SURESENSE FOAM CONTROLLERS & SENSORS

FPCFCR21/31 Rack Mounting

FPCFCW21/31 Wall Mounting

FOR HAZARDOUS AREAS

INSTALLATION AND OPERATION MANUAL

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SPECIFICATIONS

Power Supply :	FPCFCR21 & FPCFCW21 - 110 V ac. or 24 V dc. (0.5 A) FPCFCR31 & FPCFCW31 - 230 V ac. or 24 V dc. (0.5 A)	
Outputs :	Relay 1 - Dosing - Volt-free change over contacts, 240 Vac., 30 Vdc. 3A max. Relay 2 - Foam - Volt-free change over contacts, 240 Vac., 30 V dc. 3 A max Analogue - 4-20 ma.	
Indicators :	Power indicator – Green : always on Sense indicator – Red : on when foam is first detected. Activate indicator – Yellow : on after delay time. Relays activate.	
Adjustments :	Foam Delay Time: 0 - 30 seconds (3 pole d.i.l. switch) Shot Time: 0 - 30 seconds (3 pole d.i.l. switch) Foam Sensitivity 0.3K - 100K ohms impedance. (4 pole d.i.l switch) Dose Overrun Function (d.i.l switch)	
Fouling Immunity :	0.2% of sensitivity to Foam	
Hysteresis	5% between trigger & reset	
Enclosure Data:	FPCFCW21/31:	3U x 8HP 19" Eurocard. 100 x 160 mm Connections :DIN 41612 Type D Connector Mating Connector Harting type 0904 232 6823
	FPCFCW21/31:	IP65 Polystyrene with polycarbonate lid 240 wide x 220 height x 115 depth mm Colour Grey (Ral 7035) Connections: screw terminals.
Sensor Cable:	screened twisted pair cable 0.5 sq. mm - 150 metres max. (Belden 8760 or equivalent)	
Zener Barrier:	MTL 7056ac or 7756ac. 1 barrier per sensor (3 channels)	

1. INTRODUCTION

Hycontrol's FPCFCR21/31 & FPCFCW21/31 are advanced Foam Controllers from the SureSense range, designed to operate with zener barriers for foam control in a hazardous area. These controllers must be installed in a safe area and connected to a foam sensor in a hazardous area via a zener barrier. They are designed to be used with a SureSense Foam Sensor to achieve a very reliable foam control system. There are a variety of sizes and styles of Foam Sensor. They are all designed for hygienic applications and will operate in the presence of high levels of fouling (i.e. surface coating).

The Controller Unit can be used as a transmitter to signal to a process controller or alarm via volt free contacts or 4-20 ma. Alternatively the controller can be used in a "stand alone" system to control a pump or valve directly to dose antifoam by means of a 'Delay and Shot' algorithm. The FPCFCR21 & 31 are 19" rack mounting units and the FPCFCW21 & 31 are wall mounting IP65 versions.
The FPCFCR21 & FPCFCW21 are designed for operation at 110Vac and the FPCFCR31 & FPCFCW31 are designed for 230Vac. In addition all of them can be powered at 24Vdc if preferred.

These are part of a wide range of products designed and manufactured by Hycontrol for the sensing and control of foam.

2. PRINCIPLE OF OPERATION

The Hycontrol Foam Sensor 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 or liquid is present.

The Sensor is designed with two electrodes called "Sense" and "Guard". The Sense electrode is used to sense foam while the Guard electrode is designed to prevent the build-up of surface coating from causing false readings. 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 sensor from the interference caused by fouling. This gives the Sensor the ability to continue working reliably even in conditions of extreme fouling.

The controller energizes the sensor and processes the measured data. It discriminates between foam and spurious events such as splashing and interference. It can signal to a process controller when foam has been detected. Various output interfaces are available including volt-free contacts (relay), digital output and 4-20 mA.

3. INSTALLATION

3.1. Installing the Sensor

The SureSense Sensor 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 lower of the two electrodes at the end of the sensor. Ensure that the Sensor 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 Sensor 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 Sensor cannot be flooded by any liquid contents. For example, if varying liquid heights are likely, ensure that the Sensor is high enough to be always above the liquid surface, unless it is especially in use to detect the liquid level as well as foam.

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

It is essential that the sensor is connected via zener barriers in the proscribed way using an appropriate cable type: see 3.4 below for the system to be safe.

3.2. Installing A Rack Mount Controller

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

The FPCFCR21/31, is designed to be mounted into a 19" rack. The board mates with a DIN 41612 type "D" indirect edge connector, which should be mounted in the rack. Connections should be made by
soldering. Ensure that the joints are sleeved. Refer to figures C and D for the connections.

The relay 1 A & B outputs on the board operate together but are isolated from each other. They can be used to signal to a controller or computer. If used for vacuum cooling or degassing applications,
use the normally closed contacts to interrupt the supply to the control valve.
The relays can be configured to operate powered on or off, to set the failsafe condition, see section 5.5 If the board is to be mounted in a panel there are four mounting holes, which can be used. These can be used to fix the board to pillars on a back plate.

Ensure the correct supply voltage is used 240V or 120V depending on the type. Alternatively a 24V d.c. supply can be used instead. It is essential that the unit is connected to earth to provide a

return path for the Sensor. Ensure that the correct type of cable is used for the Sensor and that the length does not exceed the maximum stated in the specification. (see 3.4 below for cabling)
The cabling to the sensor must be wired via zener barriers. It is essential that the cabling is carried out as shown in figure D. No other arrangement will be acceptable.

See section 4 for notes on commissioning and configuration settings.

3.3. Installing A Wall Mount Controller

THE FPCFCW21 /31 MUST BE INSTALLED IN A SAFE AREA AND CONNECTED VIA ZENER BARRIERS AS SHOWN IN FIGURE F BELOW. THE ZENER BARRIER MUST BE CONNECTED TO A CLEAN EARTH / GROUND.

The FPCFCW21 & 31 are designed to be fastened to a wall or other permanent structure. It can be attached in one of two ways. There are two mounting brackets at the top corners and two mounting holes at the bottom on each side under the terminal cover. If the mounting brackets are inconvenient for any reason they can be removed and the top of the unit can be fixed to the wall at the top by means of a small fixing in the back of the unit in the centre. Refer to Figure I.

To connect cabling, remove the blanking plugs in the glands at the bottom of the enclosure and insert the cables. *Blanking plugs should be left in unused cable glands to maintain the IP65 rating and to prevent the ingress of moisture and dust.* Access to the terminals is via the small terminal compartment at the bottom of the unit. Ensure that suitable cable is used to provide the power connection which meets local regulations.

The FPCFCW21 should be supplied with 110Vac. The FPCFCW31 should be powered at 230Vac. Although either can operate at 24Vdc. The unit is shipped for use at the required voltage and marked accordingly. *Ensure that the unit is powered with the correct supply*. If another supply is required than the one set please contact the supplier. For connections, refer to figures E and F. Ensure that appropriate cable is used for the connections.

3.4. Sensor Cabling

It is essential that the sensor is connected with a suitable cable to the controller via zener barriers of the correct type.

The screen should never be connected to ground as this increases the capacitance of the cable and can case false readings. Neither should other cores in the same cable be connected to earth for the same reason. If an earth connection is needed a separate cable should be used. It is essential that the cable is connected correctly. If the sensor wiring is reversed the sensor may appear to function but the results will be unpredictable.

The sensor actually requires 3 wires and return to operate correctly, as follows: Sense, Guard, Test and Return. The return is usually provided by the system earth.

