HYCONTROL
LEVEL MEASUREMENT SOLUTIONS

SURESENSE RANGE

DUALFOAM CONTROLLERS AND SENSORS

FPC2CW20 (110Vac / 24Vdc)
FPC2CW30 (230Vac / 24Vdc)

INSTALLATION AND OPERATION MANUAL

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FPC2CW20 / FPC2CW30 SPECIFICATIONS

Power Supply :	230 V a.c. (FPC2CW30) / 24Vdc, 0.2A or 115 V a.c. (FPC2CW20), / 24Vdc 0.3 A (can be set by the voltage selector on the control board)
Outputs :	Volt-free change over contacts 240 V a.c. 30 V d.c. 2 A max.
Indicators :	Power indicator – Green : always on Sense indicator – Red : Indicates Sensor 1 Function Activate indicator – Yellow: Indicates Sensor 2 Function
Adjustments :	Delay Time 0 - 30 seconds (3 pole d.i.l. switch) Sensitivity 0.3K - 100K ohms impedance. (4 pole d.i.l switch) Relay function - normally off - default mode - normally on – safe mode
Fouling Immunity :	0.2% of sensitivity to Foam
Hysteresis:	5% between trigger & reset
Enclosure Data:	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 e.g. Belden 8760

1. INTRODUCTION TO THE FPC2CW DUALFOAM CONTROLLER

The Hycontrol FPC2CW20 & 30 are part of the SureSense range. These are purpose designed Foam Controller units intended for use in a permanent installation to sense and/or control foam in a reactor or other containment area and should only be used with a Hycontrol Foam Sensor to achieve the operation described. The principle parts of a system are as follows:

- Dual-Foam Sensor, or 2 x SureSense Sensors
- Interconnecting Cable
- Controller Unit (safe area)

There are a variety of sizes and styles of Foam Sensor. They are designed for hygienic applications and will operate in the presence of high levels of fouling (i.e. surface coating).

The FPC2CW20 is for 110Vac operation and the FPCF2CW30 is for 230Vac. (The unit supply voltage can be changed if necessary by means of a voltage selector switch inside, if necessary). Both can be operated at 24Vdc if required. In this manual both units will be referred to as FPC2CW.

The Controller Unit can be used as a transmitter to signal to a process controller or alarm via volt free contacts. The controller can also be used to control a pump or valve directly to dose antifoam by means of an additional contact closure. The FPC2CW is designed to be wall mounting and is IP65.

This controller has two measurement channels and is designed to be used with one DualFoam sensor which has low & high measuring points in one assembly. The lower sensor is often used to control foam and the upper one as a high alarm. Alternatively it can be used for two separate sensors.

This is one of a series of products designed and manufactured by Hycontrol for the sensing and control of foam.

2. PRINCIPLE OF OPERATION

The Hycontrol / Charis 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 is present.

The Sensor is designed with one or two pairs of electrodes. One is used to sense foam while the other is designed to supply any leakage currents which pass along the body of the Sensor. If the Sensor is covered with a fouling layer deposited on it, then a leakage current must pass through that layer and down to earth. This leakage may be measure 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 / Charis 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 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.

3. INSTALLATION

3.1 Installing the Sensor

The Hycontrol / Charis 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 properly: see 3.3 below.

3.2 Installing the FPC2CW Controller

The FPC2CW is 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 tope 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 unit can be operated at 240V or 110Vac or 24V d.c. 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. Note that the 24V dc supply should be grounded. See figure m for details.

3.3 Sensor Cabling

Use screened twisted pair cable with the screen connected to the guard as shown in fig. Q. *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.

The Sensor is connected using the terminal block in the head. For sensors with two terminals connect the sense wire to the terminal marked "+" and the guard wire to the terminal marked "-".
For sensors with 4 terminals the terminals are labeled S1, G1, S2, G2. See figure D for connections to the controller and figure K shows the sensor head connections.
Use an IP66 cable gland to seal the cable into the head and to prevent any moisture access.

It is essential that an earth return is provided for the Sensor. This is normally supplied via an earth 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. Terminal no 6 (return) is provided for this in the FPC2CW if required. 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.

3.4 Interface Cabling - Outputs

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

Relay 1 : Sensor 1 output.
Volt-free contacts - change-over type with 2 sets of changeover –contacts.
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.

Relay 2 : Sensor 2 output
Volt-free contacts - change-over type with changeover –contacts.
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. This may also be used in some cases as a high alarm function.

See figure C for sensor positions in DualFoam Sensors.

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.

4. COMMISSIONING

When power is first applied a self test in performed and as this happens 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 controller is 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 1 terminal at the Sensor head and earth. The red "sense" light on the panel should start to flash, and after a delay time of 4 seconds the red light should stay on continuously. Ensure that the information has passed correctly to the process controller or other device and that the correct channel has been used.

