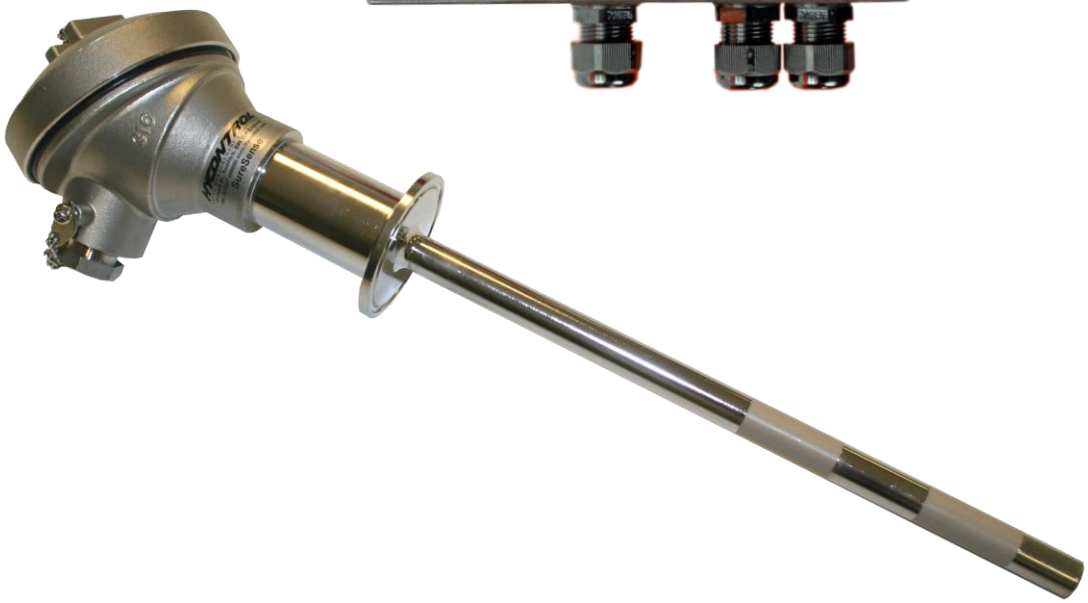
SureSense+

Foam Measurement and Control

User Manual



Hycontrol Ltd, Larchwood House, Orchard Street,
Redditch, Worcestershire, UK. B98 7DP
Tel: +44 (0)1527 406800 Fax: +44 (0) 1527 406810
Email: sales@hycontrol.com Web: www.hycontrol.com
Company registered in England No: 1755684

1. Contents

1. Contents

Table of Contents

1. Contents

1. Contents

1. Contents

Table of Figures

2. Specification

Power supply:	12V – 30V DC 0.5A (250 mA Fast acting 370 Series TR5 fuse – Littlefuse 37002500430)
Outputs:	Relay 1 – Dosing / Alarm – volt free change over contacts 250V AC, 30V DC 8A. Relay 2 – Dosing / Alarm – volt free normally open contact 250V AC, 30V DC 5A Relay 3 – Dosing / Alarm – volt free normally open contact 250V AC, 30V DC 5A Relay 4 – Alarm – volt free normally open contact 250V AC, 30V DC 5A Relay 5 – Alarm – volt free normally open contact 250V AC, 30V DC 5A Analogue 4 – 20 mA current loop
Indicators:	Power indicator – Red : always on Relay 1 – 5 – Red: On when relay in alarm state
Adjustments:	Foam sensitivity 0 – 100% Fouling sensitivity 0 – 100% Liquid sensitivity 0 – 100% Dosing settings Relay / Alarm settings
Fouling immunity:	200:1 foam to fouling
Hysteresis:	5% between trigger and reset
Enclosure:	IP65, polycarbonate, smoked grey cover.235mm X 185mm X 119mm (L X W X H). Gasket material – EPDM and polyurethane. 5 X M20 entry ports, 1 X M16
Probe cable:	Screened twisted pair cable 0.5mm^2 100m max. length (Lapp 0034250 Single or dual sensor probe, 0034251 triple sensor probe)
Battery:	CR2025 3V lithium battery
Controller temperature range:	-20°C to +60°C
Probe temperature range	+150°C Maximum
Accuracy:	±5% F.S. -20°C to +60°C
Pressure:	Non ATEX applications 10 bar / 145 psi (higher pressure available to special order) *Please contact Hycontrol in the case of **pressurised** ATEX applications.*

3. Introduction

The Hycontrol SureSense+ is an advanced foam controller with additional facilities; including extra relay outputs, multiple alarm configurations, dosing totaliser, and liquid detection. It is a purpose-designed foam controller unit intended for use in a permanent installation to sense and control foam in a reactor or other containment area and should only be used with a Hycontrol foam probe to achieve the operation described. The principle parts of a SureSense+ system are as follows:

- Foam Probe
- Interconnecting Cable
- Controller Unit

There are a variety of sizes and styles of foam probe, all of which are designed for hygienic applications and will operate in the presence of high levels of fouling (i.e. surface coating).

The SureSense+ can be used to control a pump or valve directly to dose antifoam by means of a 'Delay and Shot' or 'Proportional' (P.I. control) algorithm, to indicate the presence of foam or can be connected to a process controller using either the volt free relay outputs or the 4 – 20 mA (isolated) output. The SureSense+ has a wall mounting IP65 enclosure. The unit is powered from 24Vdc (12Vdc to 30Vdc).

4. Principle of Operation

The Hycontrol SureSense+ operates by passing a small alternating current through the foam under test, and uses this to measure impedance. The impedance of the material being sensed is used to determine when foam is present.

The probe is designed with two electrodes. One is used to sense foam while the other is designed to supply any leakage currents which pass along the body of the probe. If the probe is covered with a fouling layer deposited on it, then a leakage current must pass through that layer and down to ground. This leakage may be measured as part of the sensing current and consequently cause false readings. In the case of serious fouling this could cause a false alarm and an unnecessary intervention to the process. In the Hycontrol design the guard electrode supplies all the leakage current leaving the sense electrode to sense only foam. The guard electrode effectively isolates the probe from the interference caused by fouling. This gives the probe the ability to continue working reliably even in conditions of extreme fouling.

The controller energizes the probe and processes the measured data. It discriminates between foam and spurious events such as splashing. It also determines when foam is present and signals to a process controller or alarm that foam has been detected. Various output interfaces are available including volt-free contacts (relay), digital output and 4-20 mA.

5. Quick Start Guide

The SureSense+ comes with some pre-configured applications that can be selected as the basis for a process which allows the unit to be set up quickly. This avoids the need to set up all the parameters manually. However any of the parameters can be altered manually if required.
Refer to programming overview on page 65 for a setup summary.
See appendix Factory Applications on page 73 for a full list of basic applications

A factory application can be selected or the SureSense controller can be configured manually. In order to set the correct foam, liquid and fouling thresholds it may be necessary to ensure that a probe sensor is in contact with the foam, and subsequently in contact with the process liquid in order to determine the appropriate threshold settings.

5.1. Threshold Settings

Setting the foam threshold. This sets the sensitivity of the instrument over the range 0 – 100%.
The **foam threshold** will need to be adjusted for each configured sensor.

To enter the user menu press **Up** and **Right** together.

If a user password has been set use the **Up** / **Down** / and **Right** keys to enter the password.

Press **enter** (ENT) to accept the password (See Default password on page 74).
Press **enter** to select menu option **1/ Thresholds**.

Use the **Up / Down** keys to select one of the items. If there is more than one sensor available you may want to set the thresholds for each sensor.

Press **enter** to select an item
User the **Up / Down** keys to adjust the item value.
Press **enter** again once the adjustment is completed.

Refer to Threshold settings on page 36

Optionally

- The **liquid threshold** – this is used for alarm purposes only to indicate that liquid has touched the probe.
- The **fouling threshold** – this is used for alarm purposes only to indicate a build-up of fouling on the probe.

5.2. Relay / Alarm Settings

Alarm setup in the Miscellaneous menu.
To control a dosing pump the **Relay / Alarm settings** must be configured.

Refer to
Relay / Alarm setup on page 39.
Relay / Alarm Setup on page 60.

Enter the **user menu** as described above. Use the **Up** key to select menu option 5/ Miscellaneous. Press **enter**.
Press **enter** again to select the displayed item 1/ Relay/Alarm setup.

5. Quick Start Guide

To configure a dosing pump for sensor 1 using relay 1 as the control relay for the pump.

- Use the **Up / Down** keys to select Relay disabled.
- Press **enter** to select this item.
- Use **up** or **down** to change the relay from **disabled** to **enabled**.
  Once the relay is enabled, other relay setup parameters are displayed.
- Press **enter** to de-select this item.

- Use **Up / Down** to select the next item to be changed, **Delay**.
- Press **enter** to select **Delay**.
- Use **Up / Down** to change the **Delay** value (this is the time in seconds before the relay operates).
- Press **enter** to de-select this item.

- Use **Up / Down** to select the next item to be changed, this is the relay / alarm function.
- Press **enter** to select the relay / alarm function.
  Note the default value is 'Dosing for sensor' so this parameter may not need adjusting.
- Use **Up / Down** to change the relay / alarm function as required either 'Dosing for sensor' or 'Dosing in flood'.

Note that 'Dosing in flood' will allow dosing to continue even if liquid is touching the sensor on the probe, also this will require the liquid threshold to have been set.

- Press **enter** to de-select this item.

If there is more than 1 sensor fitted then select the sensor you wish to monitor.

- Use **Up / Down** to select the next item to be changed, **Probe**.
- Press **enter** to select **Probe**.
- Use **Up / Down** to change the Probe / Sensor number to be monitored. Note this will only show configured probes and sensors.
- Press **enter** to de-select this item.

The probe configuration is factory set (See Probe description on page 23).

- Press **down**, the display will change to a second page showing the **Output** relay control types.
- Press **enter** to select **Output**.
- Use **Up / Down** to select the next item to be changed. By default this is set to delay on (see Relay output control on page 29 for details on control output types).
- Press **enter** to de-select this item.

Note you will need to select the **Output** control type to suit your application.
Some of the output control types require additional parameters to be set (refer to Relay output control on page 29).

6. Installation

6.1. Installing the Probe

The Hycontrol Probe should be installed in such a way that the sensing electrode is positioned at the point where foam is required to be detected. The sensing electrode is the lowest of the electrodes at the end of the probe. Ensure that the probe is mounted securely and is not close to any permanent structure such that a “bridge” of foam can get caught. Ideally the sensing electrode should be more than 50 mm from any other metal parts but certainly more than 25 mm.

If the probe is in an area where air or gas is extracted, then the best location is near to the gas exit where foam could exit the vessel. However this is not essential.

Ensure that the probe cannot be flooded by any liquid contents. For example, if varying liquid heights are likely, ensure that the probe is high enough to be always above the liquid surface, unless it is specifically in use to detect the liquid level as well as foam.

It should be noted that when correctly setup the SureSense+ can detect the presence of liquid.

If the probe is installed in a pressurised vessel check that the probe fitting is tightened and sealed as appropriate before the pressure is raised.

It is essential that the probe is connected correctly, refer to Probe Cabling on page 14.

Hazardous environment installation wiring can be found under Probe Wiring For Hazardous Areas (Explosion Risk / ATEX) on page 46.

6.2. Installing the Controller

The SureSense+ is designed to be fastened to a wall or other permanent structure.

Ensure that the mounting surface is not subject to vibration and is not close to high voltage cables, contactors or drive controls. The unit should not be mounted in a confined space where temperatures may exceed the normal working temperature. If the unit is mounted outside, it must be protected from direct sunlight and severe weather conditions.

Remove the terminal cover, select knockouts in the base of the enclosure and fit cable glands to maintain the IP65 rating. Note that 3x M20 holes are already prepared. Refer to the drawing below.

For mounting point 1, fix an M4 or M5 flat-head screw in the mounting surface, leaving a 4mm gap to the surface.

Remove the terminal cover, hang the controller from the screw and secure it with 2x M4 or M5 flat-head screws at mounting points 2 & 3.

See figure 1 enclosure mounting below.

Do not use excessive force when tightening the screws and do not distort the enclosure. Replace the terminal cover unless you now intend to proceed with wiring into the terminals.

The M20 glands will need to support a cable diameter of up to 12 mm for the probe cable.

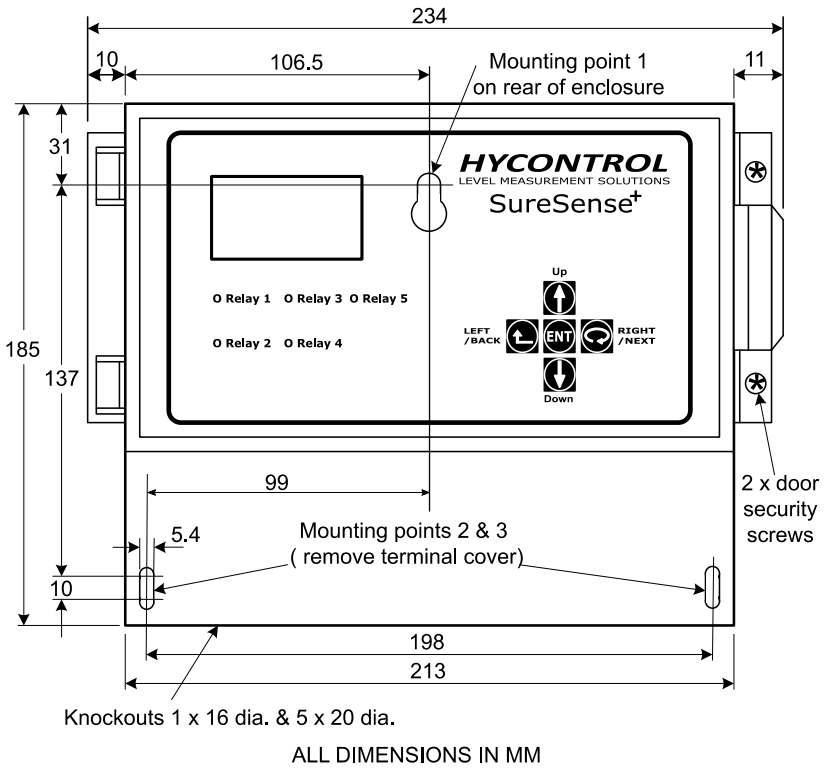


Figure 1: SureSense+ enclosure mounting

6.3. Controller Power and Interface Connections

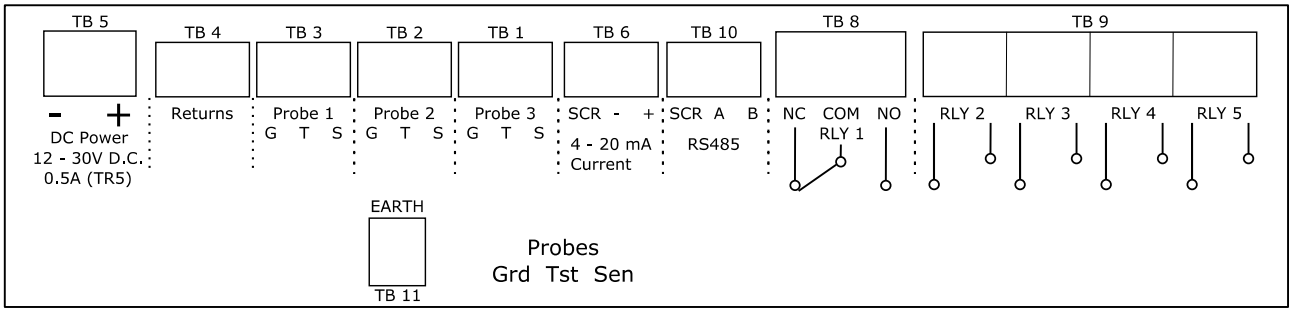


Figure 2 :Power and Probe connections

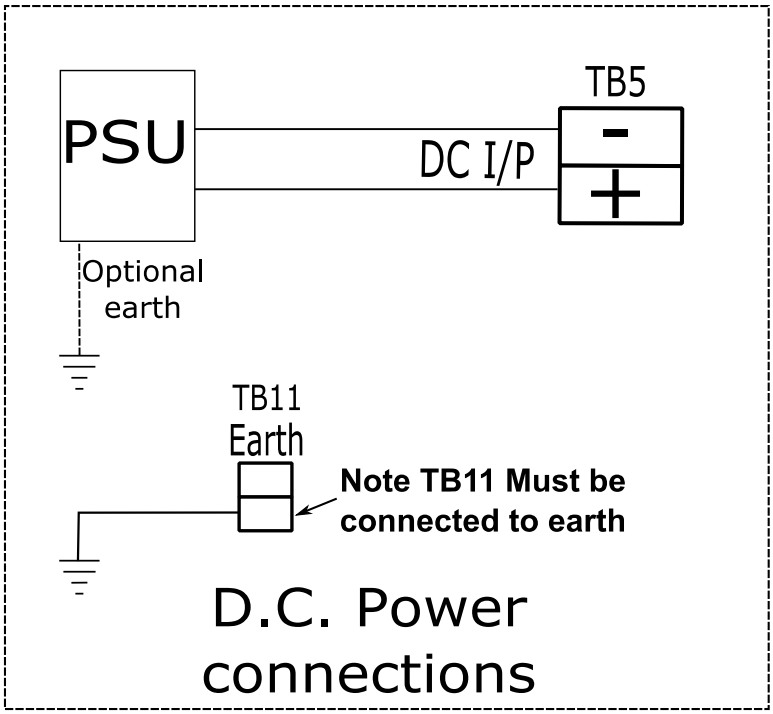


Figure 3 : SureSense+ Power connection

The unit's DC supply is connected to TB5 and a earth/ground must be connected to TB11.
A 250 mA, 250 VAC, TR5 Series, Fast Acting, Radial fuse is fitted into the instrument near TB5 (Littlefuse 37002500430).

The Earth connection at TB11 can be connected via the outer screen of the probe Lapp cable.

- DC Power
  The SureSense+ controller is powered from a 12 – 30 V DC 0.5 Amp supply. Connected as shown above in Figure 2 and Figure 3

- Returns
  Any probe earth / ground returns that are required – Provided that the controller is correctly grounded (TB11) and that the probe return is grounded at the probe itself these connections can be left unconnected.

- Probe 1 – 3
  Probe connections see Probe and Sensor Cabling on page 14, and Probe Wiring on page 17 for details.

- 4 – 20 mA Current loop
  Current loop is isolated from ground and is self-powered. Maximum load 750Ω. Cable screen should be connected at controller end only.

- RS485
  Factory use only

- Relay 1
  Volt free, change over contacts, 250V AC, 30V DC 8A

- Relay 2 – 5
  Volt free, normally open relays, 250V AC, 30V DC 5A

Please note that it is essential that the cabling used is suitable for the voltage connected in all cases. If in doubt please consult Hycontrol, or your supplier.

It is up to the customer to add the appropriate noise suppression / snubber devices to any load being switched by the relays.

