LC Series Control Units
Type 8 Installation and Hardware Configuration Manual

Date: 18.08.2011.
Issue: 4

STATUS SCIENTIFIC CONTROLS LTD.
Hermitage Lane Industrial Estate,
Kings Mill Way,
Mansfield,
Nottinghamshire.
NG18 5ER
England
Tel : 01623 651381
Fax : 01623 421063
Internet :www.status-scientific.com

The LC Controller Manuals

The LC Series Environmental Monitoring Systems have a range of manuals covering various aspects of their operation:

- **LC Controller Installation and Hardware Configuration Manual**

This manual covers all of the hardware aspects of the LC Controller. Each of the component parts of the system is discussed and hardware configuration is explained. Dimensional drawings are included.

- **LC Software Configuration and System Calibration Manual**

The operation of the LC Controller is discussed as well as the software configuration and calibration procedures.

End of Life Disposal

The LC Controller does not represent a waste hazard but must be disposed of in accordance with the European Waste Electrical and Electronic Equipment Directive (WEEE) 2002/96/EC.

This means that it should be disposed of responsibly in accordance with an approved collection and disposal scheme or alternatively returned to Status Scientific Controls Ltd for recycling or safe disposal.

Important
Status Scientific Controls strive to continually improve their products in line with customer's requirements and technological advancement. Status Scientific reserve the right to modify the design of the system at any time.

Due to continual improvement not all of the features described within this manual may be available on earlier models, contact Status for further details.

STATUS SCIENTIFIC CONTROLS

LC Controller System Installation and Hardware Configuration Manual

1 INTRODUCTION

The LC Series Control Units that provide facilities to monitor a wide variety of industry standard environmental and other sensors.

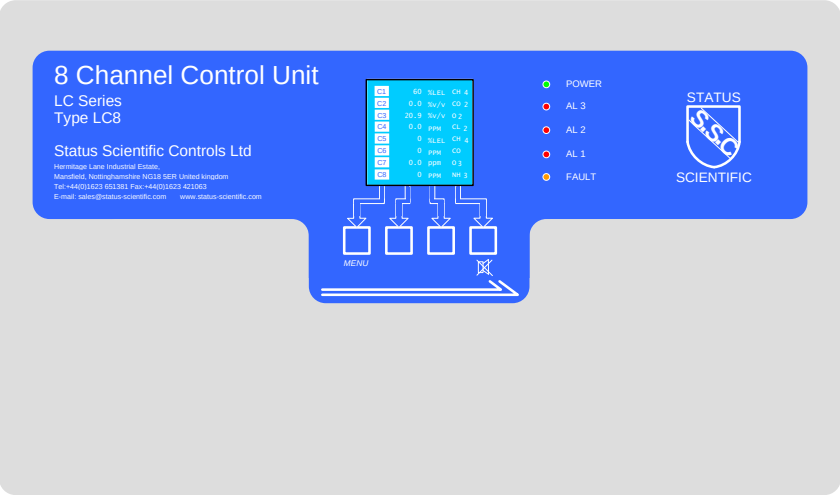
The LC8 provides up to 8 monitoring channels.

The LC range has been designed primarily for environmental monitoring. However, the versatility of the range extends its application to other aspects of industry where monitoring of remotely connected sensors is required. The specification allows the use of any sensor that can produce a voltage or current output within a specified range.

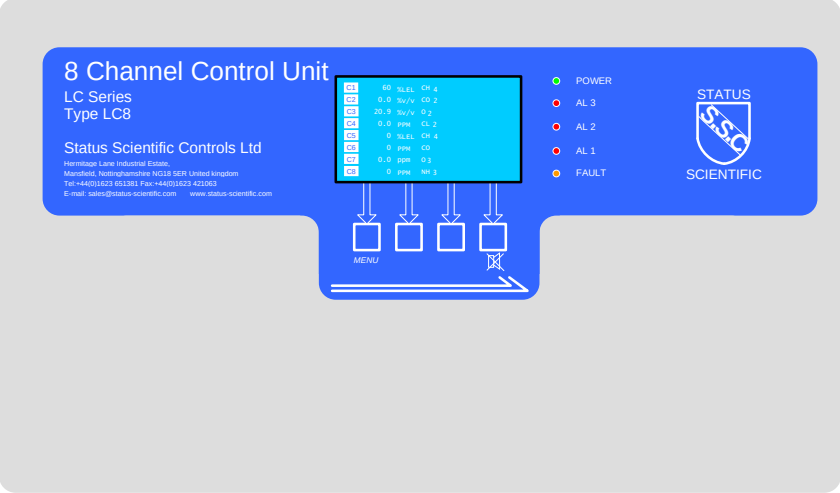
Care has been taken with the design of the MCU housings and internal chassis to facilitate ease of connection and wire termination. All on-site wiring to the system is via screw terminal connectors. The terminal cover has an internal label giving details of the external connections.

The LC Control Unit houses all of the components required to implement a sophisticated and reliable monitoring system (alarm relays etc).

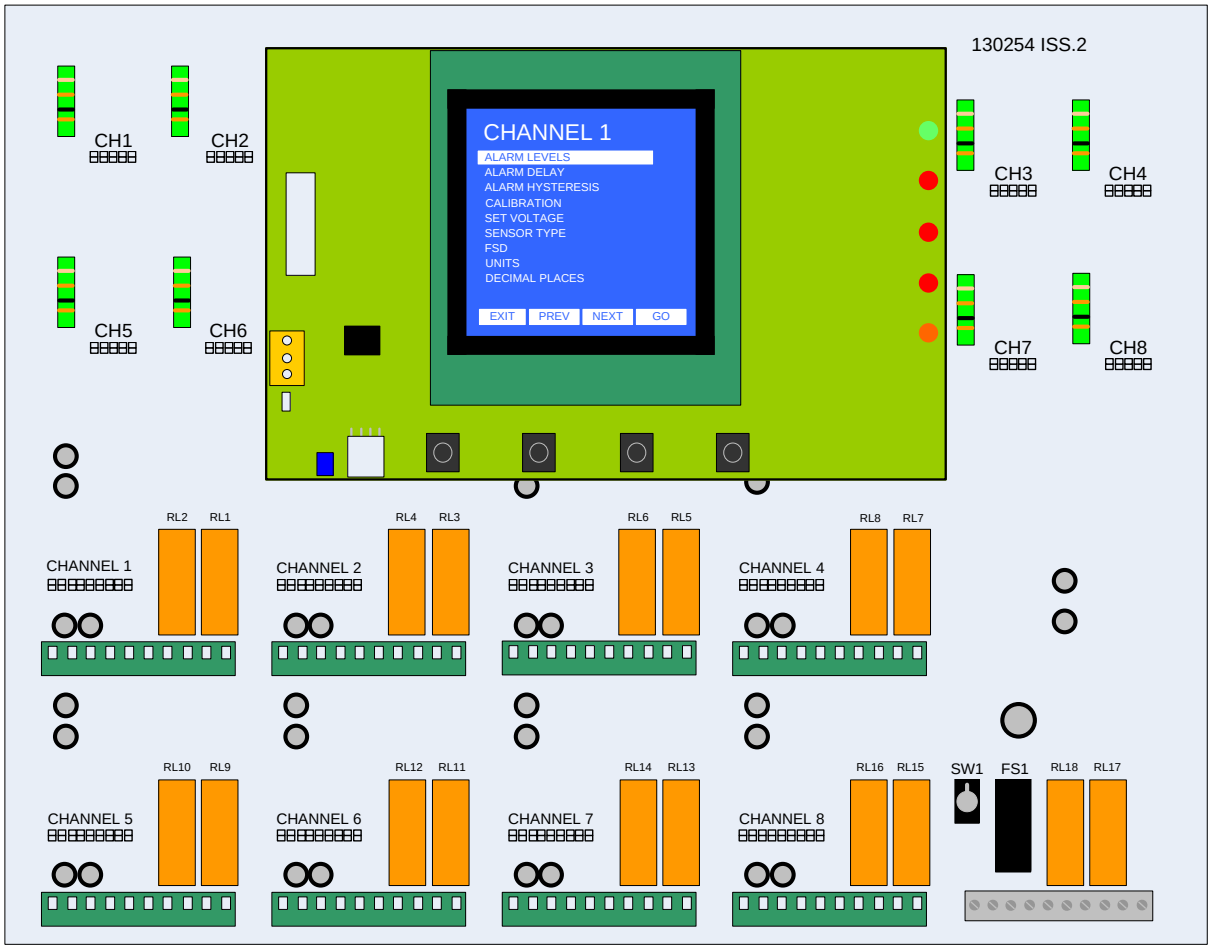
- **LC8 Control Unit – 128x128 graphics display.**



- **LC8 Control Unit – 240x128 graphics display.**



LC8 main PCB



The diagram above show a pictorial representation of the various module positions within the LC8 Control Units

There is no power supply within the LC8 PCB, the system is supplied with a nominal 24Vdc supply.

The microcontroller module and LCD display are mounted directly on the PCB via stand-off pillars and connects to the main PCB via a single flat ribbon cable.

1.1 Microcontroller Module

Situated within the LC Control Unit front panel is the Microcontroller Module. This module communicates with all Input channels connected to the system PCB.

The Microcontroller Module provides a user interface in the form of a back lit graphics display and a four button multifunction keypad.

Five LED indications are provided directly by the Microcontroller Module and these are visible via MCU front panel:

- Green LED for power.
- Red LED indication of Alarm level 3.
- Red LED indication of Alarm level 2
- Red LED indication of alarm level 1.
- Yellow LED indication of fault condition.

An Audible signal is also provided by a sounder mounted within Microcontroller module. This provides a local audible tone during alarm conditions.