Repeat the above for S2 to see that the yellow led behaves as above.

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 for a test then the unit should be tested with foam before use. If the Controller does not trigger when foam is present, then increase the sensitivity slightly and try again. (See section 5.4). *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 H. 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.

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 earth. 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 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 unit to trigger.

5. OPERATION OF THE FPC2CW20/30 CONTROLLERS

5.1 Making Adjustments

The following adjustments are provided for the operator:

Delay time	- internal d.i.l switches x 3
Sensitivity	- internal d.i.l switches x 4
Relay Mode	- internal d.i.l switch x 1

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.*

Open the front cover by pushing in the latch on the right side and 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.

5.2 Delay Time (Response Time)

The delay time switch is used to set the delay time. This is the time for which foam is continuously sensed before the output is activated. It is used to discriminate between the presence of foam and the intermittent splashing of liquid. 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 Figure H. In some cases no response time is required at all and in this case the time may be set to zero. However in most applications some short delay time is beneficial.

5.3 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 H . 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.

5.4 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. There is no adjustment available.

5.5 Relay Mode – Default / Safe

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 Fig. H for location of switch.

5.6 Summary of switch operations

LAYOUT AND FUNCTION OF SWITCHES

Switch	No	Function
SW2	1	Sensitivity settings – see figure B
	2	
	3	
	4	
	5	Delay Time settings – see figure A
	6	
	7	
	8	Not used
SW4	1	Not used
	2	
	3	
	4	Not used
	5	Not used
	6	
	7	Not used
	8	Relay 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 activates immediately)
FOR LOCATION OF SWITCH SEE FIGURE H.

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

FIGURE B – 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

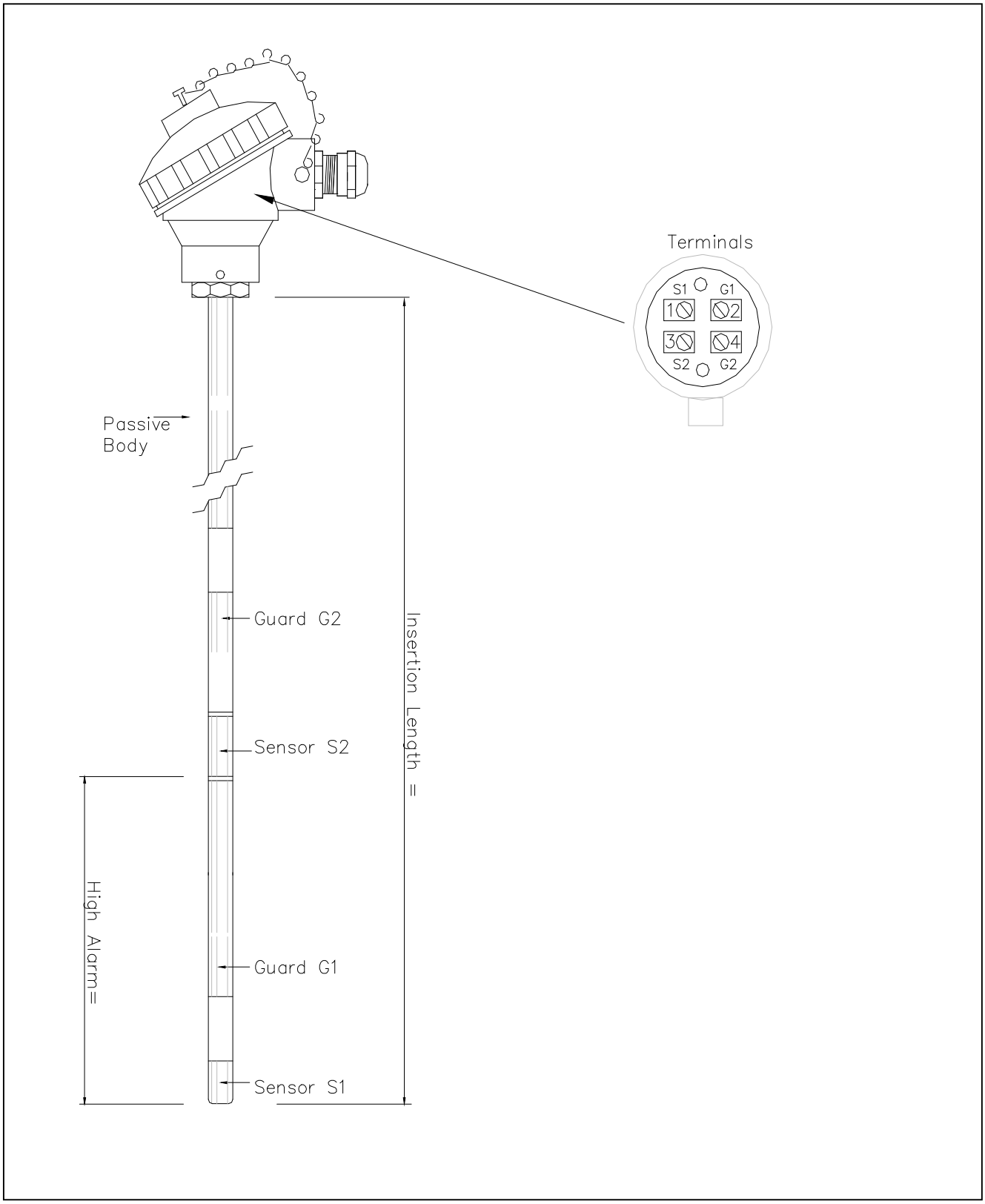
Adjust by means of SW2: 1-4 for location see Fig. H