6. Installation

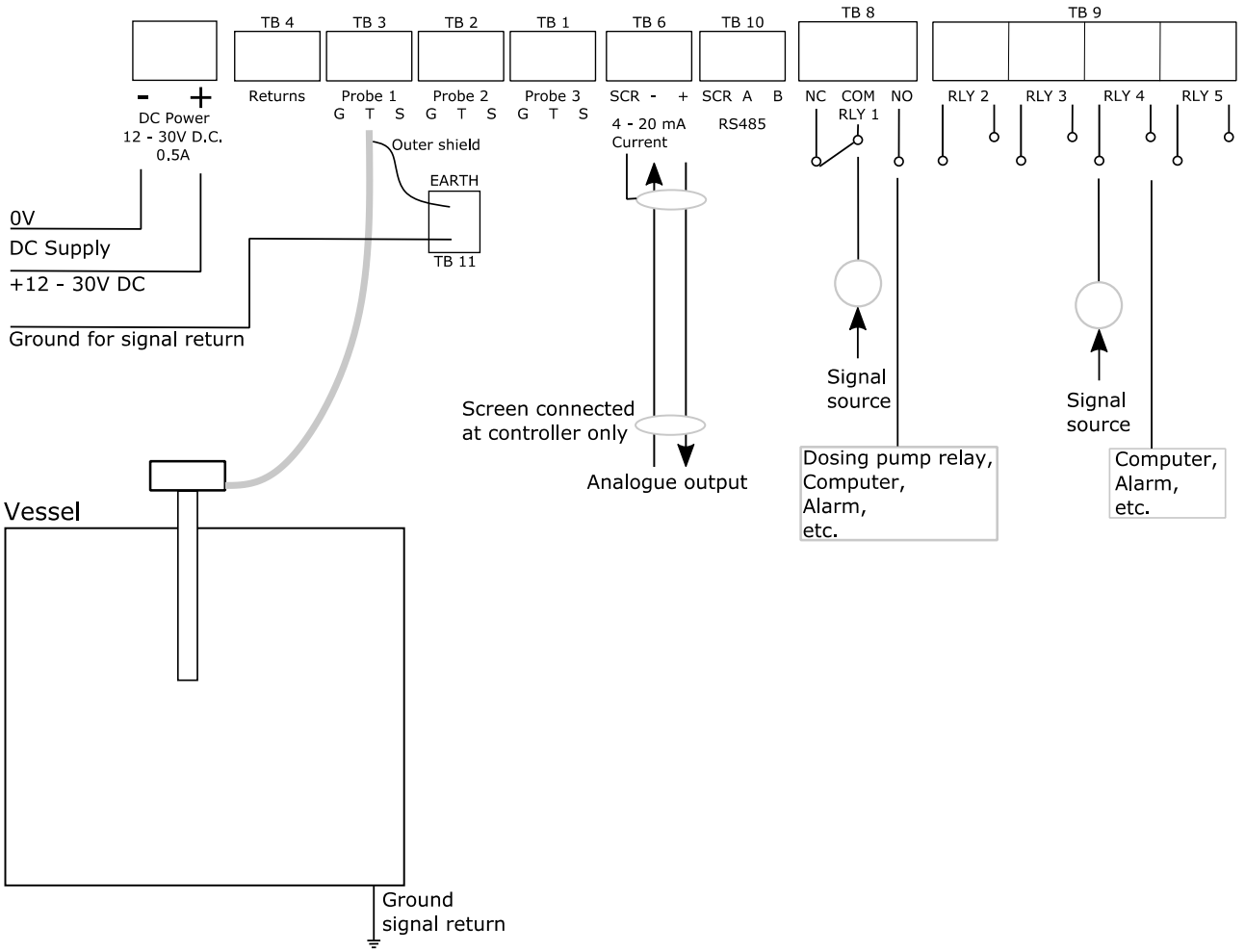


Figure 4 :Controller wiring diagram

6.4. Probe and Sensor Cabling

It is essential that the probe is connected with a suitable cable to the controller (sensor probe wiring: Single on page 17, dual on page 17 and triple on page 18). The internal twisted pair screen should never be connected to ground as this increases the capacitance of the cable and can cause false readings. Neither should other cores in the same cable be connected to ground for the same reason.

Note that SureSense+ cable, has individual screens for the twisted pair cores and a separate outer screen (see SureSense+ Cable on page 16). This outer screen must be connected to earth / ground at both ends of the cable (TB11 in the SureSense+ controller).

If a standard probe is being used, wire the cable to the terminal block in the head. Connect the sense wire to the terminal marked "S1" and the guard wire to the terminal marked "G1" and the test wire to “T1”. Use an IP66 cable gland to seal the cable into the head and to prevent any moisture access. (see Probe head connector view below on page 15)

If a laboratory type probe is used the cable is connected by means of a Lemo connector. A lead can be supplied by Hycontrol if required. Ensure that the sense and guard are the connected to the correct terminals (see Laboratory Probe Wiring on page 19).

It is essential that a ground return is provided for the probe. This is normally supplied via an earth (ground) bond to the vessel or structure in which foam is being sensed. If the vessel is not connected to earth a separate earth wire should be connected between the controller and the vessel. Connector TB11 (EARTH) is provided for this in the SureSense+ controller. If a non-conducting vessel is used, it is essential that an earth connection is made to the contents. This can be done by another electrode immersed in the liquid and connected to the instrument ground or a metal pipe or other metal connection in contact with the process liquid.
SureSense+ cable (See SureSense+ Cable on page 16) has an outer screen which should be connected to the vessel via the probe head PCB mounting screw, provided that the probe itself is grounded via the vessel. The other end should be connected to TB11 EARTH (Ground) in the controller.

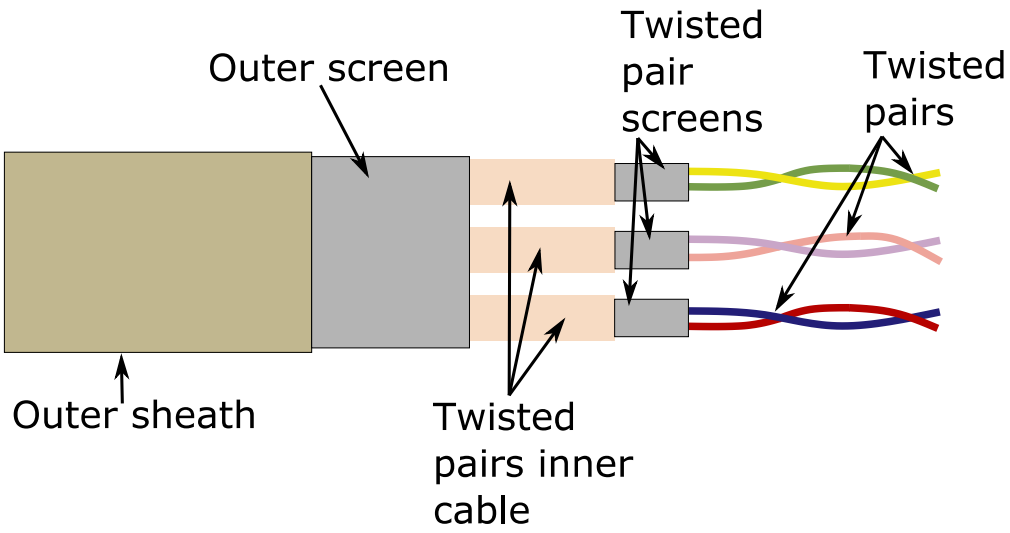


Figure 5 :Probe cable showing screen arrangement for a 3 T.P. cable

Refer to Probe Wiring For Hazardous Areas (Explosion Risk / ATEX) on page 46 for wiring details.

6.4.1. Probe Head Connectors

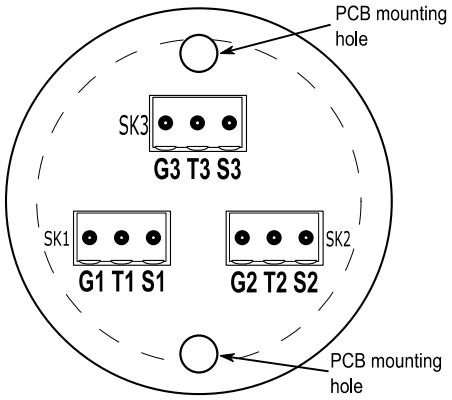


Figure 6 :Probe head connector view

The PCB is mounted into the head using 2 M4 X 8mm screws.
A ground connection can be made by attaching the outermost screen on the SureSense+ cable to one of the screws securing the PCB. **This relies on the probe housing been connected to the vessel ground**.

The probe uses removable screw type terminals.

SK1	Probe /Sensor 1
SK2	Probe /Sensor 2
SK3	Probe /Sensor 3

G1, G2, G3	Guard connections
T1, T2, T3	Test connections
S1, S2, S3	Sense connections

6.4.2. Recommended cable

6.4.2.1. For single and dual sensor probe

Lapp Unitronic CY PiDY (TP) cable Part number 0034250

6.4.2.2. For triple sensor probe

Lapp Unitronic CY PiDY (TP) cable Part number 0034251

6.4.2.3. SureSense+ Cable

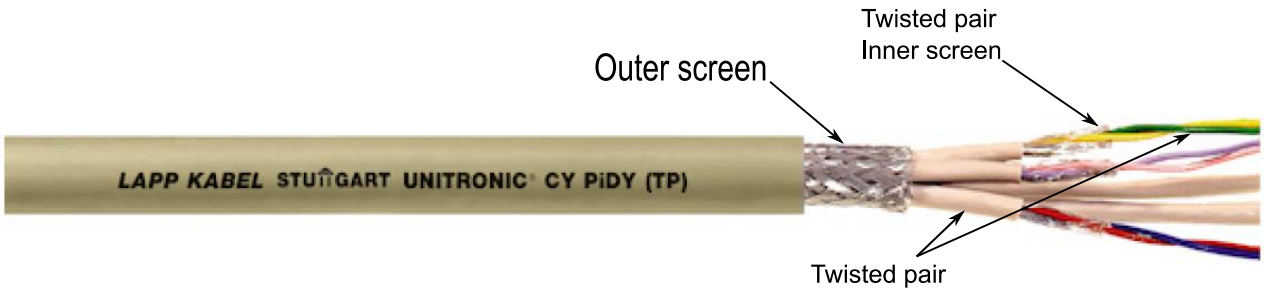


Figure 7 :Lapp cable showing outer screen, twisted pairs and twisted pair inner screens

For hazardous environments refer to Probe Wiring For Hazardous Areas (Explosion Risk / ATEX) on page 46 for wiring details.

6.4.3. Probe Wiring

6.4.3.1. Single Sensor Probe Wiring

Lapp Unitronic CY PiDY (TP) cable 0034250

Strip the outer sheath to expose a suitable length of the outer screen. Separate the outer screen strands. Using a selection of strands, twist them together to form a single wire. Cut the remaining strands off. Insulate the exposed wire to make it suitable to connect to the screw terminal (earth).

Refer to the dual sensor probe wiring below (note that the unused core must still be connected at both ends of the cable).

6.4.3.2. Dual Sensor Probe Wiring

Lapp Unitronic CY PiDY (TP) cable 0034250
All screen wires should be insulated.

- Cable outer screen connect to probe chassis under mounting screw.

- Twisted pair 1 screen connect to G1
- Test 1 (white) connect to T1
- Sense 1 (brown) connects to S1

- Twisted pair 2 screen connect to G2
- Test 2 (Green) connect to T2
- Sense 2 (Yellow) connects to S2

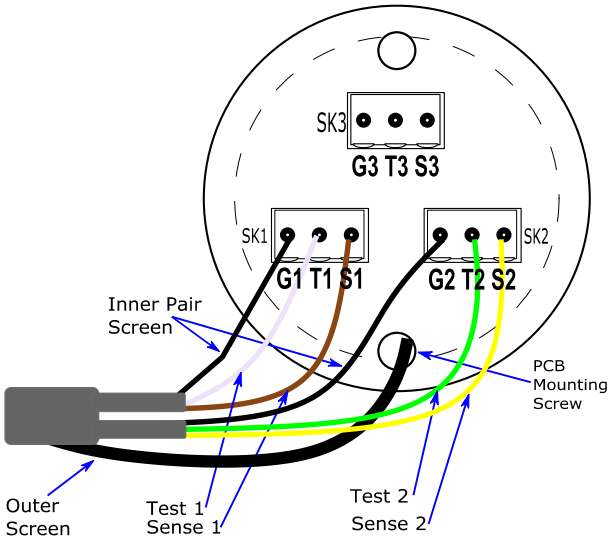


Figure 8 :Dual sensor probe wiring, Lapp cable 0034250

6.4.3.3. Triple Sensor Probe Wiring

Lapp Unitronic CY PiDY (TP) cable 0034251
All screen wires should be insulated.

- Cable outer screen connect to probe chassis under mounting screw.

- Twisted pair 1 screen connect to G1
- Test 1 (white) connect to T1
- Sense 1 (brown) connects to S1

- Twisted pair 2 screen connect to G2
- Test 2 (Green) connect to T2
- Sense 2 (Yellow) connects to S2

- Twisted pair 3 screen connect to G3
- Test 3 (Gray) connect to T3
- Sense 3 (Pink) connects to S3

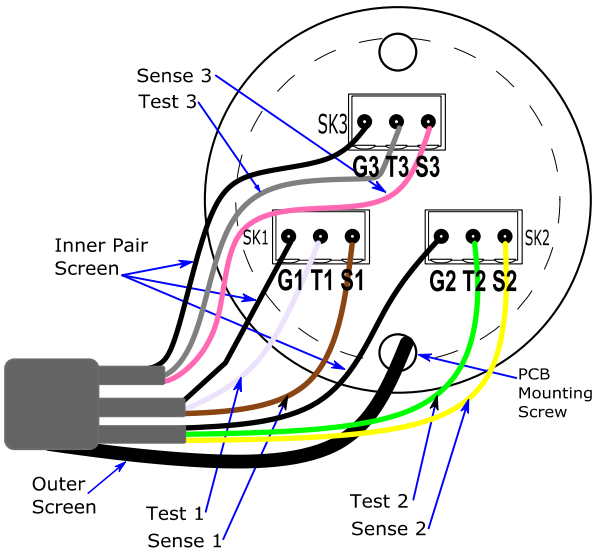


Figure 9 :Triple sensor probe wiring, Lapp cable 0034251

6.4.3.4. Laboratory Probe Wiring

Note this cable cannot be longer than 10m.

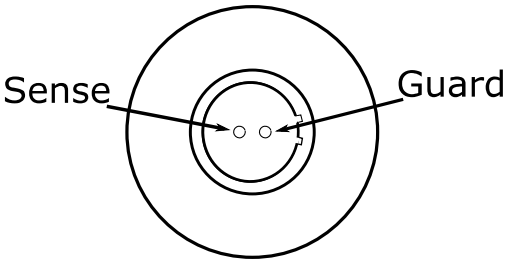


Figure 10 :Laboratory probe top view Lemo connector shown

The laboratory probe has a Lemo connector fitted (See Lemo Laboratory Probe Connector on page 72). Note that the probe only has two connections provided.

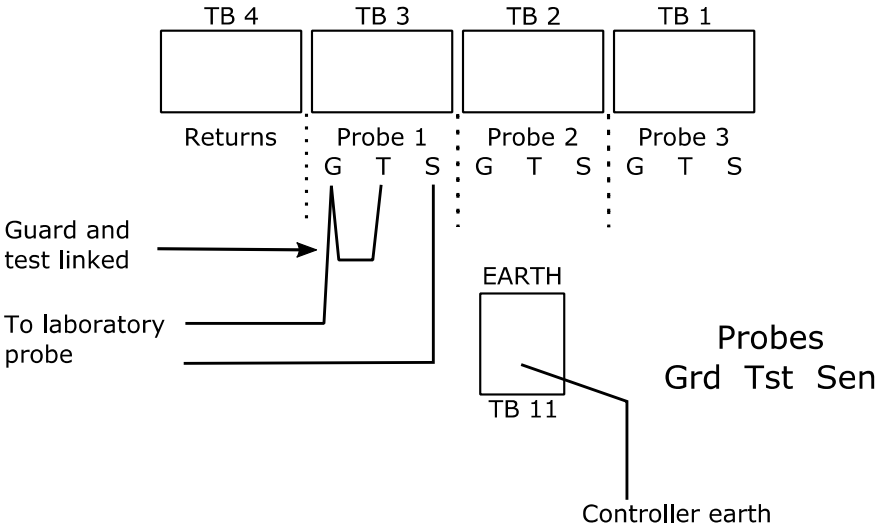


Figure 11 :Laboratory probe controller wiring

Note that for the laboratory probe the probe type must be set to FP.

6.4.4. Controller Probe Wiring

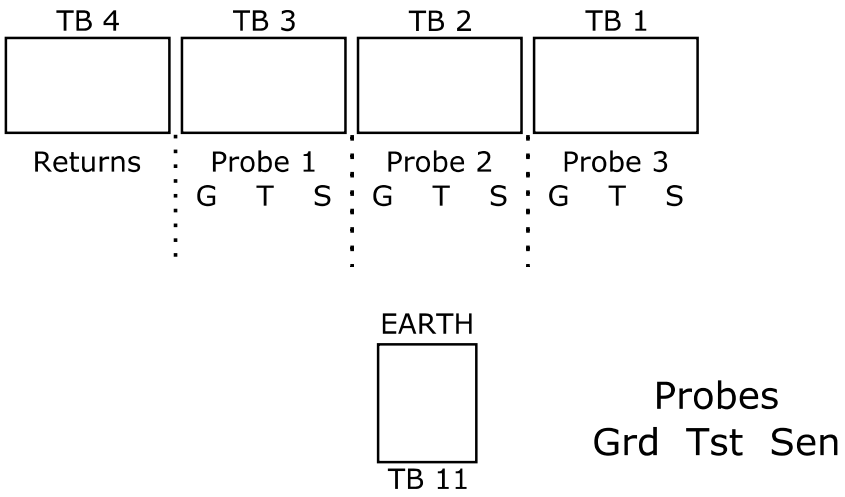


Figure 12 :Probe input connectors

Refer to probe combinations on page 70.

For Probe 1 – Connect to probe 1 terminal
Using Lapp cable 0034250

- Guard – Twisted pair screen
- Test - White
- Sense – Brown
- Outer screen Returns or TB11 Earth (ground)

Optional Sensor 2 – Connect to probe 2 terminal
Using Lapp cable 0034250

- Guard – Twisted pair screen
- Test - Green
- Sense – Yellow
- Outer screen Returns or TB11 Earth (ground)

Optional Sensor 3 – Connect to probe 3 terminal
Using Lapp cable 0034251
Sensors 1 and 2 are the same colours as above

- Guard – Twisted pair screen
- Test - Gray
- Sense – Pink
- Outer screen Returns or TB11 Earth (ground)

For a 2 or 3 probe setup, the wiring for each probe is the same as probe 1 shown above. Each probe is then plugged into the appropriate terminal.

7. Commissioning

When power is first applied a self-test is performed and as this happens Relay 1 indicator lights momentarily. After this the power light should be on and the other indicators should be off. This indicates that power is applied and that the internal processor is operating correctly.

Controllers are set up in the factory to the default settings. This will be suitable for a wide range of applications. However it may be necessary to adjust the unit for a particular application. To make a simple initial test that the unit is operating correctly make a temporary connection between the end of the probe and the vessel wall with a piece of cable. If this is impractical, make a temporary connection between the sense terminal at the probe head and ground. The display should show 100% Poss. liquid. Ensure that the information has passed correctly to the process controller or other device and that the correct channel has been used. Ensure that the temporary connection is removed and that the display returns to its previous reading. It is important that the complete measuring chain is tested together with any control feedback.

The probe should have been mounted in such a position that it will readily come into contact with the foam which is to be sensed. Ideally, if foam can be generated for a test then the unit should be tested with foam before use. If the Controller does not trigger when foam is present, then adjust the threshold to match the displayed foam percentage and try again. In most applications the sensitivity required is between 35% and 70%. The threshold adjustment is made through the user menu system - See **Thresholds** on page **25** and **36**.

In many cases it is impossible or undesirable to create foam for a test. In these situations the operation of the equipment should be monitored to ensure that it is operating as required by visual inspection.

If a sample of foam is required to be tested, ensure that it is a fresh sample and test in a metal container with a connection to ground. Some types of foam can drain quickly which will substantially change its characteristics which makes this rather difficult to do well and it is therefore not recommended. Do not use a plastic container for testing.

The delay time (or response time) gives discrimination against splashing. This acts as a response time before any action is taken. In most applications a few seconds is adequate to differentiate between occasional splashing and the presence of foam. (See **Relay Functions** on page **28** and **Relay / Alarm Setup** on page **60**) The default setting is 4 seconds but this can be adjusted if necessary. The delay may not be apparent when testing initially but should be borne in mind to allow enough time for the unit to trigger.

ATEX Barrier / Long Cable Compensation

Once a controller has been setup, it may be required to offset the effects of an ATEX barrier and long cable. Ensure that the probe is clean and not in contact with any liquid, foam or touching the enclosure. The compensation adjustments are available in the probe type setting (User menu, Miscellaneous, Probe Type).