The Microcontroller Module also provides the user with many configuration and interrogation facilities via the LCD and keypad. These facilities include:

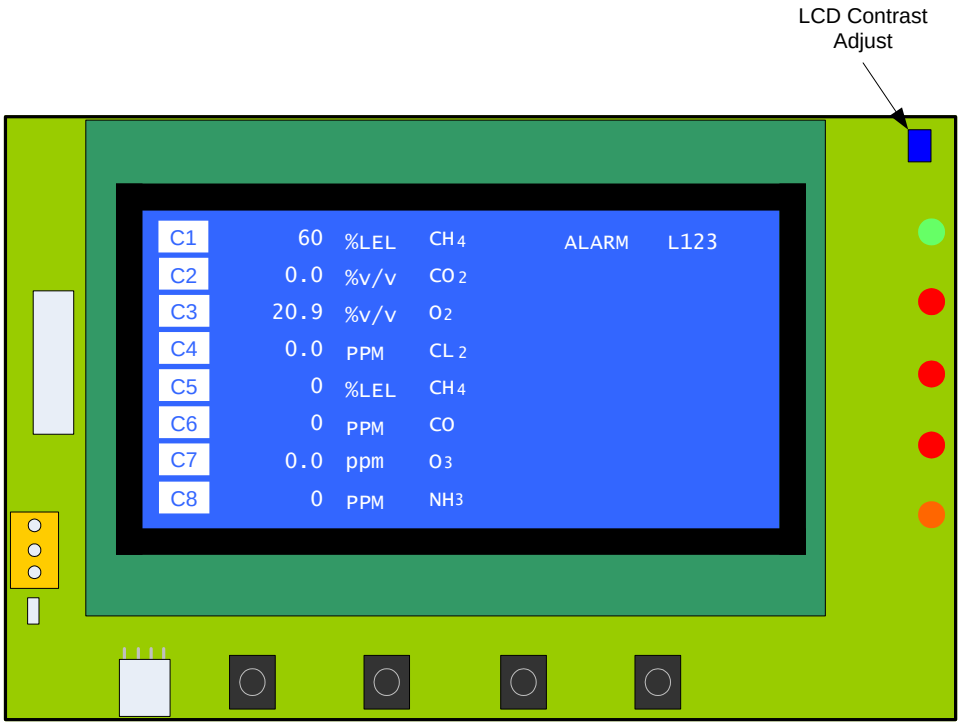
- Sensor Configuration.
  - Allows adjustment of Sensor type and range (e.g. Flammable 100%LEL).
- Calibration of the system.
  - This allows each channel to be calibrated independently. The sensor zero point and span can be set via this function.
  - Calibration of the retransmitted output for each channel.
  - Calibration of the channel power supply.
- Input Module Relay Configuration.
  - Each Input Module contains two relays for alarm levels 1 and 2. The alarm levels can be individually set to be either rising or falling.
  - Fault relay.
  - All relays can be configured normally energised or de-energised as required. Latching and non-latching functions can also be selected.

The microcontroller module contains all of the software required to communicate with up to 8 detecting channels. The software is common to all LC Series Control Units.

1.1.1 LCD contrast adjustment

128x128 Graphics Module

240x128 Graphics Module



1.2 I/O Circuitry

The input circuit is identical for all channels. Each channel monitors the status of an externally attached sensor and interfaces the signals that it receives to the microcontroller module.

The input module is designed to accommodate modules that supplies it status signal in any of the following formats:

(a) 2- wire Current source 4 – 20mA.
(b) 3-wire power plus Current source 4 – 20mA.
(c) 3-Wire Pellistor Bridge type.

The channel outputs are as follows.

The transmitted signal can be configured using jumpers to provide one of three output options:

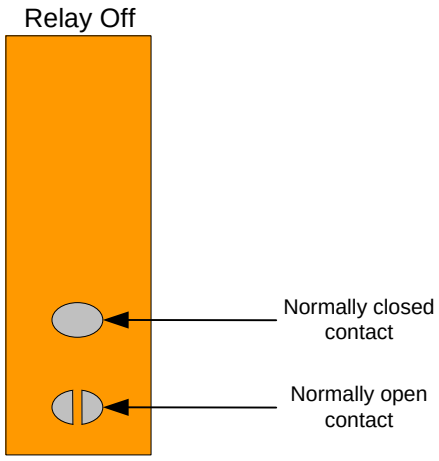
- 4 – 20mA Current Source proportional to the detected signal.
- 4 – 20mA Current Sink proportional to the detected signal.
- 0-5V Voltage Output proportional to the detected signal.

Situated on each Input Module are 2 single-pole change-over relays, each relay having contacts rated at 5A (240V AC). These relays operate at the alarm levels when enabled. Status Scientific Controls are able to implement modifications to the software to meet a customer's specific requirement. Contact Status for further information.

Note:

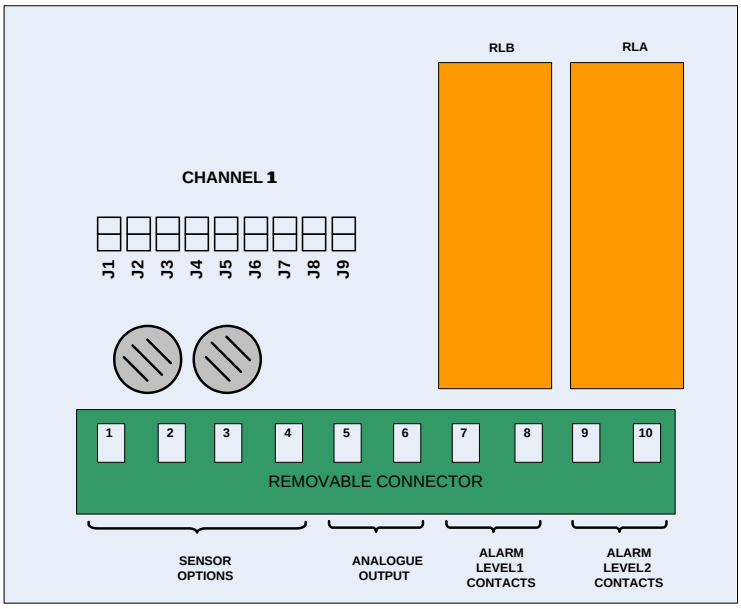
1) The relays are selected to be either normally open or normally closed by solder links on the underside of the PCB. The factory default settings are closed contacts when the power is off. This setting has been chosen such that the channel is in an alarm condition when the power fails.
2) The solder links are on the underside of the PCB to meet the low voltage directive and make sure that the user is not exposed to bare terminals that may be at high voltages when switching mains voltages.

There are two solder links under each relay. The link must be made for the desired operation. Only 1 of the links must be made. The factory default setting is shown below, the relay is energised for healthy condition, the contacts will close for an alarm condition and loss of power.

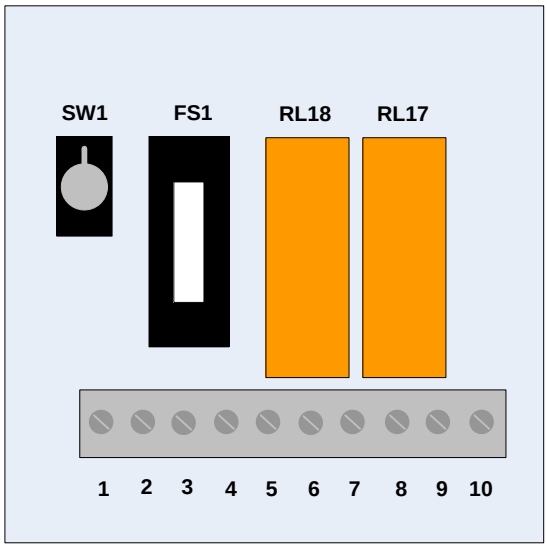


1.3 Field Connections

Located on the lower half of the main PCB is a number of screw connectors. This is used to provide connections for inputs and outputs for each channel:-



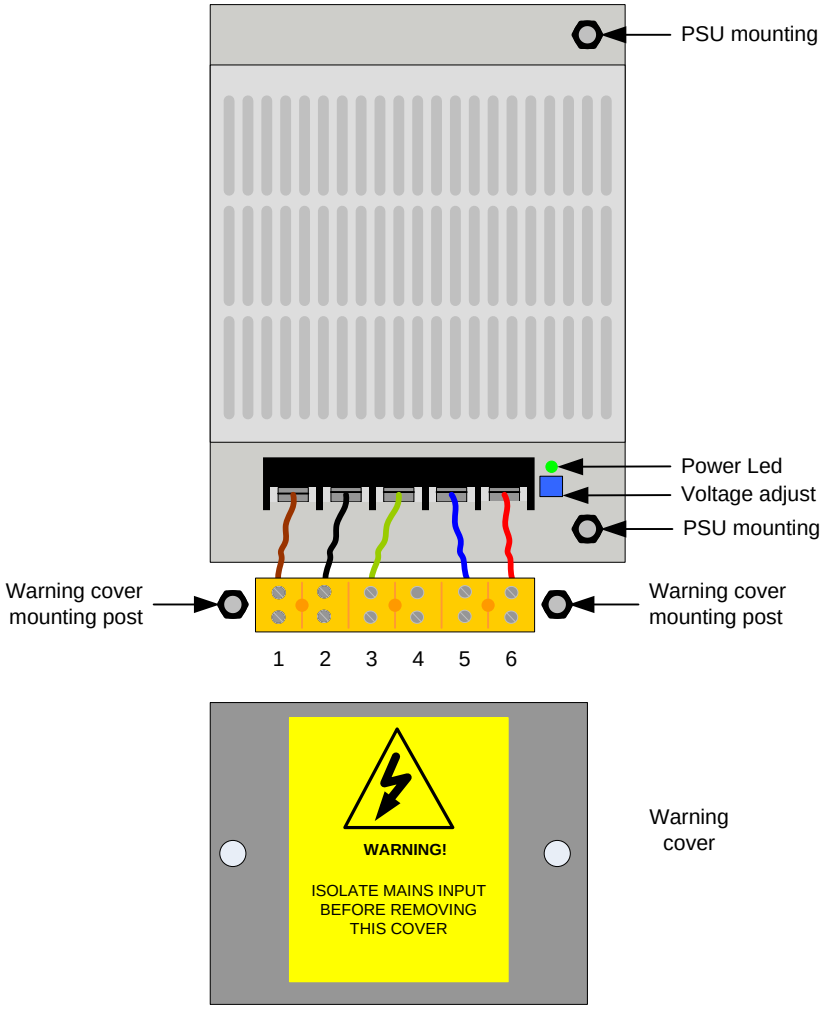
The Power input, common relays and sounder output are located at the lower RHS of the PCB. SW1 is used to isolate the main circuitry from both the incoming power supplies.