The Sense line is the measurement signal and should be a core within the screened cable. The Test line compensates for losses in long cables and should be linked to the guard at the sensor. For short cables (<20m) it can be linked at the controller; it must be linked to the guard somewhere in the system. The Guard is normally connected via the cable screen.

The return is usually supplied via an earth bond to the vessel or structure in which foam is being sensed and connects by means of the supply network. It does not normally require a separate cable.
However if the vessel is not connected to earth, a separate earth wire should be connected between the controller and the vessel. Terminal no 6 (return) is provided for this in the FCW2/Z. 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 earth.

Connect the sense wire to the terminal marked "+" and the guard and test wires to the terminal marked
"-". Use an IP66 cable gland to seal the cable into the head and to prevent any moisture access. (An appropriate cable gland is normally supplied with the Sensor). (see Fig. J)

3.5. Hazardous Areas and Zener Safety Barriers

Hycontrol SureSense sensors 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 sensor 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 sensor and controller in a 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 $8mm^2$ is connected between the barrier earth and the vessel in which the sensor 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 used for the sensor 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. This is a very common structure in Europe but less so in North America. 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.

3.6. Interface Cabling

There are various interfaces available to connect the controller to control devices or to a process control computer. These are listed below:

Relay 1 : Dosing Control Output
Volt-free contacts - change-over type with 2 sets of contacts which operate together.
For use as a dosing (delay & shot) function to drive an antifoam pump or valve. Or if the shot time is set to zero this can be used to operate simply as an alarm output which comes on when foam is detected. In both cases an initial delay time runs before the relay operates.
The relay can be connected to a low voltage to switch to a computer or may be connected to a high voltage to operate a pump or valve etc. The relay switches off at the end of the shot time following the foam dispersal.

Relay 2 : Foam Detector Output
Volt-free contacts – operates when foam is detected after a set delay time, and has no dosing function but stays on continuously while foam is detected.
The relay can be connected to a low voltage to switch to a computer or may be connected to a high voltage to operate a pump etc.

Analogue Output: 4-20 mA
The negative side is connected to the instrument ground and is not isolated. The analogue output responds to both liquid and foam.
4-18mA indicates foam
20mA indicates liquid

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

4. COMMISSIONING

When power is first applied a self test is carried out. If the controller passes the test, all the front panels lights should momentarily switch on and then go out. After this the green 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. If the self test fails all the front panel lights will flash on and off together indicating that there is a major failure. In this case contact your supplier for advice.

The FPCFCR and FPCFCW ATEX 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 Sensor and the vessel wall with a piece of cable. If this is impractical, make a temporary connection between the sense terminal at the Sensor head and earth. The red foam (sense) light on the panel should light, and after the set delay time the yellow light should switch on. Check that the signal has passed correctly to the process controller or other device and that the correct channel has been used, if appropriate. Ensure that the temporary connection is removed and that the red and yellow lights then switch off. It is important that the complete measuring chain is tested together with any control feedback.

The Sensor 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 in the process for a test then the system should be tested with foam initially. If the Controller does not trigger when foam is present, then increase the sensitivity slightly and try again. (See section 5.5). *Do not set the sensitivity higher than necessary as this could decrease the immunity to fouling.* In most applications the sensitivity required is below 20K. The sensitivity settings are shown in Figure B. The adjustment switches location are shown on figure G for FPCFCR or figure H for FPCFCW. To increase the sensitivity set a larger value as shown in the sensitivity column.

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.
Do not attempt to remove a sample of foam to test since the foam can drain quickly which will substantially change its characteristics.

The delay time gives discrimination against splashing. This acts as a response time before any action is taken. It is used for both the relays. In most applications a few seconds is adequate to differentiate between occasional splashing and the presence of foam. (See section 5.3). 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 relay to operate.

5. OPERATION OF THE FPCFCRW21/31 AND FPFCW21/31 CONTROLLERS

5.1. Operation

The FPCFCR21/31 & FPCFCW21/31 are designed specifically for measuring and controlling foam in industrial processes. These are not simply liquid level detectors which have been adjusted for foam. The controllers are set up in the factory for a typical application and may be suitable without any adjustments. However in some cases the controller may need to be adjusted to suit the application. Adjustments can be carried out by means of switches in the unit as described in the following sections.

The front panel indicators have the following functions:

'Power' - Green
This led indicates that power is applied and that the internal processor is running.

'Sense' - Red- Led
The red led switches on when foam is first sensed and stays on while foam is detected. The delay timer starts as the red indicator lights. When the foam subsides the indicator switches off immediately.

'Action' – Yellow – Led
The yellow led lights after the delay time and stays on the set shot time. Relay s activates for as long as foam is detected. Relay 2 pulses with the shot and delay algorithm. When the foam subsides the yellow led will stay on until the end of the next shot time pulse.

5.2. Manual Switch

Connections are provided for the use of an external momentary action switch. This switch may be used to override the action of the controller or test the connection to a process controller. Pressing the switch will trigger the foam controller outputs. This can be useful for priming if a pump is used.

5.3. Foam Delay Time (Response Time)

The delay time switches are used to set the foam delay time. This is the time for which foam is continuously sensed before the foam relay is activated. It is used to discriminate between the presence of foam and any intermittent effects such as splashing. It is also used to set the time between 'shots'. It is set by means of a dual in-line switch on the controller board. The default time of 4 seconds is suitable for many applications but this can be adjusted if required. To change the setting, adjust the switches with a small screwdriver or similar tool. The settings are shown in Figure A. (Sw2:5-7) The switch is located near the top edge of the board and is shown in FigureG.

In some cases no response time is required at all and in this case the time may be set to zero but this is unusual and in the majority of applications a short delay time is definitely advisable.

5.4. Shot Time

The shot time is the time for which the dosing relay (Relay1) is activated. The delay and shot function is designed primarily to dose antifoam or defoamer into a process. Antifoam often requires a finite time to take effect is best added as a dose or 'shot' and then time allowed for the chemical to be effective. This minimizes the amount of antifoam added. The delay time between shots is the same as the initial delay time. The shot time is set by internal dil switches as shown in figures G&H.(sw4:1-3). The yellow led will switch on and off with Relay1.

The settings are shown in figure A.

Once a shot time starts it will always finish regardless of the foam level. So if the foam subsides during the shot time, the dosing will continue until the end of the shot time.

If the dosing algorithm (delay & shot) is not required it can be disabled by setting the shot time to zero. In this case the controller acts like a detector. The output relay will switch on after the initial delay time and stay on until the foam subsides. This can be used to signal to a process controller or Scada system.

5.5. Foam Sensitivity

The sensitivity of the unit to foam can be adjusted if necessary. The default value, which is set in the factory, is suitable for most applications but there are times when this may need to be adjusted. *Please note that the value should not be set at a higher value than is required for the application, in order to optimize the fouling immunity.* The sensitivity of the probe to fouling is a small percentage of its sensitivity to foam. This means that if the gain is too high for the application, the fouling rejection is reduced.

The sensitivity is set by means of 4 small switches on the controller board.(SW2:1-4) The settings are shown in figure B. The location of the switches is shown in figure G (FPCFCR) and figure H (FPCFCW). Set the combination of the four switches to give the desired sensitivity as shown in figure B. The switches are marked "on" at one side and the combination of on/off sets the sensitivity.

To increase the sensitivity the value should be set to a higher number. To detect very low density foam a higher sensitivity will be needed. Low density foam is characterized by a low liquid content, large bubble size or low conductivity.

5.6. Hysteresis

Hysteresis is a means of improving the switching point and to avoid rapid cycling when the foam is only slowly changing in height. The hysteresis is a small difference between the sensitivity at which the unit triggers and the sensitivity at which it resets. This is set to 5% hysteresis to provides very clean and noise free switching. Once the unit has detected foam the switching level is changed by 5% so the foam has to fall further down to reset the unit. The hysteresis cannot be adjusted by the user on this unit.

