SURESENSE

FPCLCR20 / 30 Rack Mounting

FPCLCW20 / 30 Wall Mounting

Foam/Liquid Controllers and Sensors

INSTALLATION AND OPERATION MANUAL

Hycontrol Ltd
Larchwood House, Orchard Street. Redditch, Worcestershire, B98 7DP, U.K.
Tel: +44 (0)1527 406800 Fax: +44 (0)1527 406810
www.hycontrol.com V3.3

CONTENTS

LIST OF FIGURES

SPECIFICATIONS

Power Supply :	FPCLCR20 & FPCLCW20 - 115 Vac / 24 Vdc (0.3A) FPCLCR30 & FPCLCW30 - 230 Vac / 24 Vdc (0.3A) (can be changed by voltage selector switch)	
Outputs :	Relay 1 (Foam) -Volt-free c/o contacts, 240 Vac 30 Vdc 2 A max. Relay 2 (Liquid) -Volt-free c/o contacts, 240 Vac 30 Vdc 2 A max Analogue - 4-20 ma. (active)	
Indicators :	Power indicator – Green : always on Sense indicator – Red : Pulses when foam is first detected. On after delay time. Liquid indicator -Yellow : Pulses when liquid first detected. On after delay time.	
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) Liquid Delay Time: 0 – 300 seconds (set by 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 :	FPCLCR20/30:	3U x 8HP 19" Eurocard. 100 x 160 mm Connections :DIN 41612 Type D Connector Mating Connector Harting type 0904 232 6823
	FPCLCW20/30:	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, 0.5 sq. mm - 150 metres max (see fig Q) e.g. Belden 8760	

1. INTRODUCTION

The Hycontrol FPCLCR & FPCLCW are advanced Foam Controllers with the unique ability to sense liquid or foam and to respond differently in each case. They are often used to control foam and give a high liquid level alarm if the sensor is submerged in liquid. They are designed to be used with a Hycontrol 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 FPCLCR is a 19" rack mounting unit and the FPCLCW is a wall mounting IP65 version.

This is part of a range of products manufactured by Hycontrol for the 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 at the sensor.

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 liquid, foam and spurious events such as splashing. It can signal to a process controller whether foam or liquid has been detected. Various output interfaces are available including volt-free contacts (relay), digital output and 4-20 mA.

When foam is first detected the red light will flash and after the set foam delay time, it will switch on continuously and then give an output to indicate that foam is detected. When liquid is first detected the yellow light will flash and after the set delay time, it will switch on continuously and then give an output to indicate that liquid is detected. Once the liquid output is activated the foam output will be cleared.

The Liquid/Foam controllers will always register foam first even if the end of the probe is under the liquid. In this case the foam and liquid lights will flash together. After the liquid delay time the liquid output will be set and the foam output cleared.

3. INSTALLATION

3.1 Installing the Sensor

The Hycontrol Foam 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 3.4 below.

3.2 Installing FPCLCR20 / 30 Rack Mount Controller

The FPCLCR20 & 30 are 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.

The required supply voltage is 110Vac for the FPCLCR20 and 240Vac for the FPCLCR30. Alternatively both units can be powered from 24 Vdc 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)
See section 4 for notes on commissioning and configuration settings.

3.3 Installing the FPCLCW20 /30 Wall Mount Controller

The FPCLCW20 & 30 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 required supply voltage is 110Vac for the FPCLCW20 and 240Vac for the FPCLCW30. Alternatively both units can be powered from 24 Vdc 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)

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. For industrial sensors it is essential to use screened cable with the screen connected to the guard as shown in fig. F & 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. For laboratory type sensors (with Lemo connectors) and short cable runs (<10 m) an unscreened twisted pair cable can be used as shown in fig. D. It is essential that the sensor 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 4 wires to operate correctly, as follows: Sense, Guard, Test and Return. (The return is normally via the supply 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 (<10m) 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 FPCLCW. 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.

If an industrial Sensor is being used the cable should be wired into the terminal block in the head. 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)

If a laboratory type Sensor 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 Fig.s K & L)

3.5 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 : Foam Control Output

Volt-free contacts - change-over type with 2 sets of contacts which operate together. For use as the controller output when foam is detected with dosing (delay & shot) function, or can be set 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.

Relay 2 : Liquid Detector Output

Volt-free contacts – operate when liquid is detected after a set delay time.
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.
When relay 2 operates Relay 1 resets.

Analogue: 4-20 mA
Output

The negative side is connected to the instrument ground and is not isolated. The analogue output responds to both liquid and foam. This is an active output and should only be wired to a passive input.
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 Hycontrol, 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.

All controllers are set up in the factory to 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 pulse, and after the set delay time the red light should switch on. The yellow light will then flash and after the liquid delay time will turn full on. Check that the information 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 FPCLCR20/30 or figure H for FPCLCW20/30. 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 foam and liquid 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.

Note that the red led indicates foam and pulses when foam is first detected. The yellow led indicates liquid and also pulses when liquid is first detected. The liquid trigger level is set relative to the foam trigger level. If liquid is being detected too readily, the number should be increased to widen the margin between foam and liquid detection. If the liquid is not being detected the number should be reduced.

