Environmental Monitoring & Control Units Types MCU 3 & 4 Installation and Hardware Configuration Manual

Date: 11.6.2009.
Issue: 6

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The MCU3 & 4 Manuals

The MCU3 & 4 Environmental Monitoring Systems have a range of manuals covering various aspects of their operation:

- **MCU3 & 4 Installation and Hardware Configuration Manual**
  This manual covers all of the hardware aspects of the MCU Environmental Monitoring Systems. Each of the component parts of the system is discussed and hardware configuration is explained. Dimensional drawings are included.

- **MCU3 & 4 Software Configuration and System Calibration Manual**
  The operation of the MCU system is discussed as well as the software configuration and calibration procedures.

- **'Mentor PC' Operators Manual**
  The Mentor PC software is discussed including:
  - ◊ Software Installation
  - ◊ Hardware Configuration to facilitate downloading logged data and configuration via a PC.
  - ◊ Displaying, and archiving logged data.

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.

This manual covers all MCU Control Units containing Input Boards fitted with jumper switch configurable options. If the configuration of the Input Boards is set by the removal or fitting of jumpers then please refer to an Issue 2.0 manual available from Status Scientific Controls.

STATUS SCIENTIFIC CONTROLS

MCU System Installation and Hardware Configuration Manual

Please Note:
Page numbers within this manual are of the form:
Section – Page
e.g. 'Page 2-3' refers to Section 2, Page 3

1 INTRODUCTION

The MCU3 & 4 are environmental Monitoring Control Units (MCU) that provide facilities to monitor a wide variety of industry standard environmental and other sensors.

The MCU3 provides up to 8 monitoring channels.
The MCU4 provides up to 16 monitoring channels.

The MCU 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.

The versatile design allows a monitoring system to be initially installed using the minimum number of required channels and then, as the monitoring environment changes, more channels can be added, or alternative detector heads can be used as required.

Data logging is provided as a standard function. Data is stored within the systems' non-volatile memory thereby providing reliable storage without the risk of losing data in the event of total power loss (mains and battery backup failure). Logged data can be viewed via the LCD display situated on the front panel in either numerical or graphical form, or alternatively the data may be transferred to a P.C. (running the Mentor PC Software) via the RS232 output. This provides the system with an unlimited storage and data-logging medium.

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 removable screw terminal connectors.

A monitoring system consists of, as a minimum, an MCU3 Control Unit and 1 detector head. The MCU Control Unit houses all of the components required to implement a sophisticated and reliable monitoring system (battery back-up, alarm relays etc).

- **MCU3 Control Unit.**

The MCU3 can monitor up to eight channels.

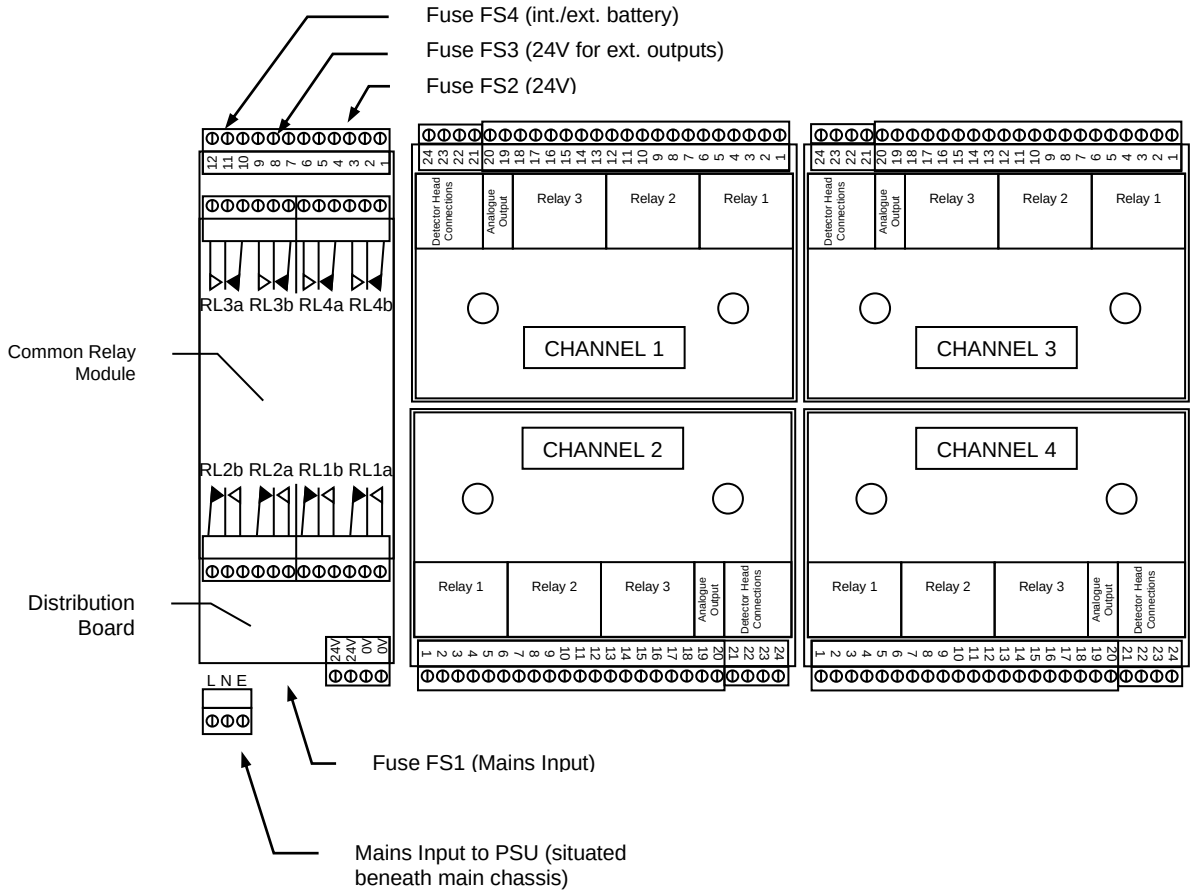
Channels 1-4 are located on a lower platform whilst channels 4-8 are located on a hinged upper level. This allows easy access to all hardware configurable options whilst maintaining its compact size.

It is supplied with interchangeable gland plates located on its upper and lower face. The lower plate has seventeen holes suitable for 20mm compression glands, or ½" NPT Conduit entries (other gland plate configurations are available on request), whilst the upper plate is blank.

- **MCU4 Control Unit**

The MCU4 contains two MCU3 systems giving the system the ability to monitor up to sixteen channels.

The MCU4 is supplied with interchangeable gland plates located on its upper and lower face. The lower plate has seventeen holes suitable for 20mm compression glands, or ½" NPT Conduit entries (other gland plate configurations are available on request), whilst the upper plate is blank.



The diagram above shows a pictorial representation of the various module positions within the MCU3 and MCU4 Control Units.

The power supply is situated beneath the main chassis and is not visible when the unit is assembled, however the four system fuses (FS1 – 4) are easily accessible. The mains input connector and FS1 are sited beneath a cover to avoid inadvertent user contact during normal operation. The standby batteries are also located beneath the main chassis.

Channels 5-8 are mounted on a hinged platform positioned above channels 1-4. This design allows easy access to channel 1-4 situated below.

The microcontroller module and LCD display are not shown on the above diagram. These are mounted on the rear of the hinged front panel of the MCU3 and MCU4 Control units.

1.1 Microcontroller Module

Situated within the MCU Control Unit front panel is the Microcontroller Module. This module communicates with all Input Modules connected to the system via an I^2C serial bus. The Microcontroller Module also communicates with the Distribution Board and Relay Module as well as providing a user interface in the form of a back lit 240 x 64 dot LCD graphical display and an eight button multifunction keypad.

Note: I^2C is a trademark of Phillips Semiconductors.

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

- Green LED indication of power on.
- Red LED indication of alarm condition.
- Yellow LED indication of fault condition.

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

Note:
This sounder is not intended for use as a main indication of alarm conditions. It is strongly advised that a more substantial sounder and/or beacon be connected to this system (e.g. Status sounder type SS367 or SS368)

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

- Setting of the Real Time Clock.
  - The system has a battery backed 24Hr clock as a standard feature.
- 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 both be set via this function.
  - Calibration of the retransmitted output for each channel.
- Common Relay Configuration.
  - There are four relays situated on the ‘Relay Module’. These relays can be configured as normally energised or de-energised, and they have several triggering options dependent on the application.
- Input Module Relay Configuration.
  - Each Input Module contains three relays. These relays can be configured normally energised or de-energised as required. The levels at which the relays operate are also engineer configurable.
- Changing of display modes.
  - The LCD has a variety of display modes dependent on the application or maybe the personal preference of the engineer.
- Interrogation of logged data.
  - The data for any channel can is displayed numerically and graphically.

The microcontroller module contains all of the software required to communicate with up to eight detecting channels. The addition of extra Input Modules therefore requires only a simple software configuration change to monitor the additional channels.