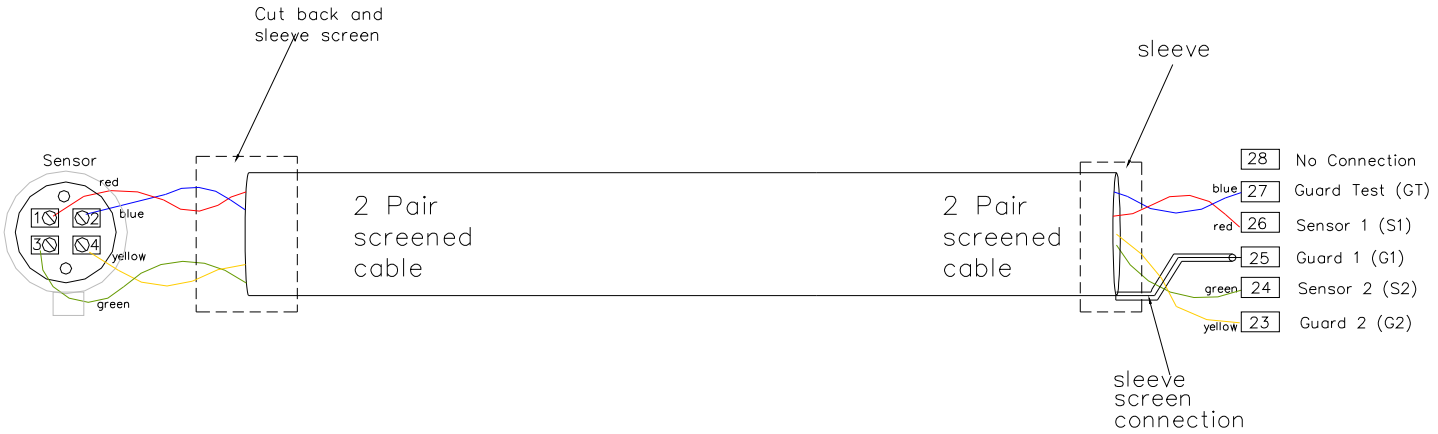
Sensitivity required is in the range 5K –20K for most applications. For less dense or lighter foam increase the sensitivity to a higher value.