5.7. Overrun Function

This function is designed to allow more action to be taken once the foam has subsided. It can be enabled or disabled using the internal switches (sw4:4). The effect of the overrun is to give one extra shot after the foam has subsided. This is sometimes useful to ensure the foam is controlled enough. However it is probably best to disable the overrun if the intention is to use the absolute minimum of chemical additives. The overrun function is suspended when liquid is sensed.

If the shot time is set to zero and the controller is operated as a detector/transmitter then the effect is to increase the on time of the relay by one delay time. This can be useful in vacuum cooling applications where a vacuum valve is being controlled to prevent 'hunting' of the valve. In other word it adds an extra delay to prevent rapid switching of an actuator.

When the Overrun function activates the red led flashes on and off faster than normal.

5.8. Analogue Output (4-20 ma)

Both controllers have an analogue output which can be used to indicate the level of foam. This will not give a precise level measurement, as in general foam is not an homogeneous material, however it will give a good indication if the foam is rising or falling which can be a useful indicator. It could also be used to input to a PID controller if required. When there is no foam detected the output will be at 4mA.

The scaling of the current output is linked to the sensitivity adjustment. When the sensitivity is changed the ma scale will change accordingly. The controller triggers to indicate foam when the 4-20 ma output is at 7.00 ma or 10ma depending on the output range factor. So to describe how it works, when no foam is present the output will be at 4.0 ma when foam builds up and reaches the sensor the output will rise above 4.0 ma and continue rises as the foam builds. At 7.0 ma the unit triggers to indicate that foam is sensed. If the foam continues to increase the output will increase up to 18 ma at which point it cannot increase any further.

If set to high, the output range factor increases the slope of the output so that it changes faster with foam. The output will be 10 ma when the controller triggers for foam and will indicate reach 18ma at a lower level of foam. This high setting can be used to increase the usable range if required.

See Figure P for switch settings.

The 4-20mA output is active and so must be connected to a passive input. It must not be connected to an active input as both ends of the loop will apply power and a very high current may flow. Please note that the 4-20 mA signal is not isolated but referred to ground potential.

5.9. Making Adjustments

The following adjustments are provided for the operator:

Delay time	- internal d.i.l switch - 3 pole
Shot Time	- internal d.i.l switch - 3 pole
Sensitivity	- internal d.i.l switch – 4 pole
Overrun	- internal d.i.l switch – 1 pole
Output range	- internal d.i.l switch – 1 pole
Manual Switch	- external switch , if fitted

These are described below; please refer to the relevant figures for settings. *Ensure that the power is switched off before adjustments are made, as there are high voltages present on this board.*

To make adjustments to the FPCFCR remove it from the rack. The location of the switches is shown in figure G.

In the case of the FPCFCW open the front cover by pushing in the latch on the left side, then remove the four screws securing the front panel. Then carefully remove the front panel from the enclosure and put to one side in a safe place. This gives access to the control board. The location of adjustment switches is shown in figure H. After adjustment replace the front panel being careful to ease the leds into the window recesses behind the panel. *Take care not to put pressure onto the leds if the panel is not located properly as this may cause damage.* Replace the four retaining screws and then ensure that the front cover is closed securely.

The switches are only read by the system when power is applied. When making changes to the switch settings ensure that the unit is turned off and then on again.

5.10 Failsafe Operation

The relays can be set to be powered up or down in the normal state. This gives the option to set the relay for the required condition in the event of a power failure or other serious fault. In the default mode when the power is off the condition indicated is the same as when no foam is detected. However in the failsafe mode when the power is off the relay state is the same as when foam is

indicated. This allows a power failure to indicate an alarm.

Default mode: the relays are powered down when foam is not present and when foam is detected the relays are powered up and switch over.

Failsafe mode: the relays are powered up when foam is not present and when foam is detected the relays are powered down and switch off.

This function is set by SW4 : 8 as follows:

SW4 : 8 Off : Relay normally off (default mode)
On : Relay normally on. (failsafe mode)

The diagrams in the manual show the relays with the default option in the normally off state, when foam is not present. See Figs. G & H for location of switch.

5.11 Summary of Switch Functions:

Switch	No	Function
SW2	1	Sensitivity settings – see figure B
	2	
	3	
	4	
	5	Delay Time settings – see figure A
	6	
	7	
	8	Reserved for future use
SW4	1	Shot time settings – see figure A
	2	
	3	
	4	Overun function – on to enable, off to disable
	5	mA o/p range factor – (0,20,40,60,80%) – see figure P
	6	
	7	4-20/0-20 ma (off for 4-20ma)
	8	Failsafe mode (on for failsafe, off for normal mode)

FIGURE A – TIME SETTINGS
CONTROLLER DELAY TIME SETTINGS

	TIME (Secs)	SW2 SWITCH 5	SW2 SWITCH 6	SW2 SWITCH 7
MAX >	30	ON	ON	ON
	20	OFF	ON	ON
	12	ON	OFF	ON
	8	OFF	OFF	ON
DEFAULT >	4	ON	ON	OFF
	2	OFF	ON	OFF
	1	ON	OFF	OFF
MIN >	0 *	OFF	OFF	OFF

ADJUST BY MEANS OF SW2: 5-7 DIL SWITCH ON THE BOARD.
(* If set to 0 relay response immediately with the red led.)

CONTROLLER SHOT TIME SETTINGS

	TIME (Secs)	SW4 SWITCH 1	SW4 SWITCH 2	SW4 SWITCH 3
MAX >	30	ON	ON	ON
	20	OFF	ON	ON
	12	ON	OFF	ON
	8	OFF	OFF	ON
DEFAULT >	4	ON	ON	OFF
	2	OFF	ON	OFF
	1	ON	OFF	OFF
MIN >	OFF **	OFF	OFF	OFF

ADJUST BY MEANS OF SW4: 1-7 DIL SWITCH ON THE BOARD.
(** if set to off the shot/delay function is disabled)
FOR LOCATION OF SWITCH SEE FIGURES G & H.
SWITCHES ARE ONLY READ AT POWER UP – CYCLE POWER

FIGURE B – FOAM SENSITIVITY SETTINGS

	SENSITIVITY	SWITCH 1	SWITCH 2	SWITCH 3	SWITCH 4
MIN >	0.35K	ON	ON	ON	ON
	0.5K	OFF	ON	ON	ON
	0.7K	ON	OFF	ON	ON
	1K	OFF	OFF	ON	ON
	2K	ON	ON	OFF	ON
	5K	OFF	ON	OFF	ON
	7.5K	ON	OFF	OFF	ON
DEFAULT >	10K	OFF	OFF	OFF	ON
	12K	ON	ON	ON	OFF
	15K	OFF	ON	ON	OFF
	20K	ON	OFF	ON	OFF
	25K	OFF	OFF	ON	OFF
	35K	ON	ON	OFF	OFF
	50K	OFF	ON	OFF	OFF
	75K	ON	OFF	OFF	OFF
MAX >	100K	OFF	OFF	OFF	OFF

Adjust by means of SW2: 1-4 for location see Fig.G or H

Sensitivity required is in the range 5K –20K for most applications. For less dense or lighter foam increase the sensitivity to a higher value.