From the rear of the MCU front panel, access can be gained to a 9-way D-type connector labelled 'Programming and Configuration' (see section **1.7**). With the aid of an interconnecting cable supplied by Status Scientific the following functions can be performed:

- *Programming and Configuration* of the MCU system via a P.C.
- Networking of MCU Control Units.
- Downloading of logged data.

A reset button is also located on the Microcontroller Module to allow the system to be reset locally in the event of an irretrievable fault. This will 'reboot' the Microcontroller but will not erase configuration data or logged data stored within the system.

1.2 Input Module

The input module 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 virtually all sensor configurations currently available. It can be connected to any sensor (Environmental or otherwise) that supplies it status signal in any of the following formats:

(a) Current Loop 4 – 20mA from 24V source.
(b) Current Loop 4 – 20mA to ground.
(c) 3-Wire Pellistor Systems.
(d) Voltage Input.

Note:
Option (d) requires hardware configuration that should be made at the factory prior to dispatch. Please request this option at time of ordering.

In addition the input module can re-transmit the signals for use by external equipment (e.g. chart recorders). The transmitted signal can be configured using jumpers to provide one of three output options:

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

Up to eight input modules can be located within an MCU3 Control Unit; up to sixteen can be located within an MCU4.

Situated on each Input Module are 3 Double Pole Change-Over Relays, each relay having contacts rated at 5A (240V AC). These relays operate at Low, Intermediate and High 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.

1.3 Distribution Board

The Distribution Board is the *distribution* point for power around the system. It allows the connection of external power supplies into the system and the use of external batteries for backup purposes. It is located at the left-hand side of the main chassis within the MCU Control Units beneath the Common Relay Module.

There are two main versions of the distribution board – see sections 1.3.2 & 1.3.3
Note that Issue 3 is fitted into all new equipment.

1.3.1 Field Connections

Located on the top edge of the distribution board is a 12 way connector. This is used to provide connections for inputs, outputs and external buttons:-

Pins 7 & 8
These pins allow the connection of an external normally open switch. This switch will allow the muting of alarms from a remote location (the control unit is the only location from which alarm conditions can be accepted or cleared). This button can be configured to perform other functions if required. Contact Status Scientific Control for further details.

Pins 9 & 10
External 24V batteries may be connected to the system via these pins. This is only required if it is anticipated that the main power source will be disconnected from the system for long periods of time, in excess of the internal battery capabilities. Note that any external batteries must be independently charged.

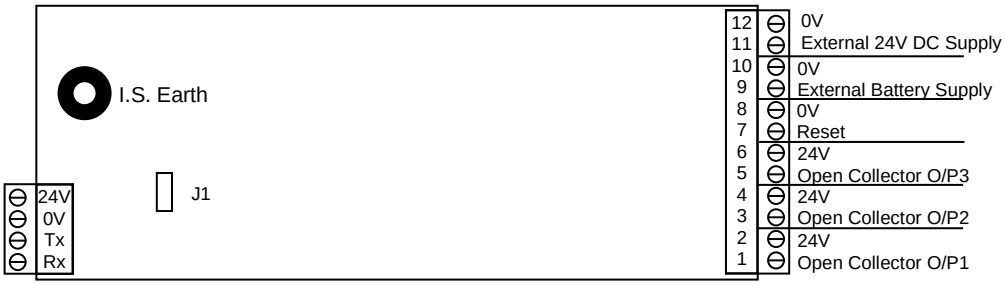
Pins 11 & 12
An external 24V DC supply may be used instead of having a mains input. Refer to section **2.4.2** for further details regarding connection of an external DC supply. The internal batteries will still maintain power in the event of the external 24V power supply failing. In order to meet all the power supply requirements of the system, the external supply must be rated at 24V DC @ 2A minimum.

Pins 1 to 6
The function of the remaining pins on the 12-way connector depends upon the issue of the distribution board fitted.
Note:
The issue of the distribution board may be determined by noting the position of jumper J1. If this not located adjacent to the 4-way connector refer to section 1.3.2. However, if the jumper is located adjacent to the 4-way connector refer to section 1.3.3.

The jumper position on the distribution board (labelled J1) allows connection of chassis earth to the system 0V. The fitting of J1 is not always required; section 3.2 discusses this link and determines whether it should be fitted in a given situation.

An I.S. Earth point is also provided on the distribution board. This is discussed in section **3.3**

1.3.2 Distribution Board - Issues 1 & 2



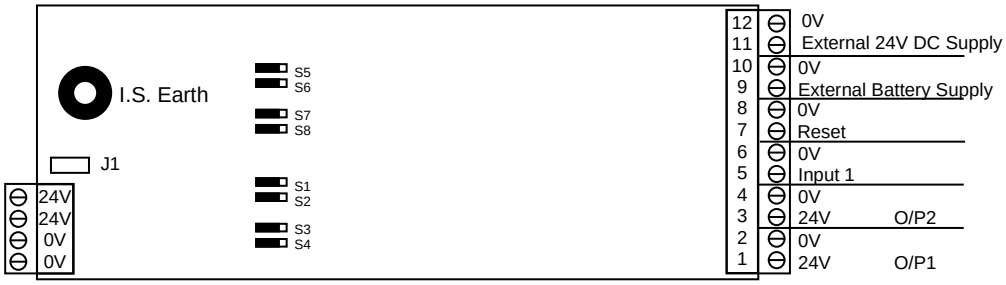
The lower 4-way connector provides a 24V and 0V connection. The voltages are always present at these terminals whilst FS2 is intact. The remaining two connections must not be used. The 24V supply is designed for use by Status Scientific Controls when powering external equipment. The amount of power available from this connector must be determined for each installation based upon the system configuration.

Pins 1 & 2, pins 3 & 4 and pins 5 & 6 of the 12 Way Connector provides three external outputs under software control. Outputs 1 and 2 are designated as Sounder and Beacon control outputs respectively (consult section 8.1 for sounder and beacon installation details) and Output 3 is spare. Each output is capable of switching a maximum of 200mA. Fuse protection is provided by FS3 situated on the Power Supply (refer to section **1.5**).

It should be noted that the external outputs are not switched via voltage free contacts. 24V is always present at pins 2, 4 and 6 and the 0V line is switched via an open-collector transistor.

Note: *In certain circumstances outputs 1, 2, and 3 can be configured as Inputs. Contact Status Scientific for further information.*

1.3.3 Distribution Board - Issues 3 and above

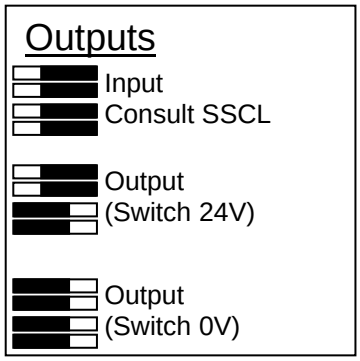


The lower 4-way connector provides two 24V screw terminals, and two 0V screw terminals. The voltages are always present at these terminals whilst FS3 is intact. This supply is taken from the 24V supply of the system and is used by Status Scientific Controls when powering external equipment. The amount of power available from this connector must be determined for each installation based upon the system configuration.

Pins 1 & 2 and pins 3 & 4 of the 12 Way Connector provides two external outputs under software control. Output 1 is designated as the sounder output, whilst Output 2 is designated as the Beacon output. Each output is capable of switching a maximum of 200mA. Fuse protection is provided by FS3 situated on the Power Supply (refer to section **1.5**).

Jumpers are located on the lower half of the distribution board. The jumpers allow the engineer to configure the outputs for either 24V switching or 0V switching at installation.

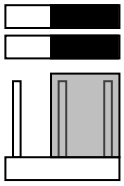
A label appears on the PCB indicating the correct jumper settings for each option:



Input – Allows the outputs to be configured as inputs in some circumstances. Contact Status Scientific for further details.

Output (Switch 24V) – 0V always present at connector, 24V is switched via a relay under processor control.

Output (Switch 0V) – 24V always present at connector, 0V is switched via relay under processor control.



The label shown above indicates the correct positioning of jumpers to obtain the specified output configuration.

It should be noted that the external outputs are not switched via voltage free contacts. Depending on the configuration, either 24V or 0V will be permanently available at the connector with the remaining supply being switched via a relay.

Under no circumstances must mains supply voltages be connected to any of the distribution board terminals.

Pins 5 & 6 provide connection for an external switch.