DO NOT SET SENSITIVITY HIGHER THEN REQUIRED FOR THE APPLICATION

Power up after adjusting switches

FIGURE C - Dual-Foam Sensor Configuration & Terminals





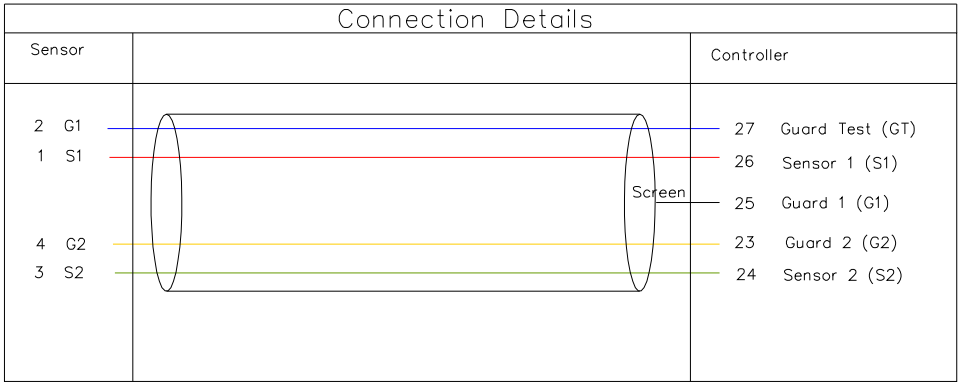


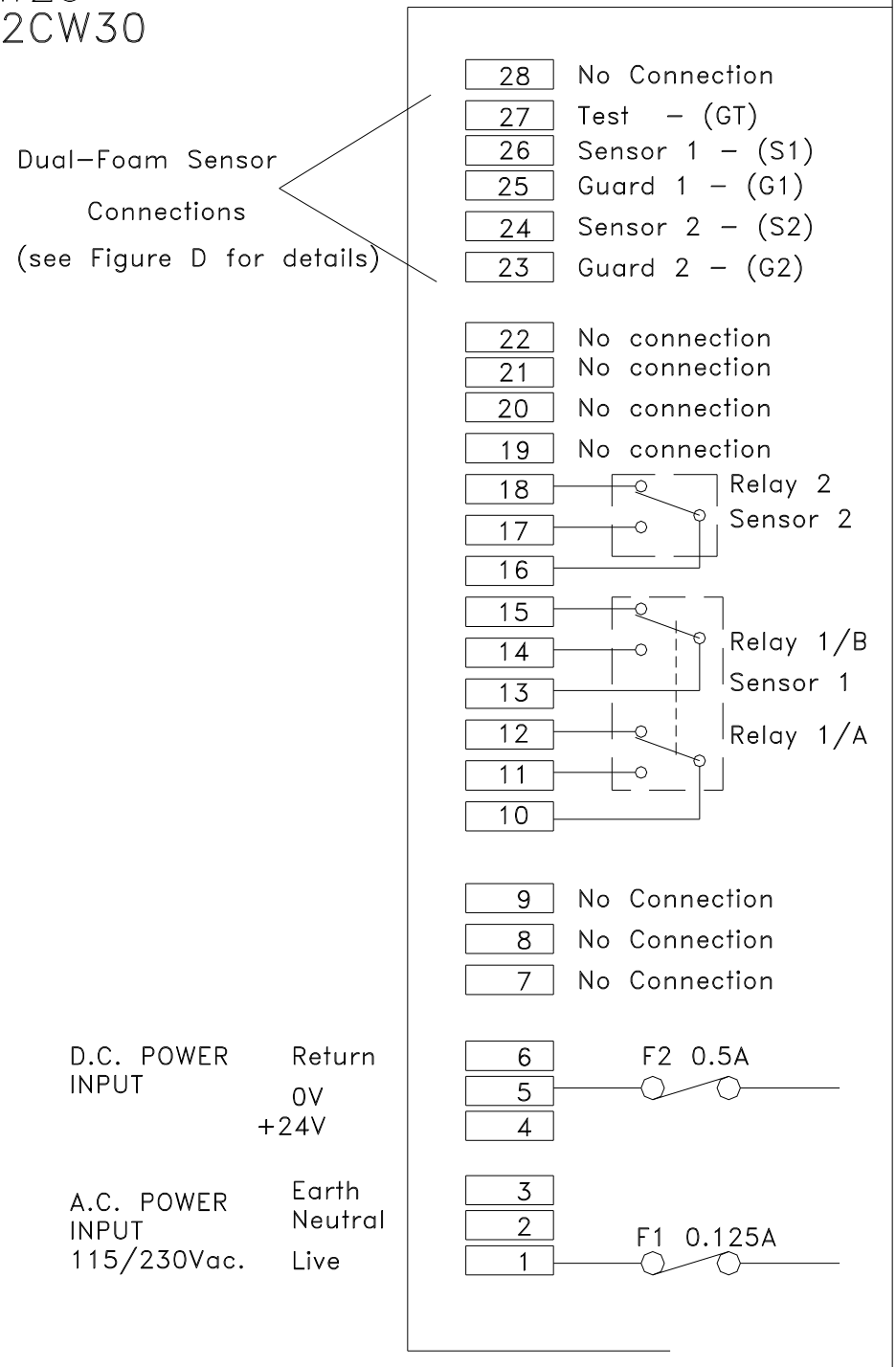
Figure D
Cabling Schematic FPC2CW20/30 to DualFoam Sensor