DO NOT SET SENSITIVITY HIGHER THEN REQUIRED FOR THE APPLICATION

Power up after adjusting switches

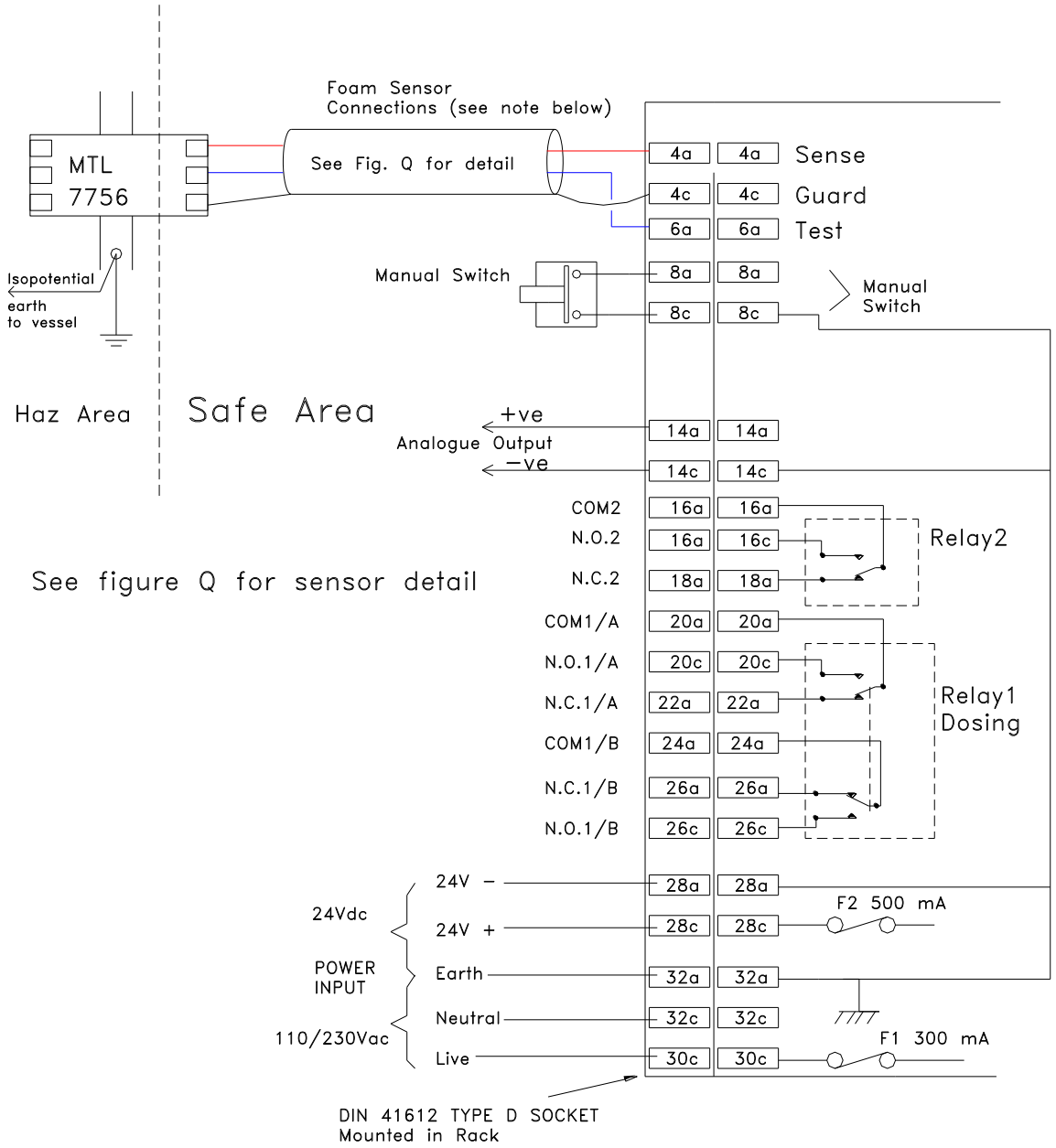
FIGURE C - TERMINALS - RACK MOUNTING CONTROLLER FPCFCR21 &31

TERMINAL	DESCRIPTION
4A	SENSE -FOAM SENSOR
4C	GUARD-FOAM SENSOR
6A	GUARD TEST (must be linked to guard)
6C	ACTIVE DRIVE (used for special applications only)
8A	MANUAL SWITCH
8C	MANUAL SWITCH
14a	ANALOGUE OUTPUT + (4-20mA)
14c	ANALOGUE OUTPUT - (ground)
16a	RELAY 2 COMMON CONTACT
16c	RELAY 2 NORMALLY OPEN CONTACT
18a	RELAY 2 NORMALLY CLOSED CONTACT
20A	RELAY 1/A COMMON
20C	RELAY 1/A NORMALLY OPEN CONTACT
22A	RELAY 1/A NORMALLY CLOSED CONTACT
24A	RELAY 1/B COMMON
26A	RELAY 1/B NORMALLY CLOSED CONTACT
26C	RELAY 1B2 NORMALLY OPEN CONTACT
28C	DC SUPPLY +(18 – 24V)
28A	D.C. SUPPLY–(0V) (instrument ground)
30C	A.C. SUPPLY – LIVE (line)
32C	A.C. SUPPLY RETURN – NEUTRAL
32A	SUPPLY GROUND Connected internally to 30A, 28A
30A	SUPPLY GROUND

Note: Relay connections refer to the normally off condition with no foam present. If the failsafe mode is set to normally on, then the relay normally open contacts will be closed when foam is not present.
Connect a.c. or d.c. supply – not both.

Figure D

Cabling Rack Mount Controller FPCFCR21&31



Use only screened twisted pair with screen connected to Guard.

FIGURE E - CONNECTIONS TO WALL MOUNTING UNITS

FOAM CONTROLLER TYPE FPCFCW21 & FPCFCW31

TERMINAL	DESCRIPTION
1	A.C. Supply – LINE (115/230 V a.c.)
2	A.C. Return – NEUTRAL
3	Supply Ground / EARTH
4	D.C. Supply + (18-24 V)
5	D.C. Supply 0 V
6	Return
7	Sensor: SENSE Connection
8	Sensor: GUARD Connection
9	Sensor: TEST Connection (link to guard)
10	Relay 1/A Common.
11	Relay 1/A Normally Open
12	Relay 1/A Normally Closed
13	Relay 1/B Common
14	Relay 1/B Normally Open
15	Relay 1/B Normally Closed
16	Relay 2 Common.
17	Relay 2 Normally Open
18	Relay 2 Normally Closed
19	4-20 mA +ve Analogue
20	4-20 mA –ve (0 V d.c.) Output
21	Manual Switch
22	Manual Switch.

Connect A.C. <u>or</u> D.C. supply - not both. Ensure that cabling has suitable rating.