5. OPERATION OF FOAM AND LIQUID CONTROLLERS

5.1 Operation

The FPCLCW20/30 & FPCLCR20/30 are unique devices which are designed for foam control but can also measure and indicate liquid if the sensor becomes flooded. The overall sensitivity is set up in relation to the foam which is being controlled. The liquid sensitivity is calculated automatically from the setting for foam. The system will detect foam or liquid but not both at the same time. If the end of the sensor is submerged it will not be able to detect foam.

Indicators:

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

'Sense' - Red- Foam Led
This pulses slowly when the foam is first sensed and continues to pulse for the foam delay time. This is designed to prevent splashing and intermittent effects which can cause false triggers. After the delay time the red led stops pulsing and is on continuously and the foam relay (relay1) activates. If the dosing function ("delay and shot") is on the red led will be continuous when the relay is on and pulse when the relay is off.
During overrun the red led flashes faster. (see 5.7)

'Action' – Yellow – Liquid Led
This pulses when liquid is first sensed and after the delay time will switch on continuously. The liquid relay (relay2) will operate after the delay time and then stay on. There is no dosing function for the liquid measurement.

If foam is sensed and then liquid is sensed the yellow led will pulse for the delay time. During this time if the liquid stops being sensed the controller will stay in the foam mode. Liquid must be measured continuously for the liquid delay time for the controller to activate the liquid output.

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. Closing 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 or liquid 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 Figure G. 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.
While the delay time is in progress the red led will flash.

5.4 Shot Time

The shot time is the time for which the foam relay is operated. 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 so in can be 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 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 shot time terminates.

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.

When the shot is active the red foam led (sense) will be on continuously. Between shots the red led will pulse. The shot time has no effect on the liquid sensing.

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 (FPCLCR) and figure H (FPCLCW). 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.

The sensitivity of the controller to liquid is calculated relative to the foam sensitivity. This can be adjusted. See figure P.

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 Foam Density Adjustment

The foam density setting is used by the controller to discriminate between foam and liquid. The normal setting can be used for most types of foam. However if the foam density is very high then sometimes liquid may not always be sensed correctly. In this case the density setting can be adjusted. The adjustment range is from 20 to 55 x the foam reading. If liquid is sensed when there is only foam present the ratio should be increased. The foam density is set by internal dil switches as shown in figures G&H. (sw4:6-8). See section 6 for more information on how the liquid is sensed. See figure P for the settings.

5.9 Liquid Delay Time

The controller switches to liquid mode after a preset period of time if the sensor is submerged in liquid. If the liquid delay factor switch is set to normal then the liquid delay is equal to the foam delay. If the liquid delay switch is set to long, then the delay is 10x the foam delay.

i.e. Liquid delay factor off: Liquid delay = Foam delay

Liquid delay factor on: Liquid delay = Foam delay x10.

The switch is sw2:8 as shown in figures G&H. See section 6 for advise on how to set this.
The default setting is off with a foam delay of 4 seconds, which gives a liquid delay of 4 seconds.

5.10 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. The output will also respond to liquid. (See section 5.13 for response to liquid). The 4-20 range is used as follows:

4-18 mA - Foam
20 mA - Liquid

The range up to 18mA indicates that foam is being measured, once liquid is sensed the output will switch to 20mA. The range between 18 – 20mA is not used.

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 7.00mA or 10mA depending on the output range factor. So to describe how it works, when no foam is present the output will be at 4.0mA when foam builds up and reaches the sensor the output will rise above 4.0mA and continue rises as the foam builds. At 7.0mA 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 10mA 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. Please note that the 4-20mA signal is not isolated.

5.11 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
Foam Density	- internal d.i.l switch – 3 pole
Liquid delay	- internal d.i.l switch – 1 pole
Output range	- internal d.i.l switch – 1 pole
Manual Switch	- external switch , if fitted

These are listed 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 adjust the FPCLCR20 / 30 remove it from the rack. The location of the switches is shown in figure G.

In the case of the FPCLCW20 / 30 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.

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	Liquid Delay Factor (off=1, on =10)
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 – (off – default; on – high)
	6	Foam density setting: see figure P
	7	
	8	

5.12 How Liquid and Foam are Discriminated.

The FPCLCW and FPCLCR controllers are designed for the control of foam in conditions where liquid level may vary significantly and so flood the sensor. The controller can be used to carry out different functions depending on whether foam or liquid is sensed. This can be used to ensure that antifoam is not wasted and as a high level liquid alarm. The controller will indicate that the sensor is in foam or liquid. If the sensor is flooded with liquid it cannot sense foam.

The liquid content of foam is almost always less than 10% and is more typically ~1%. This means that the response from the sensor when liquid is sensed is very much larger than that for foam. This fact is used to discriminate between foam and liquid at the sensor.

The sensitivity of the unit is set for the measurement of foam. The level for liquid is calculated internally from this. If the foam is very dense, for example, in the case of sludge, there may be less difference than expected between liquid and foam. In extreme cases liquid may not be sensed correctly, so a special setting is provided to adjust this. This is set by SW2:6-8 and should be changed if foam is sensed correctly but liquid is not sensed correctly. (Normally SW2:6-8 should be set to 30x) See figures G&H for the position of this switch.