1.4 Common Relay Module

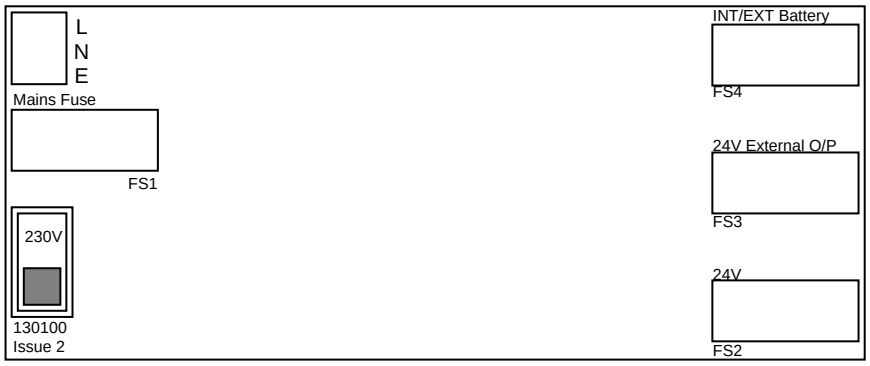
Situated on the Relay Module are 4 Double Pole Change-Over Relays, each relay having contacts rated at 8A (240V AC). Each of the relays can be configured as normally energised or de-energised.

The standard configuration for these relays is

Any channel incurs a low alarm, common relay 1 will operate.
Any channel incurs a medium alarm, common relay 2 will operate.
Any channel incurs a high alarm, common relay 3 will operate.
RL4 is designated as a fault alarm relay.

These relays can be configured to provide alternative features via the software if required. Status Scientific are able to implement modifications to the software to meet a customers specific requirements, contact Status for further information.

1.5 Power Supply Module



The Power Supply is situated beneath the main chassis of the control unit 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.

There are three power source options available to the system:

1. 220-240V AC Mains Supply Switch Selectable
2. 110-120V AC Mains Supply Switch Selectable
3. 24V DC Supply No switch position change required

Options 1 & 2 are easily selected via an on board switch (sited beneath a yellow protective cover). Option 3 is provided as an alternative to an AC mains supply and allows the use of an external 24V DC power supply (connected via the Distribution Board).

There are four fuses situated on the power supply PCB. These are:

FS1 (T1.0A) Mains Fuse
FS2 (T2.0A) Internal 24V Supply
FS3 (F1.0A) 24V to Outputs 1 – 3
FS4 (F2.0A) Internal/External Battery (see Note below).

Note:
The internal batteries will supply power to the system as soon as FS4 is fitted. However, an external power source will be selected once connected to the system and the internal batteries will charge. The internal batteries will not provide backup if FS4 is not fitted or it has blown.

The power supply provides the charging current for the internal standby batteries such that in the event of an external power failure, the system will continue to operate for sufficient time to allow reconnection of the external supply. The backup time provided is dependent upon:

1. Quantity and type of Detector Heads used
2. Time since last Mains power fail and duration of power fail
3. Alarm status, and other external loads placed upon system

Refer to section **1.6** for further details.

The system will automatically select the internal batteries in the event of the external AC/DC supply failing and will reselect the external supply on its reconnection. If it is necessary to disconnect all power to the system, mains power should be removed followed by the removal of fuse FS4.

1.6 Battery Backup

The MCU control units are supplied with a pair of 12V 1.2Ahr maintenance free backup batteries mounted beneath the main chassis (MCU4 contains 2 pairs of batteries). The batteries are connected in series enabling them to provide the 24V required by the system in the event of an external power failure. The power supply for the system provides the charging current required maintaining the batteries in a fully charged state.

Should the main source of power fail, the system will indicate to the users that it is operating from its batteries by flashing the green power LED, whilst lighting the yellow fault LED. The fault relay (RL4) located within the 'Common Relay Module' will also operate and therefore trigger any warning devices added to the system by the user. No audible alarm will be generated.

The backup time provided can not be stated without first considering the configuration of the system. The backup time is dependent upon:

1. Quantity and type of detector heads used.
2. Time since last power fail and duration of power fail.
3. Alarm status.
4. Relay configuration (whether normally energised or de-energised).
5. External loads placed on the system.

The table below lists the various modules that can be connected to the MCU system and the load that they place on the system.

Module and Condition	Current Required
Quiescent current of Microcontroller Module + Display	36mA
Display Backlight	244mA
Quiescent current of Input Module	5mA
Input Module c/w Toxic Head (Zero Gas)	8mA
Input Module c/w Toxic Head (Full Scale)	24mA
Input Module c/w Oxygen Head (20.9%)	17mA
Input Module c/w Flammable Head (Zero Gas)	41mA
Input Module c/w Flammable Head (Full Scale)	58mA
Common Relay Module with relays energised.	17mA per Relay
Input Module Relays with relays energised.	17mA per Relay
Input Module Analogue Output (Zero Gas)	4mA
Input Module Analogue Output (Full Scale)	20mA

The time for which the battery will supply power can now be calculated by taking into account the modules fitted to the system and the configuration of alarm relays (i.e. whether normally energised or normally de-energised)

To calculate an approximate time for battery backup we need to make several assumptions: -

1. No alarm conditions are encountered during the battery-backed time.
2. Display backlight is off.
3. The batteries are fully charged.

For instances where a longer back up time is required, Status can supply an external battery unit. This will connect into the system at the Distribution Board and consists of its own internal charger. Contact Status for more information.

1.6.1 Calculation Examples

Three examples follow demonstrating how the backup time may be calculated.

Example 1 (Typical Configuration)

A 4 channel system comprising of 3 toxic channels and 1 flammable channel. All system relays are configured as normally energised. No analogue outputs are being provided by the system.

Module and Detector Heads	Qty		Current			
μController & Display	1	x	36	=	36	mA
Input Module & Toxic Head	3	x	8	=	24	mA
Input Module & Oxygen Head	0	x	17	=	0	mA
Input Module & Flammable Head	1	x	41	=	41	mA
Common Relays (Energised)	4	x	17	=	68	mA
Input Module Relays (Energised)	12	x	17	=	204	mA
Input Module Analogue Output	0	x	4	=	0	mA
Total Current Required under normal conditions =					**373**	**mA**

Batteries are 1.2Ahr, therefore backup time is 1200/**373** = 3.2 Hrs = 3 Hours 12 mins

Example 2 (Worst Case)

An eight channel system comprising of 8 flammable channels. All system relays are configured as normally energised. All analogue outputs are providing signals to external equipment.

Module and Detector Heads	Qty		Current			
μController & Display	1	x	36	=	36	mA
Input Module & Toxic Head	0	x	0	=	0	mA
Input Module & Oxygen Head	0	x	0	=	0	mA
Input Module & Flammable	8	x	41	=	328	mA
Common Relays (Energised)	4	x	17	=	68	mA
Input Module Relays (Energised)	24	x	17	=	408	mA
Input Module Analogue Output	4	x	4	=	16	mA
Total Current Required under normal conditions =					**856**	**mA**

Batteries are 1.2Ahr, therefore backup time is 1200/**856** = 1.4 Hrs = 1 Hour 24 mins

Example 3 (Best Case)

A 4 channel system comprising of 4 toxic channels. All system relays are configured as normally de-energised. No analogue outputs are being provided by the system.

Module and Detector Heads	Qty		Current			
μController & Display	1	x	36	=	36	mA
Input Module & Toxic Head	4	x	8	=	32	mA
Input Module & Oxygen Head	0	x	17	=	0	mA
Input Module & Flammable Head	0	x	41	=	0	mA
Common Relays (Energised)	0	x	17	=	0	mA
Input Module Relays (Energised)	0	x	17	=	0	mA
Input Module Analogue Output	0	x	4	=	0	mA
Total Current Required under normal conditions =					**68**	**mA**

Batteries are 1.2Ahr, therefore backup time is 1200/**68** = 17.6 Hrs = 17 Hours 36 mins

1.6.2 Calculating the backup time for your system

Notes for Calculation

1. The μController Module is always present on a functioning system and therefore its quiescent current must always be included in any calculations.
2. If an external load is placed upon the system then the current that the load requires must be added to the table prior to performing the final calculation.

Consider the system being installed, the detector heads being used and the normal status of all relays within the system. Enter the quantities in the table below to assist in battery life calculations.

Module and Detector Heads	Qty		Current			
μController & Display	1	x	36	=	36	mA
Input Module & Toxic Head		x	8	=		mA
Input Module & Oxygen Head		x	17	=		mA
Input Module & Flammable Head		x	41	=		mA
Common Relays (Energised)		x	17	=		mA
Input Module Relays (Energised)		x	17	=		mA
Input Module Analogue Output		x	4	=		mA
External Loads (e.g. Status Lamp)		x		=		mA
Total Current Required under normal conditions =						**mA**

The battery life can now be calculated by dividing 1200 by the total current required by the system under normal conditions.

1.7 MCU System Communications

Located at the rear of the Microcontroller Module is a 9-way D-type socket labelled 'Programming and Configuration'. This is the systems RS232 communications port. This provides the system with three useful communications features:-

Note:
The PC must be running the 'Mentor PC Software' to perform any of communications functions.

1.7.1 MCU System Configuration and Interrogation

This provides the ability to perform all of the functions available via the Control Unit keypad (and more) using a PC.
e.g.

- Displaying live data on the PC screen.
- MCU system configuration.
- Downloading logged data from MCU.
- View and export downloaded data (graphical or tabular format).

These features may be advantageous if the MCU Control Unit is located in a dirty environment. The system could be remotely monitored from a 'clean' room.