Probe Fault Detection

With a ATEX barrier fitted it is not possible for the probe to detect a fault / missing probe connection, it is therefore necessary to set the probe type to FP (even if a FR probe is fitted). This will prevent the probe detection functionality from present false probe faults.

Fouling Compensation

If a fouling reading is indicated with the probe in free air, adjust the foul compensation until the foul percentage reads zero. Ensure that this is started from the minimum value (one). The compensation has a range of 1 to 199 inclusive.

Foam Compensation

If a foam reading is indicated with the probe in free air, adjust the foam compensation until the foam percentage reads zero. Ensure that this is started from the minimum value (0). The compensation has a range of 0 to 400 inclusive.

8. Probe Description

A probe consists of at least one sensor and may have up to three sensors fitted. The probes are ordered with the controller and are built at Hycontrol to the customers requirement.

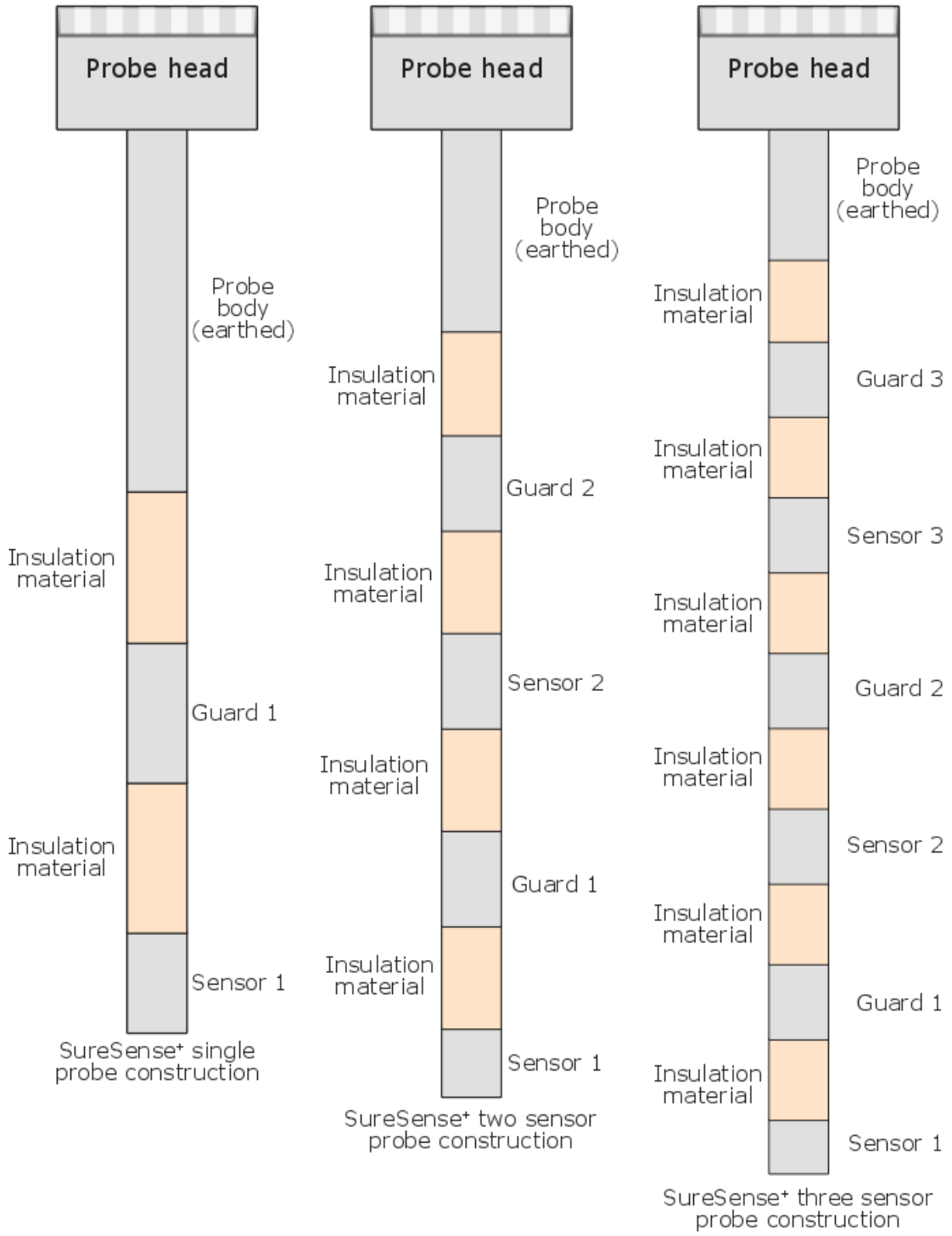


Figure 13 : SureSense+ Probe construction

Probe sensors are always numbered from the tip of the probe upwards (Provided that the correct connection to the controller is made).

9. Operation

9.1. The Main Display

When the unit is switched on the Hycontrol logo and version are briefly displayed. The unit then shows the configured probe and sensor readings.

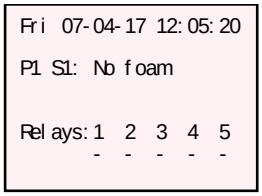


Figure 14 : Example main display

From this screen it is possible to view several other screens:-
Fouling, measured foam resistance, miscellaneous and totaliser information.

Pressing the right/next key displays the following.

Main display Fouling display Foam resistance Miscellaneous Main display

Press left at any point will take you back a step

To display the totaliser information press the Up key

Main display Totaliser display.

Pressing the right / next key will advance the relay number to the next relay.

Pressing down while in the totaliser display will show the security code.

Pressing left at any point will take you back to the main display.

The SureSense+ is configured by means of a menu system driven from the front panel and display. To access the menu system the user should press Up and right / next keys simultaneously.

Refer to the menu descriptions on page 56 for details.

Refer to Relay Status Indicators on page 69 for the relay states shown at the bottom of the display.

9.2. Thresholds

Output control is determined by a set of thresholds that can be configured for the SureSense+ unit. The threshold settings can be accessed from the User menu, 1/ Thresholds.

Each sensor has its own threshold settings. The following threshold settings are available:-

- Foam threshold
  - The point at which foam is detected. When the foam touches the probe a measurement is made, when the measurement reaches this threshold, then foam is registered.
- Liq. threshold
  - The point at which liquid is detected. If the liquid level rises and touches the probe, the measured value can be compared against this threshold and used to determine that liquid is present.
- Liquid delay
  - This is the delay after liquid has touched the probe before the presence of liquid is registered.
- Foul threshold
  - As fouling builds up on the probe, provided that a measurement path exists, it can be measured. The current fouling level is displayed on the fouling display. A relay output can be configured as a fouling alarm if required.
- Tot. Th *[1]
  - A totaliser function is available for the dosing relays, which can be used to approximate how much antifoam has been used. This threshold can be used to configure a relay output for an antifoam usage warning.

*1 Note that this value is rounded down to the nearest whole number for relay / alarm function.

9.3. Totaliser Function

9.3.1. Description

As part of the dosing function it is possible to setup a totaliser that accumulates while a relay (configured for dosing) is dosing. By setting a value in User menu, 4 Tot. flow rate (total flow rate) the total amount of antifoam used can be approximated, allowing the user to estimate when a limited supply is getting low, or to monitor the amount of antifoam used in a given time period.

The totaliser works in the following manner:

- A relay is configured for dosing using a given probe / sensor.
- That sensor must have thresholds set for foam and totaliser (amongst others)
- When a totaliser flow rate is set the controller will increment the totaliser when dosing is performed.
- A relay (normally relay 4 or 5) can be set to give an alarm when the totaliser reaches the totaliser threshold value set in the thresholds setup for the given sensor.

9.3.2. Setting the Totaliser

Refer to Totaliser flow rate on page 37 and User Menu on page 58.
Setting the total flow rate to a value other than zero will allow an accumulation of antifoam used.
To set the flow rate select **Tot. flow rate** in the User menu.
Select the relay that is to be totalled by using **Up** / **Down** to select the relay number line, then pressing **Enter** to allow adjustment.
Use **Up** / **Down** to set the relay number then press **Enter**.
Select the flow line using **Up** / **Down**, then press **Enter** to allow adjustment.
Use **Up** / **Down** to change a digit, and the **Right** key to select the next digit. Once the flow rate has been entered press **Enter**.
Press the **Left** key to exit the menu.

9.3.3. Clearing the Totaliser

Refer to Resets on page 41 and Reset Items on page 62.
To clear the current total the user will need to enter the Miscellaneous menu and select the **Resets** option, then select **Total flow**.
The dosing **relay number** should be selected by using the **Up** key.
Press the **Right** key to enable the reset
Press **Enter** to reset the total.
Press the **Left** key to exit.

9.3.4. Setting An Alarm on the Totaliser

Refer to Relay / Alarm Setup on page 60.
One of the alarm relays can be configured to operate once the totaliser reaches a pre-set value. From the **Miscellaneous menu**, select **Relay / Alarm** setup. Select the relay to be used for the alarm (normally this would be relay 4 or 5), then set the alarm type to **Totaliser on sensor** or **Totaliser any sensor**.

The **Totaliser threshold** will need to be set to the value required for the alarm. From the **User menu** select **Thresholds**, then adjust the **Tot. Th** to the required value.
Note that the totaliser threshold refers to a sensor number not a relay. The dosing relay will be configured to work with a given sensor which has a threshold set which in turn can be used by an alarm relay configured for a totaliser alarm.

9.3.5. Viewing the Current Totaliser Value

The totaliser value can be seen by pressing the Up key at the Main display.

9.3.6. Setting Totaliser Alarm Summary

As an example, given that the flow rate of the dosing pump is 10 litres per hour and the supply contains 50 litres.
Given that relay one is configured for dosing on probe one, sensor one.

- The flow rate would be set to 10 (User menu 4/ Tot. flow rate) for sensor 1.
- Set the threshold EG to 45 (User menu 1/ Thresholds -> Tot. Th) for sensor 1.
- Clear any existing totaliser value (Miscellaneous menu 7/ Resets -> Total flow) for relay 1.
- Set an alarm for the totaliser value EG Relay 4 set for totaliser on probe 1 – Sensor 1 set (Miscellaneous menu 1/ Relay / Alarm setup).

This would activate relay 4 when the current totaliser value reaches 45 (the totaliser threshold value for sensor 1).

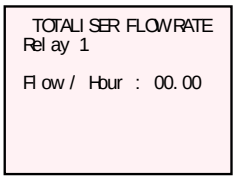


Figure 15 :Setting totaliser flow rate screen

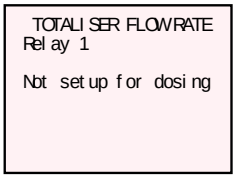


Figure 16 :Setting totaliser flow rate - relay not configured for dosing

9.4. Relay Functions

Relay functions are accessed from the user menu option 5 (miscellaneous menu), followed by option 1 in the miscellaneous menu (Alarm setup).
Each relay has a number of parameters which can be configured to suit the application.

- Enabled / Disabled
  - The relay is disabled by default
- Normally De-energised / Energised
  - The normal position for the relay (open or closed)
- Delay
  - Delay in seconds before the relay operates
- Function
  - The function or alarm action required EG dosing, liquid detection etc.
- Probe / Sensor
  - If more than one sensor is fitted, then the sensor that is to be monitored should be selected.
- Output
  - The type of output control that is required – see below for details.

9.4.1. Relay Output Control

9.4.1.1. Any relay

Delay on:

Each relay can be configured so that after a delay the relay comes on when an alarm condition is detected and switches off when the alarm condition clears.

- Delay
  - The time in seconds before the relay operates.
  - Can be set from 1 to 30 seconds.

9.4.1.2. Dosing Relay Only

Shot and Delay:

A dosing relay can be configured for shot and delay. When the relay first goes into alarm a delay is applied. The relay then comes on for Ton (relay on time) seconds. After Ton seconds the relay will switch off for Toff (relay off time) seconds. The cycle will repeat until no foam is detected (the foam level must fall 5% below the set foam threshold).

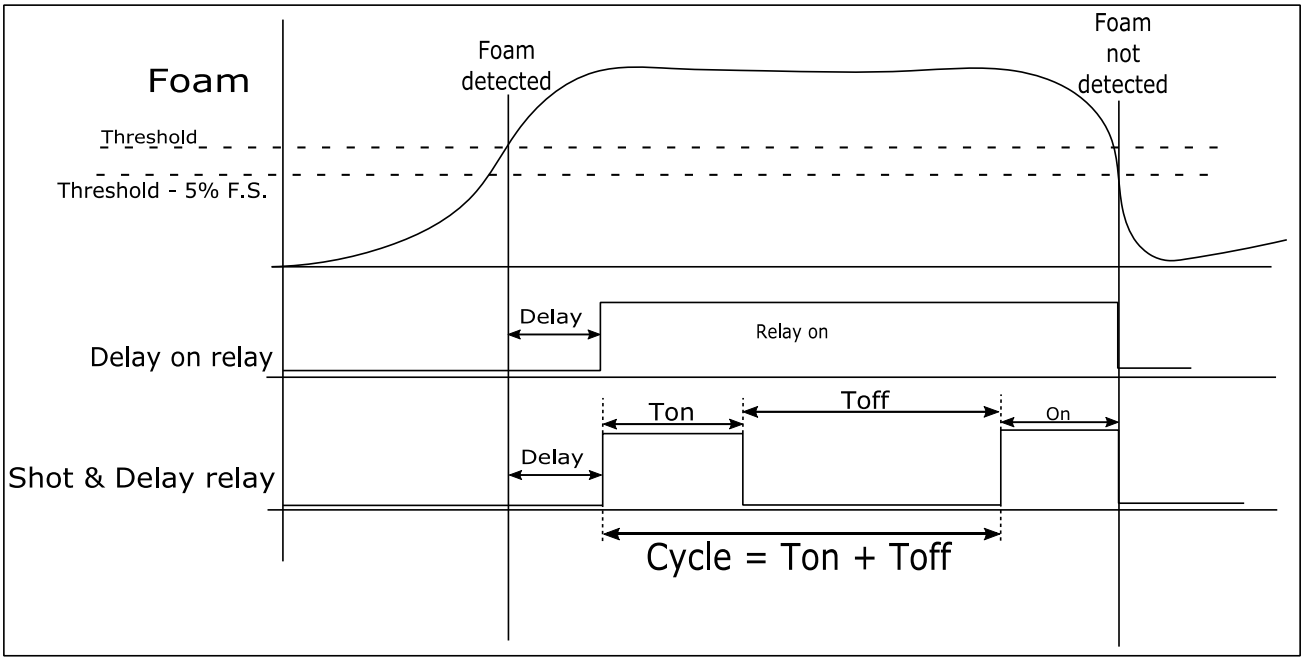


Figure 17 :Delay on and shot and delay relay outputs

For Shot & Delay output control there are two additional parameters that need to be configured.

- Relay on time (Ton)
- Relay off time (Toff)

Ton and Toff must be at least 1 second.

Ton + Toff must be less than or equal to 600 seconds. This gives a cycle time of Ton + Toff which can be from 2 seconds to 600 seconds.

Care must be taken with the minimum Ton time to ensure that your pump / solenoid is operated for sufficient time without damage and that the pump is not operated too quickly (Toff time).

P.I. Control:

P.I. control (Proportional, Integral control) attempts to control the level of the foam by controlling the amount of dosing (Note P.I. control is referred to as proportional control in the SureSense+). As the foam level increases the amount of dosing also increases. The P and I factors are adjusted such that the level of foam is maintained with as little variation as possible using the minimum of anti-foam.

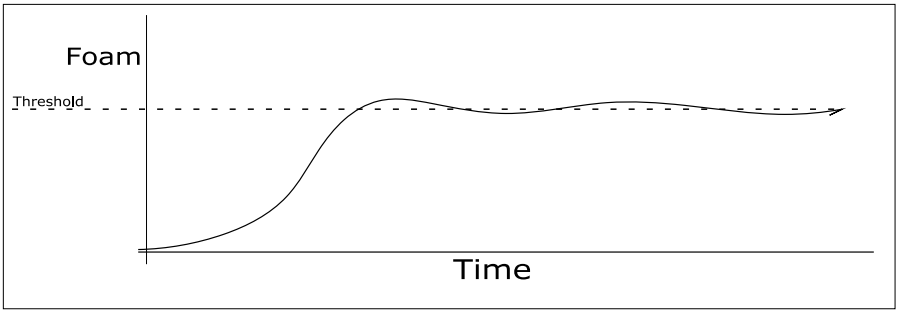


Figure 18 :An example of P.I. control with a steady foam level

For P.I. control there are two additional parameters that need to be configured.

- Proportional factor (P)
- Integral factor (I)

P can be any number from 0 to 100 inclusive.
I can be from 0 to 1000 inclusive.

- Setting either P or I to zero will disable the zeroed term so that it does not contribute to the P.I. control. Disabling both terms will leave the relay always off with no control.
- Larger proportional values will cause the output to turn on for a larger initial on time as the foam crosses the threshold.
- Larger integral values will cause the output to remain on for a longer period, and will keep the output on for a limited time after the foam has dropped below the threshold.

It should be noted that even when the foam drops below the threshold the dosing pump may still operate (due to the integral value), as the controller tries to keep the foam level from building up. With the foam level above the threshold setting, the pump will tend to operate for a longer period of time and remain on for a longer period after the foam drops below the threshold which suits a slower moving process.

In summary
Error = measured foam value – threshold value
The proportional term will affect the output: % output = Error * proportional value
The integral term will affect the output: % output = Error * integral value * Error, where error is not zero.
When error is zero the integral value remains unchanged.
Negative errors only affect the integral term.
Output % = proportional term + integral term.

9.4.2. Relay Functions

9.4.2.1. Relays 1 – 3

Relays 1 – 3 can be used for controlling dosing pumps. The following functions can be assigned to these relays:-

- Dosing for sensor
    - The relay operates when the foam threshold is reached. The relay can be set to delay on, shot and delay or P.I. control. Dosing will stop when liquid is detected.
- Foam for sensor
    - The relay operates when the foam threshold is reached. The relay output can only be set to delay on.
- Fouling for sensor
    - The relay operates when the fouling threshold is reached. The relay output can only be set to delay on.
- Liquid for sensor
    - The relay operates when the liquid threshold is reached. The relay output can only be set to delay on.
- Dosing in flood
    - The relay operates when the foam threshold is reached. The relay can be set to delay on, shot and delay or P.I. control. However the relay will continue to operate when liquid is detected (the liquid threshold has been reached).

9.4.2.2. Relays 4 and 5

Relays 4 and 5 will only operate with delay on output control and are intended for general alarm use.
Relays 4 and 5 can be configured for a variety of alarm conditions as follows:-

- Foam for sensor
  - The relay operates when the foam threshold is reached.
- Fouling any sensor
  - The relay operates when the fouling threshold is reached on any configured sensor.
- Fouling for sensor
  - The relay operates when the fouling threshold is reached.
- Liquid any sensor
  - The relay operates when the liquid threshold is reached on any configured sensor.
- Liquid for sensor
  - The relay operates when the liquid threshold is reached.
- Sensor Fault
  - The relay operates if the unit fails to detect a probe and given sensor.
- Any Sensor Fault
  - The relay operates if the unit fails to detect any of the configured sensors / probes.
- Failsafe
  - In failsafe the relay is set to normally energised
- Dosing tm any sensor
  - The relay operates when dosing is on for more than the dosing timeout time on any configured sensor.
- Dosing tm sensor
  - The relay operates when dosing is on for more than the dosing timeout time .
- Dosing on sensor
  - The relay operates when dosing is active for the selected sensor (note that the sensor must have a relay configured for dosing).
- Totaliser any sensor
  - The relay operates when the totaliser threshold is reached on any configured sensor.
- Totaliser on sensor
  - The relay operates when the totaliser threshold is reached.

For sensor – a sensor number must be selected.
Any sensor, the relay will operate if any configured sensor condition matches the set condition.