The controller has three modes of operation as follows:

1) Standby:	Relay1 =off,	Relay2 = off.
2) Foam :	Relay1 =Shot/delay function,	Relay2 = off.
3) Liquid:	Relay1 = off,	Relay2 = on,

An adjustable delay has to pass before the controller will change from one mode to another. This allows the unit to be set up for different conditions. The mode always changes to foam before it changes to liquid.

5.13 Liquid Settings

A delay time (liquid delay), in which liquid is sensed continually, is required before the controller switches to the liquid mode. During this delay time the yellow light flashes but the foam algorithm will continue to operate as normal. Once liquid is verified, the yellow light will be full on and the red foam light will be off.

The liquid delay time can be set to be the same as the foam delay or 10x longer. This is set by sw2:8, which is on for a long delay and off for a short delay. The liquid delay setting is a useful parameter to enable the controller to work correctly in a range of applications. In general if a high liquid level is a relatively unusual event then a long liquid delay time may be appropriate. Since the controller always moves through the foam mode to the liquid mode, a long liquid delay causes the foam control action before the liquid mode triggers. This is not a problem if the liquid mode only occurs occasionally. However this may not be helpful if a high liquid level occurs relatively frequently, since too much foam control action may take place. With a short liquid delay, the controller moves immediately from foam to liquid mode.

5.14 Reset from Liquid Mode

In liquid mode when the liquid level falls below the sensor, the controller will reset automatically to the standby mode. However the sensor has to be out of the liquid for two seconds for the mode to change. During this "off time" the yellow light flashes quickly. If no liquid is sensed during the off time then the mode will change to standby. If liquid is sensed again during the off time the mode will not change. This ensures a clean and positive response if the liquid surface is turbulent. The off delay cannot be changed by the user, but is fixed at 2 seconds.

5.15 Response of Analogue Output to Liquid

The 4-20mA output will respond to whatever is being measured by the sensor, whether this is foam or liquid. When no foam or liquid is present the output will be 4 mA. This will increase as material is sensed. If liquid is sensed, since the response is so much larger than that of foam, the output will be at full scale, i.e. 20mA. The response to foam will depend on the density and will increase as the foam level increases. A typical response will be as follows:

Material	Output (mA o/p factor = 0)	Output (mA o/p factor = 1)
Air	4	4
Foam (first touch)	6	8
Foam (trigger)	7	10
Foam (maximum)	18	18
Liquid	20	20

FIGURE A – TIME SETTINGS

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 responds immediately with the red led.)

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.