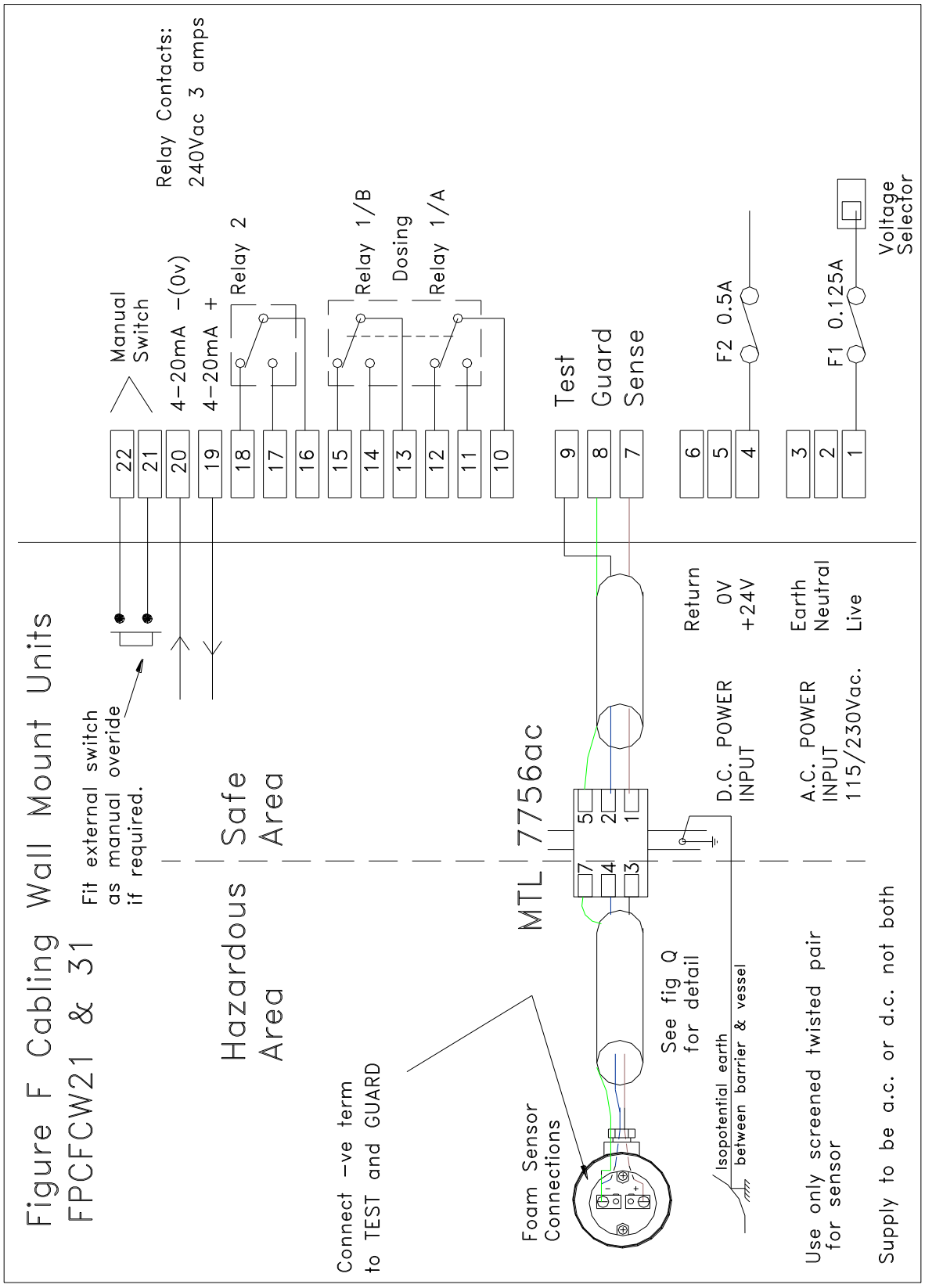


Figure F Cabling Wall Mount Units
FPCFCW21 & 31
Fit external switch as manual overide if required.
Hazardous Area
Safe Area
MTL 7756ac
Manual Switch
4-20mA -(0v)
4-20mA +
Relay 2
Relay 1/B
Dosing
Relay 1/A
Relay Contacts: 240Vac 3 amps
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Test
Guard
Sense
F2 0.5A
F1 0.125A
Voltage Selector
Return
0V
+24V
D.C. POWER INPUT
Earth
Neutral
Live
A.C. POWER INPUT 115/230Vac.
Connect -ve term to TEST and GUARD
Foam Sensor Connections
See fig Q for detail
Isopotential earth between barrier & vessel
Use only screened twisted pair for sensor
Supply to be a.c. or d.c. not both