9.4.3. Common Relay Settings

Each relay can have the following parameter set:-

- Enabled / disabled
  - The relay can be enabled for dosing alarm functions, or made inactive.
- Norm. De-energised / energised
  - The relay can be set so that its normal non-alarm state is either open or closed. In the case of the changeover relay this means that the normally open contact will be normally closed when there are no alarms. Normally de-energised means that in a non-alarm condition the relay is not operated whereas normally energised, the relay is always operated until there is an alarm condition.
- Delay
  - The relay on delay is set to 1 – 30 seconds. This is the delay after a condition has been reached before the relay operates (does not apply to P.I. control).

9.5. Current Loop (4 – 20 mA)

The 4 – 20 mA current can be configured to give an indication of the measured foam. The current loop also supports two alarm states, only one of which can be active at any given moment.

9.5.1. Current Loop Foam Indication

As previously stated the current loop can reflect the measured foam. In the case of more than one sensor fitted to a probe, the current loop can provide a scaled mA value based on two or three sensors.

9.5.1.1. Single Sensor Probe

The 16 mA span represents the displayed measurement, where 0% is 4 mA and 100% is 20 mA.

9.5.1.2. Two Sensor Probe

Each sensor will give a foam measurement from 0% to 100% (this covers no foam to liquid).

The 4 – 20 mA loop has a span of 16 mA.
For two sensors, the 16 mA span is divided into two 8mA spans. This results in sensor 1 covering 4 – 12 mA and sensor 2 covering 12 – 20 mA.
As the foam rises it will contact sensor 1 first which will be indicated in the range 4 – 12 mA and if it continues to rise eventually reach sensor 2. Once sensor 2 starts measuring then the current loop will indicate a value from 12 mA to 20 mA.
Note that the transition from the first 8 mA span to the second may involve a jump in loop current as the foam for example may only be measuring at 40% even with the sensor fully covered, so when the foam reaches sensor 2, the loop current will jump from 7.2 mA to a value over 12 mA.

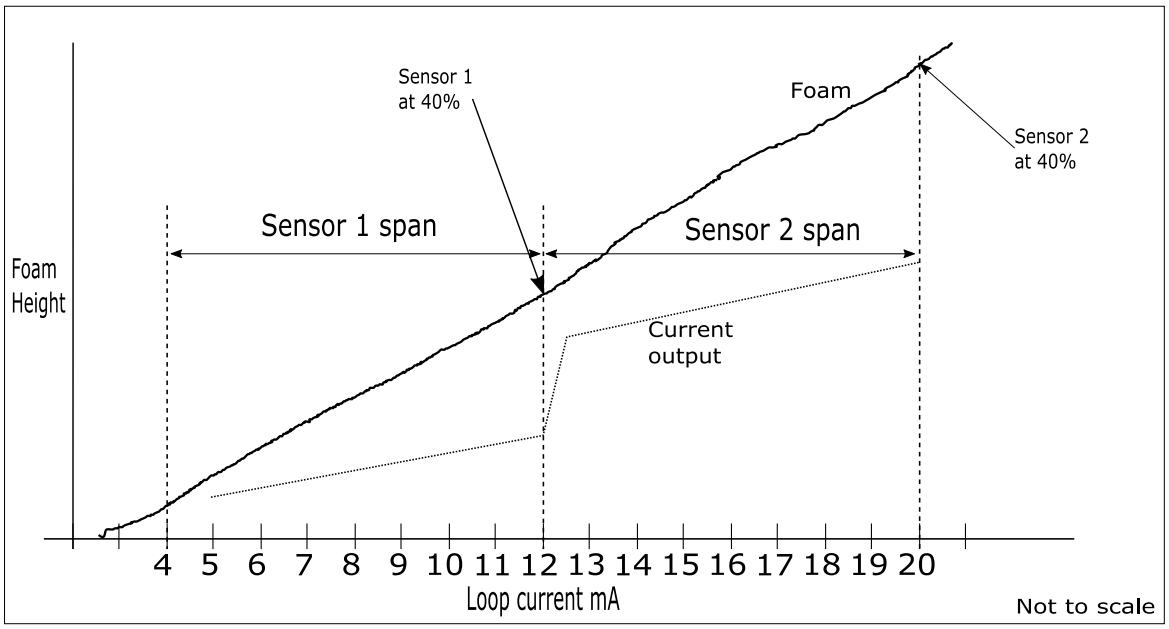


Figure 19 : Dual sensor probe foam and loop current

9.5.1.3. Three Sensor Probe

This works in the same manner as the two sensor probe above except that the 16 mA span is divided into 3.

With three sensors, each sensor would have a representative span of 5.3 mA.

9.5.2. Current Loop Alarms

High alarm – Loop current is set to 22 mA

Low alarm – Loop current is set to 3.5 mA

If two alarms occur at the same time, then the high alarm will be indicated.
In the case where one alarm occurs followed at some later time by another alarm, then only the first alarm to be active will be indicated.

If the first alarm clears, then the second alarm if still active will be indicated.

The following alarm states are available for configuration:-

- Liquid alarm on
- Fouling alarm on
- Totaliser alarm on
- Dosing jam alarm on
- Fail safe on

Note

- The first alarm to occur is the only alarm that will be indicated by the current loop.
- If two alarms occur at the same time, then the high alarm will be indicated.
- The **failsafe** alarm will **fix** the current to either the **high or low** value depending which alarm was set.

10. Programming and setup Guide

Please note that a majority of these settings are applied at the point they are changed. Some require extra key presses to save the changes. The user is prompted when this is required.

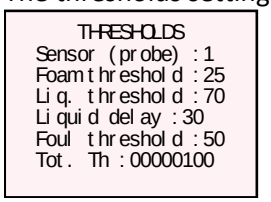
10.1. User Menu

Refer to **Menu Layout** on page **56** for further details.

The user menu has the following functions:-

1. Thresholds
2. Applications
3. Dosing Time Out
4. Tot. flow rate
5. Miscellaneous
6. Contrast

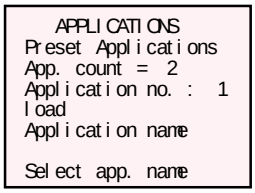
1. Thresholds
   The thresholds settings are used to control the point at which events happen.



   A sensor is mounted on a probe. A probe may have more than one sensor on it. These settings apply to a given sensor. There a maximum of 3 sensors (the configuration is factory configured when the unit is ordered).

   Foam threshold: The point at which an alarm should become active or dosing should start.
   Liq. Threshold: The point at which liquid is detected.
   Liquid delay: A value in seconds before the unit will alarm after liquid is initially detected.
   Foul threshold: The point at which fouling has built up on the probe and the probe requires cleaning.
   Tot. Th: When the totalised value reaches this point an alarm can be triggered.

2. Applications
The SureSense+ is supplied with a number of Factory Applications (on page 73) which can be loaded into the unit by the user. Also the user can set the unit up to their requirements and save the unit configuration as a user application.

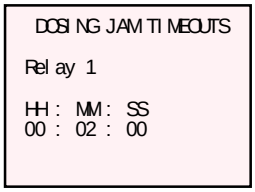


Preset Applications: Load a pre-set factory configuration. Or change to **User Applications** and **save**, **load,** create a **new** configuration or **delete** an existing configuration.

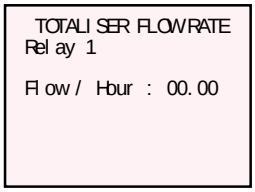
The configuration that is saved is based on the current setup of the SureSense+. This includes thresholds, relay settings, dosing time outs, flow rates and current loop settings (including the alarm configuration).

Select either **Preset** or **User** Applications.
For **Preset** Applications it is only possible to **load**.
For **User** Applications select **load**, **save**, **new** or **delete**
For **load**, **save** or **delete** select the application name.
For **new**, the user must enter an application name.

3. Dosing timeout
For a given relay, a dosing jam timeout value can be configured. This is used for a configured relay function to alert the user to a possible fault condition if the dosing relay is active for longer than this period. This may be due to prolonged foam (because no antifoam is been added into process) or a faulty relay. Note this does not detect the actual flow of antifoam, so for example a faulty dosing pump which does not turn off will not be detected.

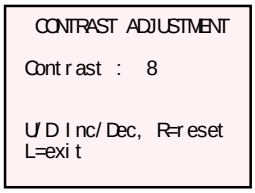


4. Totaliser flow rate
This is the amount of antifoam in flow per hour. If this is configured then the total flow can be calculated by the SureSense+ and used as an alarm relay function.
The total flow is calculated as flow rate per hour * time.
The calculated value is displayed on the totaliser information screen display.



5. Miscellaneous
   This provides access to the miscellaneous menu.

6. Contrast
   The display contrast can be adjusted in this screen



   Up and down increment or decrements the contrast setting.
   Right / next resets the contrast setting to the factory default value.
   Left exits the contrast adjustment.

Note that the contrast can also be adjusted on the front panel when main display (or option screens) is shown by:-

- Pressing and holding Enter and Right / Next at the same time
- Pressing Up or Down to adjust the contrast

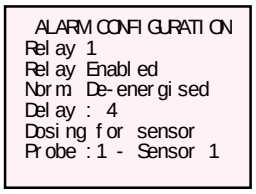
10.2. Miscellaneous Menu

Refer to Miscellaneous Menu on page 59 for further details.

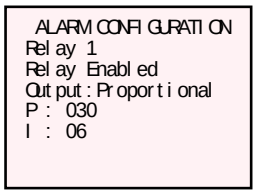
1. Relay / Alarm setup
2. Current loop menu
3. Test menu
4. Change user P/W
5. RS485 setup
6. Set Date and Time
7. Resets
8. Show Serial No.
9. Probe type
10. Factory menu

1. Relay / Alarm setup
   This option allows the relays to be configured for a required function. Each relay can be:-
   - Enabled / Disabled
   - Normally De-energised / Energised
   - Delay
   - Function
   - Probe / Sensor
   - Output

   See Relay Functions on page 28 for a detailed description of the relay setup.



Alarm configuration example - page 1



Alarm configuration example - page 2

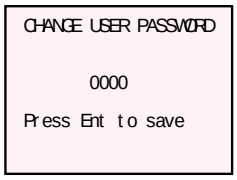
2. Current loop menu
   Allows the user to configure the 4 – 20 mA current loop. See Current Loop Menu on page 43 below.

3. Test menu
   Allows the user to perform basic tests on the controller outputs (Relays, 4 – 20 mA current loop). See Test Menu on page 44 below.

   This menu will not time out and the user must exit this menu when testing is complete.

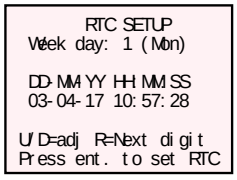
   Note When testing the relays and current loop you should disconnect any equipment which is operated by the relay or current loop outputs.

4. Change User Password
   The default user password to access the user menu is 0000. This can be changed by the user.



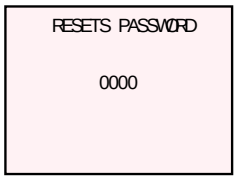
5. RS484 Setup
   Factory use only

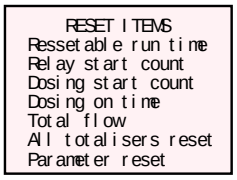
6. Set Date and Time
   The real time clock can be set via this menu selection.



   Press **Up** / **Down** to adjust each digit.
   Press **Right** / **Next** to move to the next digit.
   Press **Enter** to set the date and time.

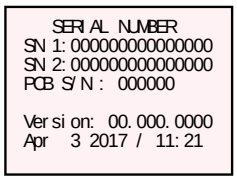
7. Resets
   The user must enter a password (See Default Password on page 74) to gain access to the resets screen.
   A list of items that the user can reset are provided.



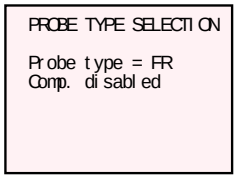


   Use **Up** / **Down** to select the item to reset
   Press **Enter** to display reset item
   Press **Right** / **Next** to enable reset
   Press **Enter** to reset

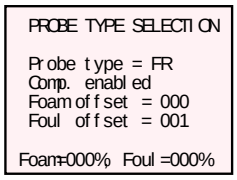
8. Show Serial No.
   Displays serial number and version information.



9. Probe Type
   The SureSense+ can support old style probes without the probe detection.



   Probe type with ATEX cable compensation disabled



   Probe type with ATEX cable compensation enabled showing the foam and fouling compensation.

   Use the **Up** and **Down** keys to navigate to each line
   Press **Enter** to select Probe type
   Press **Up** key to change probe type
   Press **Enter** to finish adjustment

   Press **Enter** to select compensation disabled / enabled
   Press **Up** / **Down** key to toggle enabled / disabled
   Press **Enter** to finish adjustment

   Press **Enter** to select foam offset
   Press **Up** / **Down** key to adjust foam offset value
   Press **Enter** to finish adjustment

   Press **Enter** to select foul offset
   Press **Up** / **Down** key to adjust foul offset value
   Press **Enter** to finish adjustment

   FR is SureSense+ probe with probe detection.
   FP is SureSense probe without probe detection.

10. Factory menu
    Not user accessible.

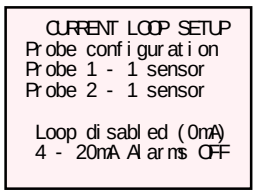
10.3. Current Loop Menu

This menu allows the user to setup the 4 – 20 mA current loop and enable alarms for the 4 – 20 mA current loop to indicate.

1. Current loop setup
2. Current loop alarms

1. Current loop setup

The probe and sensor configuration is displayed at the top of the display. The current loop enable state is shown next. Note that with the current loop disabled any alarms set on the current loop will also be disabled. Setting an alarm on the current will automatically enable the current loop.



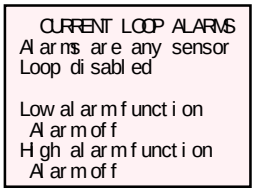
Probe Configuration – Information only
Loop disabled – changed enabled / disable state
4 – 20mA Alarms OFF – Information only

2. Current loop alarms

Alarms set on the 4 – 20 mA are for any sensor.
Low alarm function – the alarm current is 3.5 mA
High alarm function – the alarm current is 22 mA

The following alarm functions for both low and high alarms are available:-

- Liquid alarm on
- Fouling alarm on
- Totaliser alarm on
- Dosing jam alarm on
- Fail safe on



10.4. Test Menu

This menu will not time out and the user must exit this menu when testing is complete.

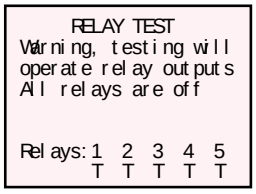
<u>Note</u> When testing the relays and current loop you should disconnect any equipment which is operated by the relay or current loop outputs.

The test menu as the name suggests is used for testing the relay and 4 – 20 mA current loop outputs. It is also possible to view the time statistics for the unit and to reset the resettable run time.

Refer to Test Menu on page 63.

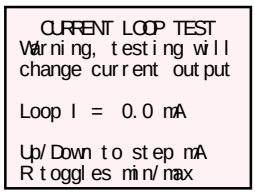
1. Relay test
2. Current loop
3. Time stats
4. Reset run time

1. Relay test.
   Each relay can be individually toggle on / off, or all relays operated simultaneously.



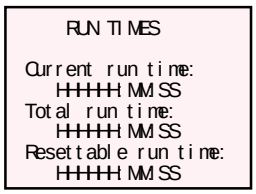
   All relays can be turned on by pressing **Enter**.
   All relays can be turned off by pressing **Down**.
   To select a relay press the **Right / Next** key.
   To toggle a relay on / off press the **Up** key.
   Left exits this test screen.

2. Current loop
   This screen can be used to set a number of pre-defined current outputs.

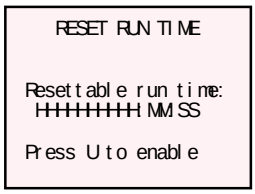


   Up / Down will step through the following pre-set current outputs:-
   0.0 mA, 3.5 mA, 4.0 mA, 12.0 mA, 20.0 mA and 22.0 mA
   Right / Next will toggle between 0.0 mA and 22 mA
   Left exits this test screen

3. Time stats
   This screen is for information only and allows you to view the following:-
   Current run time – On time since the last reset or power on.
   Total run time – On time since manufacture
   Resettable run time – On time since this time was reset.
   The current run times are displayed.



4. Reset run time
   This screen allows you to reset the resettable run time to zero. The current run time is displayed.



   Press **Up** key to enable the reset action, then
   Press the **Right / Next** key to reset the run time.

11. Probe Wiring For Hazardous Areas (Explosion Risk / ATEX)

11.1. Application Note

APPLICATION NOTE: INTRINSICALLY SAFE SYSTEMS - ATEX

Hycontrol FP type probes are passive devices ("Simple Apparatus") with no charge storage elements, as such they conform to EN60079-25. These probes must be used in conjunction with appropriate zener barriers to form an I.S. system. The probes can be installed into zones 0,1 or 2. The classification is normally Ex ia IIC T4, SGS Baseefa certificate 12Y0019X (up to an ambient temperature of +110°C).

The control units must be installed into a safe area.

Note that since these probes are not isolated from earth, it is necessary to include a potential equalising conductor from the zener barrier bus bar to the earth bond of the vessel into which the foam probe is installed. This is required by the simple apparatus rules .

Note that the 'ATEX' option is required for the Controller to ensure correct operation with zener barriers.

Barrier safety Description:	3V, 10 Ω, 300ma (3 channels required per probe sensor IE a dual sensor probe will require two safety barriers)
Recommended Barrier:	MTL 7756ac
Potential Equalising Conductor:	4 mm^2 or greater earth cable. This is essential. (max 200m)
Cable Type:	Screened twisted pair . (screen must not be earthed- see below)
Cable Size:	0.75 mm^2 or smaller will meet cable parameters.
Cable IS Parameters:	40μF, 0.04mH, 52 μH/Ω max. (with 3 barrier channels)
Max. Cable Length:	100 metres

11.2. Probe Marking

Marking of approved probe according to directive 2014/34/EU:

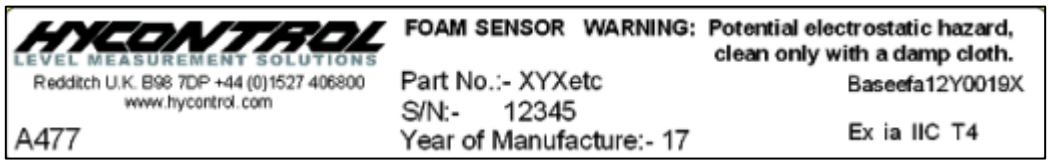


Figure 20 :Probe ATEX label

Where part number takes the form FP6*****

Guidance for installation and repair:
Installation, setup and maintenance must be in accordance with the applicable codes of practice and harmonised standards for Ex ia (intrinsically safe) equipment and by qualified technical personnel only.

User repairs are not permitted, in case of fault return the probe to Hycontrol.

To avoid electrostatic hazard, in case of the plastic insulators used in the probe construction, the following safety rule shall be observed:

- The non-metallic parts of the foam sensor enclosure constitute a potential electrostatic hazard, do not rub or use solvents, clean only with a damp cloth.

11.3. Probe Wiring In Hazardous Areas

A Zener barrier is fitted between the controller (safe area) and the probe (hazardous area) for ATEX protection.

THE SureSense+ MUST BE INSTALLED IN A SAFE AREA AND CONNECTED VIA ZENER BARRIERS AS SHOWN IN FIGURE BELOW. THE ZENER BARRIER MUST BE CONNECTED TO A CLEAN EARTH / GROUND.

Hycontrol SureSense probes contain no energy storing components and so are classed as “Simple Apparatus” under the ATEX rules. They can be used as part of an intrinsically safe system in a hazardous area. If the probe is to be used in a hazardous area – i.e. an area with an explosion risk then a zener barrier must be used. The only type which Hycontrol recommends is an MTL 7756ac barrier. It is essential that a zener safety barrier is used for the system to be safe.