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

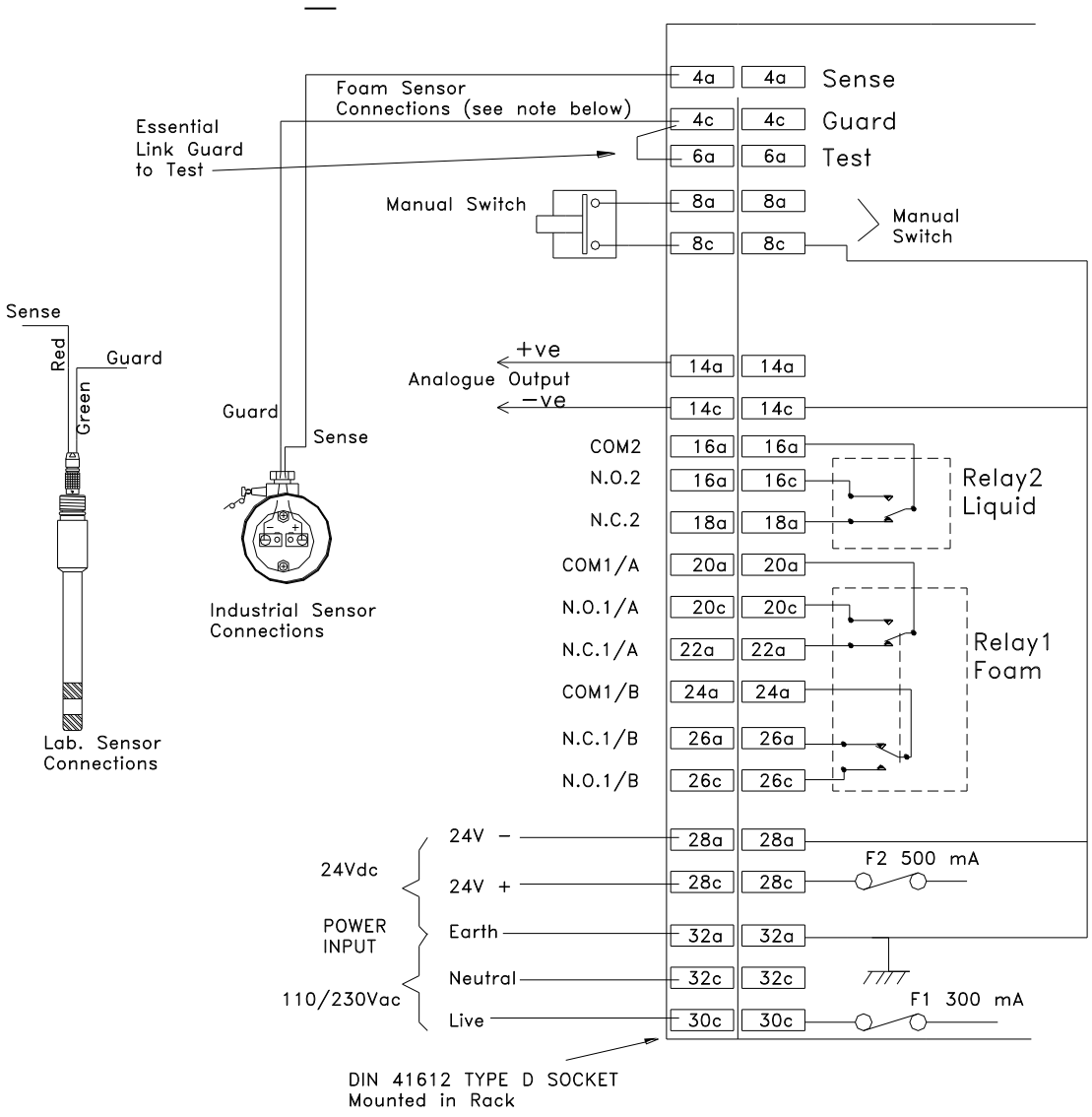
Power up after adjusting switches

FIGURE C - TERMINALS - RACK MOUNTING CONTROLLER FPCLCR20 / 30

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 / DIGITAL OUTPUT
8C	MANUAL SWITCH / DIGITAL OUTPUT RETURN
14a	ANALOGUE OUTPUT + (4-20mA)
14c	ANALOGUE OUTPUT - (ground)
16a	RELAY 2 (liquid) COMMON CONTACT
16c	RELAY 2 (liquid) NORMALLY OPEN CONTACT
18a	RELAY 2 (liquid) NORMALLY CLOSED CONTACT
20A	RELAY 1/A (foam) COMMON
20C	RELAY 1/A (foam) NORMALLY OPEN CONTACT
22A	RELAY 1/A (foam) NORMALLY CLOSED CONTACT