FIGURE E - CONNECTIONS TO DUAL-FOAM CONTROLLER

TYPE FPC2CW20 & 30

TERMINAL	DESCRIPTION	
1	Line Supply – LIVE (115/230 V a.c.)	
2	Line Return – NEUTRAL	
3	Supply Ground / EARTH	
4	D.C. Supply +24 V	
5	D.C. Supply 0 V	
6	Return	
7	No Connection	
8	No Connection	
9	No Connection	
10	Relay 1/A Common.	-Sensor 1
11	Relay 1/A Normally Open	-Sensor 1
12	Relay 1/A Normally Closed	-Sensor 1
13	Relay 1/B Common	-Sensor 1
14	Relay 1/B Normally Open	-Sensor 1
15	Relay 1/B Normally Closed	-Sensor 1
16	Relay 2 Common.	-Sensor 2
17	Relay 2 Normally Open	-Sensor 2
18	Relay 2 Normally Closed	-Sensor 2
19	No connection	
20	No connection	
21	No connection	
22	No connection	
23	Sensor - G2	
24	Sensor - S2	
25	Sensor - G1	
26	Sensor - S1	
27	Sensor – GT	
28	No Connection	

Figure F Connections – Dual Foam
FPC2CW20 & FPC2CW30



see figure M for more details on supply connections.