The barrier must be installed between the **probe (Hazardous area)** and **controller (Safe area)**. The barrier must be connected as shown in the diagrams below and must be connected to a clean IS earth or ground. In addition it is an essential part of the rules that an isopotential earth wire of $4mm^2$ is connected between the barrier earth and the vessel in which the probe is installed. This is always required even if the vessel has its own earth. The isopotential earth connection ensures that the earth potential (voltage) is the same at the vessel as at the barrier even if earth currents are flowing in the vessel earth.

The cable type used for the probe should be exactly as shown in the wiring diagrams. The MTL7756ac barrier has 3 channels which are identical. There is also a ground connection on a terminal on the bottom of the barrier which is not labelled with a number. Normally this kind of barrier is mounted onto a DIN rail inside an instrument cabinet. The DIN rail connects to the ground terminal of the barrier as well as holding it to a panel. A spring clip in the barrier holds it to the rail. It can be removed by levering the clip with a screw driver to spring it off the rail. The ground connection can be made to the din rail if required. *The barrier must have a ground connection for it to function. Without the ground it will not function and so the whole system will not be safe*.
The terms “ground” and “earth” are identical for the purposes of this manual.

For **ATEX** applications the probe part number **MUST** start with **FP** see Figure 31 : Miscellaneous menu layout on page 59 for setting the probe type.

11. Probe Wiring For Hazardous Areas (Explosion Risk / ATEX)

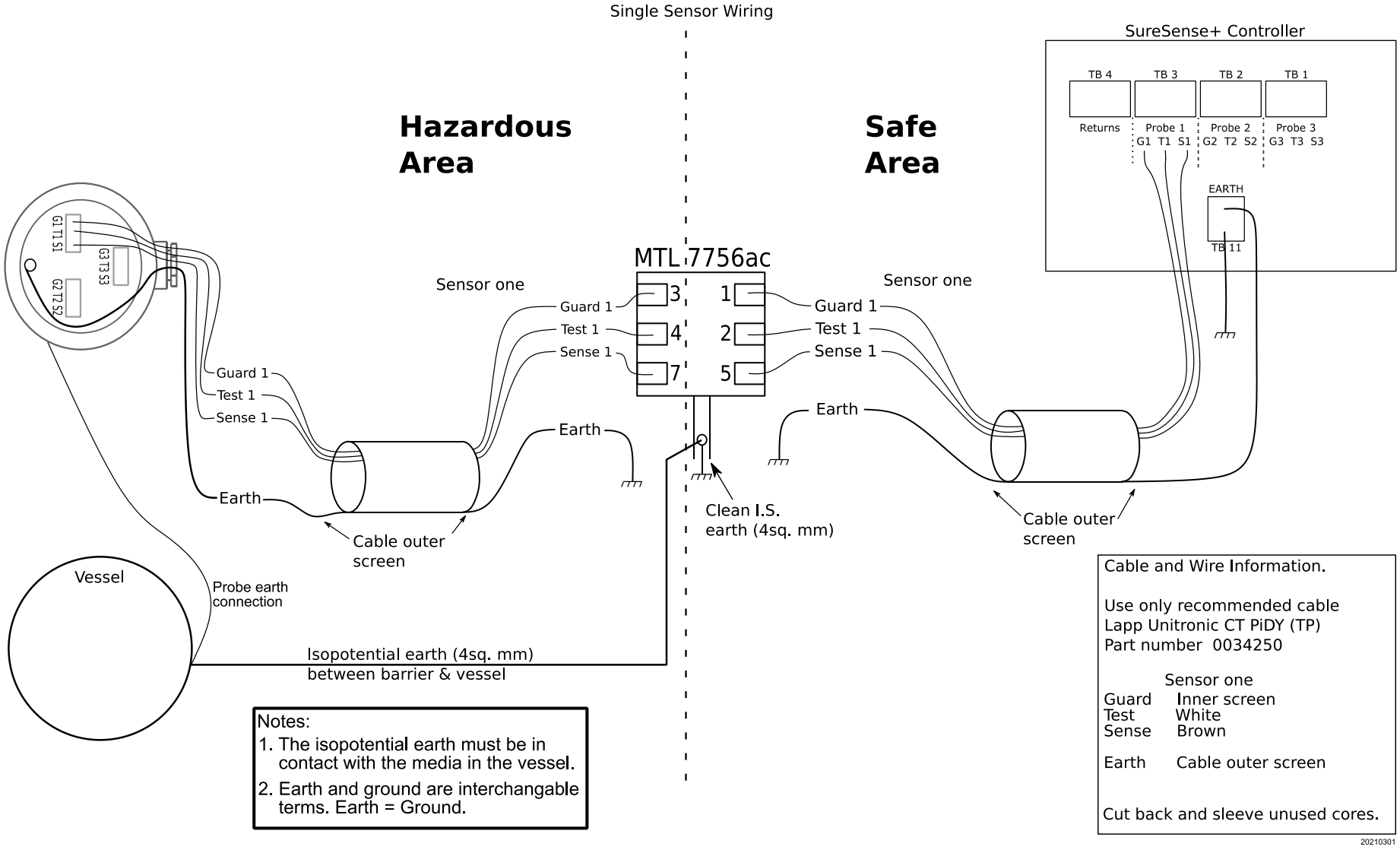


Figure 21 :Single sensor probe Hardardous Area wiring diagram

11. Probe Wiring For Hazardous Areas (Explosion Risk / ATEX)

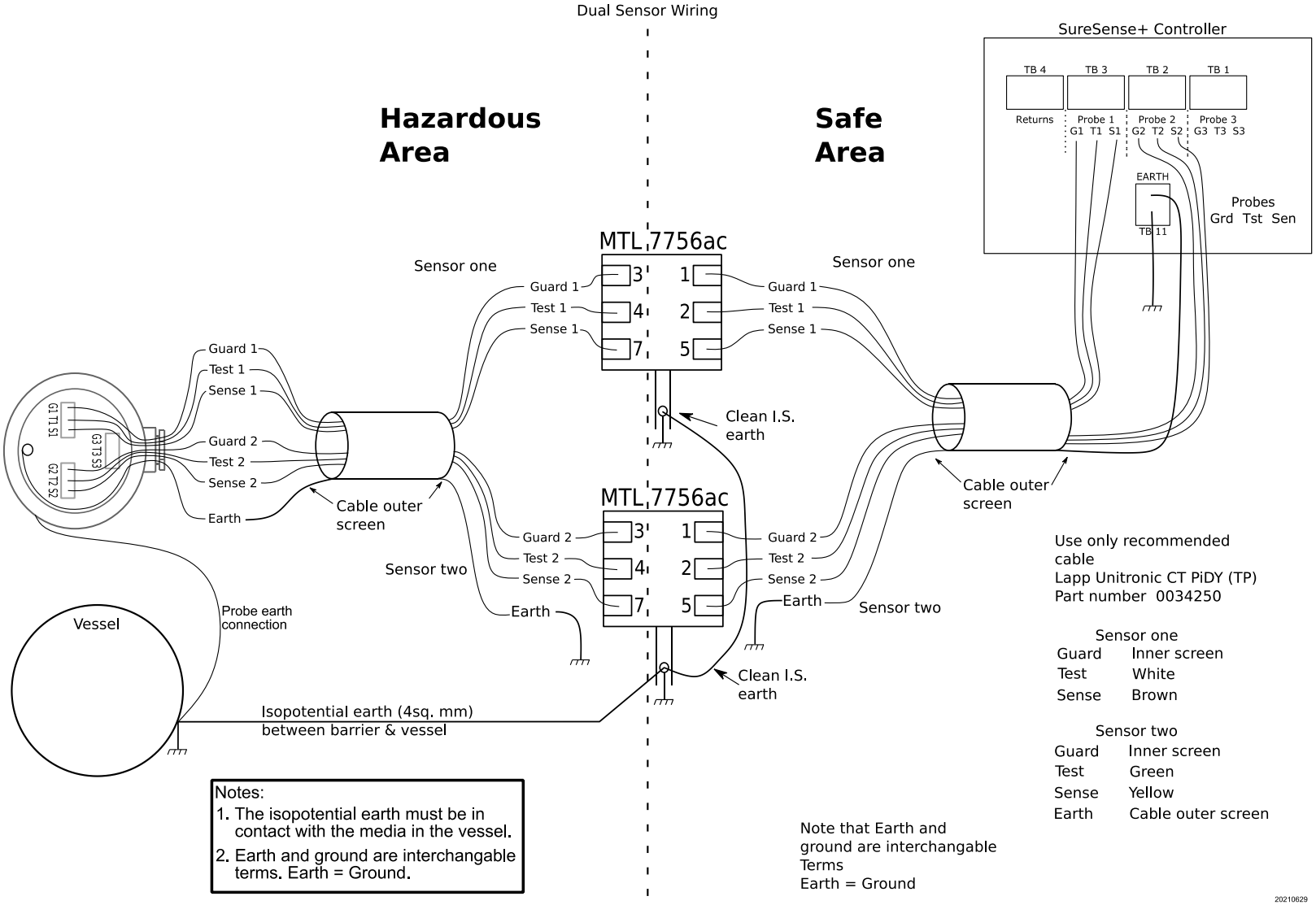


Figure 22 :Dual sensor probe Hardardous Area wiring diagram

11. Probe Wiring For Hazardous Areas (Explosion Risk / ATEX)

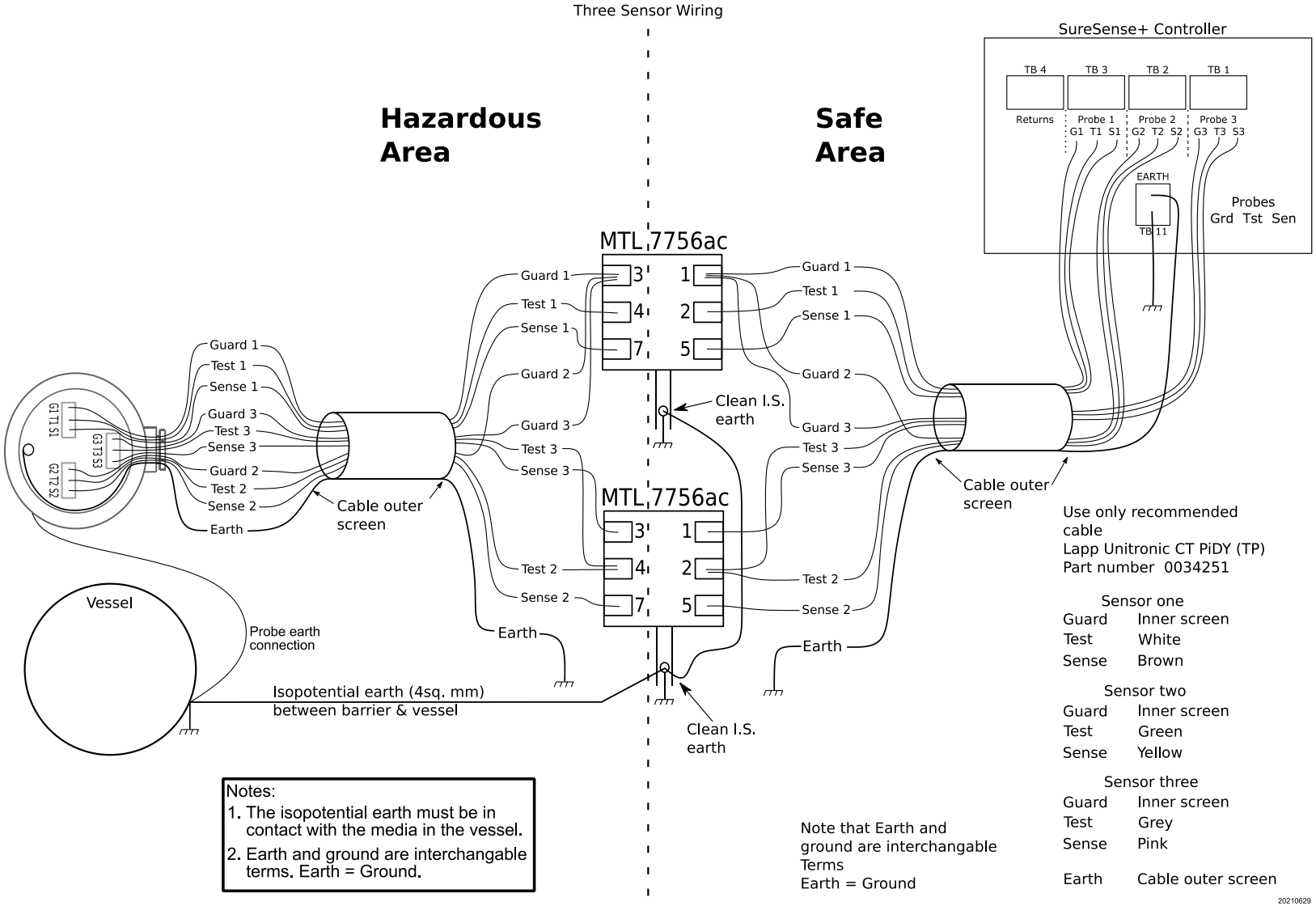


Figure 23 :Three sensor probe Hardardous Area wiring diagram

11. Probe Wiring For Hazardous Areas (Explosion Risk / ATEX)

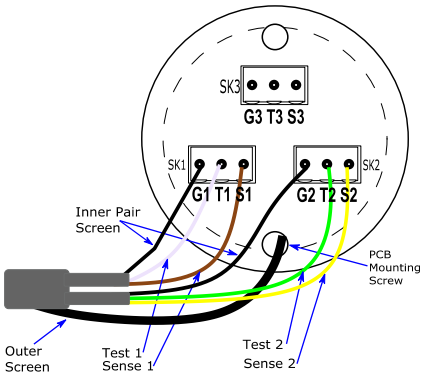


Figure 24 :Probe head two sensor wiring diagram

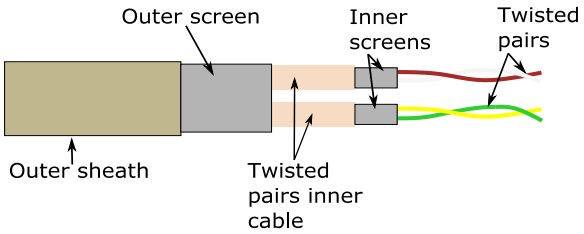


Figure 25 :Probe cable construction detail for two sensor probe

Wiring instructions

- The cable will need to be threaded into the probe head via the cable entry gland.
- Strip back approximately 8 cm of the outer insulation
- The outer screen can be either
    - Cut back to a small tail and a wire (18 AWG) soldered to the screen, and sleeving used to cover the exposed screen and joint. An M4 crimp fitted to the other end.
      OR
    - The screen can be divided in two, one half cut back. The remaining half should be twisted and sleeved and a M4 crimp fitted to the screen.

- For each of the used sensors the appropriate twisted pairs are identified by colour.
    - Sensor 1
        - Brown and white wires
    - Sensor 2
        - Yellow and green wires
    - Sensor 3
        - Grey and pink wires

- Strip each used twisted pair by approximately 2 cm.
- The inner screen should be twisted together (optionally tinned at end).
- The wires should be stripped by approximately 7 mm.
- Each wire end should be twisted (optionally tinned).

See Figure 26 :Probe / sensor cable Preparation on page 53 for details.

Unused cores should be cut back and sleeved (E.G. A probe with a single sensor, the core with the yellow and green wires can be cut back).

11. Probe Wiring For Hazardous Areas (Explosion Risk / ATEX)

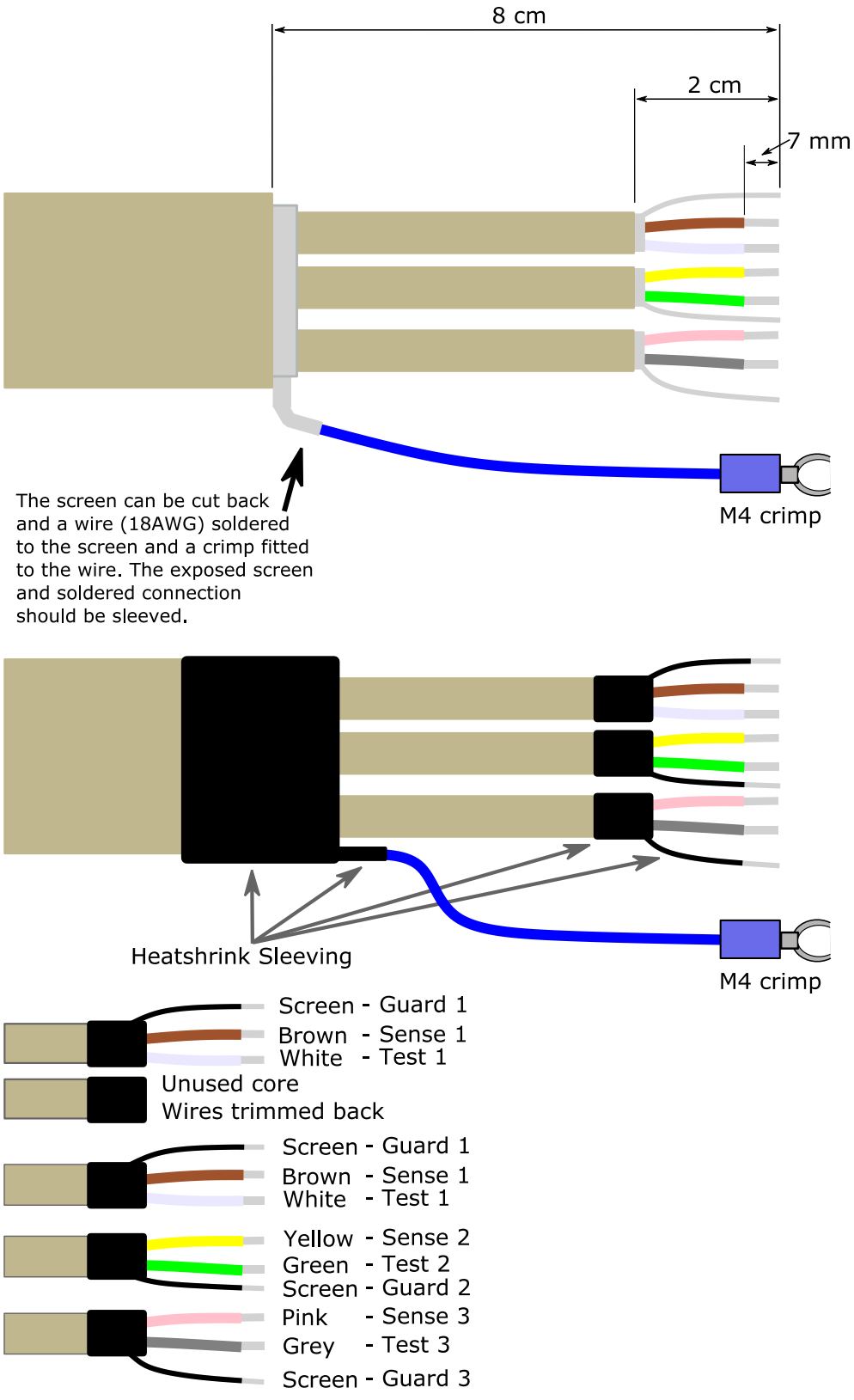


Figure 26 :Probe / sensor cable Preparation

11.4. Type FP Probe Wiring

Where FP probes are supplied with a terminal block fitting instead of a PCB the following wiring scheme can be used.