24A	RELAY 1/B (foam) COMMON
26A	RELAY 1/B (foam) NORMALLY CLOSED CONTACT
26C	RELAY 1B2 (foam) 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 fail safe mode is set to normally on, then the relay NO contacts will open when foam is present.

Figure D
Cabling Rack Mount Controller FPCLCR20 / 30



CABLE TO PROBE MUST BE SPECIFIED TYPE
If < 20M long unscreened twisted pair can be used with link as shown.
If > 20 M long connect use screened twist pair as shown in Figure Q

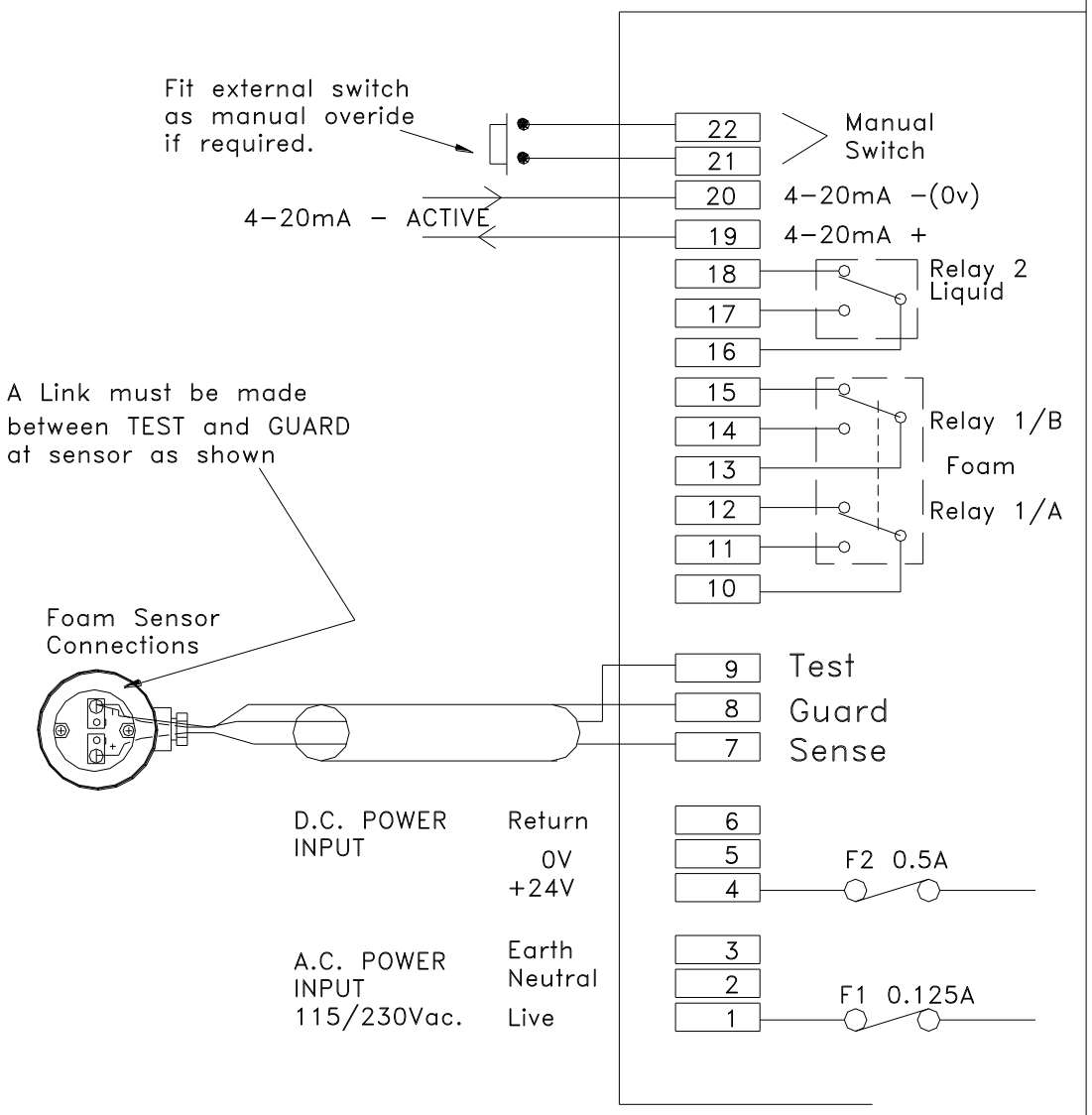
FIGURE E - CONNECTIONS TO WALL MOUNTING UNITS