1	Fused power input +Ve 24Vdc.
2	Fused power input -Ve.
3	Battery power input +Ve 24Vdc, fused on PCB, FS1.
4	Battery power input -Ve.
5 & 6	Fault relay contacts, RL18.
7 & 8	Common alarm level 3 relay contacts, RL17.
9	Sounder +Ve 24Vdc.
10	Sounder -Ve supply.

1.4 Power Supply Module

The Power Supply is situated on the RHS of the main PCB within the enclosure and provides the power for the whole system. The power supply is a standard item and does not require any modifications regardless of the type and quantity of detector heads being used.



The warning cover must be removed to gain access to the terminal connections. The power supply connections are as follows:

1. Live 100-240V AC Mains supply input.
2. Neutral 100-240V AC Mains supply input.
3. Earth 100-240V AC Mains supply input.
4. No connection
5. –Ve DC supply output.
6. +Ve DC supply output.

2 MCU INSTALLATION

The MCU Control Units and FGD Gas Detectors are fully tested prior to delivery. However, after installation we strongly recommend that full system testing and commissioning be carried out. Status Scientific Controls Service personnel are best equipped to perform the relevant tests and commissioning and will be able to offer advice regarding installation faults.

WARNING Installation should be made in accordance with either British Standard BS EN60079-14 (which supersedes BS5345) "Electrical Apparatus for Explosive Gas Atmospheres", or in accordance with the relevant National or Local regulations.

CAUTION
The MCU Control Units and associated modules contain no user serviceable parts. Refer all servicing to qualified service personnel.

2.1 Siting the MCU

THE LC SERIES CONTROL UNITS MUST BE SITED IN A NON-HAZARDOUS LOCATION WHERE THERE IS NO RISK OF THE PRESENCE OF POTENTIALLY EXPLOSIVE GAS.

Either a 100-240VAC 50 Hz supply or a 24V DC supply can be used to power the control unit.

The site of installation should be chosen with regard to the following:

- This equipment should not be located near to known sources of heat.
- Operating personnel should be within convenient reach of the equipment and within audible distance of alarms.
- Maximum loop lengths of cable runs and cable inductance to resistance ratios must not exceed limits shown in the relevant loop diagrams (refer to section 3.2).
- Avoid mounting this equipment near potential sources of electrical interference e.g. motors, switch gear, radio transmitters etc.

Mounting details for the LC Controller enclosures are located within the Appendix (section 5).

2.2 System Wiring

All connections should be made according to the appropriate sensor or loop diagram for the configuration required. It is advised that 'Bootlace Ferrules' or 'flat blade crimps' be used for tidy and reliable connections of wires into the Control Unit and Detector Head connectors.

2.3 Power Supply Input

An isolating switch should be provided between the power source and the MCU control units to allow the supply to be easily disconnected. This should incorporate over current protection or a circuit breaker. Alternatively a fused supply would suffice.

2.3.1 A.C. Mains Connection

The LC8 is powered from a mains supply that is housed within the enclosure.
The power supply has a 6-way screw terminal connector assigned for the connection of an AC supply.

Pin 1 = Live input
Pin 2 = Neutral input
Pin 3 = Earth

Recommendation for mains input cable:
3-Core - Conductors having cross sectional area of 0.75mm^2 minimum (24/0.2).

The output from the mains power supply is

Pin 4 = N/C
Pin 5 = 0V DC
Pin 6 = +24V DC

2.3.2 DC Voltage Connection

The main PCB has two DC inputs.

Internal supply:

Pin 1 = +24V DC input
Pin 2 = 0V DC input

External supply, which may be a battery back-up supply.

Pin 3 = +24V DC input
Pin 4 = 0V DC input

Note: the two supplies are connected together after two reverse blocking diodes. This means that the supply that has the highest voltage will power the system.

Warning: some switch mode battery chargers may damage the processor and display, consult Status Scientific Controls for advice.

Cable Routing

Due to the low signal levels generated by gas detectors it is recommended that all wiring to the sensors by segregated away from AC mains or other high voltage/power lines to avoid interference.

2.4 Cable Screening

The use of a screened cable is recommended for the installation of all detector heads. The screening is used to minimise the effects of electrical interference generated by external equipment e.g. motors, switchgear etc. The correct strategy for connecting the screens depends upon the area in which the detector head is to be used (i.e. hazardous/ non-hazardous). In all cases the screen should not be connected at the detector head.

3 GAS DETECTOR HEAD INSTALLATION

3.1 Siting the Detectors

Mounting positions for the gas detectors need to be considered individually, Status Scientific Controls will offer advice and assistance with regard to the siting of detectors in varying environments. Some initial points for consideration are:

- Ensure all gas detectors are mounted to allow routine calibration and maintenance to be carried out as required.
  Note: Sensors can operate reliably for several years however the environment may reduce the sensor expected life.
- Ensure the proposed site will not interfere with movement of existing equipment, e.g. cranes, doors etc
- Install all cables neatly and securely.
- Detectors for gases that are lighter than air should be positioned at a high level.
- Detectors for gases that are heavier than air should be located at below head height.
- Avoid siting the gas detectors adjacent to potential sources of radio frequency interference, e.g. radio transmitters, control switchgear, motors etc.
- Ensure the detectors are mounted with sufficient space to allow air movement around the sensor section, and the opening of the front hinged lid.

3.2 Installation in a Non-Hazardous Area

Where gas detector heads are to be installed in an area where there is no potential of an explosive gas hazard present, the cable lengths are limited solely by the resistance of the cable. The FGD2, FGD3 or FGD10b gas detectors fitted with either oxygen or toxic sensors require a minimum of 6V at its terminals to operate correctly. The maximum cable loop resistance is therefore (20-6)/25mA i.e. 560Ω.

Cable resistance values depend upon the size of the cable. Typical resistance values are:

1.0mm^2 solid core	40Ω/Km loop.
1.5mm^2 solid core	25Ω/Km loop.

The correct wiring method for all Status Scientific FGD2 / FGD3 Detector Heads (in a non-hazardous location) is shown below. It is important to note that this drawing shows the wiring connections but does not discuss the Input Module configuration. Prior to connecting the Detector Head ensure the Input Module is correctly configured (refer to section **4.1**).

For installation diagrams for FGD Flammable Gas Detector Heads refer to section **3.3**.

3.3 Installation in a Hazardous Areas

Where gas detector heads are to be mounted within a potentially explosive atmosphere then electrical safety barriers must be fitted in order to limit the electrical energy that is supplied into the hazardous area. This prevents an incendive spark occurring under an electrical fault condition.

When using barriers to create an I.S. supply, certain restrictions are imposed on the parameters of the interconnecting cables used. These parameters are defined by the manufacturer of the barrier and limit the maximum capacitance, inductance and inductance to resistance ratio of the cable. The installation is only intrinsically safe when the combination of the barrier and connecting cables comply with the manufacturer's specification.

As with a non-I.S. installation, the cable length is restricted by the cable loop resistance. With the introduction of a barrier, the cable loop resistance is reduced because of the internal resistance of the barrier. The end to end resistance of the barrier must therefore be subtracted from the overall cable loop resistance when calculating cable lengths.

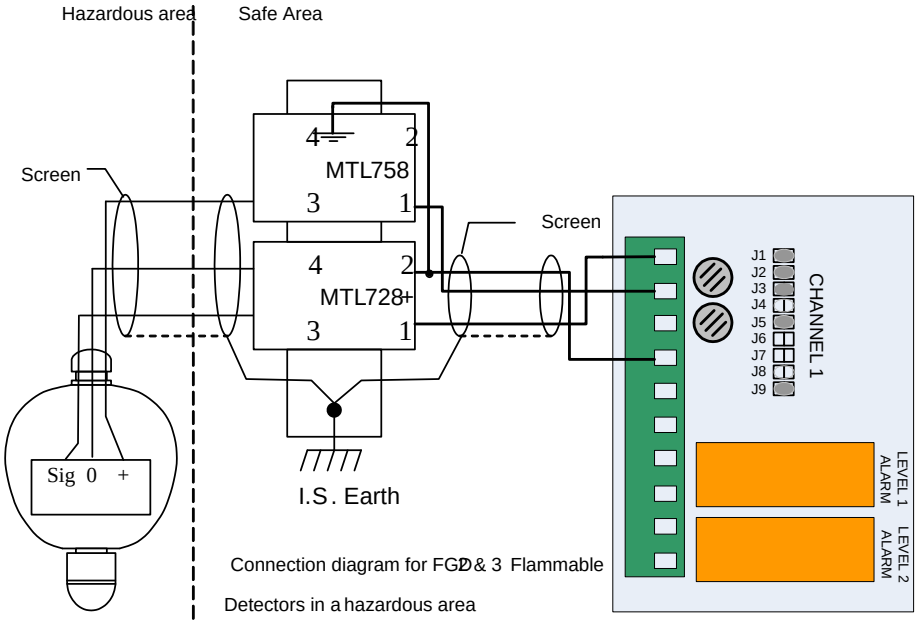
Barriers must be selected to restrict the parameters of the I.S. supply to the gas detectors within the following limits:

Gas Detector	Terminals	U_{max}	I_{max}	P_{in}
FGD2/3 Oxygen or Toxic	0V and SIG	30V	0.15A	0.81W
FGD2/3 Flammable	0V and SIG	30V	0.15A	0.81W
	0V and PWR+	7.5V	0.75A	1.4W