Note:
An RS232 cable is usually only suitable for short cable runs (e.g. 10ft), however cables having lengths of 30-40ft have been known to provide reliable communications.

1.7.2 MCU System Networking

RS485 Network Cards are available from Status Scientific Controls. These interface the RS232 signals from the MCU into a more suitable format for transmission over longer distances. This provides the MCU system with two powerful features:

- As section **1.7.1** but with less restriction on the cable lengths between PC. and MCU Control Unit (up to 1km possible).
- The PC can monitor more than one MCU system when utilising network cards.

All PC's have at least one RS232 COM port to allow communications with external equipment. The network cards supplied by Status Scientific Controls allow the PC to monitor a maximum of 32 MCU systems via one com port.

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 module servicing to qualified service personnel.

2.1 Siting the MCU

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

Either a 110V-120V or a 220V-240V AC supply can be used to power the control unit; alternatively a 24V DC supply can be used.

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 MCU enclosures are located within the Appendix (section **8**).

2.2 Assembling

The MCU Control Units are supplied with the Standby Battery fuse (FS4) not fitted. This fuse should be fitted once the Control Unit is mounted in position and ready for use. It should be noted that once this fuse is fitted, power will be connected to all modules and Sensor Heads connected to the system. All wiring tests and commissioning should therefore be performed prior to fitting this fuse.

Note: FS4 is supplied in a plastic bag inside the MCU control unit.

It is advisable to familiarise yourself with the Control Unit and its connections before mounting. In particular observe the mounting positions of any Input modules which have been modified to comply with an uncommon sensor configuration. It is also a convenient time to set the jumper switches for all the input modules according to the sensor type to be used.

Note:
Incorrect Input Module configuration can cause damage to the system.

2.3 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.

2.4 Power Supply Input

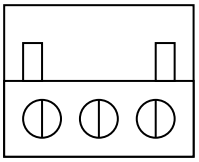
An isolating switch should be provided between the power source and the MCU control units to allow the supply to be easily disconnected. This should incorporate over current protection or a circuit breaker. Alternatively a fused supply would suffice. For information regarding the current requirement of the control units, refer to the specification located in section **9.1**.

2.4.1 A.C. Mains Connection

All mains voltage connectors etc. have been positioned beneath a yellow protective cover to prevent inadvertent user contact.

The power supply board has a three pin screw terminal connector assigned for the connection of an AC supply. This is located to the lower left-hand side of the MCU shrouded by a yellow protective cover. The AC supply can be either 240V or 110V. The 110V mains supply can be derived from either a 0V-110V AC power source or a 55V-0-55V AC power source. In all cases ensure the safety earth (E) is connected.

To connect AC power to the system it is necessary to unplug the three-terminal connector (PL1) from the power supply PCB. The screw terminals are connected as shown



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

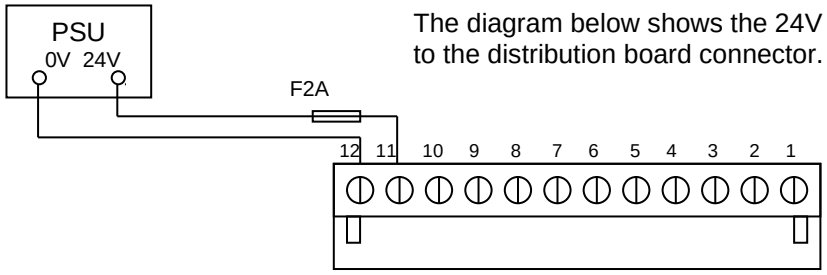
2.4.1.1 Selecting Mains Input Voltage

1. Ensure AC mains supply is disconnected from the MCU Control Unit.
2. Rotate the screw located centrally on the yellow cover anti-clockwise until the cover is released. It is not necessary to completely remove the screw from the cover assembly.
3. Slide the voltage selector switch into the appropriate position dependent upon the AC Mains Voltage to be used.
   Note that the 115V setting is used for 110-120V supplies and the 230V setting is used for 220-240V supplies.
4. Refit yellow cover before connecting AC mains supply.

Note
FS1 (located to the right of the mains input connector) is a T1.0A fuse.

2.4.2 24V DC Connection

The MCU system can be powered from an external power supply. The external PSU must provide a fused 24V (2A min) supply. The fuse should be F2A rated.



The diagram below shows the 24V and 0V connections to the distribution board connector.

2.5 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.

2.6 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: The sensors used within the gas detectors have a finite life. Pellistors have an expected life span in excess of two years, whilst electrochemical sensors have an expected life span of approximately two years.
- 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.

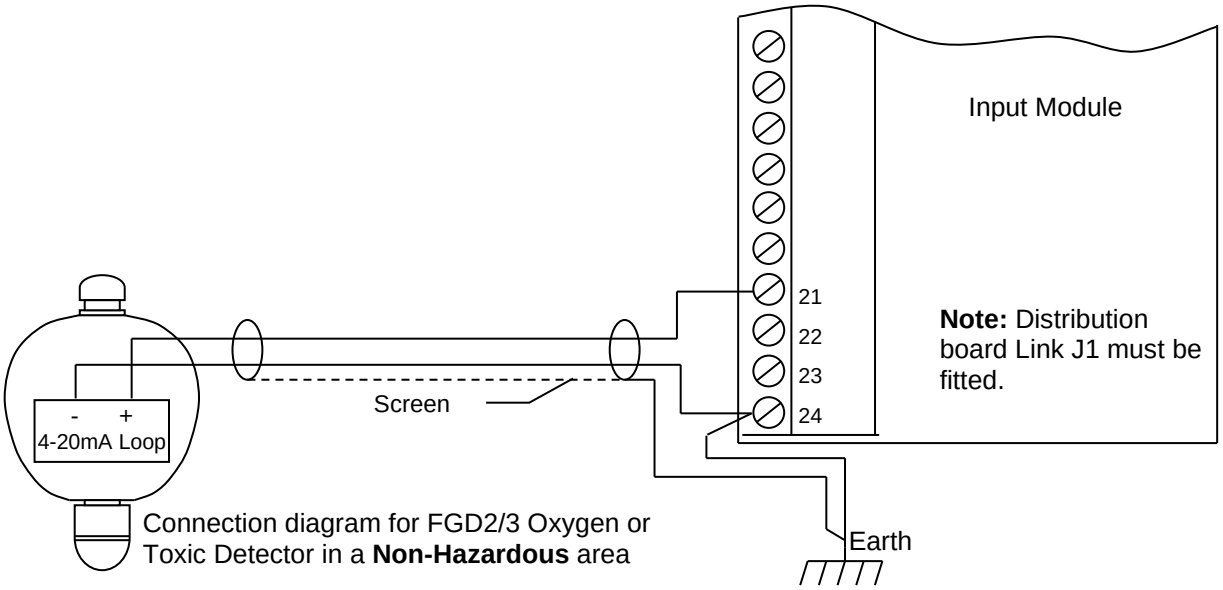
Mounting details for Status Scientific Detector Heads are located in section **8.6** within the appendix.

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 or FGD3 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.



Connection diagram for FGD2/3 Oxygen or Toxic Detector in a **Non-Hazardous** area

The correct wiring method for all Status Scientific FGD2 / FGD3 Detector Heads (in a non-hazardous location) is shown above. 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**).

Note:
The screens from each cable are connected to the chassis earth of the control unit. The connection between the system 0V and the earth of the chassis is made by fitting Jumper J1 located on the distribution board.

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.

There are two methods by which safety barriers can be provided:-

a). using an optional Status Scientific Controls barrier type FGDIO fitted integral to each output channel of the MCU unit.

b). using externally mounted proprietary safety barriers of the correct type in series with each remote detector head.