Relay Contacts: 240 Va.c. / 30 Vd.c. 2 amps Rating

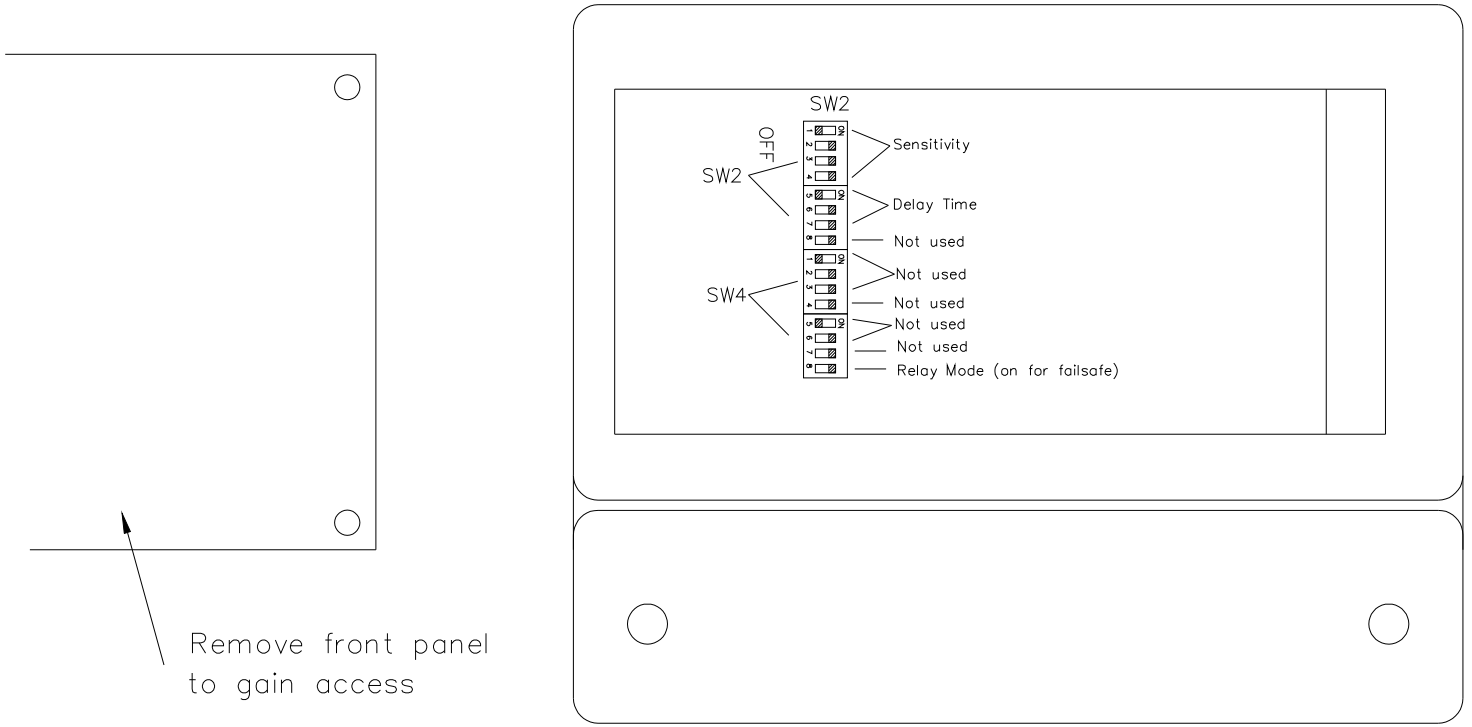