FOAM CONTROLLER TYPE FPCLCW20/30

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) +ve (alternative to A.C. supply)
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 (Foam) Common.
11	Relay 1/A (Foam) Normally Open
12	Relay 1/A (Foam) Normally Closed
13	Relay 1/B (Foam) Common
14	Relay 1/B (Foam) Normally Open
15	Relay 1/B (Foam) Normally Closed
16	Relay 2 (Liquid) Common.
17	Relay 2 (Liquid) Normally Open
18	Relay 2 (Liquid) 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 FPCLCW20 & FPCLCW30



FPCLCW30 – USE 230 Vac
FPCLCW20 – USE 110 Vac

Use screened twist pair and connect as shown.
See Figure Q for more detailed information

Relay Contacts: 240 Va.c. / 30 Vd.c. 3 amps Rating

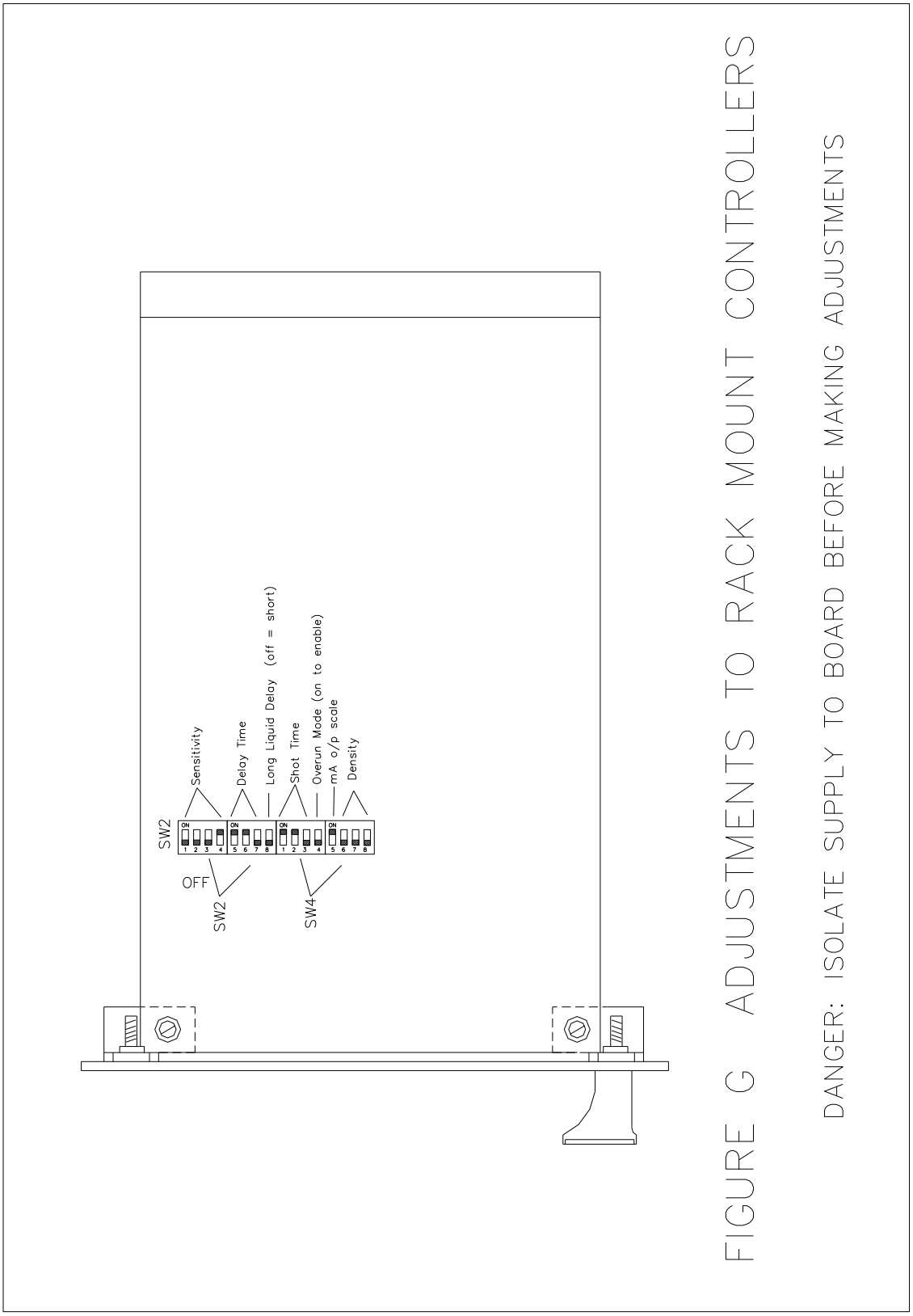


FIGURE G ADJUSTMENTS TO RACK MOUNT CONTROLLERS

DANGER: ISOLATE SUPPLY TO BOARD BEFORE MAKING ADJUSTMENTS

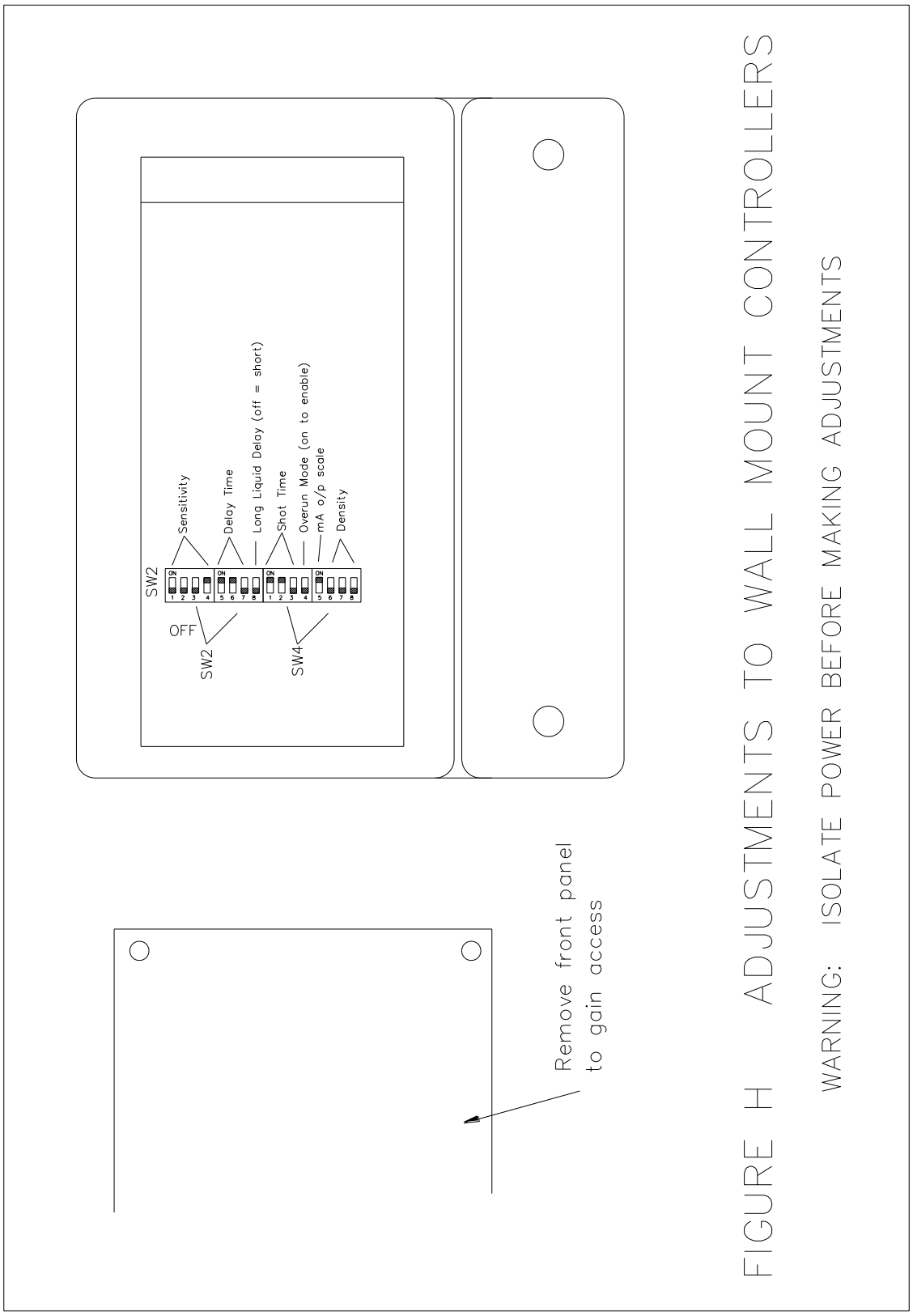


FIGURE H ADJUSTMENTS TO WALL MOUNT CONTROLLERS
WARNING: ISOLATE POWER BEFORE MAKING ADJUSTMENTS
Remove front panel to gain access
SW2
Sensitivity
Delay Time
Long Liquid Delay (off = short)
Shot Time
Overun Mode (on to enable)
mA o/p scale
Density
OFF
SW2
SW4