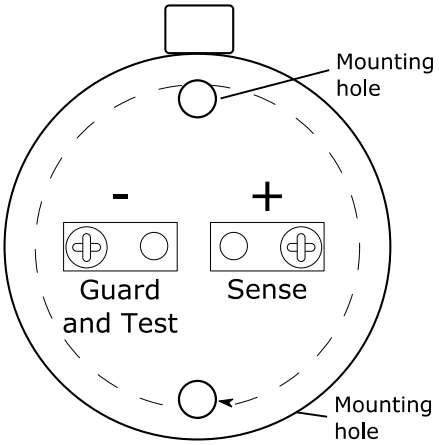


Figure 27 :FP type probe with single sensor

Sense 1	Brown
Test1	White
Guard 1	Pair screen

Where guard and test are linked together

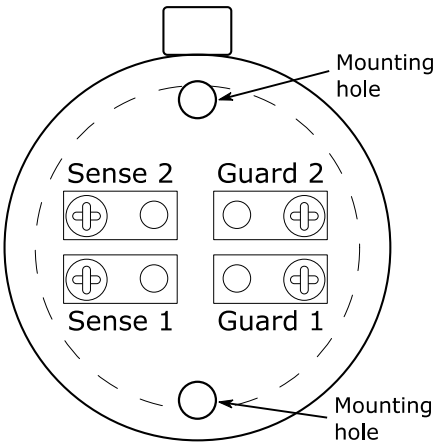


Figure 28 :FP type probe with dual sensors

Sense 1	Brown
Test1	White
Guard 1	Pair screen

Sense 2	Yellow
Test2	Green
Guard 2	Pair screen

Where guard and test wires are both linked together at the guard connection.

12. Troubleshooting

No foam

- Check foam in contact with probe
- Check foam threshold setting
- Check probe wiring
- Ensure that an earth / signal return is present

Probe fault

- Check type of probe fitted
- Ensure probe type is set correctly in controller see Figure 31 : Miscellaneous menu layout on page 59.
- Check probe wiring
- Check probe fouling – excessive fouling may cause a false probe fault reading

Probe fault when controller switched on

- The controller can show a probe fault for several seconds (typically less than 5 seconds) at power on, this is normal if there is no foam present as the probe detection only occurs at intervals of approximately 5 seconds.

Not dosing

- Check alarm / relay setting
- Check relay operation – Test function
- Check relay wiring to dosing pump

No display

- Check power LED on
- Check fuse FS1 near power connector in controller
- Check that 12V – 30V DC is present on connector TB5
- Check contrast (see Contrast Adjustment on page 56)

Relay Chattering

If the threshold is set to 5% or less and the relay delay time is reduced to one second, the relay could chatter if the foam is fluctuating slightly.

- Check relay delay time (see RelayFunctions on page 28) – increase delay time to prevent chattering
- If possible increase the threshold setting above 5% (see Thresholds on page 25 and 36)

False fouling reading

- With a long cable it is possible to get a fouling value displayed, even with a clean probe. Any fouling threshold setting should be set to a value greater than the false reading.

13. Appendix

13.1. Membrane Key Symbols

Up Key Symbol

Down Key Symbol

Left / Back Key Symbol

Right / Next Key Symbol

Enter Key Symbol

13.2. Contrast Adjustment

In addition to the menu option to adjust the display contrast, the display contrast can be adjusted from the front panel by:-

- Pressing and holding Enter and Right / Next at the same time
- Pressing Up or Down to adjust the contrast