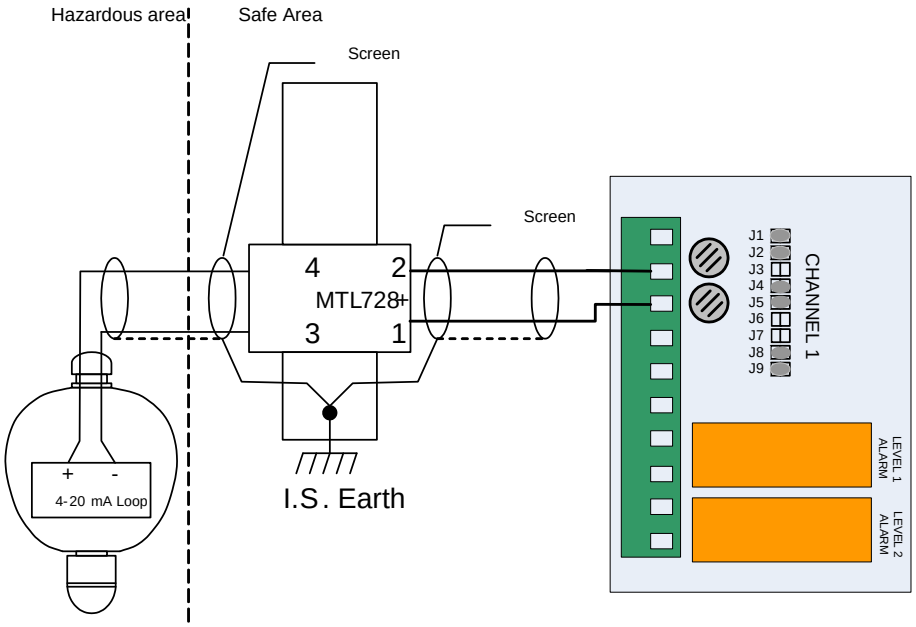
When considering the capacitance and inductance allowable across the barrier output terminals, note:
There is zero capacitance and zero inductance between terminals 0V and SIG on any model of FGD Detector head.
There is an equivalent of 1.4μF capacitance and zero inductance between terminals 0V and PWR on the FGD2 and FGD3 flammable gas detectors.

3.3.1 Hazardous area installations using Safety Barriers.

The following diagrams show how proprietary I.S. barriers can be used (barriers manufactured by MTL are shown).



Connection diagram for FGD & 3 Flammable Detectors in a hazardous area



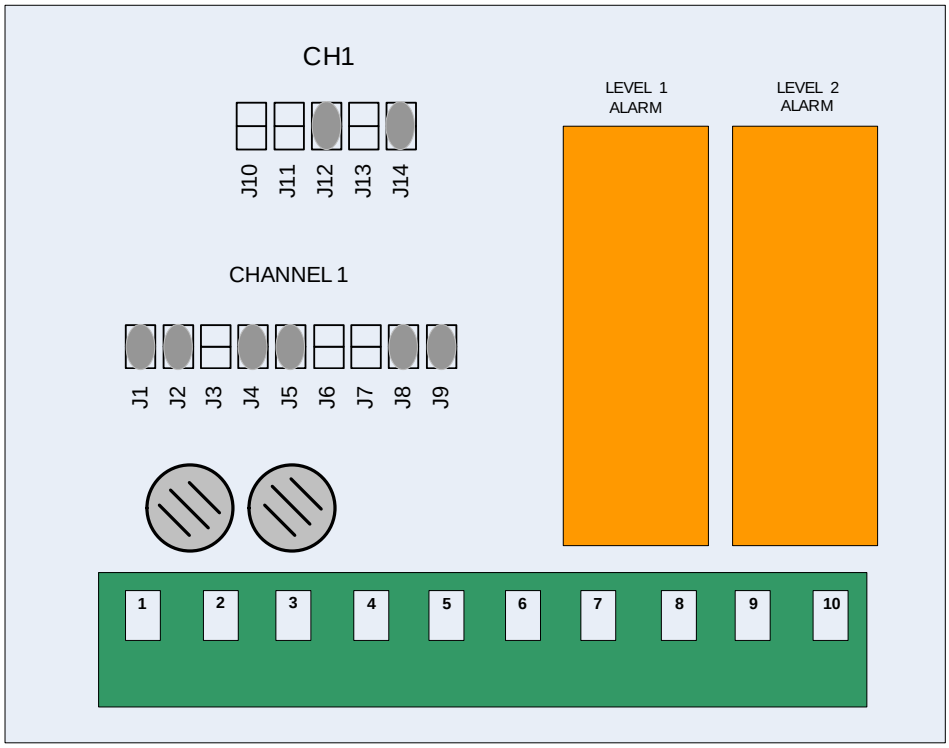
Note:
The system 0V is **NOT** connected to the earth.

The I.S Earth connection on the power distribution PCB must be connected to the installations' I.S. earth point. The connection must be made via a conductor of minimum 4mm^2 cross sectional area. Refer to EN60079-14 (previously BS5345:Part 4, section 16) for further details of earthing requirements.

4 INPUT MODULE CONFIGURATION

The MCU Systems have been designed to cater for almost all requirements of available detector heads. For this reason many of the options available require either software or hardware configuration.

The diagram below shows the Input module and the positions of switches etc required during configuration.



The relay connections shown are with the relay coil in its de-energised state.

Input configuration

J1 and 9 are for the sensor gain.
J2, J4, J5, J6, J7 and J8 signal conditioning.

Analogue output

J10, J12 and J13 is for current sink / source.
J11 is for voltage output.
J14 select internal 24V to power the loop.

Note: the position of jumpers J10 to J14 are not located next to the relays as shown in the diagram above, refer to the LC8 main PCB diagram in section 1-1

4.1 Input Configuration

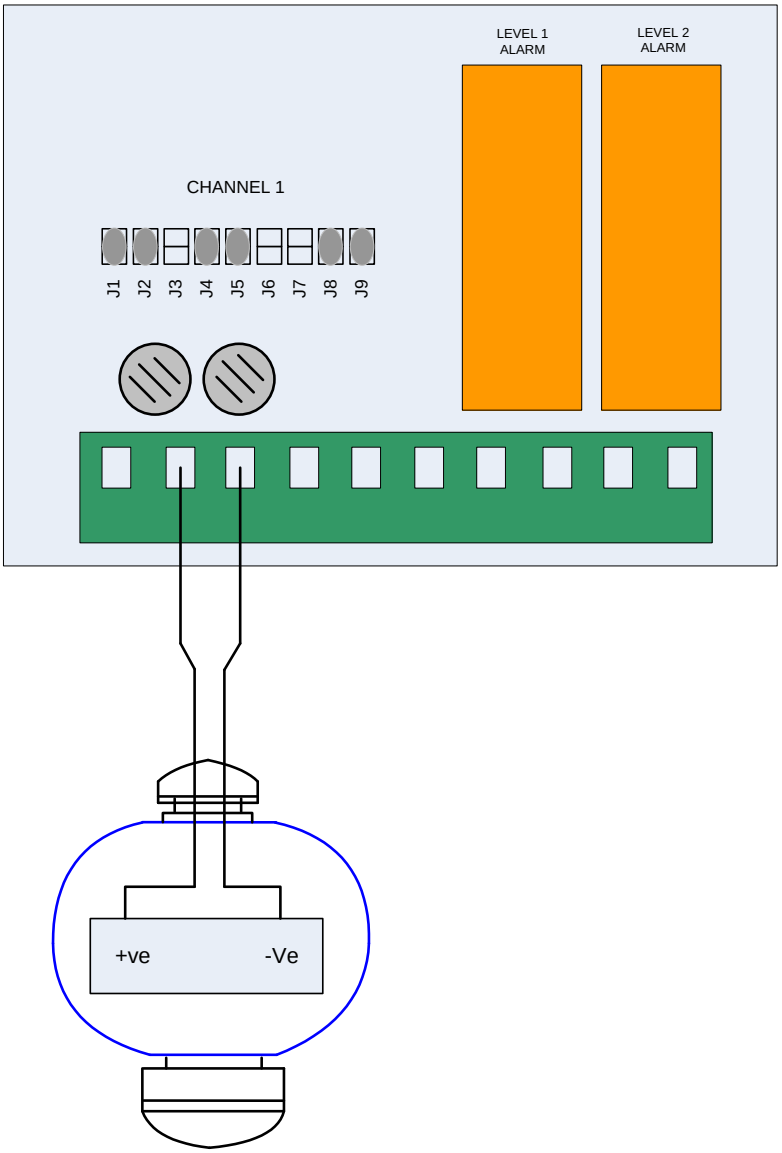
Section 4.2 discusses the most common configuration options. These are also the configurations adopted by Status Scientific for use with FGD detector heads (manufactured by Status Scientific Controls).

Note: *The input configurations shown are for detector heads located in non-hazardous environments. I.S. Barriers are required when mounting in areas where there is a flammable gas hazard, refer to section* **3.3***.*

4.2 Status Scientific Controls Gas Detectors

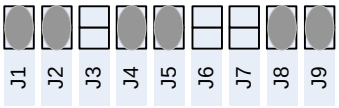
Status Scientific Controls design and manufacture a variety of fixed gas detectors. The detector head used for monitoring oxygen or toxic gases (using conventional sensors) requires a 2-wire connection whilst detector heads incorporating infrared sensors or pellistors require a 3-wire connection.