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
FGD2/3 Flammable	0V and PWR+	7.5V	0.75A	1.4W

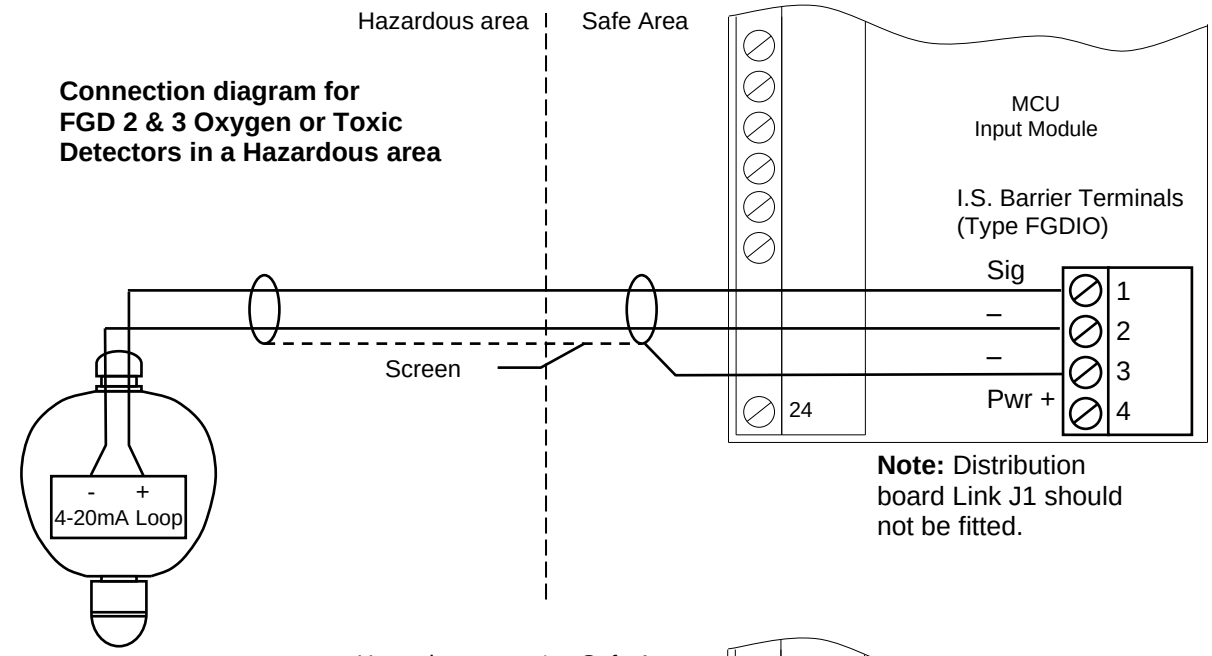
When considering the capacitance and inductance allowable across the barrier output terminals, note:

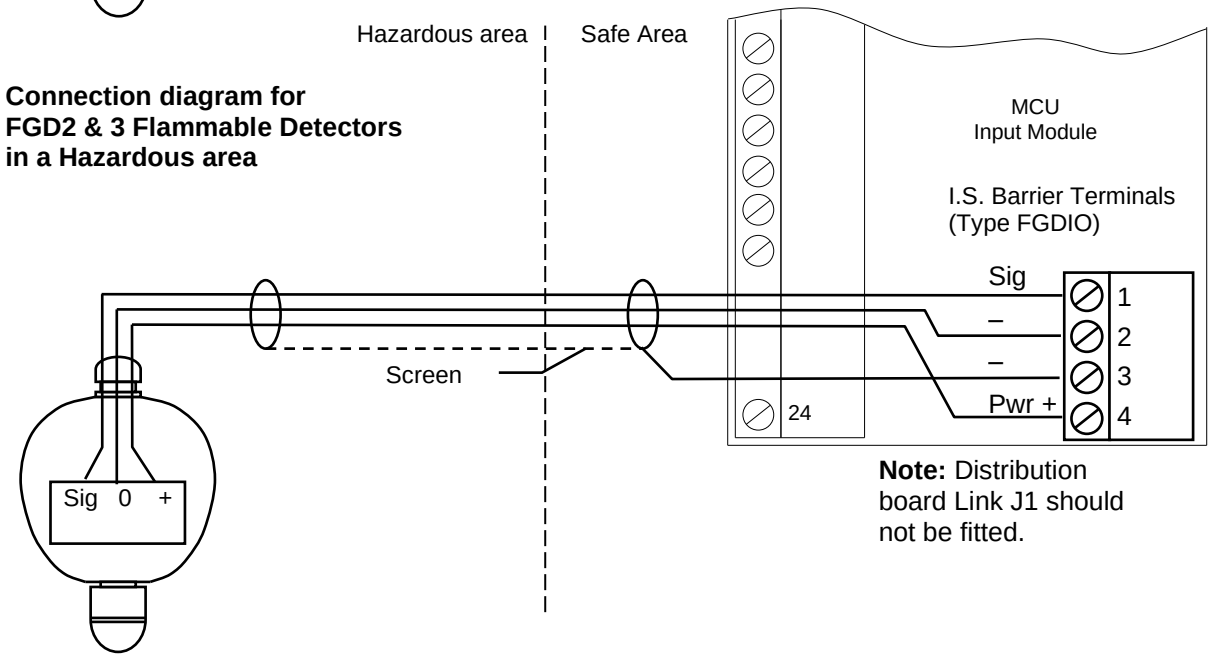
There is zero capacitance and zero inductance between terminals 0V and SIG on any model of FGD Detector head.
There is an equivalent of 1.4μF capacitance and zero inductance between terminals 0V and PWR on the FGD2 and FGD3 flammable gas detectors.

3.3.1 Hazardous area installation using barrier type FGDIO

A Status Scientific Controls barrier type FGDIO can be fitted to each output channel module within the MCU unit.

The following diagrams show the connections between FGD Detector heads and an Input Module fitted with an FGDIO Intrinsically Safe Barrier:





The I.S Earth connection on the power distribution PCB must be connected to the I.S. earth point for the installation. 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.

The barrier has two outputs having the following electrical parameters:-

Channel 1 Output, Terminals 1 & 2:	28V DC 0.112 Amps 0.8 Watts Internal Resistance = 270Ω ±5%
Channel 2 Output, Terminals 3&4:	7.5V DC 0.66 Amps 1.24 Watts Internal Resistance = 12Ω ±5%

In order to maintain intrinsic safety, the capacitance and Inductance or Inductance to Resistance (L/R) ratio of the loads connected to the terminals of the FGDIO Barrier must not exceed specified values:

The capacitance and Inductance or Inductance to Resistance (L/R) ratio of the load connected to terminals 1 and 2 must not exceed the following values:

GROUP	CAPACITANCE in μF	INDUCTANCE in mH	OR	L/R RATIO in μH/ohm
IIC	0.083	3		44
IIB	0.65	12		177
IIA	2.15	25		355

The capacitance and Inductance or Inductance to Resistance (L/R) ratio of the load connected to terminals 4 and 3 must not exceed the following values:

GROUP	CAPACITANCE in μF	INDUCTANCE in mH	OR	L/R RATIO in μH/ohm
IIC	11.1	0.07		28
IIB	174	0.28		114
IIA	1000	0.56		228

Warning:
When considering the suitability of an installation in terms of the load capacitance and inductance, account must be taken of the interconnecting cable itself. The figures in the tables must not be exceeded by the combination of the load parameters and the cable parameters. This may restrict the permissible cable length in some applications. If in doubt, consult Status Scientific Controls for assistance.

3.3.2 FGDIO Intrinsically Safe Output Module Installation

Where an MCU system has been purchased with the FGDIO barriers already fitted, it will be delivered correctly configured for the specified detector heads.

If an existing MCU system requires the addition of an FGDIO barrier, a kit of parts can be purchased from Status Scientific Controls. This includes:

Input Module
Grey Protective Cover incorporating the FGDIO Barrier
Fitting Hardware (i.e. hex spacers, screws, washers etc…)

Tools Required:

5mm A/F Spanner Flat blade screwdriver Multimeter

Install the input module and the FGDIO barrier as follows:

1. Switch OFF the power supply to the MCU system.
2. Locate the position within the control unit for the new channel. Unscrew the two knurled black thumbscrews that retain the grey protective cover.
3. Remove the two hexagonal spacers and associated washers that are revealed beneath the cover.
4. Take the new input/barrier module assembly and pull the barrier cover away from the input module circuit board.
5. Locate the new input module over the protruding studs (at the appropriate position within the control unit) taking care to align the pins of the motherboard header plug with the corresponding circuit board sockets.
6. Fit the M3x8 screws with shakeproof washers into the two holes at the front of the circuit board. Replace the LHS hexagonal pillar and fit the M3x14 pillar and shakeproof washer on the RHS.
7. Connect a multimeter set to measure voltage between pins 24 (0V) and 22 (+V).
8. Connect power to the control unit.
9. Determine the type of detector head to be used with the FGDIO module:
   O_2 / Toxic Detector Head:
   Rotate VR1 and VR2 (fine and coarse adjust respectively) until the voltage indicated by the multimeter reads 2.0V ±0.5V.
   Flammable Detector Head:
   Adjust VR1 and VR2 (fine and coarse adjust respectively) until the voltage indicated by the multimeter reads 8.0V ± 0.1V.
10. Switch off the power supply to the control unit.
11. Take the grey cover incorporating the FGDIO module and refit this over the input module. Ensure the FGDIO connector locates into its mating half correctly. Secure the cover in position using an M3x16 countersunk head screw on the RHS of the barrier cover.
12. Connect the detector head to the output terminals of the FGDIO barrier following installation diagrams (see section 3.3.1Error! Reference source not found.).
13. Reconnect power to the system.
14. Calibrate the new channel.