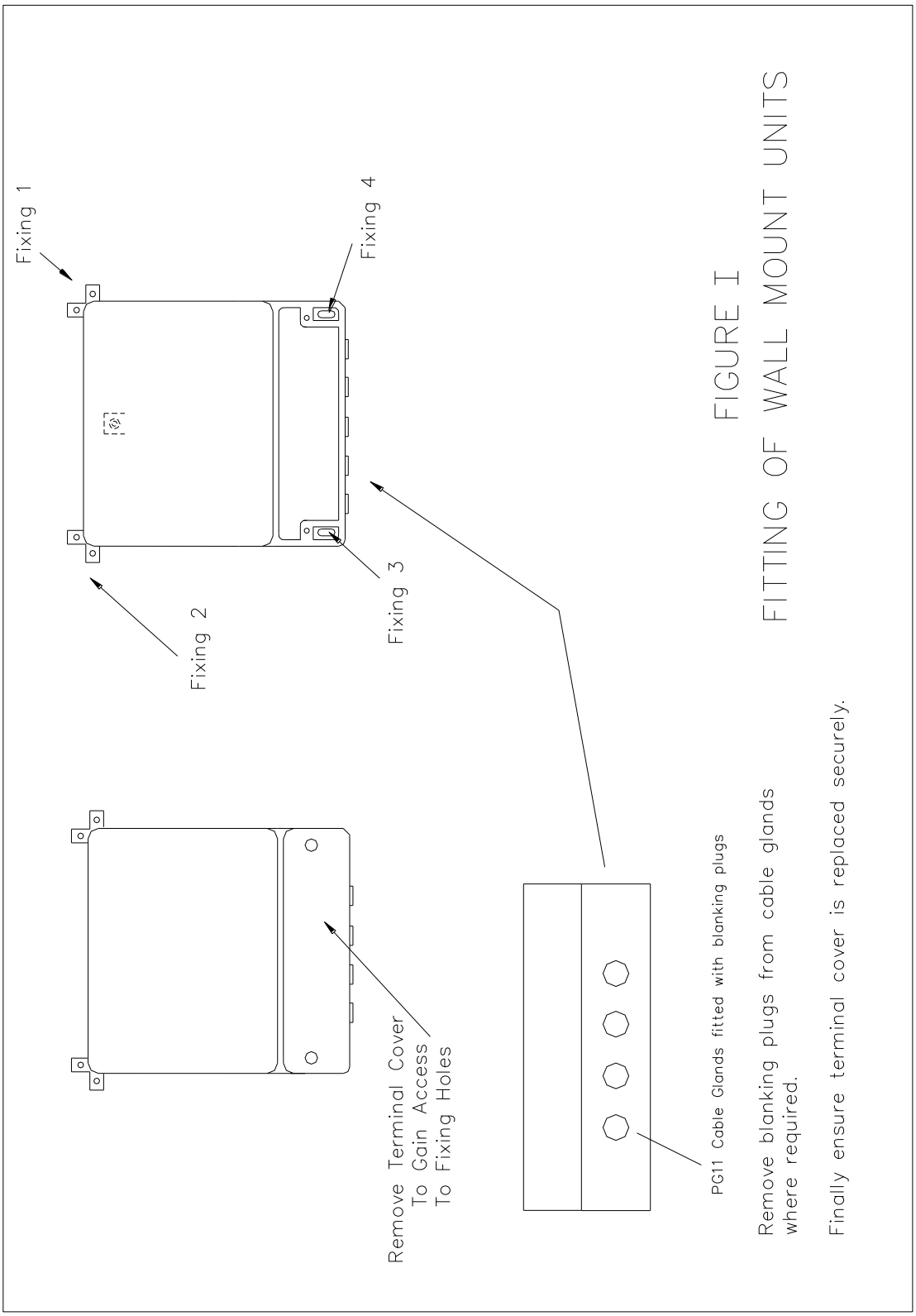
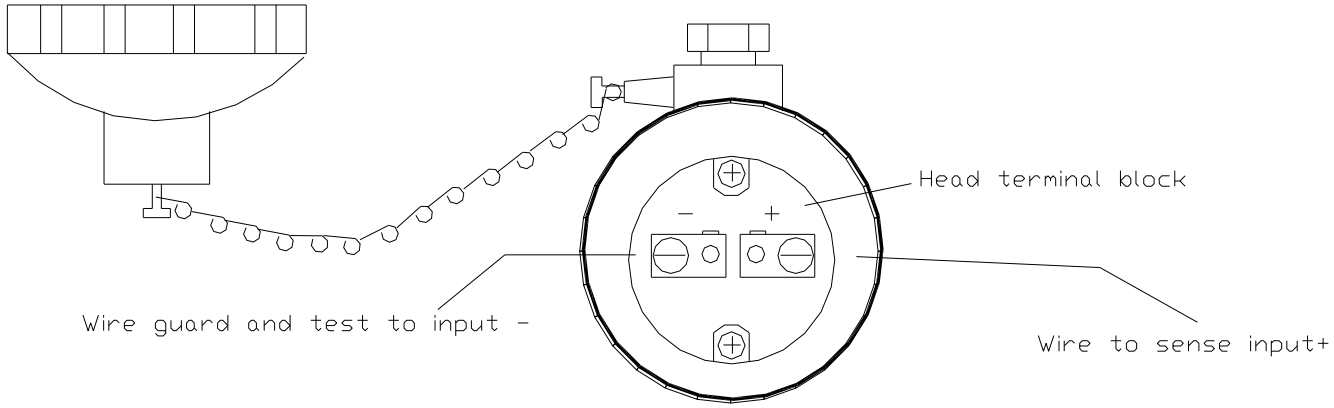