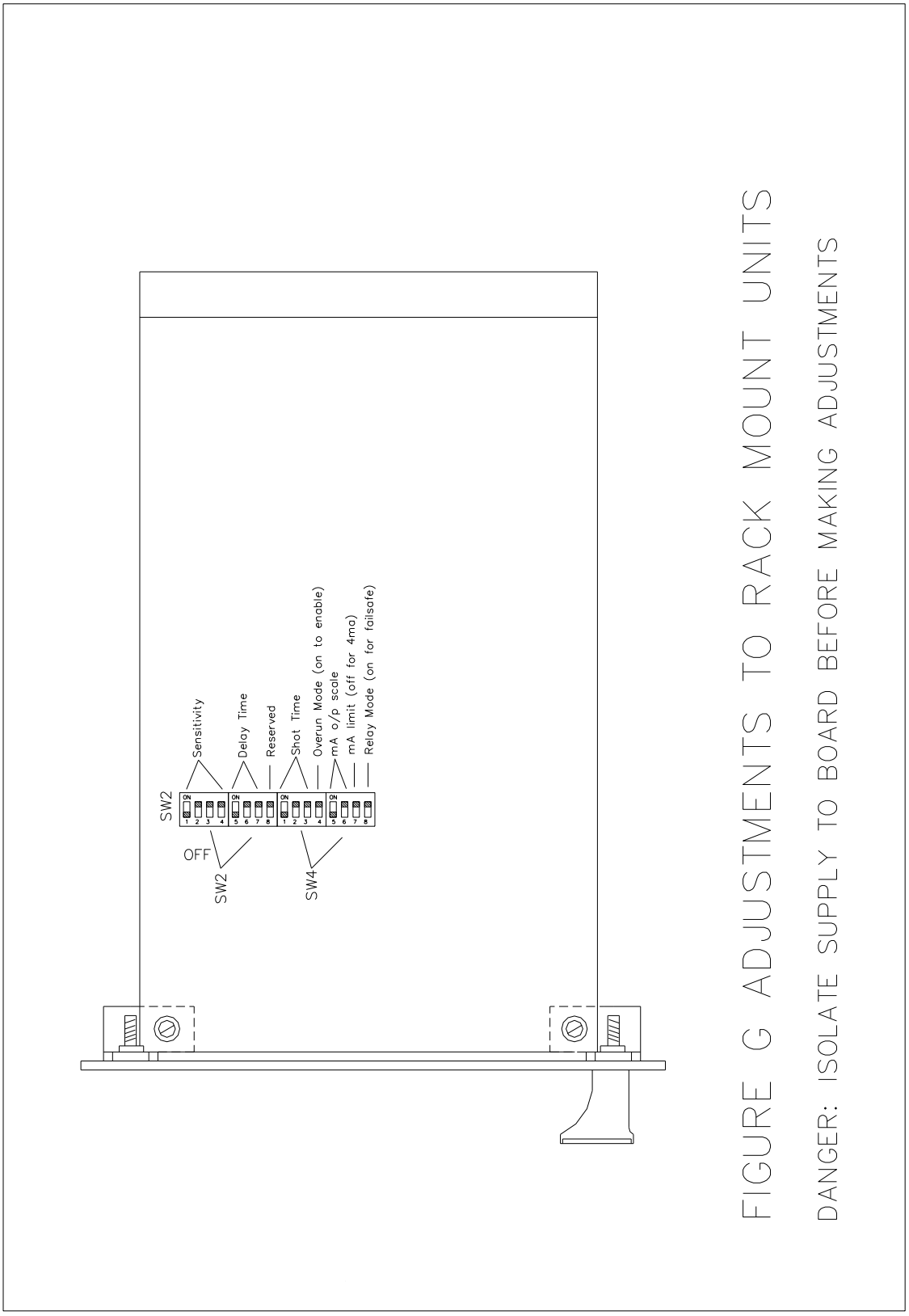


FIGURE G ADJUSTMENTS TO RACK MOUNT UNITS

DANGER: ISOLATE SUPPLY TO BOARD BEFORE MAKING ADJUSTMENTS

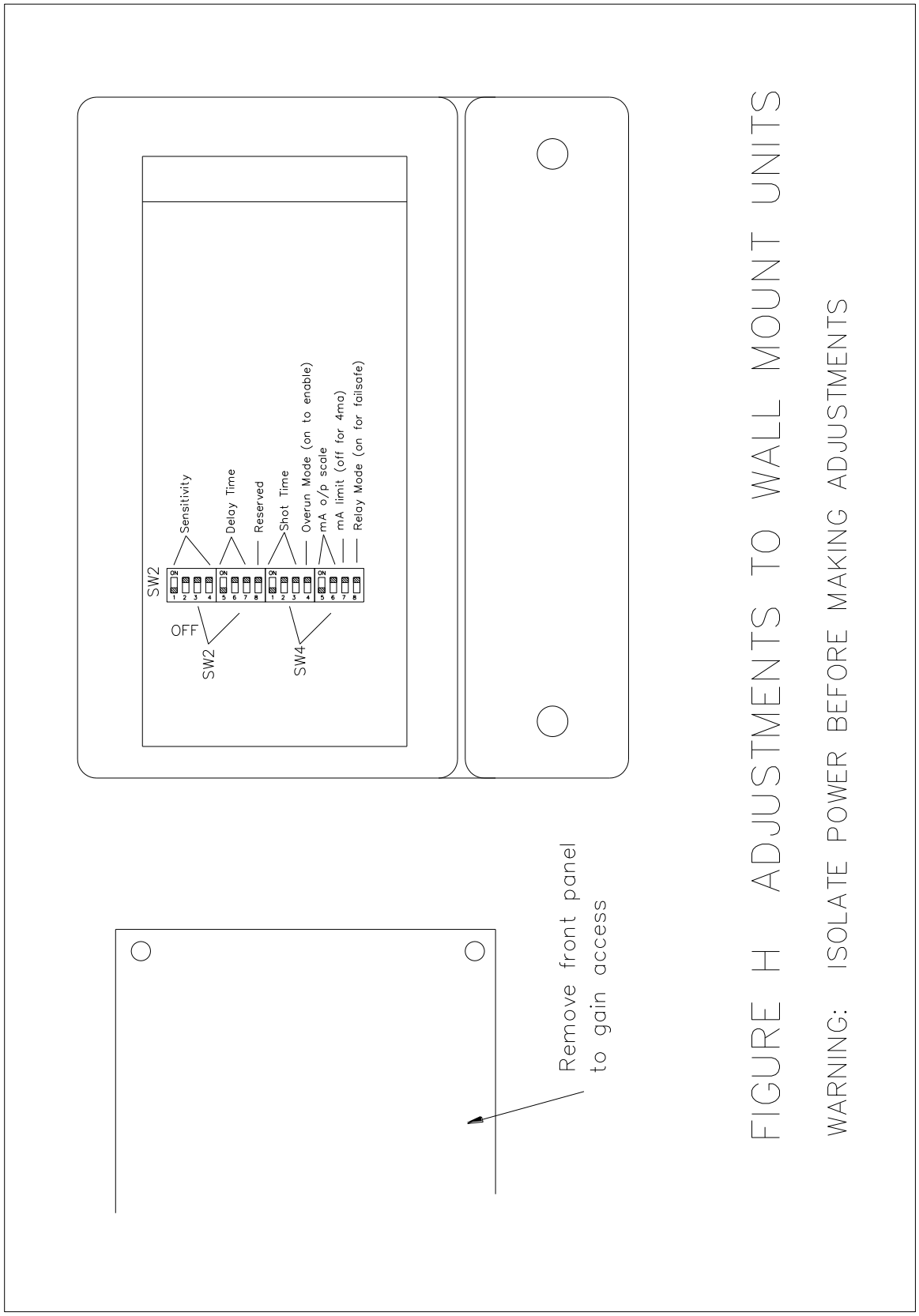


FIGURE H ADJUSTMENTS TO WALL MOUNT UNITS
WARNING: ISOLATE POWER BEFORE MAKING ADJUSTMENTS
Remove front panel to gain access
SW2
Sensitivity
Delay Time
Reserved
Shot Time
Overun Mode (on to enable)
mA o/p scale
mA limit (off for 4ma)
Relay Mode (on for failsafe)
OFF
SW2
SW4