4.2.1 FGD2, FGD3, FGD4 and FGD10b O_2 and Toxic Detector Heads



Connection Procedure

- Disconnect power from the system.
- Remove the terminal cover to gain access to the wiring.
- Remove the terminal cover and display module to gain access to the configuration link settings.
- Configure the PCB solder links as shown below (i.e. J1, J2, J4, J5, J8 and J9 switched ON, all others OFF)

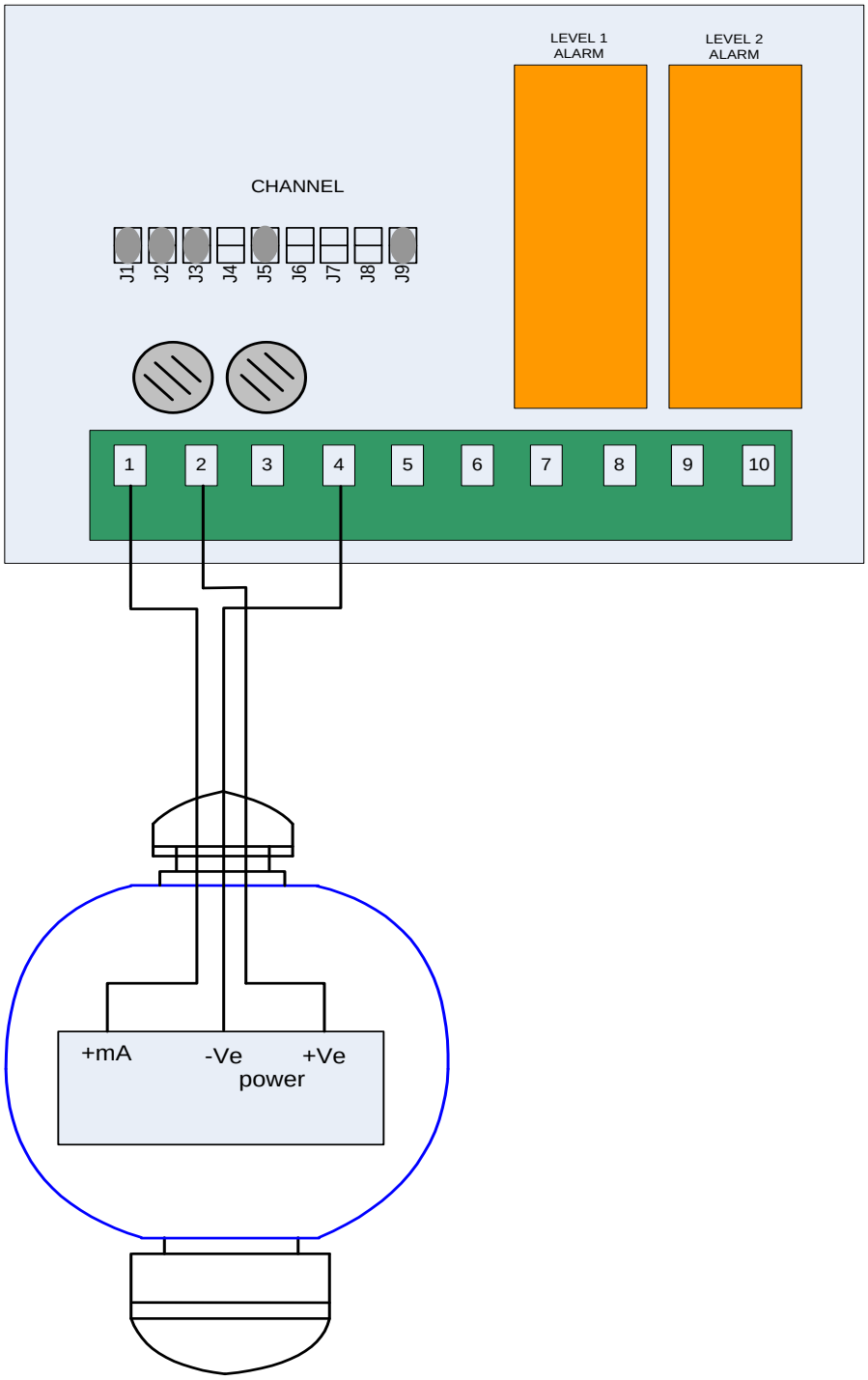


- Connect the wires from the detector head to connector on the input module observing the following:

Detector Head Label 4-20mA Loop	Channel Pin Number
+	2
-	3

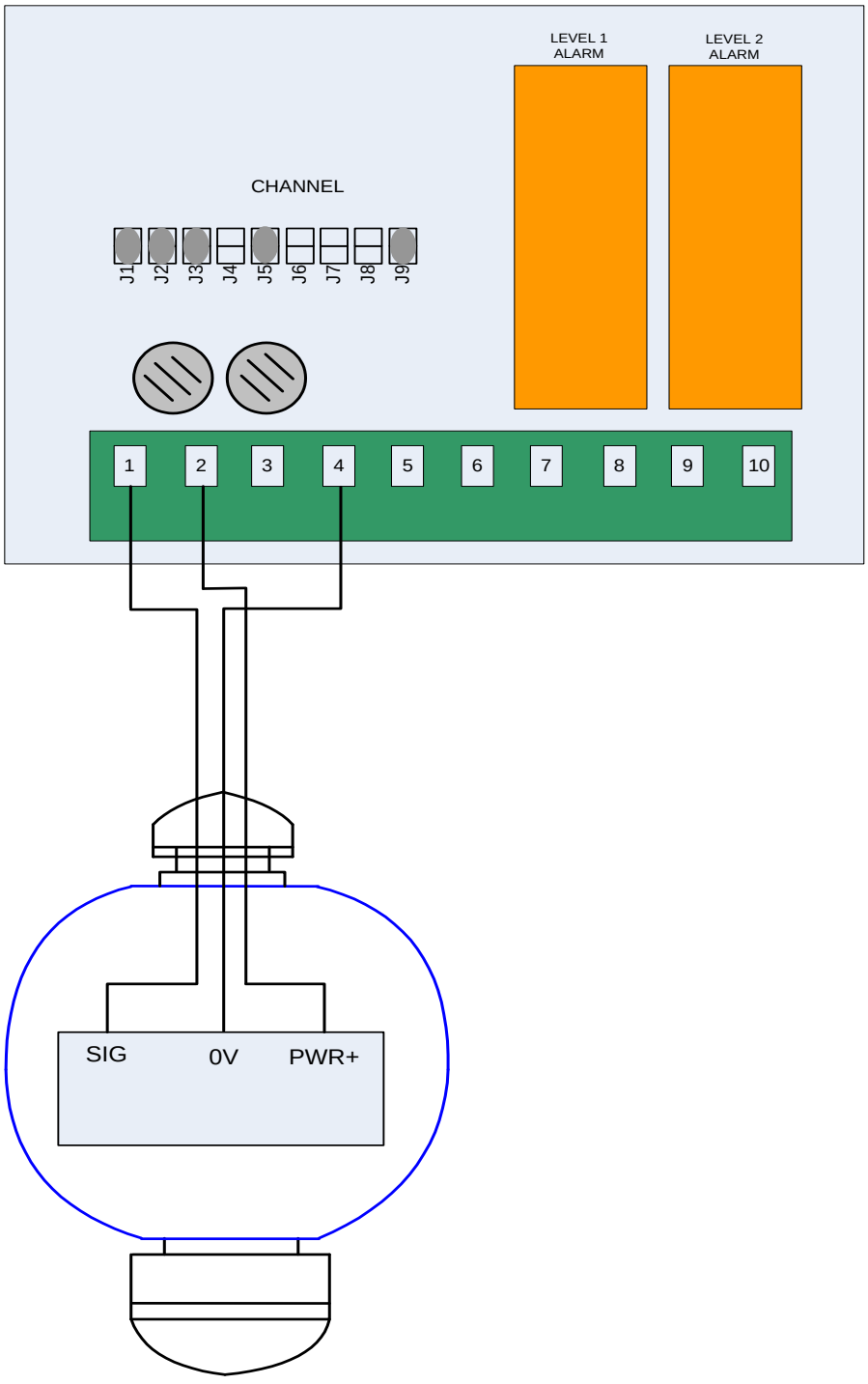
- Connect power to the system and ensure the detector head operates (text on LCD display, LED will flash once every six seconds approximately).
- Perform software configuration (refer to 'LC Software Configuration and System Calibration Manual').
- Perform system calibration (refer to 'LC Software Configuration and System Calibration Manual').

4.2.2 FGD3 Infrared Gas Detector Head



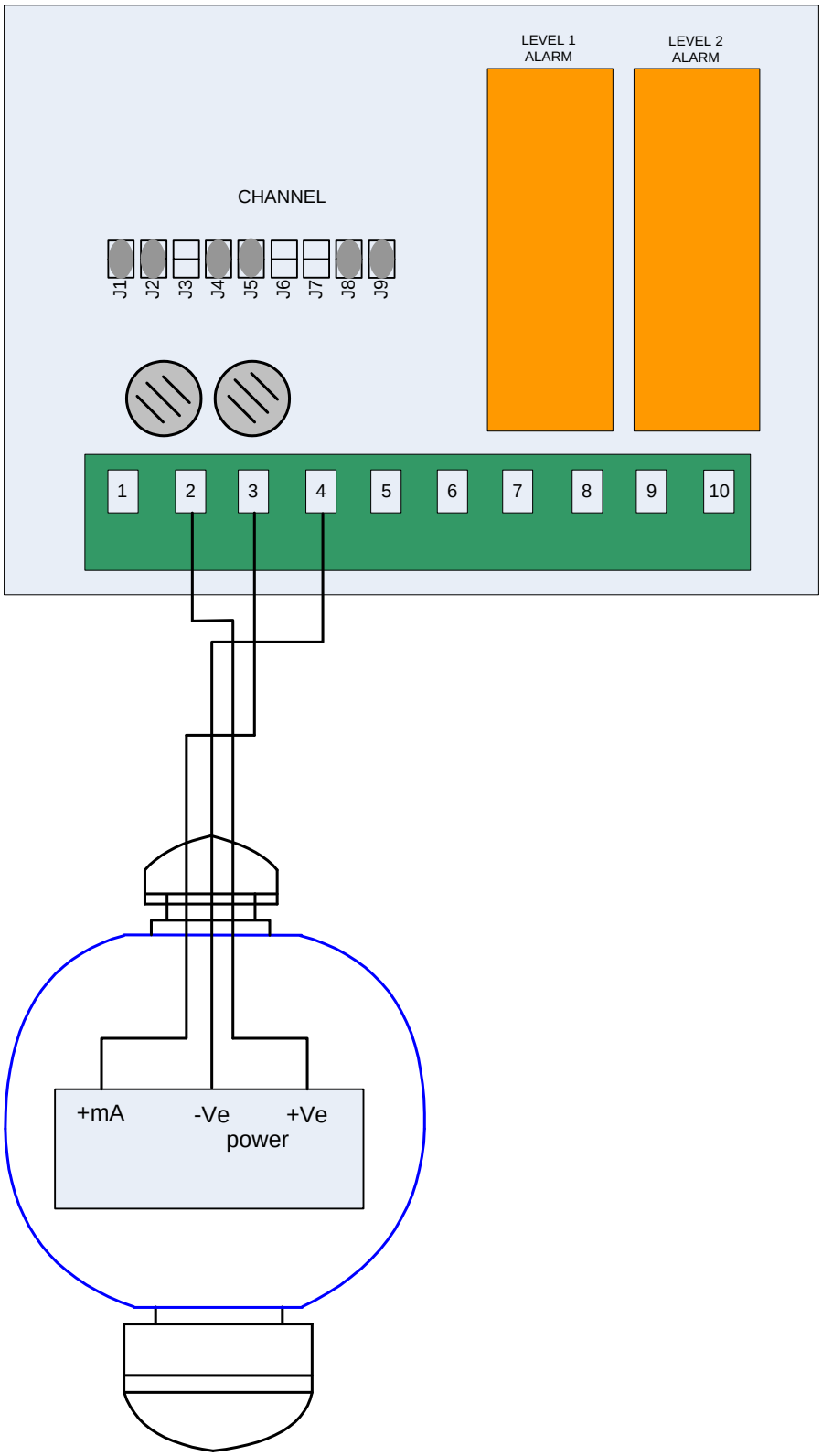
Note: Adjust the voltage between terminals 15 & 16, 27 & 28, 39,& 40, 51 & 52 channels 1, 2, 3, 4 to that of the requirements of the FGD3, usually between 5.8 and 7.5V – see the LC Series Software Manual.