13.3. Menu Layout

Shown below are the menu layouts

13. Appendix

13.3.1. Main Display and Menu Overview

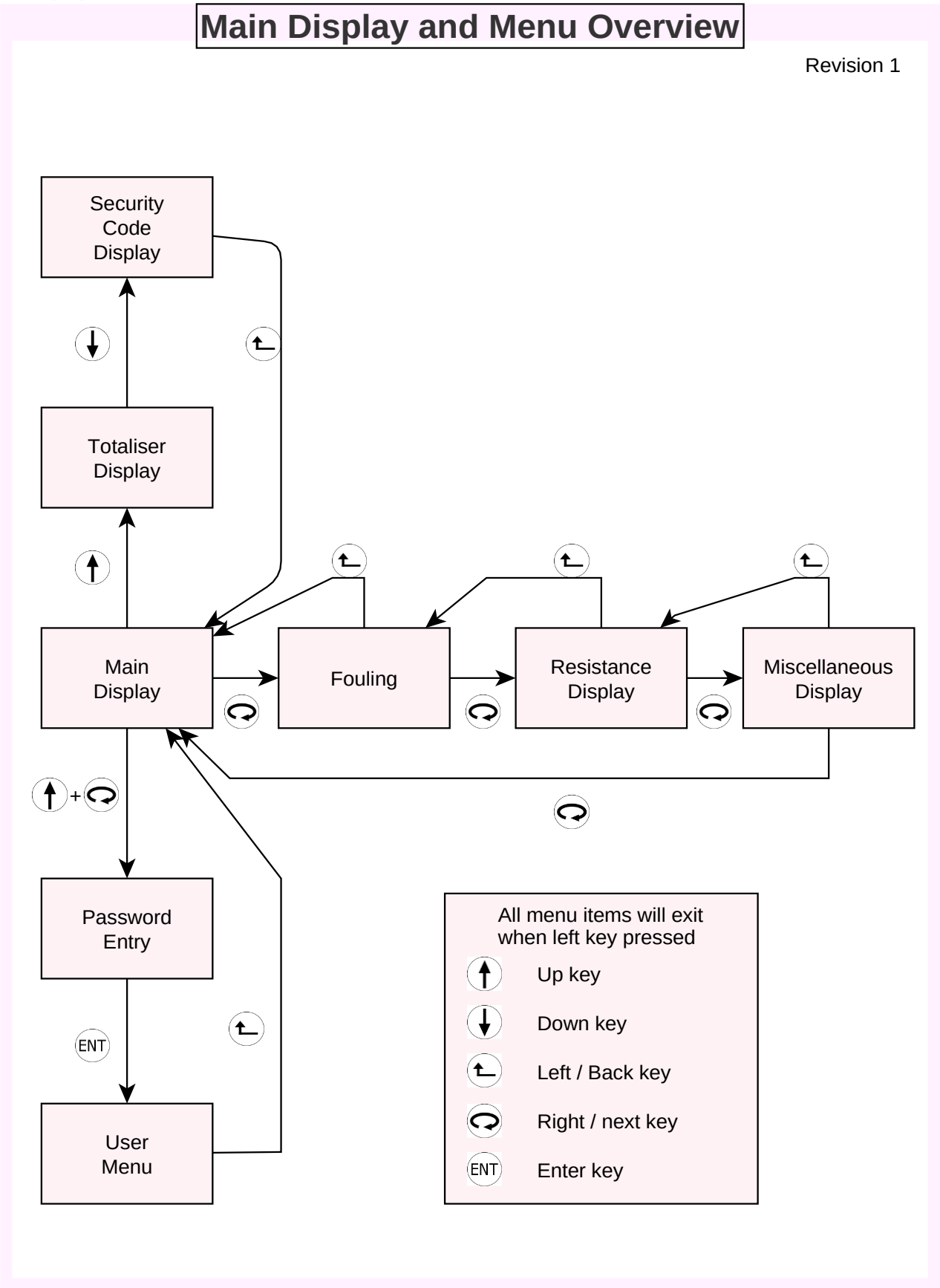


Figure 29 :Display screen overview

13. Appendix

13.3.2. User Menu

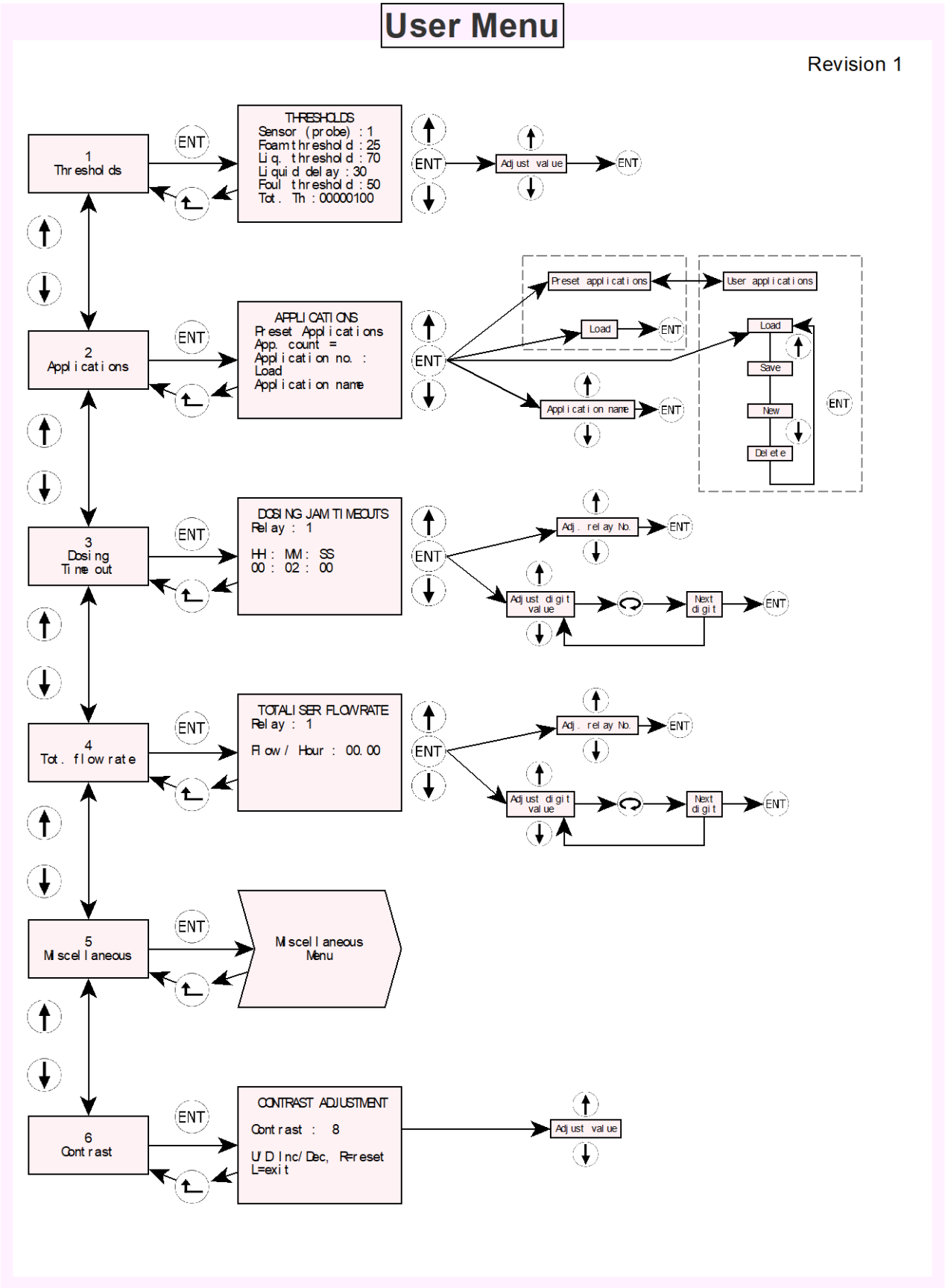


Figure 30 : User menu layout

13. Appendix

13.3.3. Miscellaneous Menu

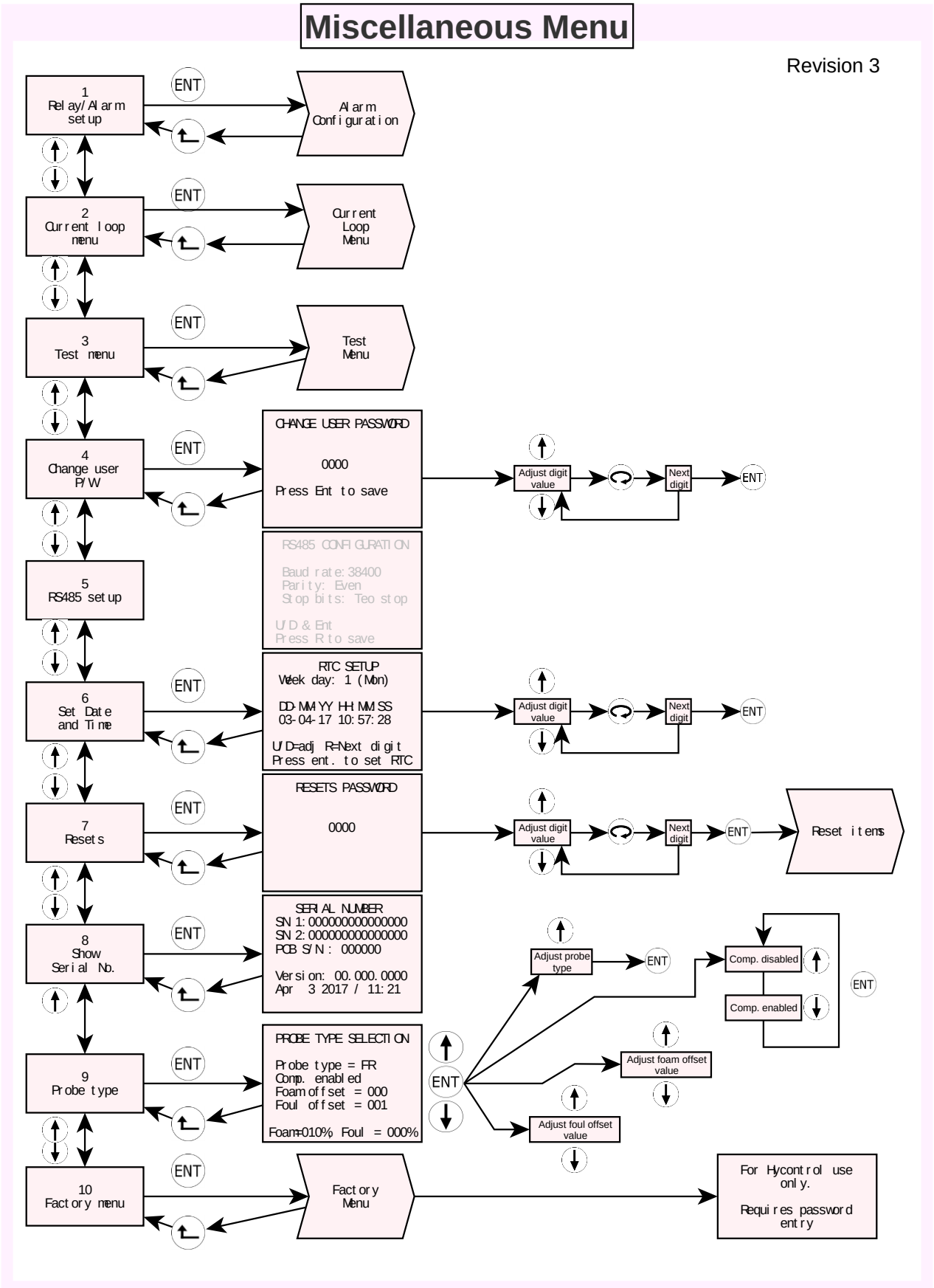


Figure 31 : Miscellaneous menu layout

13. Appendix

13.3.4. Relay / Alarm Setup

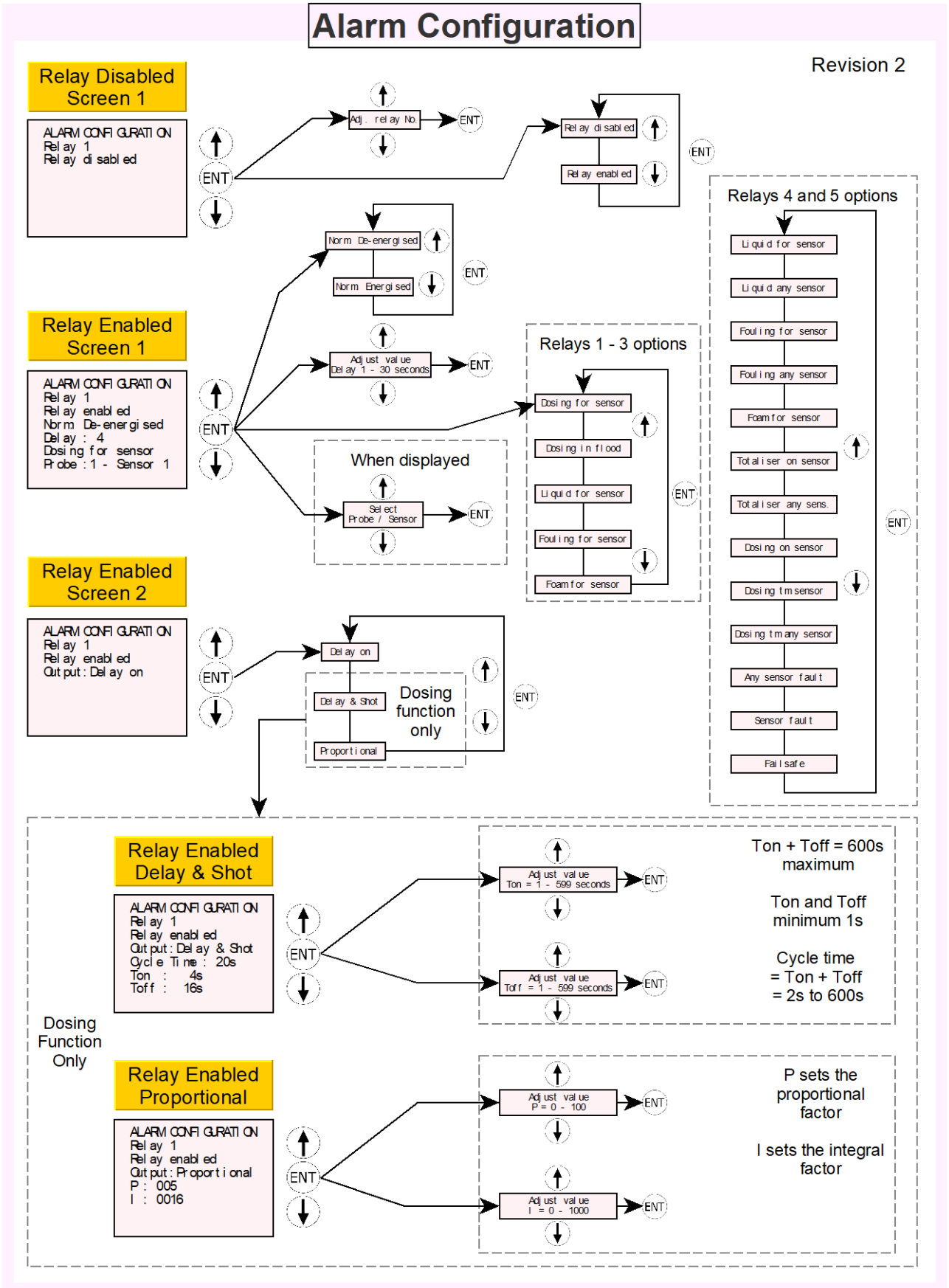


Figure 32 : Alarm setup displays

13.3.5. Current Loop Menu

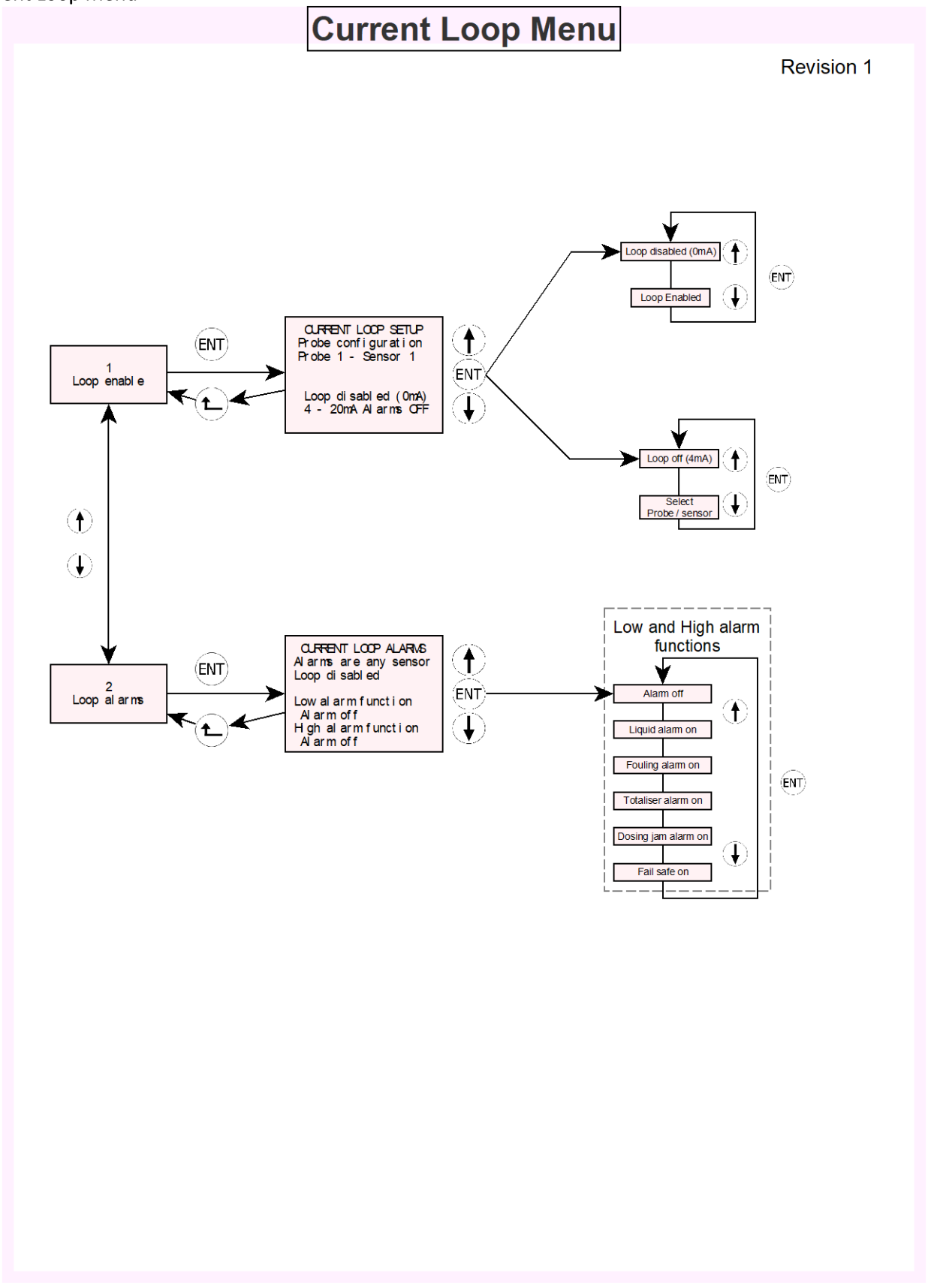


Figure 33 :Current loop menu layout

13.3.6. Reset Items

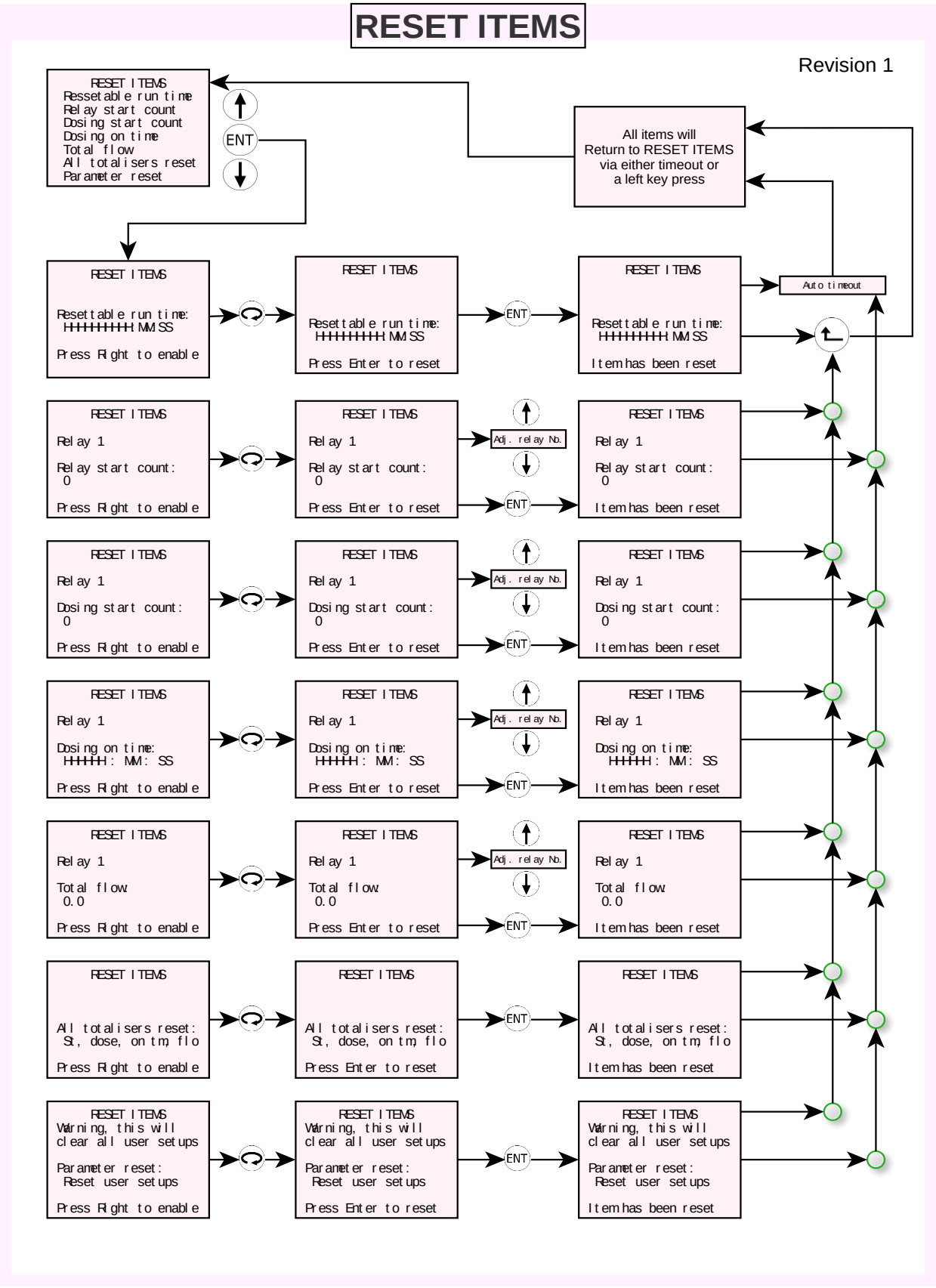


Figure 34 : Reset items displays

13.3.7. Test Menu

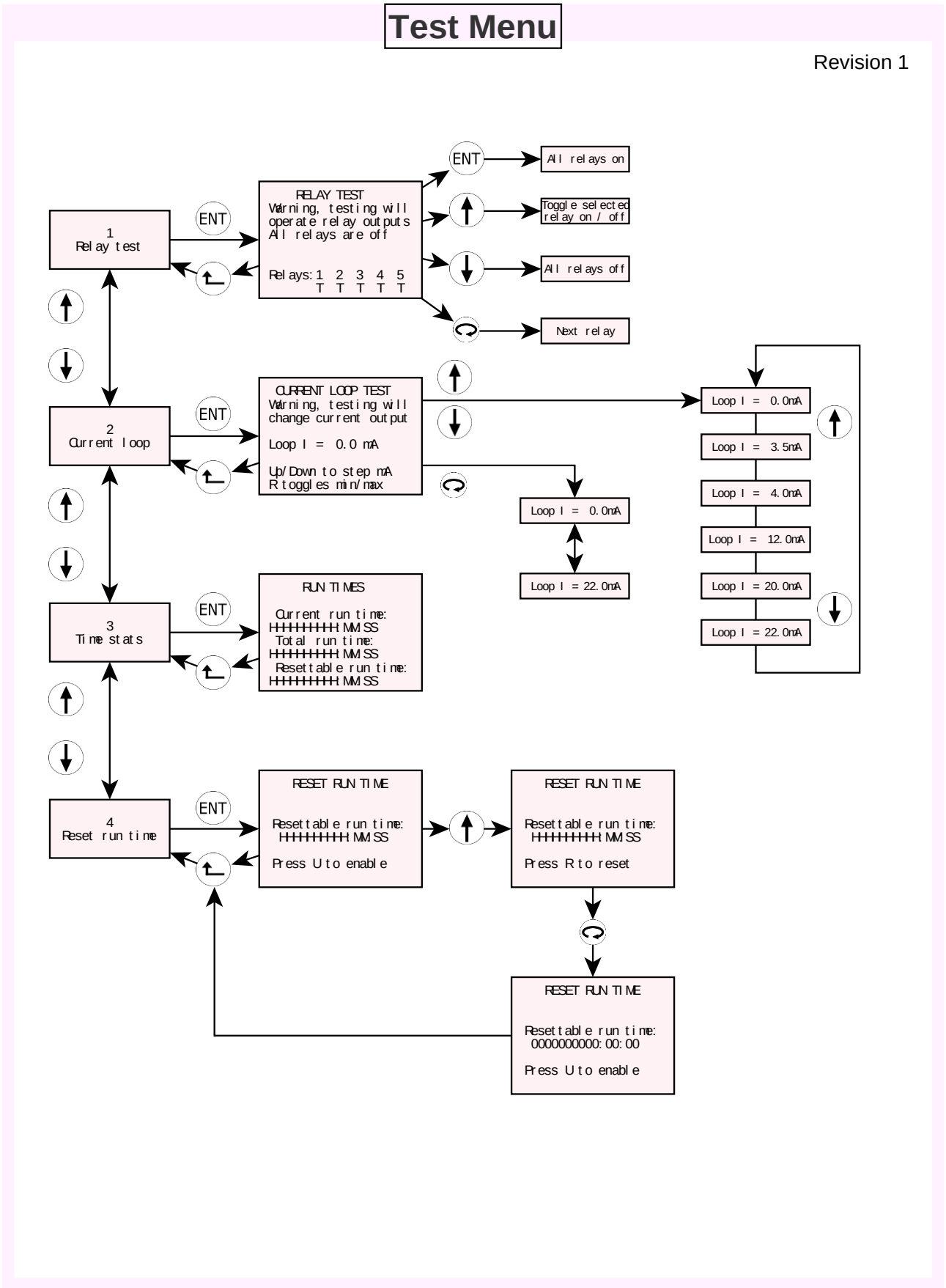


Figure 35 : Test menu layout

13.3.8. Upgrade Option Code Entry

If a user requires an upgrade of the SureSense+ controller a six digit code (can be purchased from Hycontrol) can be entered via the key pad. To gain access to the option code entry the following key presses must be completed.
Enter the user menu
Select the Miscellaneous menu
Select Display serial number
Press “Up + Right + Down” together
The screen should show “ENTER OPTION CODE”.
Enter each digit using the up / down keys and pressing Right / Next to move to the next digit.
Follow the on screen prompts to complete the option code entry.
Note each code is unique to the individual controller and you will need to provide the unit serial number to Hycontrol Limited.

13.4. Programming Overview

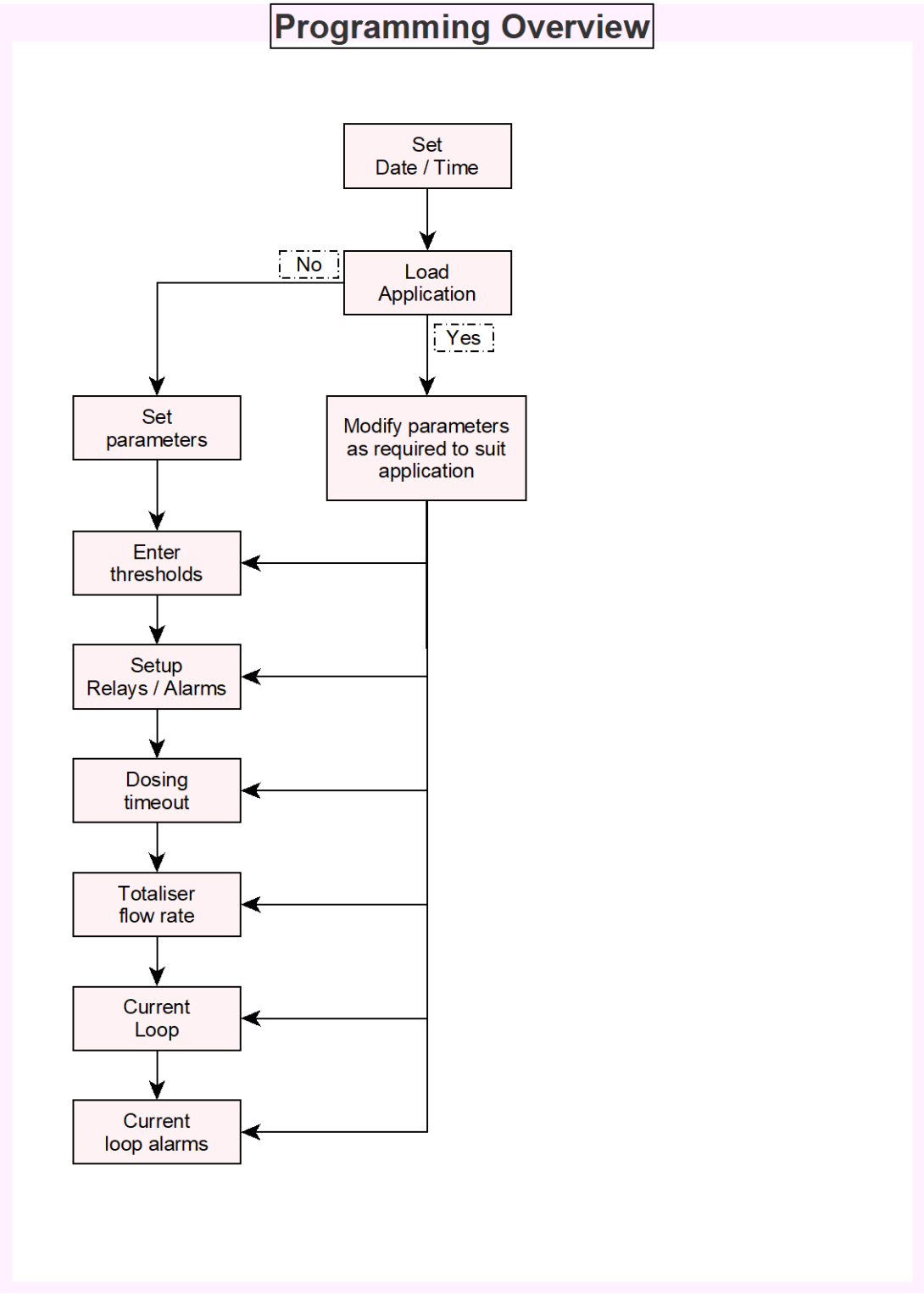
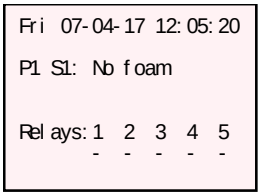


Figure 36 :Programming Overview

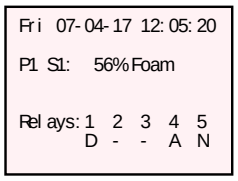
Note that some of the steps shown in the programming overview can be considered as optional depending on application requirements (Alarms required / not required, current loop required / not required etc.).

13.5. Sample Screen Displays

13.5.1. Main Display

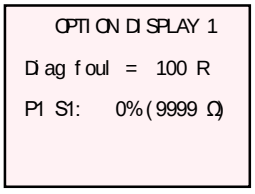


Showing the date and time, foam indication and relay status.
See relay status indicators on page 69 for more information



Main display showing 56% foam, controller relay 1 is dosing, and there is an active alarm on relay 4. Relay 5 is configured, but not in alarm. Relays 2 and 3 are not configured for any function.

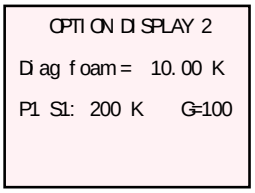
13.5.2. Fouling Display



Diag foul – The built in self-test of the controller. This represents 100 ohms of fouling.

P1 S1 – Probe 1 sensor 1, this shows fouling as a percentage with the resistance shown in brackets.

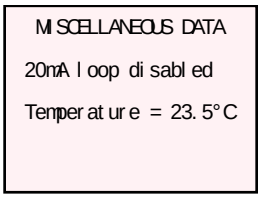
13.5.3. Measured Foam Resistance



Diag foam – The built in self-test of the controller. This represents 10 K ohms of foam.

P1 S1 – Probe 1 sensor 1, this shows foam as a resistance and the current gain of the channel (normally 100).

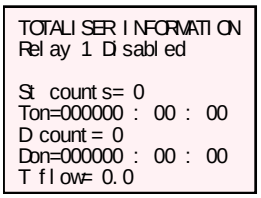
13.5.4. Miscellaneous Display



20mA loop current status. In the above image the current loop is disabled. If the current loop has been configured it will show the mA value and any active alarms that have been configured.

The displayed temperature is the enclosure internal temperature.

13.5.5. Totaliser Display



This display shows the totaliser information for a given relay. To step to the next relay press the right/next key .

St counts

This represents the number of times the relay has been operated since the last reset of the totaliser information.

Ton

This is the total on time for the relay since the last reset of the totaliser information.

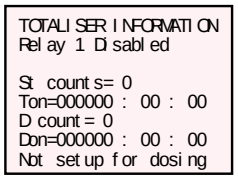
Don

This is the total dosing on time since the last reset of the totaliser information.

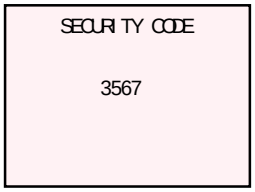
T flow

If a totaliser flow rate has been configured for a given relay this is the total calculated flow.
Calculated as total time * flow rate.
The flow rate is specified in units / hour.

If the relay has not been configured for dosing then the totaliser (T flow) function is not applied



13.5.6. Security Code



13. Appendix

13.6. Relay Status Indicators

The relay / alarm states are shown below the relay numbers on the main display (See page 66)

- '-' Relay not configured
- 'N' Relay configured, **not in alarm**, normally de-energised
- 'n' Relay configured, **not in alarm**, normally energised
- 'A' Relay configured, **in alarm**, normally de-energised
- 'a' Relay configured, **in alarm**, normally energised
- 'D' Relay configured for dosing, **dosing active**, normally de-energised
- 'd' Relay configured for dosing, **dosing active**, normally energised

13. Appendix

13.7. Probe Combinations

13.7.1. Basic Unit

Single Probe only

13.7.2. Advanced unit

Note the required probes must be specified when ordering the SureSense+

- Single sensor probes
  - Up to 3 probes
- Dual sensor probe
  - 1 dual sensor probe
  - Optionally 1 additional single sensor probe
- Triple sensor probe
  - 1 triple sensor probe

13. Appendix

13.8. Accessories Part Numbers

13.8.1. DC Power supply connector

21.950M/2-E (IMO)

- Pluggable screw terminal block
- 5.08 mm pitch
- 2 way
- 24 AWG - 12 AWG

13.8.2. Returns / Probe 1 / Probe 2 / Probe 3 connector,
13.8.3. Current loop (4 – 20 mA) and
13.8.4. RS485 connector

20.1550M/3-E (IMO)

- Pluggable screw terminal block
- 3.5 mm pitch
- 3 way
- 28 AWG - 16 AWG

13.8.5. Relay 1 Connector

21.950M/3-E (IMO)

- Pluggable screw terminal block
- 5.08 mm pitch
- 3 way
- 24 AWG - 12 AWG

13.8.6. Relays 2 – 5 connector

21.950M/8-E (IMO)

- Pluggable screw terminal block
- 5.08 mm pitch
- 8 way
- 24 AWG - 12 AWG

Or 4 off 2 way 5.08mm pitch end stackable connectors.

13.8.7. Earth (ground) connector

1792770000 (WEIDMULLER)

- Pluggable screw terminal block
- 3.81 mm pitch
- 2 way
- 28 AWG - 16 AWG

13.8.8. Lemo Laboratory Probe Connector

This is the connector that plugs the cable into the laboratory probe.

Plug for cable end.
Lemo FGJ.OB.302.CLLD52Z + Grommet GMA.OB.040.DN

or

Cable assembly is ordered as
CH-F1158-FL1-NN
Where NN is in metres up to a maximum of 10m

13.8.9. Cable Glands

M20 IP68 Maximum cable diameter 12 mm.
M16 IP68 Maximum cable diameter 10 mm.