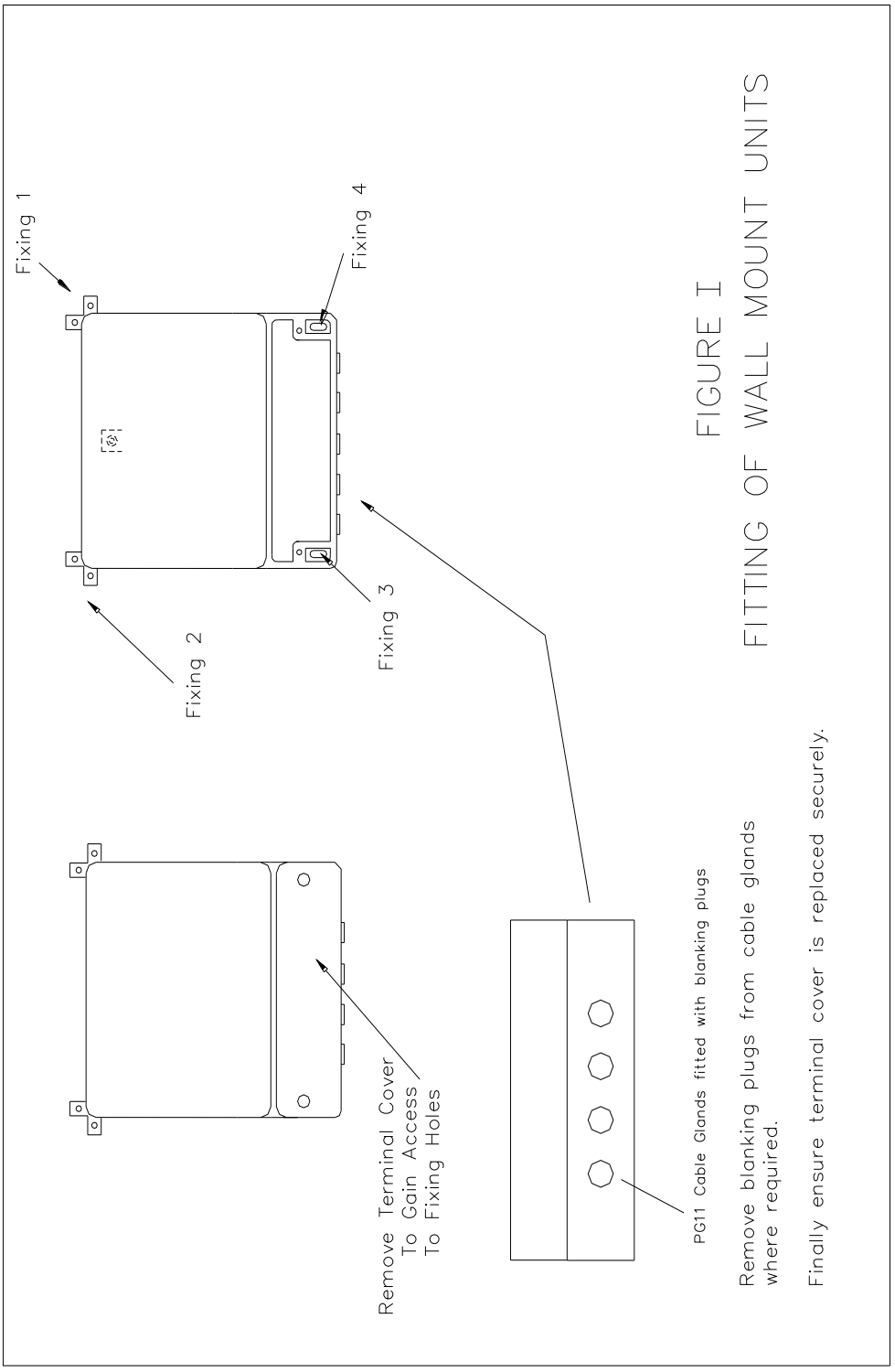
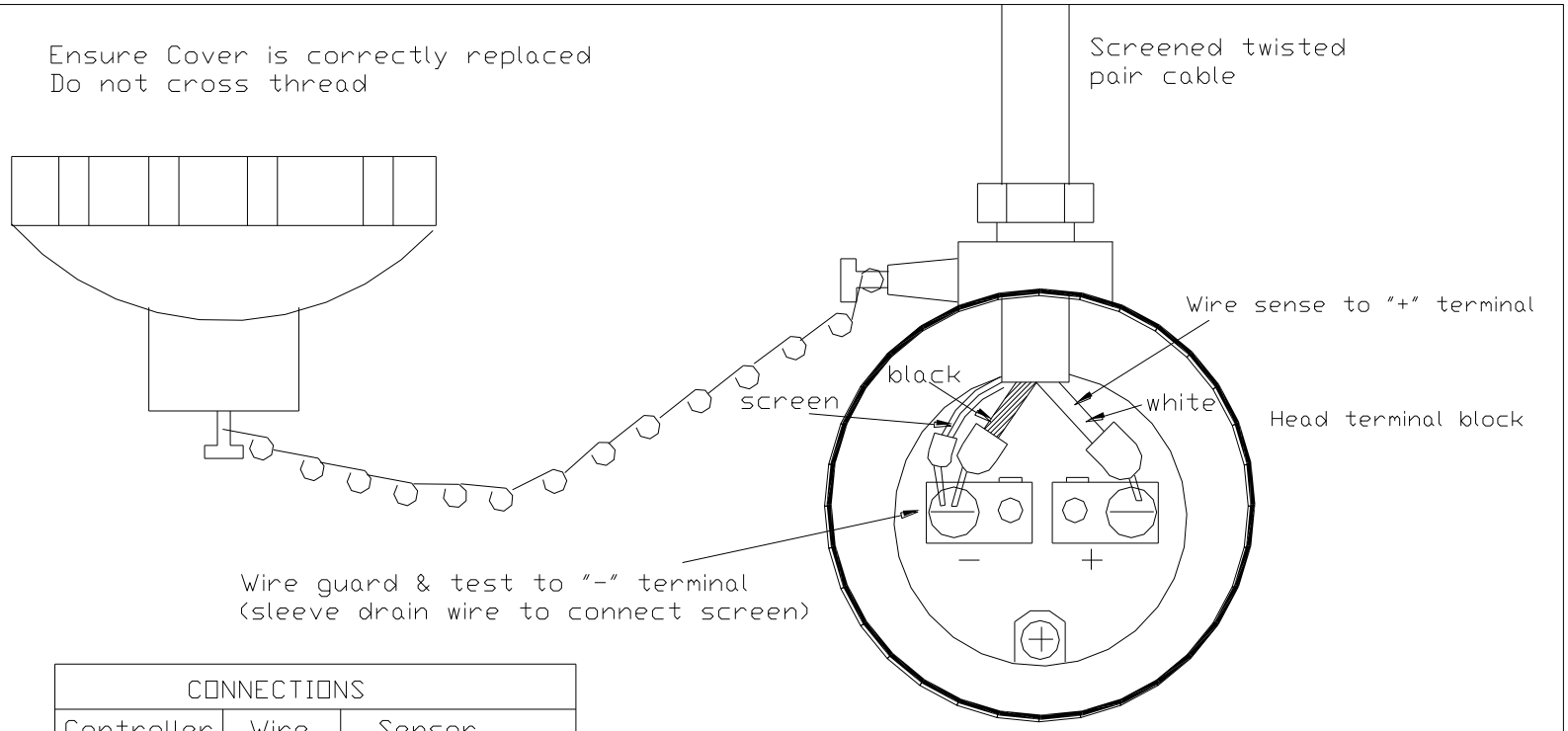


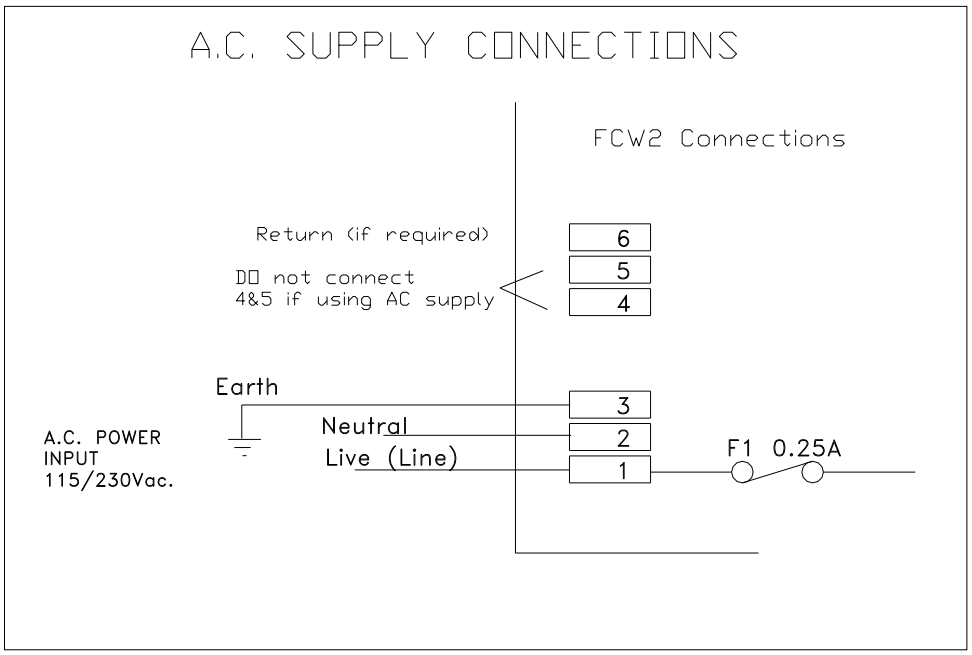
FIGURE I
FITTING OF WALL MOUNT UNITS
Fixing 1
Fixing 2
Fixing 3
Fixing 4
Remove Terminal Cover
To Gain Access
To Fixing Holes
PG11 Cable Glands fitted with blanking plugs
Remove blanking plugs from cable glands where required.
Finally ensure terminal cover is replaced securely.