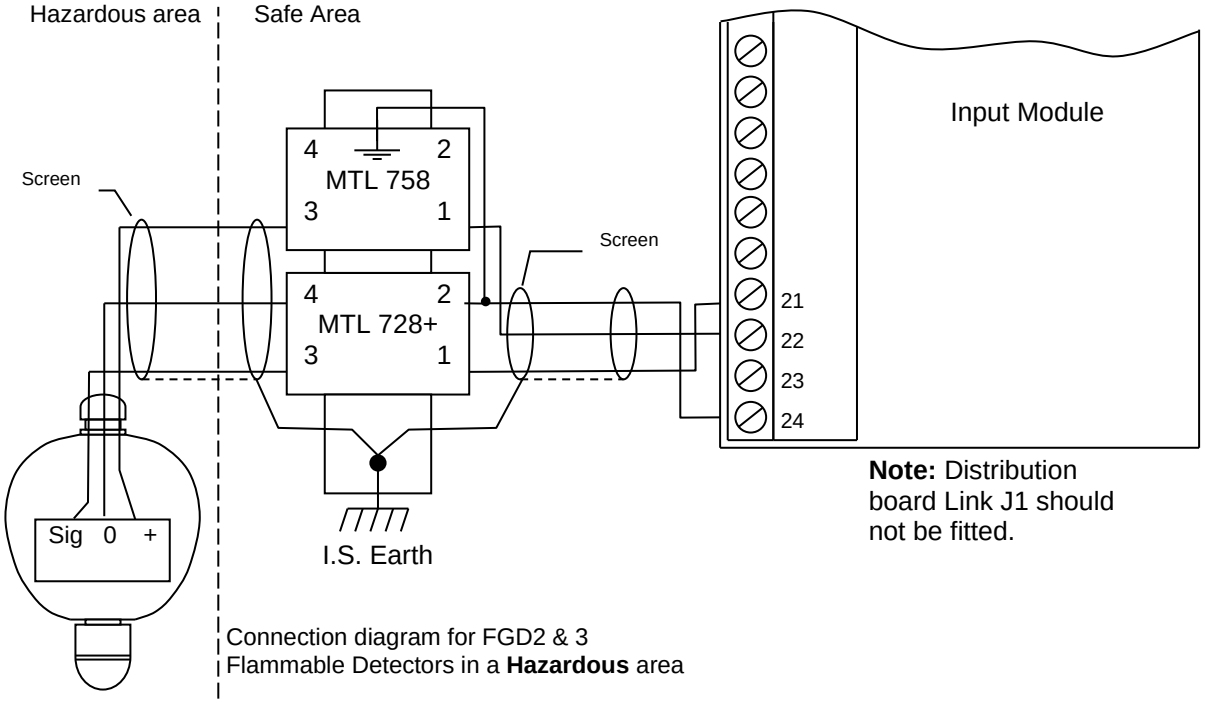
Note:
RHS and LHS apply to modules located in even number channel positions. Where the input module is being installed in an odd number channel position these locations must be reversed.

When wiring to the input module connector, ensure that no stray strands of wire exist between the two intrinsically safe (I.S.) outputs. The use of bootlace ferrules is recommended. To comply with the certification of the module, ensure there is always at least 50mm between exposed non-intrinsically safe module outputs.

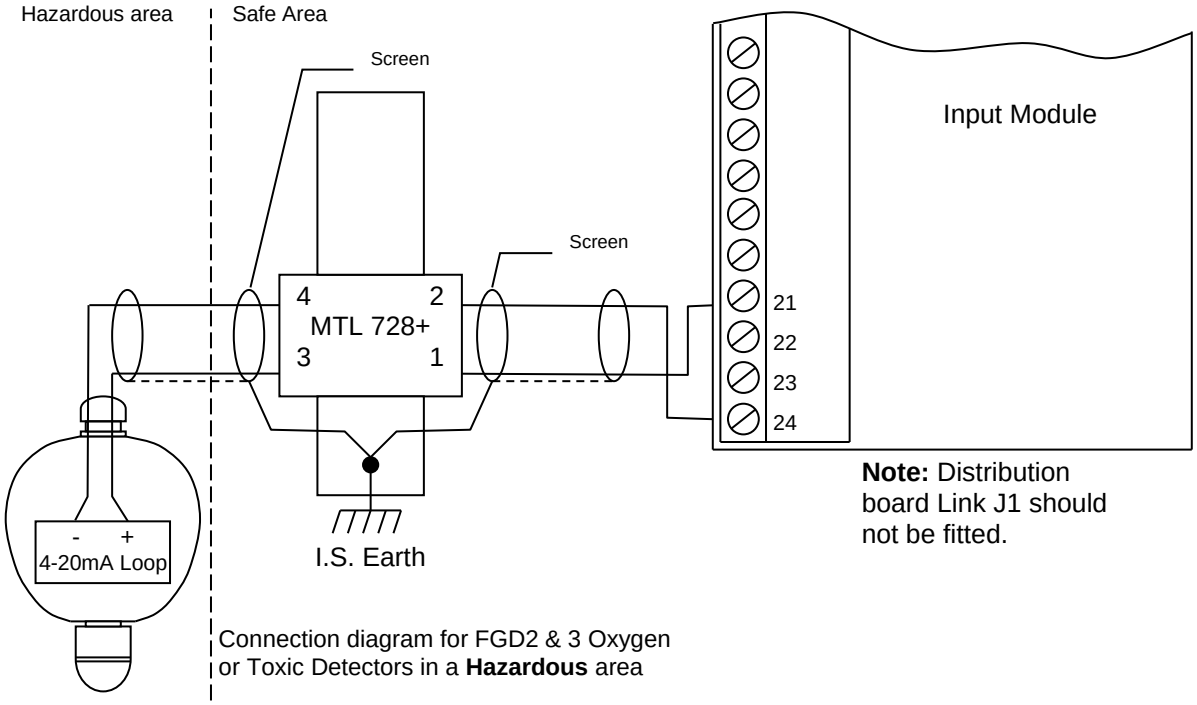
The connection between the system I.S. earth and the control unit I.S. earth must be made using at least one conductor with a minimum of $4mm^2$ copper. Further guidance on the correct installation of I.S. systems is provided by EN60079-14:1997 (which replaces BS5345, parts 1, 3-8).

3.3.3 Hazardous area installations using Proprietary Safety Barriers.

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



Connection diagram for FGD2 & 3 Flammable Detectors in a **Hazardous** area



Connection diagram for FGD2 & 3 Oxygen or Toxic Detectors in a **Hazardous** area

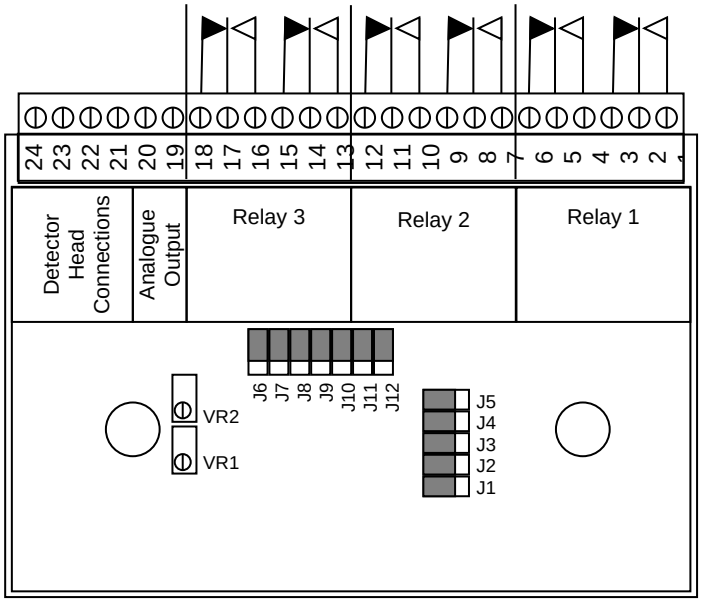
Note:
The system 0V is **NOT** connected to the earth. Ensure J1 on the Distribution Board is not fitted.

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.

Jumper switches J1-J5 select the chart recorder output configuration, whilst Jumper switches J6-J12 configure the input card for the detector head to be used.

4.1 Input Configuration

Section **4.1.1** 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). Section **4.1.2** discusses less common configurations. These configurations allow alternative manufacturers detector heads to be used.

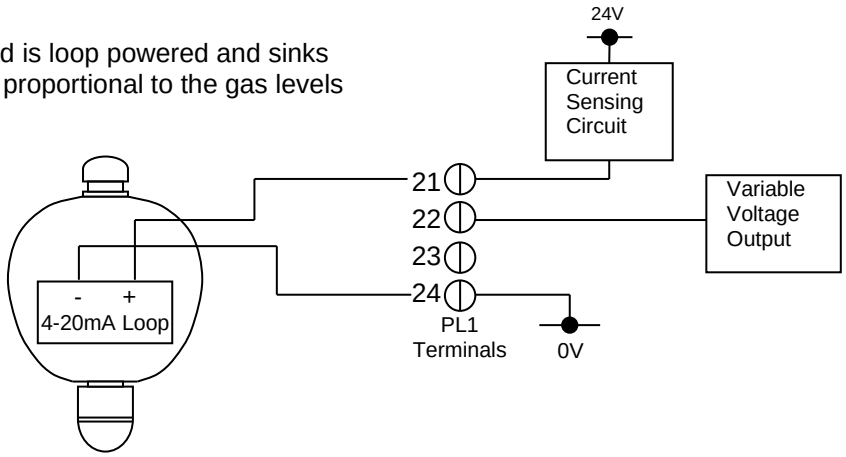
Note: *The input configurations shown are for detector heads located in non-hazardous environments. I.S. Barriers are required when mounting in areas where there is a flammable gas hazard, refer to section **3.3**.*

4.1.1 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.