13.8.10. Cables

Power	Screened or unscreened 2 core cable
4 – 20 mA Current loop	Screened 2 core cable (T.P.)
Relay outputs	Multicore, unscreened – SY Cable, 12 core (O/D = 11.6 mm)
Probe cable:	

For single of dual probes

- Lapp Unitronic CY PiDY (TP) cable - Part number 0034250

For tri-probes

- Lapp Unitronic CY PiDY (TP) cable - Part number 0034251

Also Refer to **Probe and Sensor Cabling** on page **14** for further details.

13.8.11. Battery

CR2025
Varta part number 6025101501

13. Appendix

13.9. Factory Applications

Name	Probes	Sensors / probe	Foam setpoint	Liquid setpoint	RLY1	RLY2	RLY3	RLY4	RLY5	Response Time (Sec)	Shot Time (Sec)	Delay Time (Sec)
Fermentation1	1	1	35%	86%	Dosing	Foam	-	-	Liquid	4	4	16
Fermentation2	3	1	35%	86%	Dosing	Dosing	Dosing	-	Liquid	4	4	16
Effluent	1	1	60%	95%	Dosing	Foam	-	-	Liquid	20	20	20
Digesters	1	2/3	60%	95%	Dosing	Foam	-	-	Liquid	20	60	20
Veg Prep.	1	1	75%	86%	Dosing	-	-	-	Liquid	10	2	60
Veg Prep. 3	3	1	75%	86%	Dosing	Dosing	Dosing	-	Liquid	10	-	-
DualFoam	1	2	70%	95%	Dosing	Foam(1)	Foam(2)	-	Liquid	4	-	-
TriFoam	1	3	70%	95%	Dosing	Foam(1)	Foam(2)	Foam(3)	Liquid	4	-	-
ATEX general	1	1	70%	86%	Dosing	-	-	-	Liquid	10	-	-
ATEX Dual	1	2	70%	86%	Dosing	Foam(1)	Foam(2)	-	Liquid	10	-	-
Vac Cooling	1	1	70%	N/A	Dosing	Foam	-	-	-	1	30	30

Note that two probes with two sensors on the first probe and one sensor on the second probe have no pre-set applications.

13. Appendix

13.10. Default Password

User password	0000
Resets password	0010

13. Appendix

13.11. Controller Ordering Information

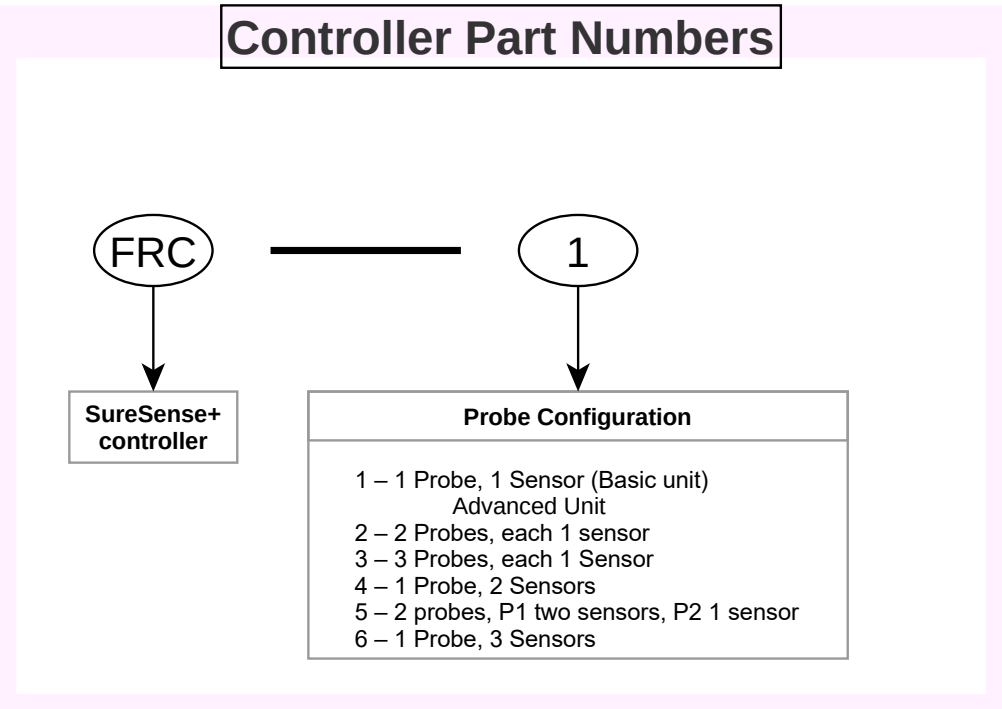


Figure 37 :Controller part numbers

Basic unit

- FRC-1
  - Basic unit, 1 probe, 1 sensor

Advanced unit

- FRC-2
  - 2 probes, each with 1 sensor
- FRC-3
  - 3 probes, each with 1 sensor
- FRC-4
  - 1 probe, 2 sensors
- FRC-5
  - 2 probes, probe one with 2 sensors and probe two with 1 sensor
- FRC-6
  - 1 probe, with 3 sensors

Note that only a single and dual sensor probes can be used with an ATEX barrier. Contact Hycontrol for details on ordering ATEX probes.

Refer to Probe Wiring For Hazardous Areas (Explosion Risk / ATEX) on page 46 for wiring details.

13. Appendix

13.12. Probe Ordering Information

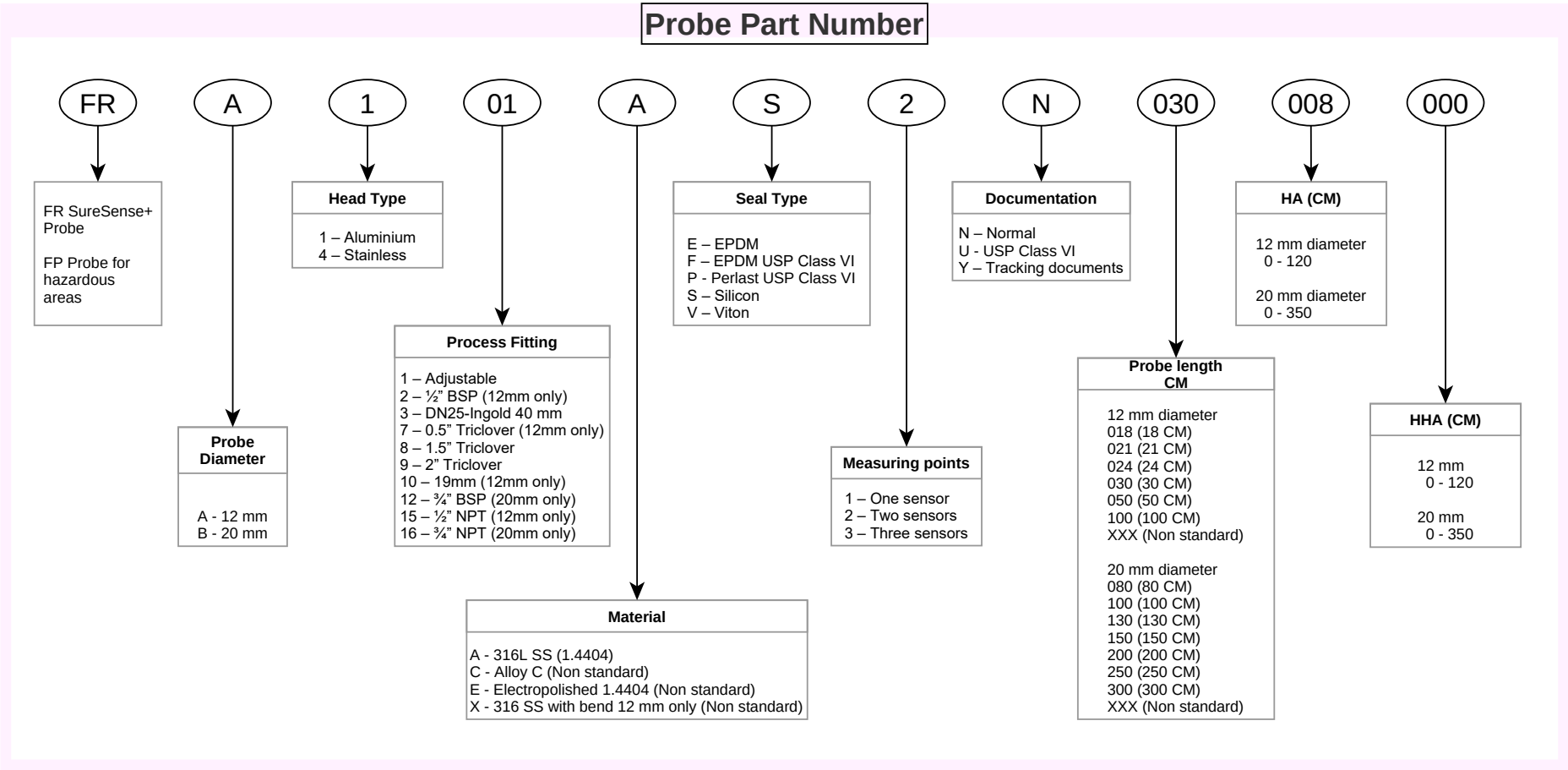


Figure 38 :Probe part number

13. Appendix

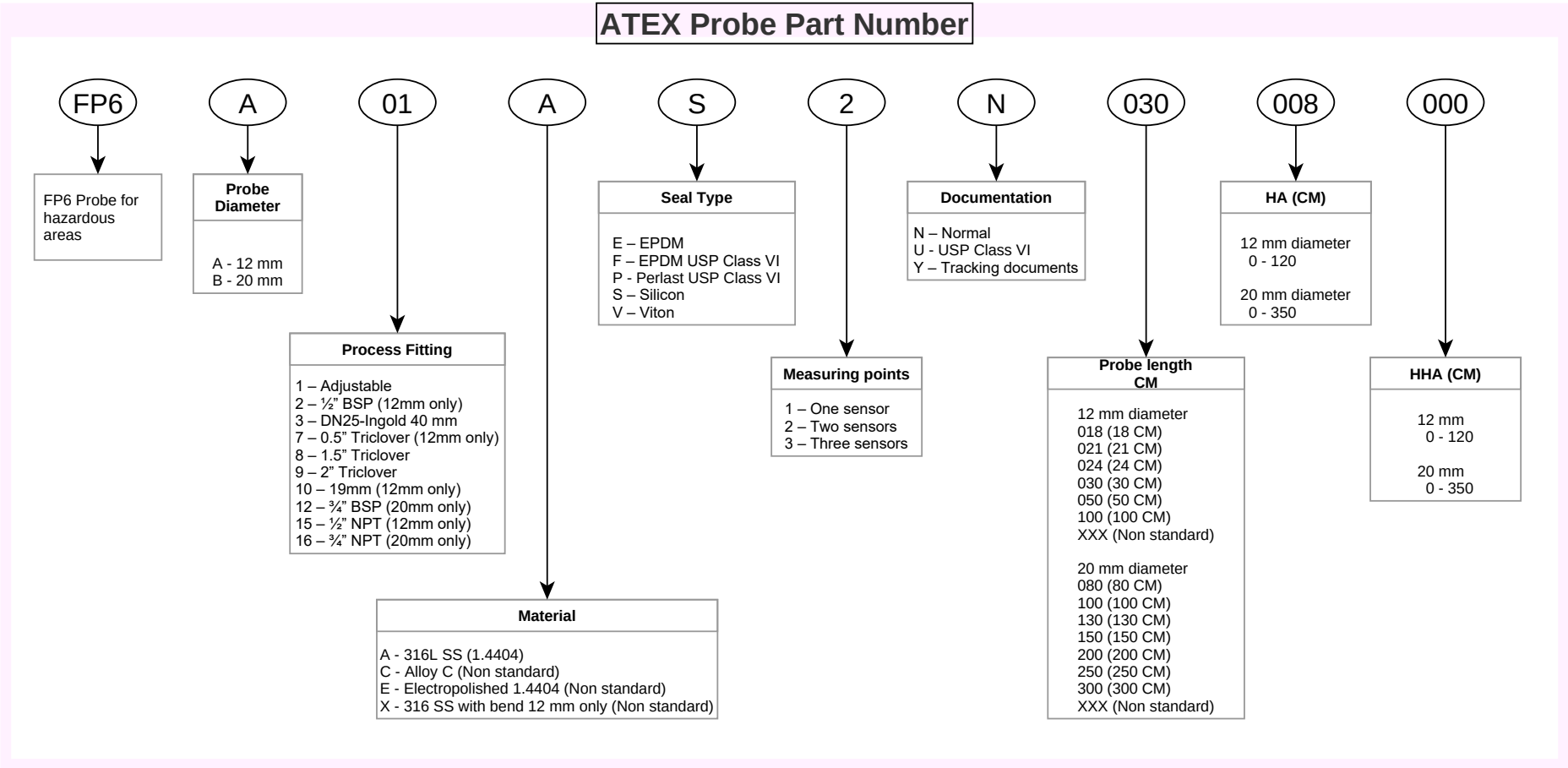


Figure 39 :ATEX Probe part numbers

13. Appendix

Standard Insertion Lengths

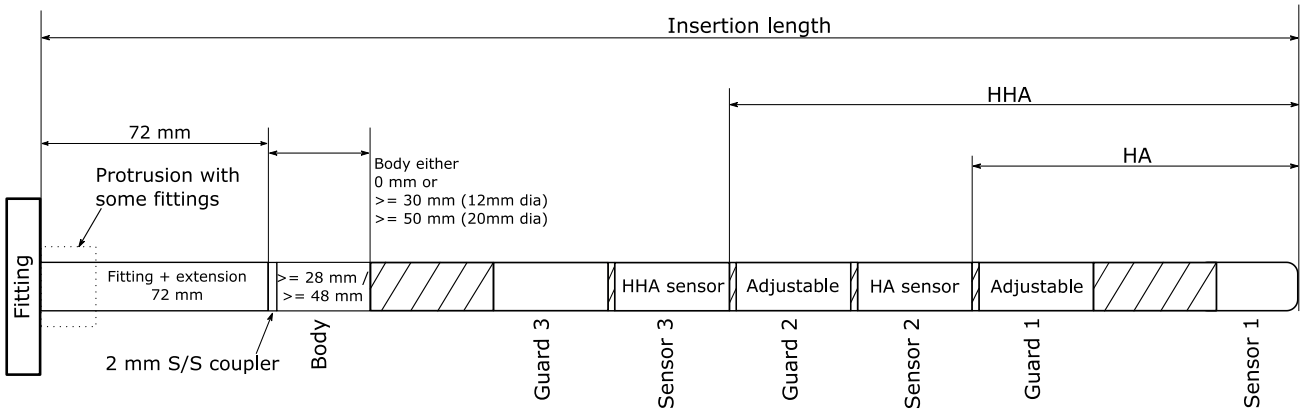


Figure 40 :Probe alarm (High alarm and high high alarm) layout

High Alarm is set by adjusting the length of guard 1 (when fitted)
High High Alarm is set by adjusting the length of guard 2 (when fitted)
HA and HHA are in mm

Probe insertion length (mm)	Sensor 1	Sensor 2 *1 HA	Sensor 3 *2 HHA	
180	180	X	X	
210	210	X	X	
240	240	80 mm	X	
300	300	80 – 110 mm or 140 mm	140 mm	
500	500	80 – 310 mm or 340 mm	140 – 310 mm or 338 mm	
800	800	80 – 610 or 640 mm	140 – 610 or 640 mm	
1000	1000	80 – 810 or 840 mm	140 – 810 or 840 mm	

Table 1: Standard 12 mm diameter probe lengths

Probe insertion length (mm)	Sensor 1	Sensor 2 *1 HA	Sensor 3 *2 HHA	
800	800	100 – 550 mm or 600 mm	200 – 550 mm or 600 mm	
1000	1000	100 – 750 mm or 800 mm	200 – 750 mm or 800 mm	
1300	1300	100 –1050mm or 1100 mm	200 – 1050 mm or 1100 mm	
1500	1500	100 – 1250 mm or 1300 mm	200 – 1250 mm or 1300 mm	
2000	2000	100 – 1750 mm or 1800 mm	200 – 1750 mm or 1800 mm	
2500	2500	100 –2250 mm or 2300 mm	200 – 2250 mm or 2300 mm	
3000	3000	100 –2750mm or 2800 mm	200 – 2750 mm or 2800 mm	

Table 2: Standard 20 mm diameter probe lengths

*1 The minimum HA values can be applied in all cases, the maximum HA value assumes that there is no third sensor (HHA).
*2 The HHA value assumes that the HA is set to the minimum value.

For non-standard probe lengths please contact your Hycontrol distributor.

Fittings and Probe Diameter
1 – Adjustable
2 – ½" BSP (**12mm only**)
3 – DN25-Ingold 40 mm
7 – 0.5" Triclover (**12mm only**)
8 – 1.5" Triclover
9 – 2" Triclover
10 – 19mm (**12mm only**)
12 – ¾" BSP (**20mm only**)
15 – ½" NPT (**12mm only**)
16 – ¾" NPT (**20mm only**)

13.13. Cable Ordering Information

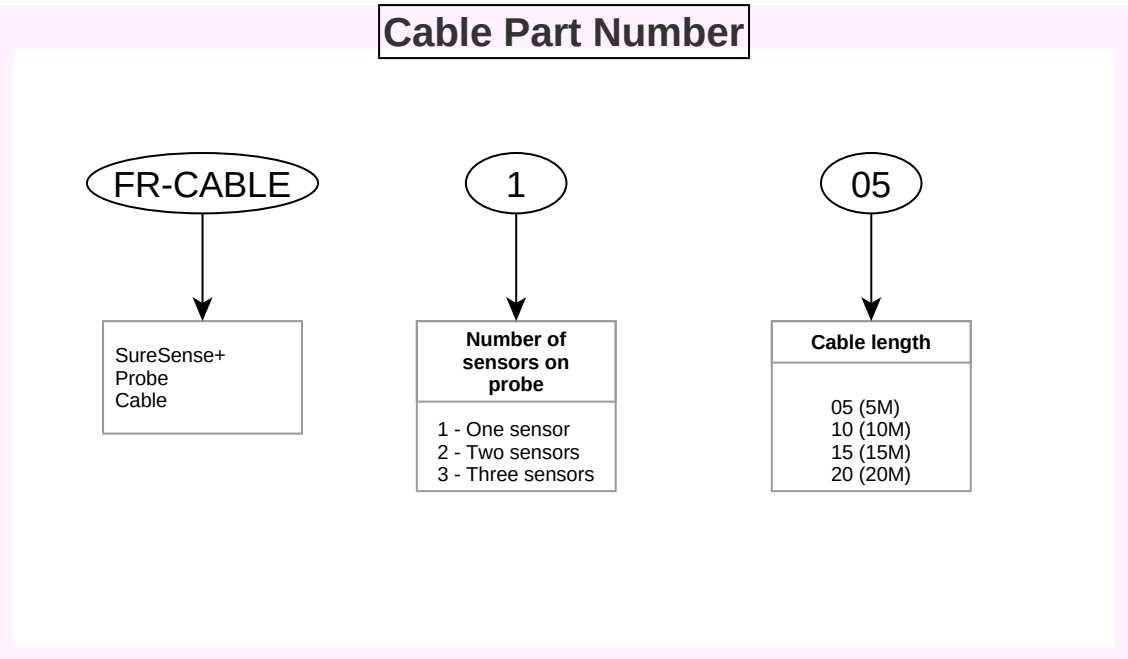


Figure 41 :Cable part numbers

13.14. Controller Display, Resistance and 20 mA Loop Output Values

Display %	100	94	82	72	61	45	35	24	10	0
4-20mA	20	19.04	17.12	15.52	13.76	11.2	9.6	7.84	5.6	4
KΩ	0.1	0.2	0.5	1	2	5	10	20	50	100

Where Display % = Percentage of foam.