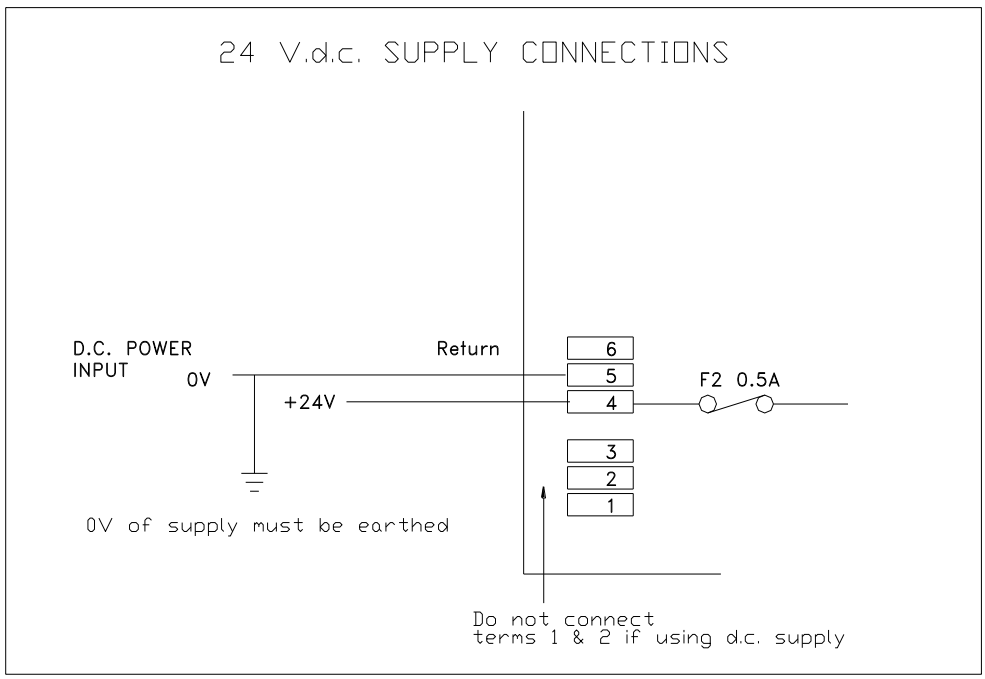


CONNECTIONS		
Controller	Wire	Sensor
Sense	white	+ terminal
Test	black	- terminal
Guard	screen	- terminal

FIGURE J INDUSTRIAL SENSOR CONNECTIONS

FIGURE M: POWER SUPPLY CONNECTION OPTIONS





The return terminal can be used to connect to the vessel if it is not earthed, to provide a return signal. It most installations it is not required. See section 3.4 for details.

FIGURE P

ANALOGUE OUTPUT SETTINGS (4-20 mA)

RANGE FACTOR

	TRIGGER %	TRIGGER POINT ON 4-20 mA	TRIGGER POINT ON 0-20 mA	SW4 SWITCH 5	SW4 SWITCH 6
	80	16.8	16.0	ON	ON
	60	13.6	12.0	OFF	ON
DEFAULT >	40	10.4	8.0	ON	OFF
	20	7.2	4.0	OFF	OFF

LOWER CURRENT LIMIT

Current Range	SW4 SWITCH 7
4-20 mA	OFF
0-20 mA	ON

FOR LOCATION OF SWITCH SEE FIGURES G & H.

SWITCHES ARE ONLY READ AT POWER UP
(SWITCH POWER OFF AND ON AFTER SWITCHES ARE CHANGED)

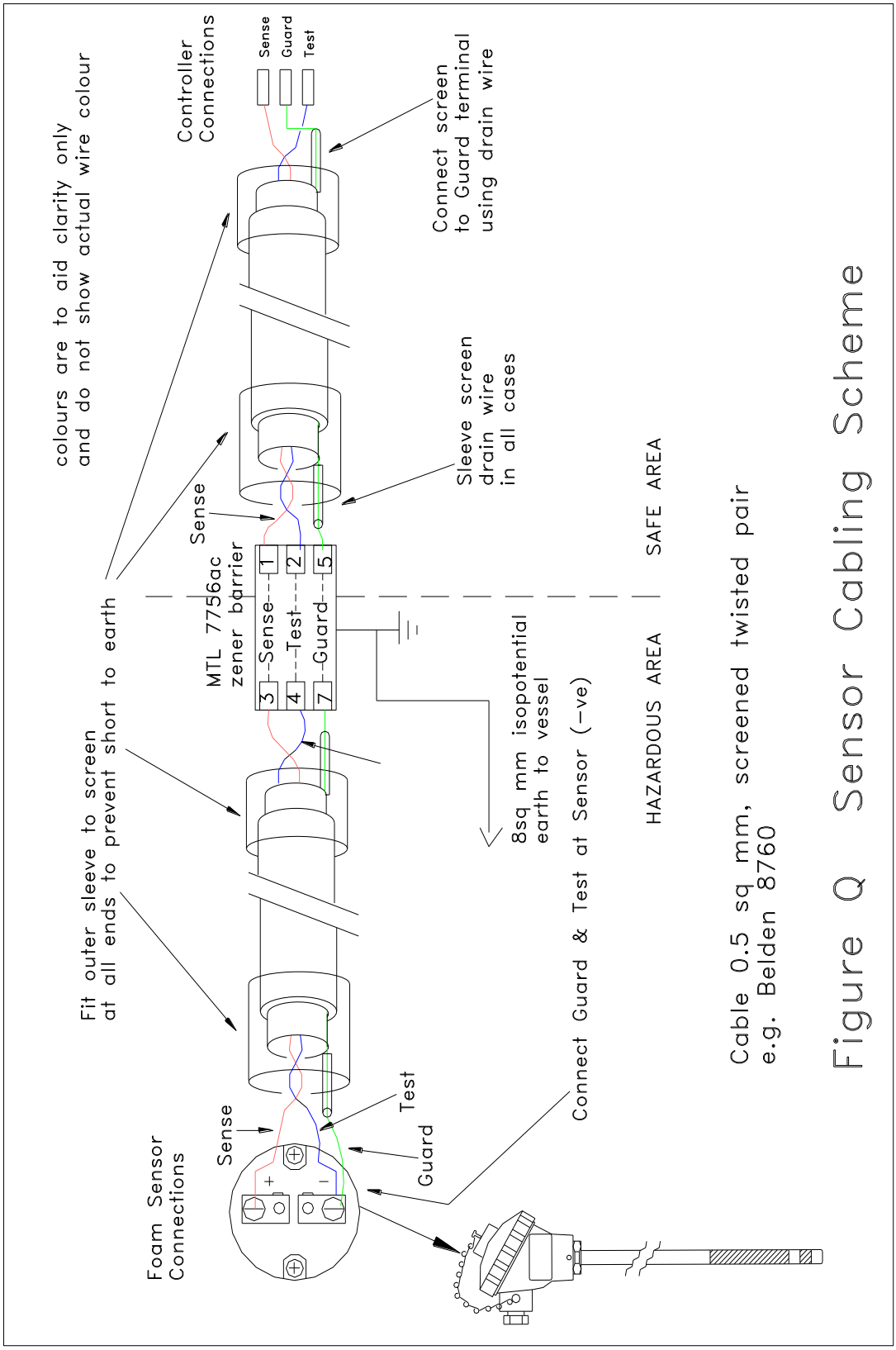


Figure Q Sensor Cabling Scheme

HYCONTROL FOAM CONTROL SYSTEMS

APPLICATION NOTE: INTRINSICALLY SAFE SYSTEMS - ATEX

Hycontrol Foam Sensors are passive devices with no charge storage elements. As such these devices conform to the "Simple Apparatus" rules of BS EN 60079-14 part 4 and Cenelec EN50 014 clause 1.3. These sensors can be used in conjunction with appropriate zener barriers to form an I.S. system. The sensors can be installed into zones 0,1 or 2. The temperature classification is normally T4 although it may be possible to raise this in some cases. Suitable for all gas groups including group IIC.
BASEEFA have issued a system certificate to cover this product when connected with zener barriers. (Bassefa12Y0019X)

The control units must be installed into a safe area.

Note that since these sensors 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 sensor 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 sensor)
Recommended Barriers:	MTL 7756 x 1, or 7056 x 1 or 755 x 2.
Potential Equalising Conductor:	8 mm2 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:	150 metres (assuming one sensor per vessel) For multiple sensors cable parameters must be calculated.
Certificate No:	Baseefa12Y0019X
Labelling:	Must be labelled as I.S. System

Connections are shown below.

IMA SENSING
Registered Trade Mark