FIGURE I

FITTING OF WALL MOUNT UNITS

Ensure Cover is correctly replaced
Do not cross thread



Use screened twisted pair cable with screen connected to Guard at controller
Connect Test to black core and Sense to white core.
Connect Guard (screen) and Test to - terminal

FIGURE J INDUSTRIAL SENSOR CONNECTIONS

FIGURE P

FOAM DENSITY SETTING

	FOAM/LIQUID RATIO	SW4 SWITCH 6	SW4 SWITCH 7	SW4 SWITCH 8
MAX >	55:1	ON	ON	ON
	50:1	OFF	ON	ON
	45:1	ON	OFF	ON
	40:1	OFF	OFF	ON
	35:1	ON	ON	OFF
DEFAULT >	30:1	OFF	ON	OFF
	25:1	ON	OFF	OFF
MIN >	20:1	OFF	OFF	OFF

ADJUST BY MEANS OF SW4: 6-8 DIL SWITCH ON THE BOARD.
FOR LOCATION OF SWITCH SEE FIGURES G & H.

Note that the Foam Density Setting determines the way in which the instrument discriminates between liquid and foam.

If liquid is indicated when only foam is present then adjust the setting above to a larger ratio. i.e. move the setting towards the top of the table.

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

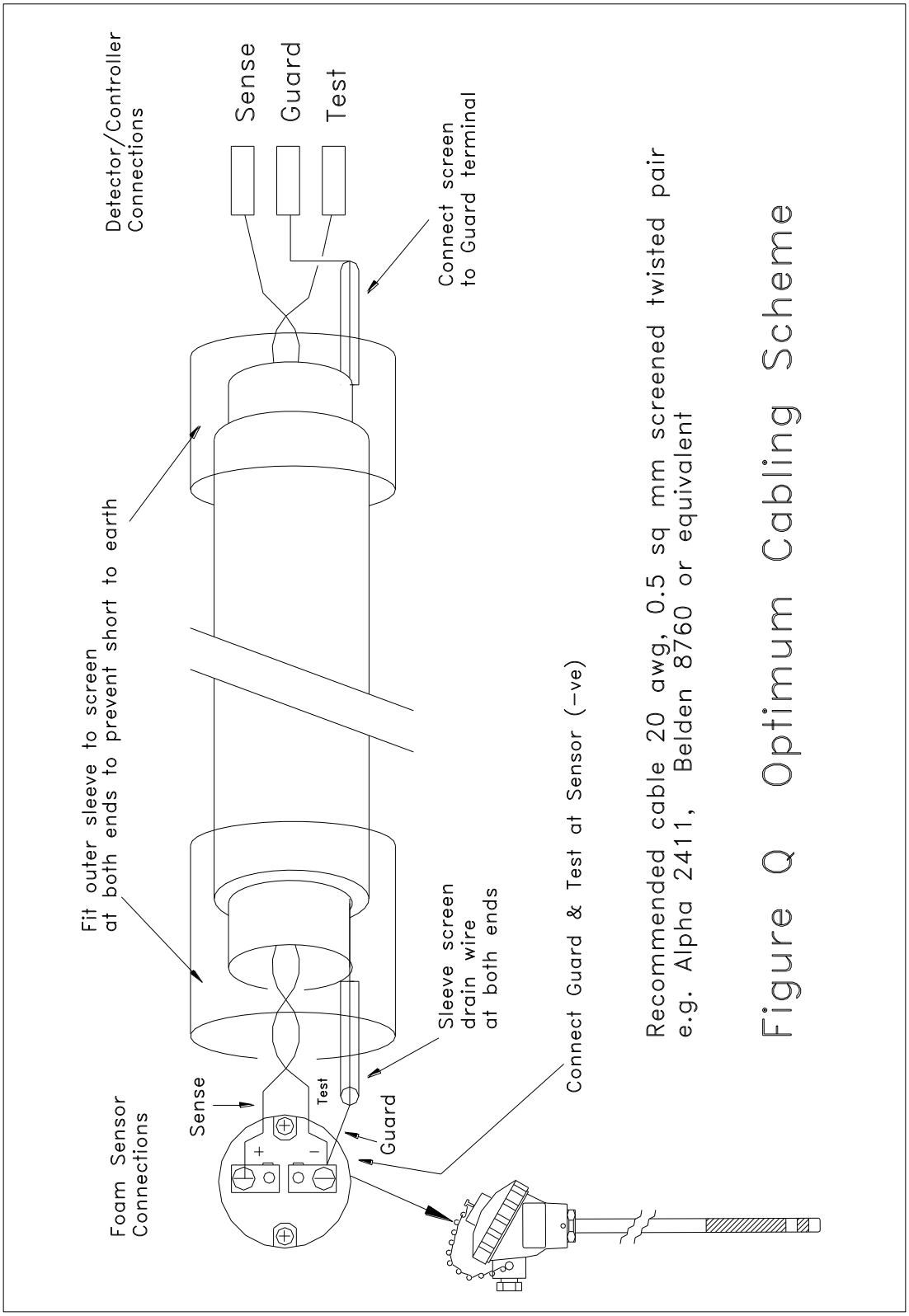


Figure Q Optimum Cabling Scheme