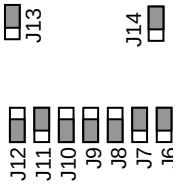
4.1.1.1 FGD2 and FGD3 O_2 and Toxic Detector Heads

The detector head is loop powered and sinks a current directly proportional to the gas levels that it detects.



Connection Procedure

- Disconnect power from the system.
- Remove the grey protective cover from the associated input module.
- Configure the jumper switches as shown below (i.e. J6, J7, J11, J13 and J14 switched ON, all others OFF)



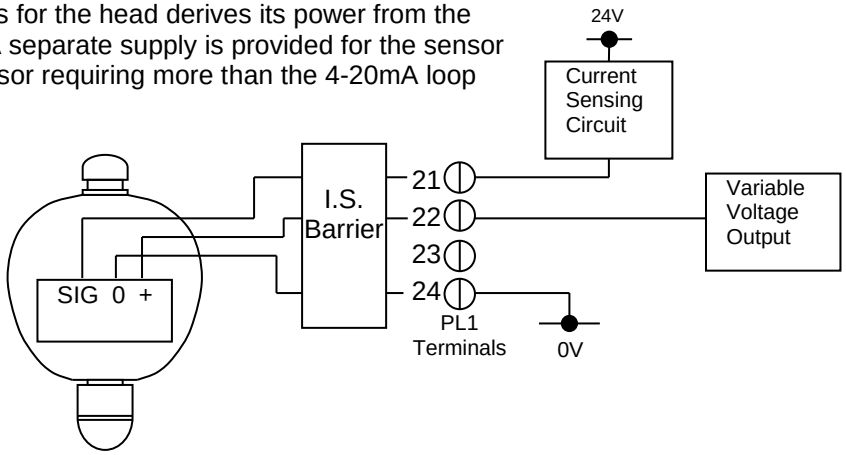
- Connect the wires from the detector head to PL1 on the input module observing the following:

Detector Head Label 4-20mA Loop	PL1 Pin Number
-	24
+	21

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

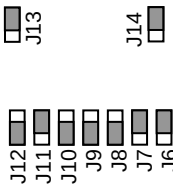
4.1.1.2 FGD2 and FGD3 Flammable Detector Heads

The electronics for the head derives its power from the current loop. A separate supply is provided for the sensor due to the sensor requiring more than the 4-20mA loop current range.



Connection Procedure

- Disconnect power from the system.
- Remove the grey protective cover from the associated input module
- Configure the jumper switches as shown below (i.e. J6, J7, J11, J13 and J14 switched ON, all others OFF)



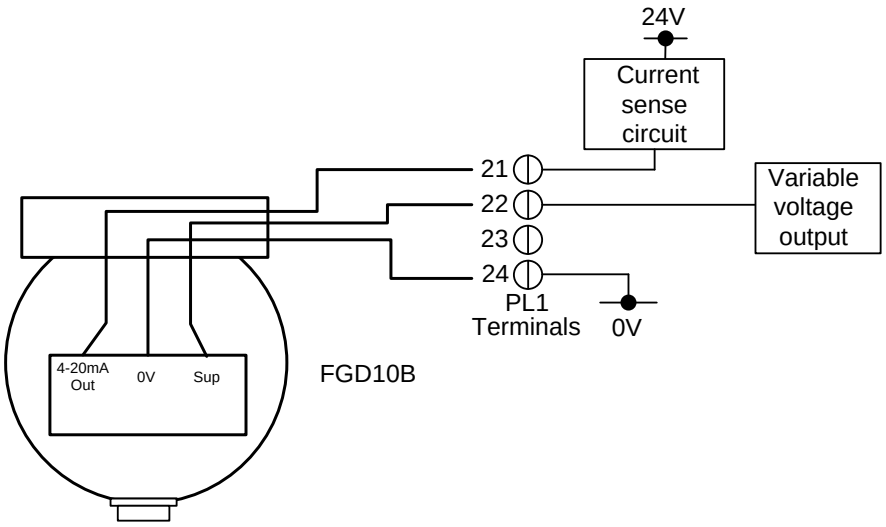
- Connect a voltmeter (range 0-24V min) between pins 22 (+V) and 24 (0V) of PL1.
- Connect power to the system.
- Adjust VR1 and VR2 until voltmeter reads 4.5V ±0.5V (VR1 and VR2 provide fine and coarse voltage adjustment respectively).
- Disconnect power to the system and connect the wires from the detector head to PL1 on the input module observing the following:

Detector Head Label 4-20mA Loop	PL1 Pin Number
0	24
+	22
Sig	21

- Connect power to the system and ensure the detector head operates (text on LCD display, LED will flash once every six seconds approximately)
- Measure the voltage between the + and 0 terminals at the detector head.
- If necessary adjust VR1 and VR2 at the Input Module to give 4.5V ±0.5V at the detector head (7.0V absolute maximum).
- Refit grey protective cover.
- Perform software configuration (refer to 'MCU Software Configuration and System Calibration Manual').
- Perform system calibration.

4.1.1.3 FGD10B Infrared Current Sink

The electronics for the head derives its power from the current loop. A separate supply is provided for the sensor due to the sensor requiring more than the 4-20mA loop current range.



Connection Procedure

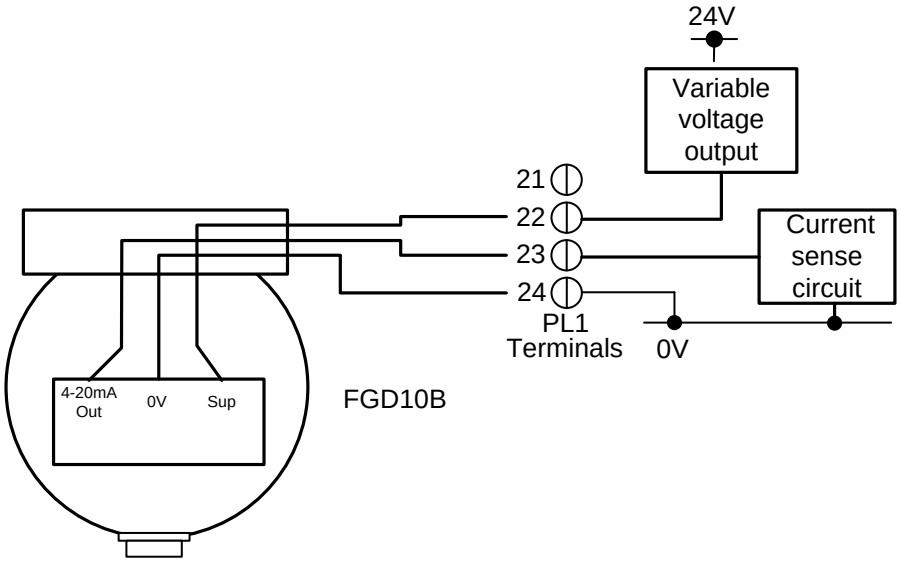
- Disconnect power from the system.
- Remove the grey protective cover from the associated input module
- Configure the jumper switches as shown below (i.e. J6, J7, J11, J13 and J14 switched ON, all others OFF)

- Connect a voltmeter (range 0-24V min) between pins 22 (+V) and 24 (0V) of PL1.
- Connect power to the system.
- Adjust VR1 and VR2 until voltmeter reads between 15V and 24V (VR1 and VR2 provide fine and coarse voltage adjustment respectively).
- Disconnect power to the system and connect the wires from the detector head to PL1 on the input module observing the following:

Detector Head	PL1 Pin Number
0	24
Supp	22
4-20mA out	21

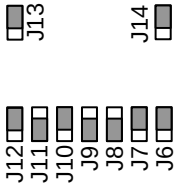
- Connect power to the system and ensure the detector head operates.
- Measure the voltage between the + and 0 terminals at the detector head.
- Refit grey protective cover.
- Perform software configuration (refer to 'MCU Software Configuration and System Calibration Manual').
- Perform system calibration.