4.2.3 FGD3 Pellistor Gas Detector Head



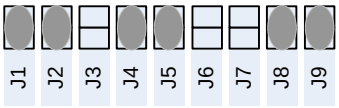
Note: Adjust the voltage between terminals 15 & 16, 27 & 28, 39,& 40, 51 & 52 channels 1, 2, 3, 4 to that of the requirements of the FGD3, usually between 4.0 and 5.0V – see the LC Series Software Manual.

4.2.4 FGD4, FGD9, FGD10a, FGD10b Gas Detector Heads



Connection Procedure

- Disconnect power from the system.
- Remove the terminal cover to gain access to the wiring.
- Remove the terminal cover and display module to gain access to the configuration switch settings.
- Configure the PCB solder links as shown below (i.e. J1, J2, J4, J5, J8 and J9 switched ON, all others OFF)



- Connect the wires from the detector head to connector on the input module observing the following:

Detector Head	Channel Pin Number
PSU+	2
Aout +	3
PSU -	4

- Connect power to the system and ensure the detector head operates (text on LCD display, LED will flash once every ten seconds approximately)
- Measure the voltage between the + and 0 terminals at the detector head.
- If necessary adjust the voltage to give 9 to 10V at the detector head. (refer to 'LC Software Configuration and System Calibration Manual').
- Refit grey protective cover.
- Perform software configuration (refer to 'LC Software Configuration and System Calibration Manual').
- Perform system calibration.

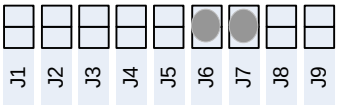
Note: FGD4, FGD10b infrared current source version.

4.2.5 Pellistor Only Gas detectors

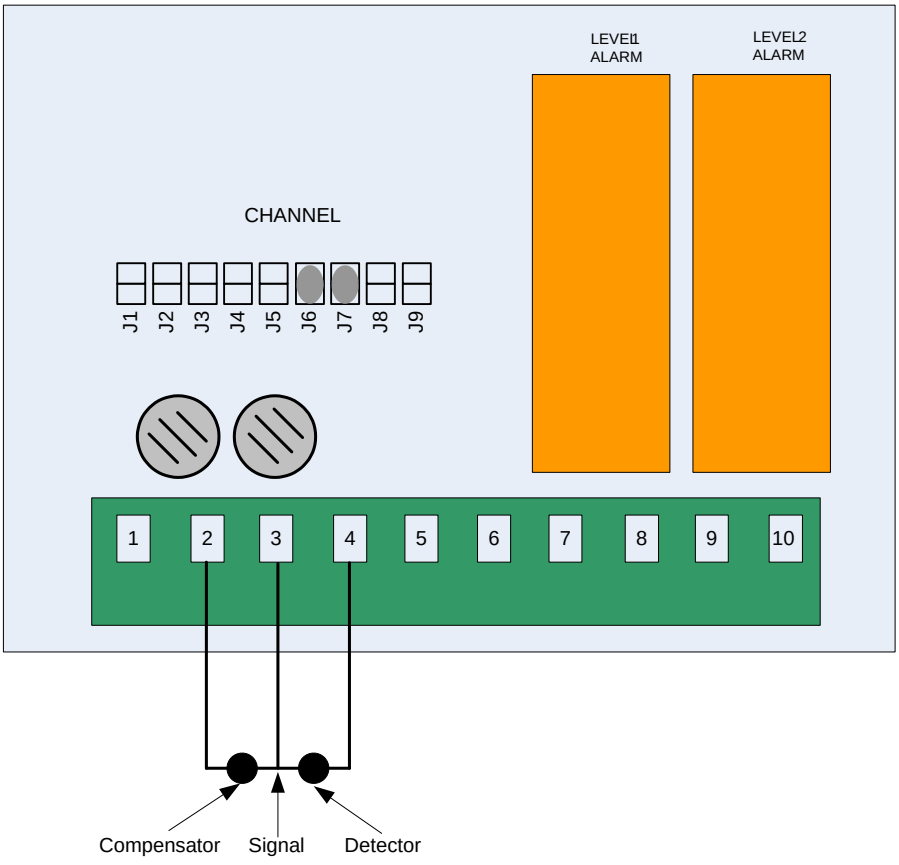
Connection Procedure

Note: For use in hazardous areas, the pellistors must be housed in an Exd enclosure mounted on an Exe terminal housing.

- **DO NOT** connect the pellistors at this time.
- Configure the links as shown below (i.e. J6,J7 fitted, all others removed)



- Connect a voltmeter between pins Compensator (pin 2) and Detector (pin 4).
- Adjust the voltage to match the pellistor type. (refer to 'LC Software Configuration and System Calibration Manual').
  Note: Connecting a voltage of greater than the recommended level can cause irreparable damage to the pellistors.
- Connect the pellistors to the input module observing the above diagram.
- Check that the voltage across the pellistors remains at the specified voltage ± 0.05V, adjust if necessary.
  Note: Measure the voltage at the pellistors, not at the input module terminals. Check the pellistor supply voltage, some are up to 5V including the FGD56-IR detector.
- Perform software configuration (refer to 'LC Software Configuration and System Calibration Manual').
- Perform system calibration.

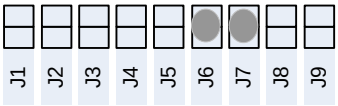


4.2.6 FGD56-IR

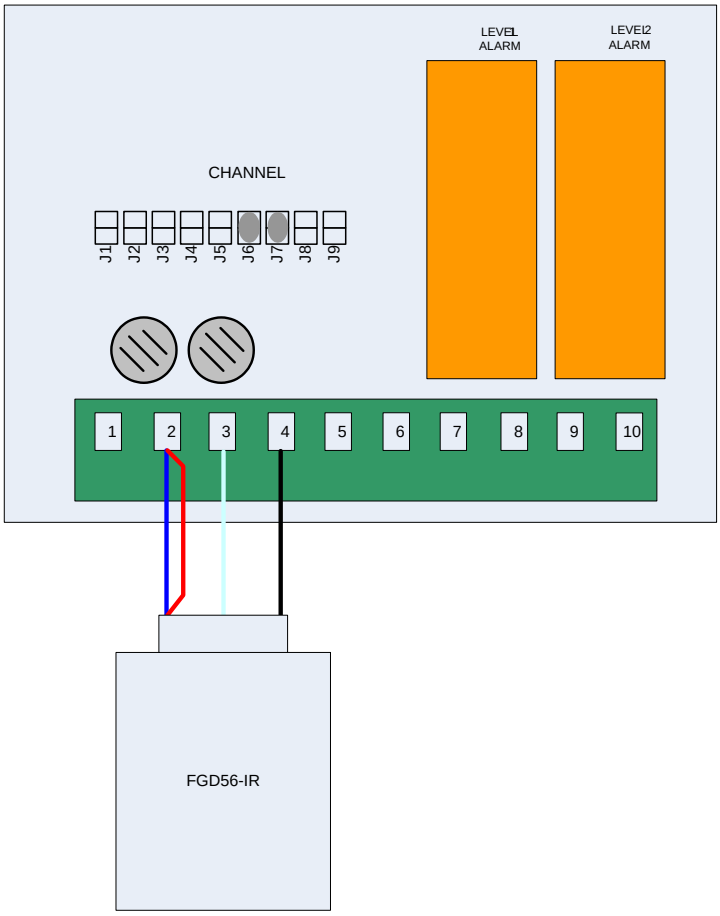
Connection Procedure

Note: For use in hazardous areas, the FGD56-IR must be mounted on an Exe terminal housing.