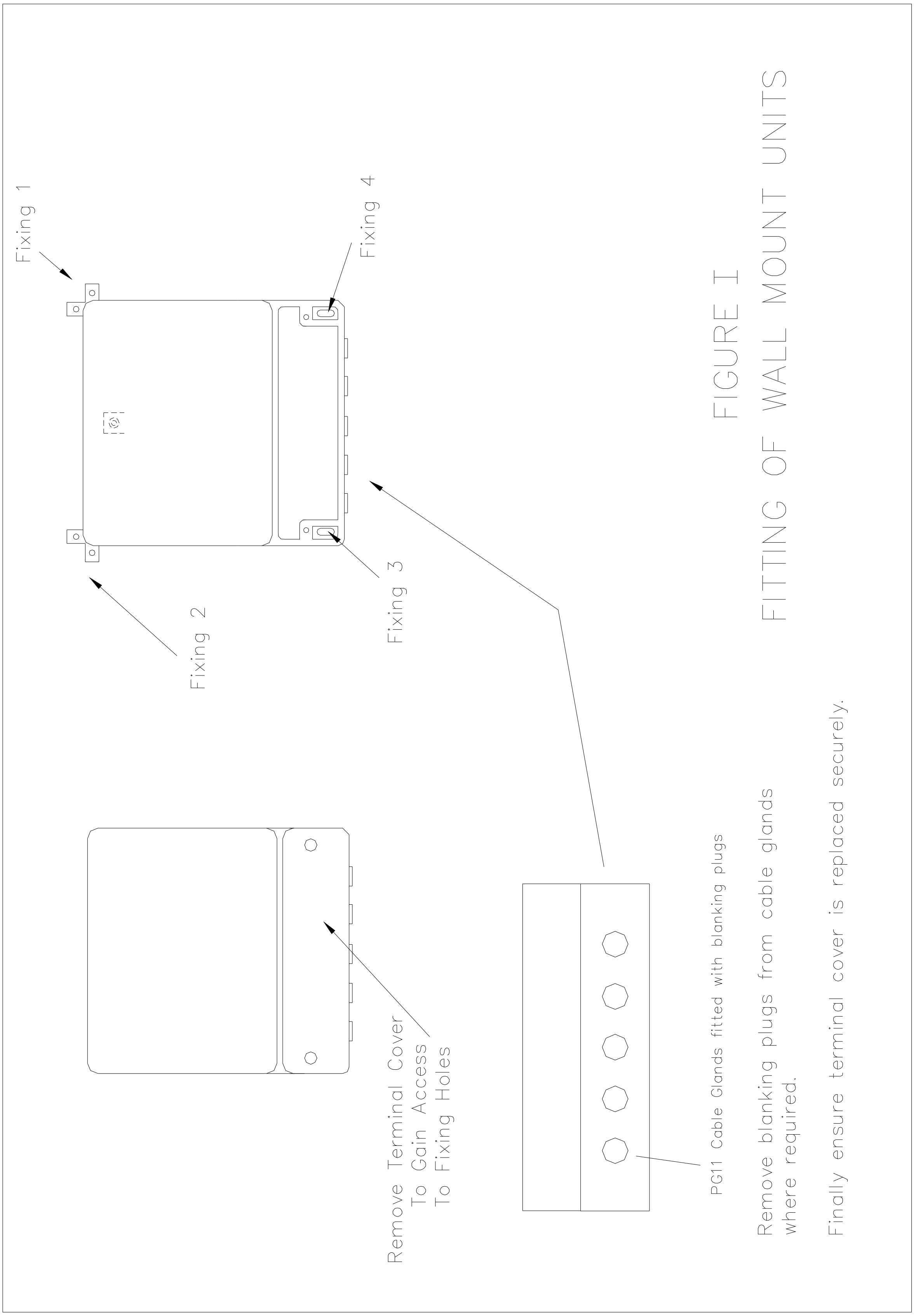
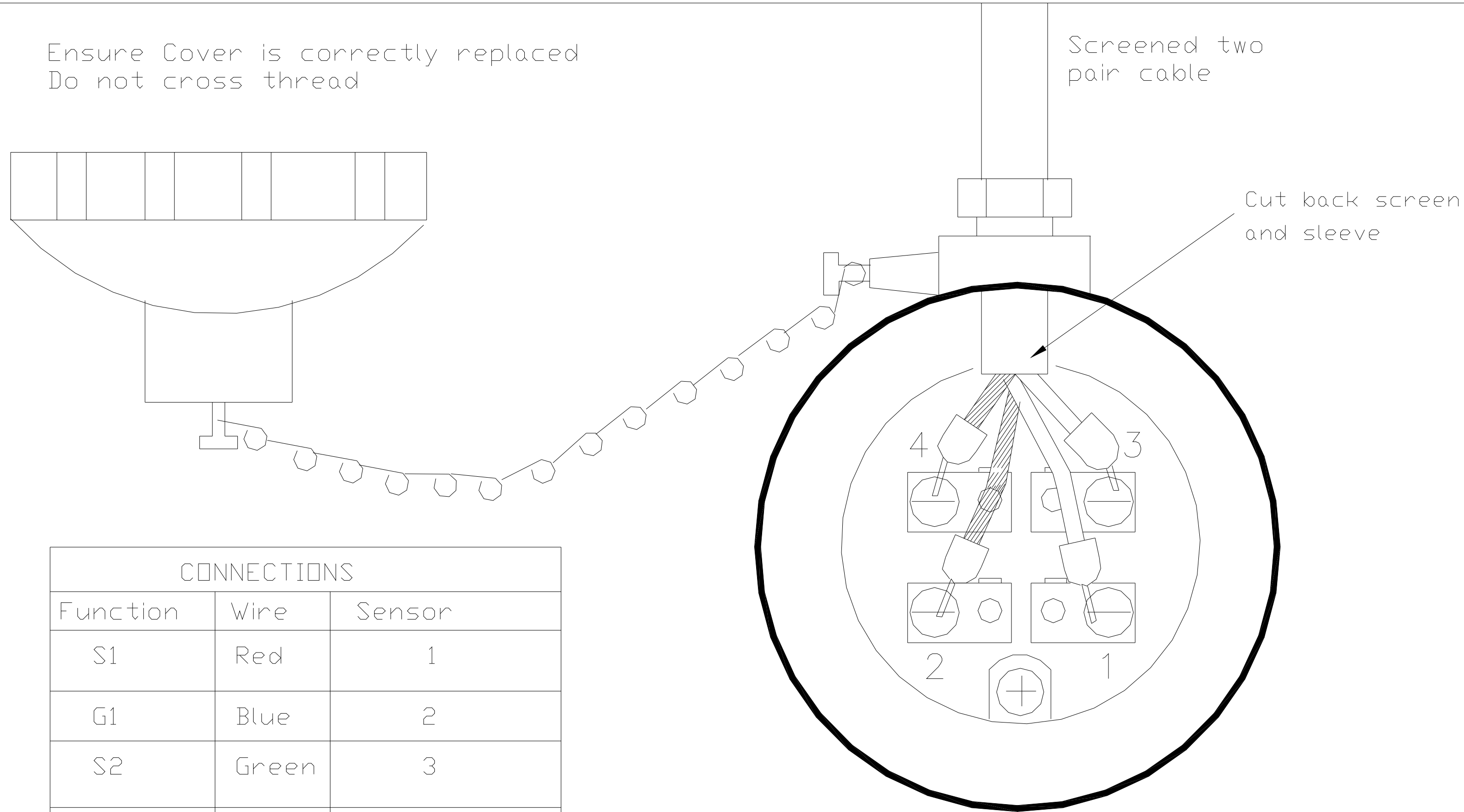


