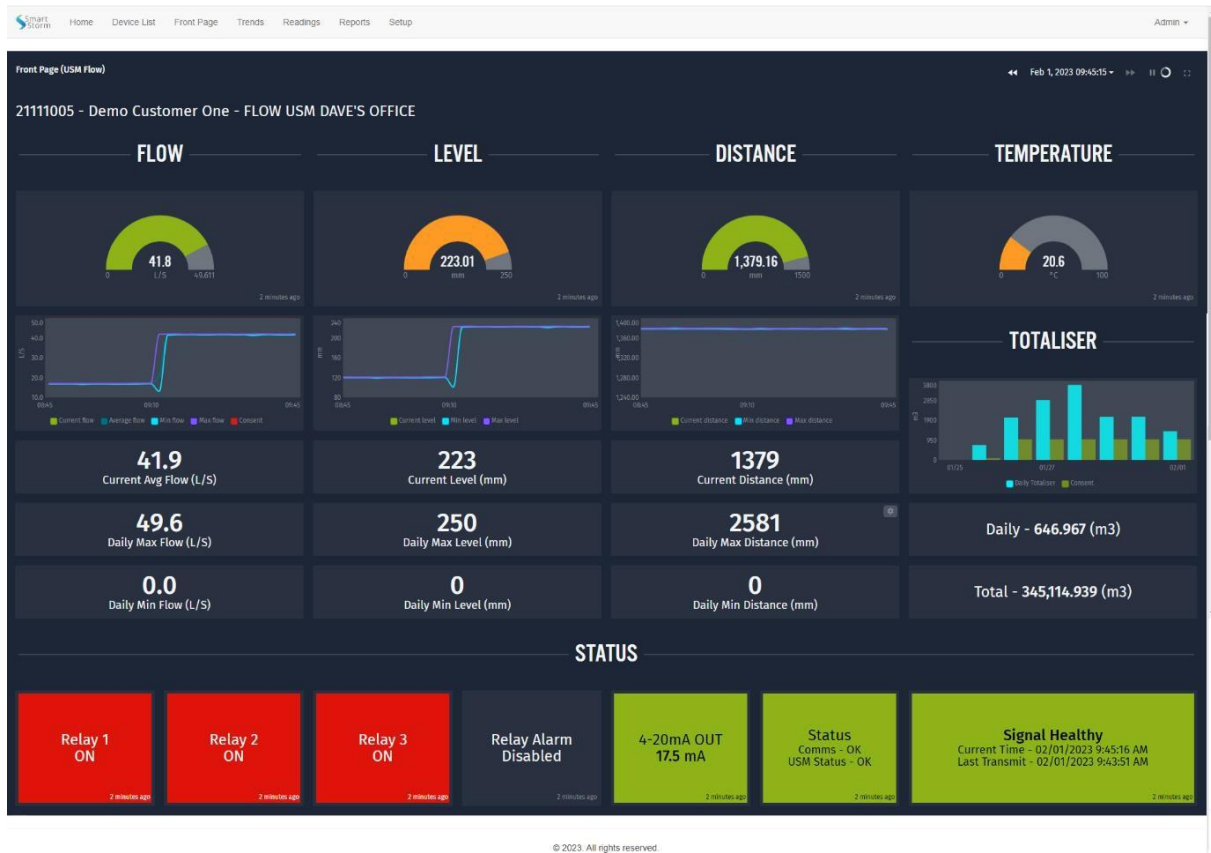


Figure 25-1 Remote Monitoring

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

26. 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 sensor is 15V
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 25.1 Fault Finding

27. Appendix

27.1. 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
m ³ /s (cubic metres per second)	1000
m ³ /mn (cubic metres per minute)	16.67
m ³ /hr (cubic metres per hour)	0.278
m ³ /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
ft ³ /s(cubic feet per second)	7.48052
ft ³ /mn(cubic feet per second)	0.24675
ft ³ /hr(cubic feet per second)	0.002078

28. Version Control.

V3.0 12/06/24 Original Version for Version 3.0 Software.

Declaration of Conformity

We
Smart Storm Limited
1 Lon Cae Darbi,
Cibyn Industrial
Estate,
Caernarfon. LL55 2BD
United Kingdom.

Declare under our sole responsibility that the products:

USI, Hydrocell, USM, Avocet 9000, Mudsens, Greasebuster FS

to which this declaration relates, is in conformity with the following directive.

The Electromagnetic Compatibility (EMC) Directive 2004/108/EC

And the following harmonised European Norms (EN standards), IRC and Environment Agency standards.

<u>Standard</u>	<u>Issue</u>
BS EN 50081-1 Emissions	1992
BS EN 50082-2 Immunity	1995
IEC 801 Immunity	1992
BS EN61010-1 Low Voltage	1993

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.

Dr John Duffy
Managing Director