- Configure the links as shown below (i.e. J6,J7 fitted, all others removed)

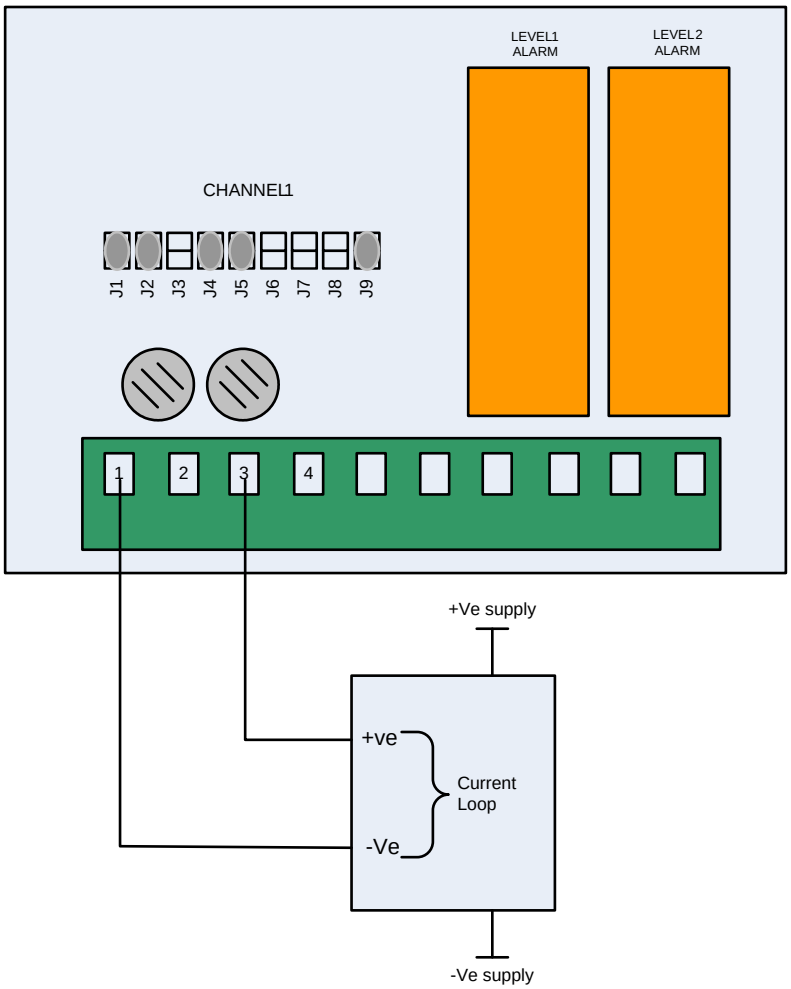


- Connect a voltmeter between pins Compensator (pin 2) and Detector (pin 4).
- Adjust the voltage to between 4.5 and 5.5V, typically 5.0V (refer to 'LC Software Configuration and System Calibration Manual').
  Note: Connecting a voltage of greater than the recommended level can cause irreparable damage to theFGD56-IR.
- Connect the pellistors to the input module observing the diagram below.
- Check that the voltage across the pellistors remains at the specified voltage ± 0.05V, adjust if necessary.
  Note: Measure the voltage at the FGD56-IR, not at the input module terminals.
- Perform software configuration (refer to 'LC Software Configuration and System Calibration Manual').
- Perform system calibration.



Note: The FGD56-IR gas detector should have the signal set to rising, connect the blue wire to the red wire.

4.2.7 External powered 4-20 mA Source

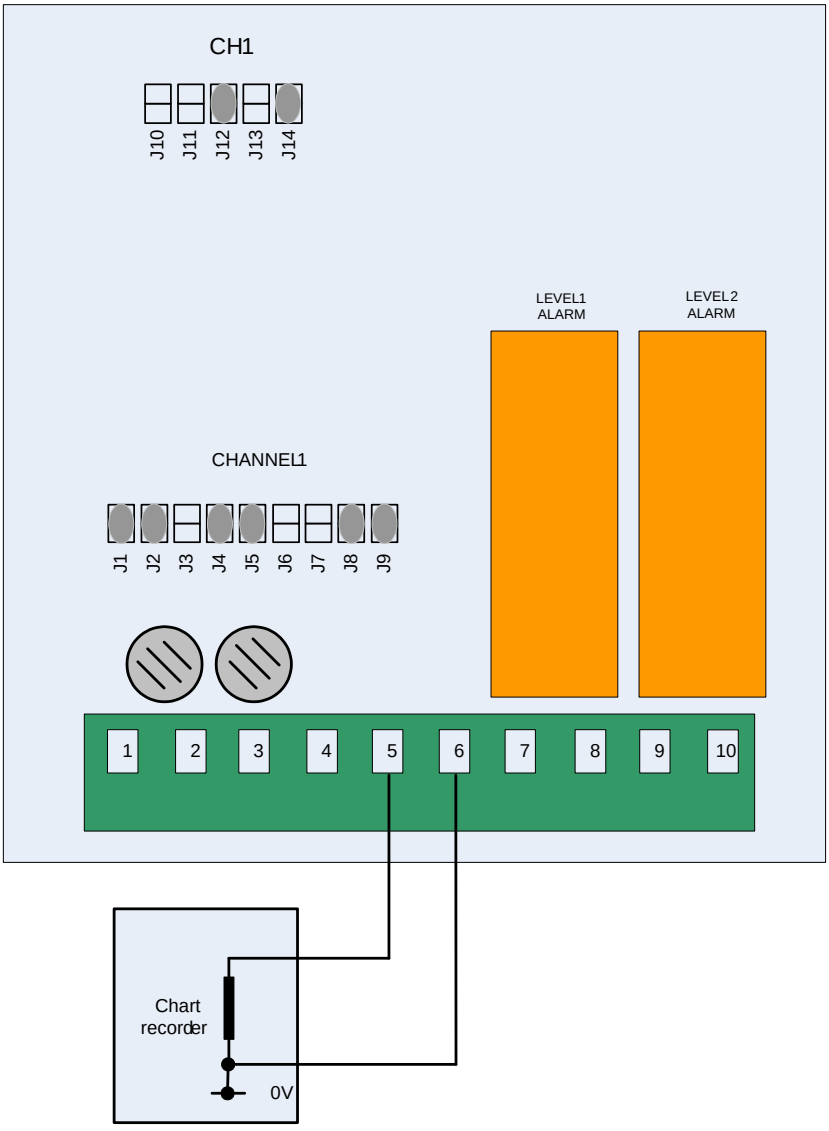


4.3 Analogue Output Configuration

In addition to providing the connections for various connector types, the Input Module can also provide an analogue output. This output mimics the signal detected so that it may be used by external equipment (e.g. chart recorders, data loggers) for a variety of purposes.

Note: It is important to ensure that the Analogue Output is calibrated if in use (refer to 'MCU Software Configuration and System Calibration Manual').

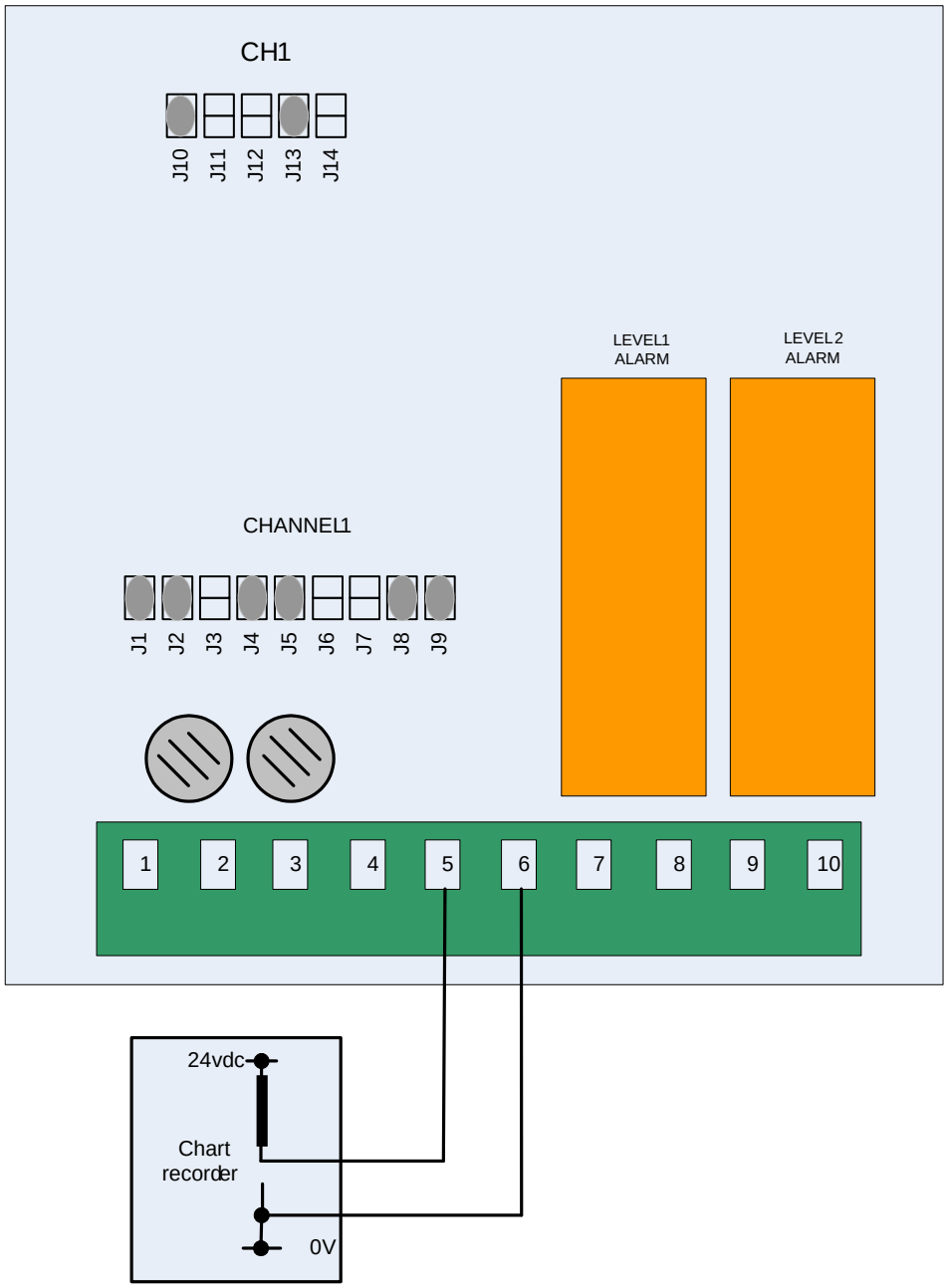
4.3.1 4-20mA Current Source



The Input Module sources current proportional to the detected gas level.
i.e. zero gas = 4mA
full scale = 20mA
The supply is taken from the internal PSU. Switch ON J12 and J14

NOTE: Incorrect jumper switch configuration can cause damage to the system.