FIGURE H ADJUSTMENTS

WARNING: ISOLATE POWER BEFORE MAKING ADJUSTMENTS


Fixing 1
Fixing 2
Fixing 3
Fixing 4
FIGURE I
FITTING OF WALL MOUNT UNITS
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.

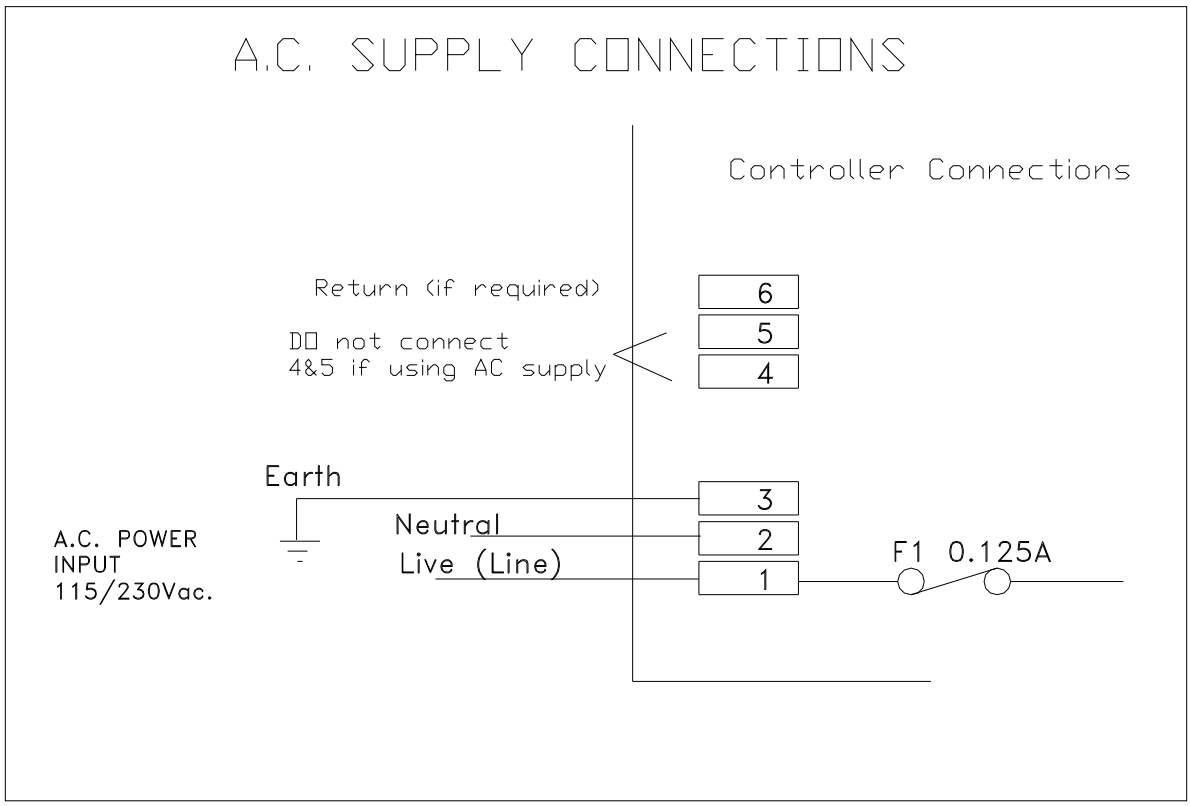


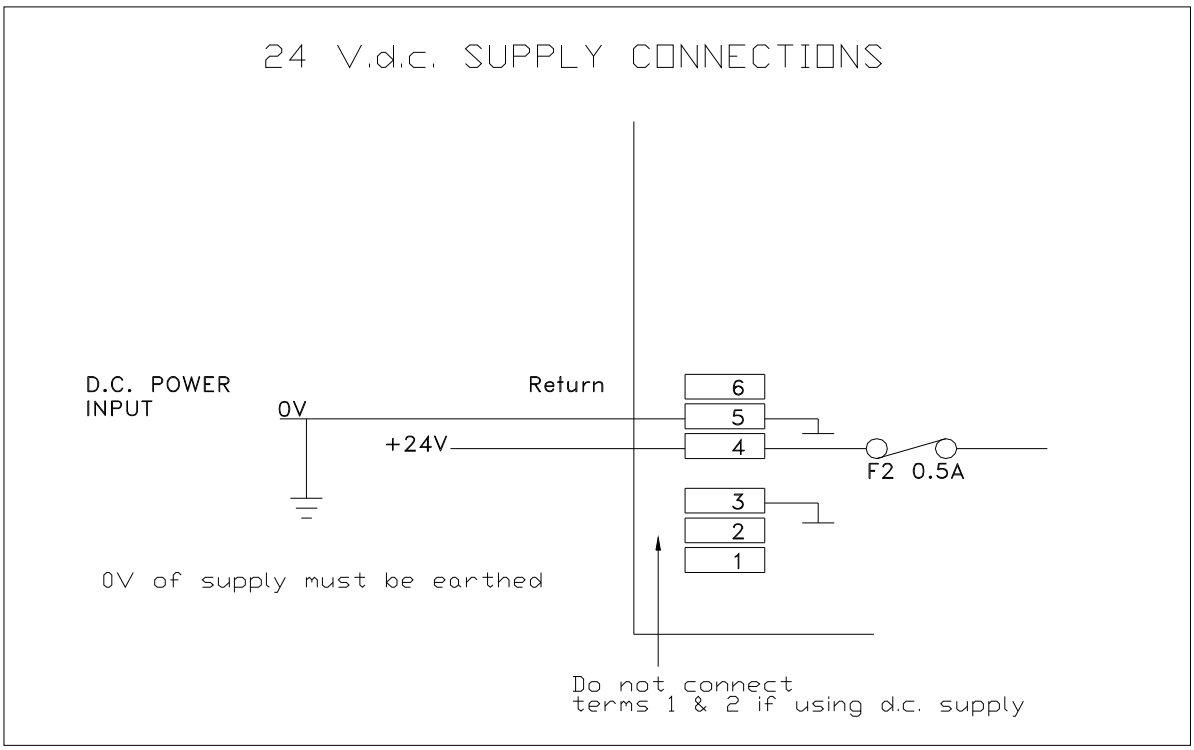
CONNECTIONS		
Function	Wire	Sensor
S1	Red	1
G1	Blue	2
S2	Green	3
G2	Yellow	4

CAUTION: Ensure screen is isolated from earth and all metal parts. Use sleeving.

FIGURE K DUAL-FOAM 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 3.3 for details.