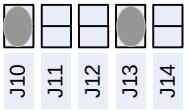
4.3.2 4-20mA Current Sink



The Input Module can also sink current proportional to the detected gas level.
i.e. zero gas = 4mA
full scale = 20mA

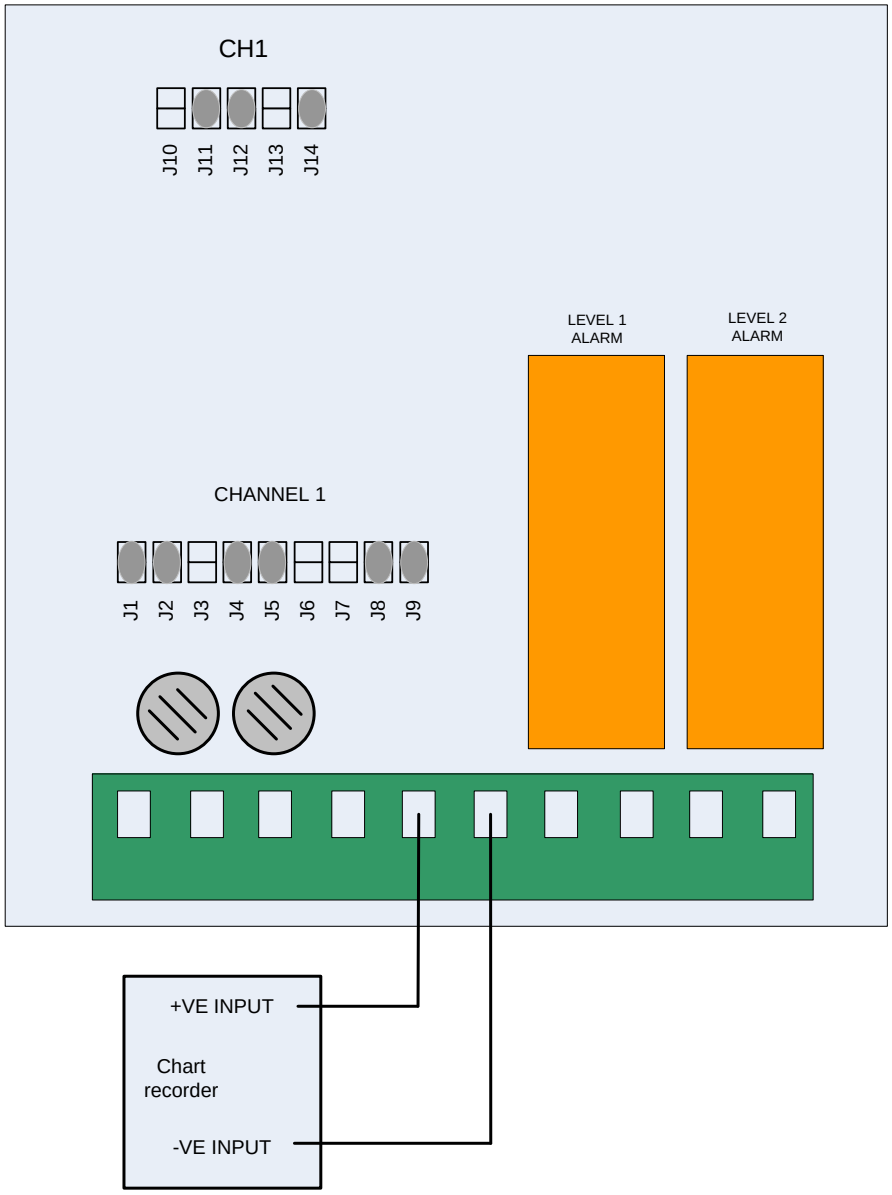
The supply is derived from the external equipment.

Notes
Switch ON J10 and J13



NOTE: Incorrect jumper switch configuration can cause damage to the system.

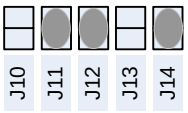
4.3.3 1-5V Voltage Output



The LC Control Unit can provide a voltage output.
i.e. zero gas = 1V
full scale = 5V

This output is not ideal when transmitting a signal over a large distance. The resistance of a cable attached will cause a voltage drop to occur.

Links ON J11, J12 and J14.



NOTE: Incorrect link configuration can cause damage to the system.

4.4 Routine Servicing

The MCU Control Unit will provide a reliable and fault free service but they rely upon sensible housekeeping and regular calibrations.

It is recommended that the system be calibrated **at least** once every six months. This can be arranged with Status Scientific Controls as part of a maintenance contract.

4.4.1 Routine Inspection

It is advisable to periodically inspect the LC Control Unit Installation:

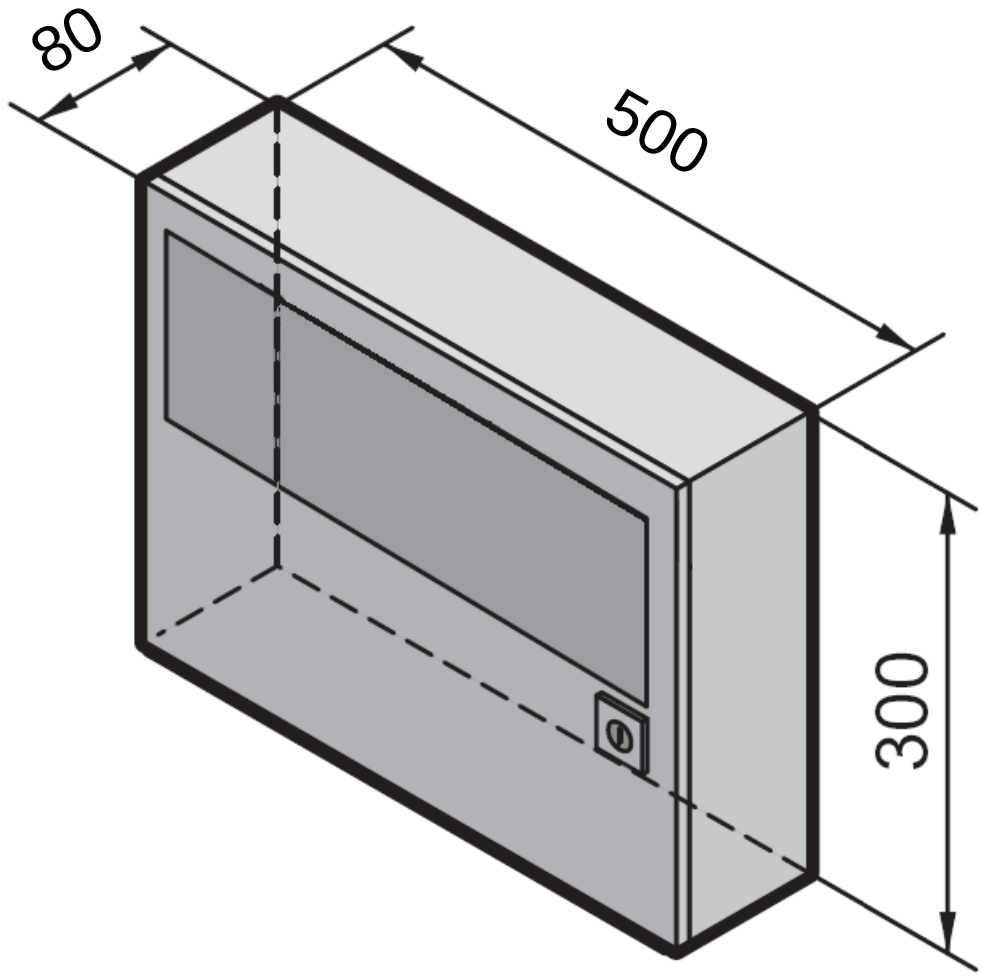
- Check cables to ensure no damage has occurred.
- Clean control unit casing using a clean cloth.
- Clean detector heads using a clean DAMP cloth.
  Note: Use of a dry cloth would constitute a static hazard.
- Inspect detector heads and ensure the sensor housings aperture is not obstructed.

Note: Do not use solvents to clean the LCD display window on the control units or the detector heads.

The time interval between routine inspections will depend upon the area in which the equipment is installed. A clean laboratory installation may only require inspection at the time of calibration, whereas an installation in a particularly dirty environment may require weekly inspections. It is the responsibility of the system engineer to assess the installation environment and determine the frequency of routine inspections.

5 DIMENSION DETAILS

5.1 LC8 Control Unit



6 SPECIFICATIONS

6.1 LC8 Control Unit

Type	LC8
Size (nominal) 'mm'	500 x 300 x 80
Weight (approx)	6Kg
Operating Temp	-10ºC to +50ºC
Storage Temp	-20ºC to +50ºC
Humidity Range	0 to 95% R.H. Non-condensing
Input Voltage	18-28V DC, or 100-240V AC 50/60 Hz
Environmental Rating	IP65

User Interface	
Display Option 1	LED Backlit 128 x 128 dot Liquid Crystal Display (LCD)
Display Option 2	LED Backlit 240 x 128 dot Liquid Crystal Display (LCD)
Keyboard	4 button multifunction keypad
LED Indications	Green Indicates power ON Red Indicates alarm level 3 condition. Red Indicates alarm level 2 condition. Red Indicates alarm level 1 condition. Yellow Indicates fault condition.

Input Modules	
Number of channels	8 max
Signal Inputs x 8	4-20mA Current Loop sink, source or 3-Wire Pellistor Systems.
Analogue Output x 8	4-20mA Current sink, source or voltage proportional to detected signal.
18 – Relays Contacts Rating	1 relay assigned to alarm level 1, channel 1 to 8. 1 relay assigned to alarm level 2, channel 1 to 8. 1 relay assigned to common alarm level 3. 1 relay assigned to fault condition. Single Pole Changeover Contacts (voltage free), N/O or N/C selected by links on underside of PCB. 5A 240V AC.

Additional	
Fuse 1	T2.0A located next to power input connector
Switch	DC isolation switch next to Fuse holder