4.1.1.4 FGD10B Infrared Current Source



Connection Procedure

- Disconnect power from the system.
- Remove the grey protective cover from the associated input module
- Configure the jumper switches as shown below (i.e. J6, J7, J10, J12, J13 and J14 switched ON, all others OFF)



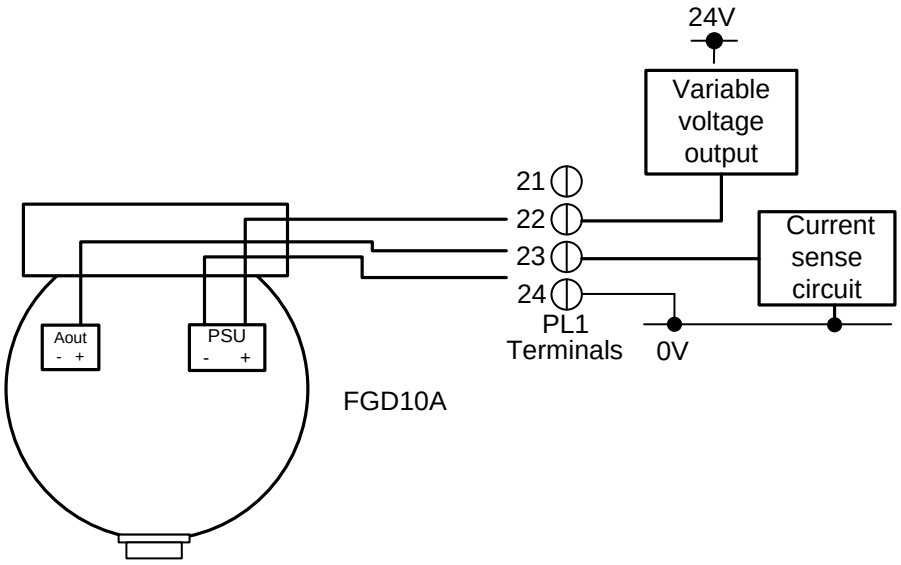
- Connect a voltmeter (range 0-24V min) between pins 22 (+V) and 24 (0V) of PL1.
- Connect power to the system.
- Adjust VR1 and VR2 until voltmeter reads between 15V and 24V (VR1 and VR2 provide fine and coarse voltage adjustment respectively).
- Disconnect power to the system and connect the wires from the detector head to PL1 on the input module observing the following:

Detector Head	PL1 Pin Number
0	24
Supp	22
4-20mA out	21

- Connect power to the system and ensure the detector head operates.
- Verify that the voltage between the Supp and 0 terminals at the detector head is correct.
- Refit grey protective cover.
- Perform software configuration (refer to 'MCU Software Configuration and System Calibration Manual').
- Perform system calibration.

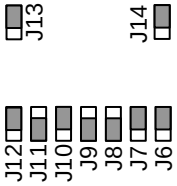
4.1.1.5 FGD10A Infrared Current Source

The FGD10A is a current source device, i.e. the 4 to 20 mA signal is derived from the detector.



Connection Procedure

- Disconnect power from the system.
- Remove the grey protective cover from the associated input module
- Configure the jumper switches as shown below (i.e. J6, J7, J10, J12, J13 and J14 switched ON, all others OFF)



- Connect a voltmeter (range 0-24V min) between pins 22 (+V) and 24 (0V) of PL1.
- Connect power to the system.
- Adjust VR1 and VR2 until voltmeter reads between 15V and 24V (VR1 and VR2 provide fine and coarse voltage adjustment respectively).
- Disconnect power to the system and connect the wires from the detector head to PL1 on the input module observing the following:

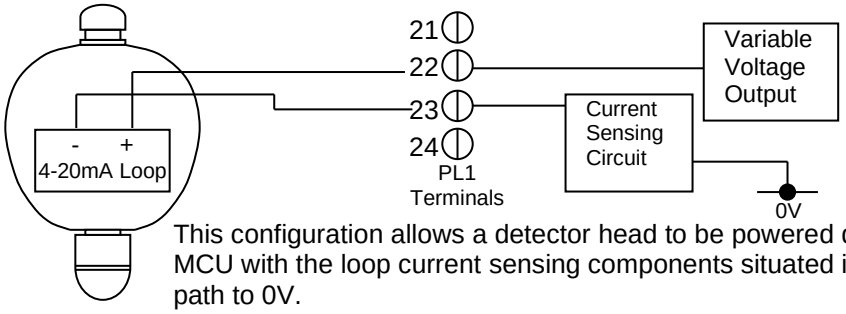
Detector Head	PL1 Pin Number
PSU -	24
PSU +	22
Aout +	23

- Connect power to the system and ensure the detector head operates.
- Verify that the voltage between the PSU+ and PSU- terminals at the detector head are correct.
- Refit grey protective cover.
- Perform software configuration (refer to 'MCU Software Configuration and System Calibration Manual').
- Perform system calibration.

4.1.2 Alternative Detector Heads

The MCU Control Units have been designed to accommodate detector heads built by other manufacturers; section 4.1.2 shows the relevant diagrams and procedures.

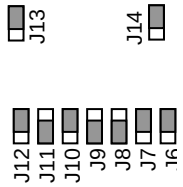
4.1.2.1 4-20mA Sink to Ground Using Internal PSU



This configuration allows a detector head to be powered directly from the MCU with the loop current sensing components situated in the return path to 0V.

Connection Procedure

- Disconnect power from the system.
- Remove the grey protective cover from the associated input module.
- Configure the jumper switches as shown below (i.e. J6, J7, J10, J12, J13 and J14 switched ON, all others OFF)

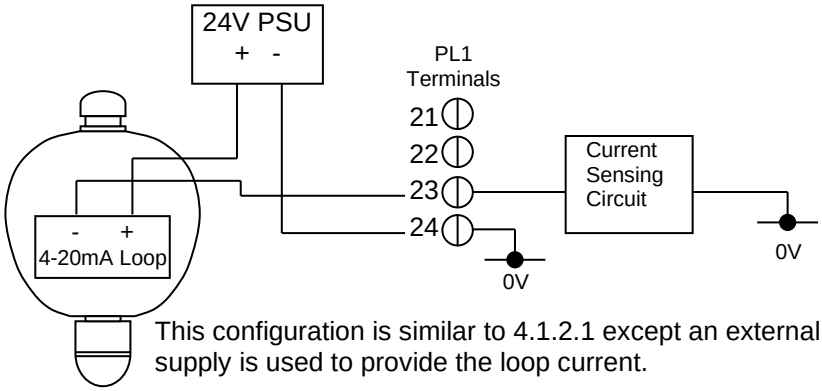


- Connect a voltmeter between pins 22 (+V) and pin 24 (0V) of PL1.
- Connect power to the system.
- Adjust VR1 and VR2 until the appropriate voltage is observed on the meter, typically 22V ±2V. Consult detector head instructions for recommended supply voltage.
- Disconnect power from the system.
- Connect the wires from the detector head to PL1 on the input module observing the following:

Detector Head	PL1 Pin Number
-	23
+	22

- Connect power to the system and ensure the detector head operates.
- Refit grey protective cover.
- Perform software configuration (refer to 'MCU Software Configuration and System Calibration Manual').
- Perform system calibration. Refer to 'MCU Software Configuration and System Calibration Manual' and detector head manufacturers instructions.

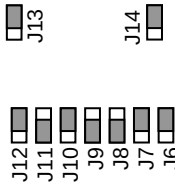
4.1.2.2 4-20mA Sink to Ground Using External PSU



This configuration is similar to 4.1.2.1 except an external power supply is used to provide the loop current.

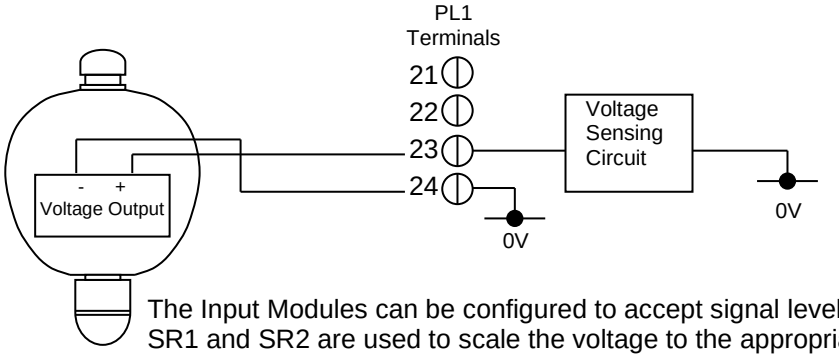
Connection Procedure

- Disconnect power from the system.
- Remove the grey protective cover from the associated input module
- Configure the jumper switches as shown below (i.e. J6, J7, J10, J12, J13 and J14 switched ON, all others OFF)



- Connect the detector head to PL1 observing the above diagram.
- Connect power to the system and ensure the detector head operates.
- Refit grey protective cover.
- Perform software configuration (refer to 'MCU Software Configuration and System Calibration Manual').
- Perform system calibration. Refer to 'MCU Software Configuration and System Calibration Manual' and detector head manufacturers instructions.

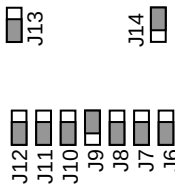
4.1.2.3 DC Voltage Input



The Input Modules can be configured to accept signal levels in voltage form. SR1 and SR2 are used to scale the voltage to the appropriate level.

Connection Procedure

- Disconnect power from the system.
- Remove the grey protective cover from the appropriate input module
- Configure the jumper switches as shown below (i.e. J9 and J14 switched ON, all others OFF)



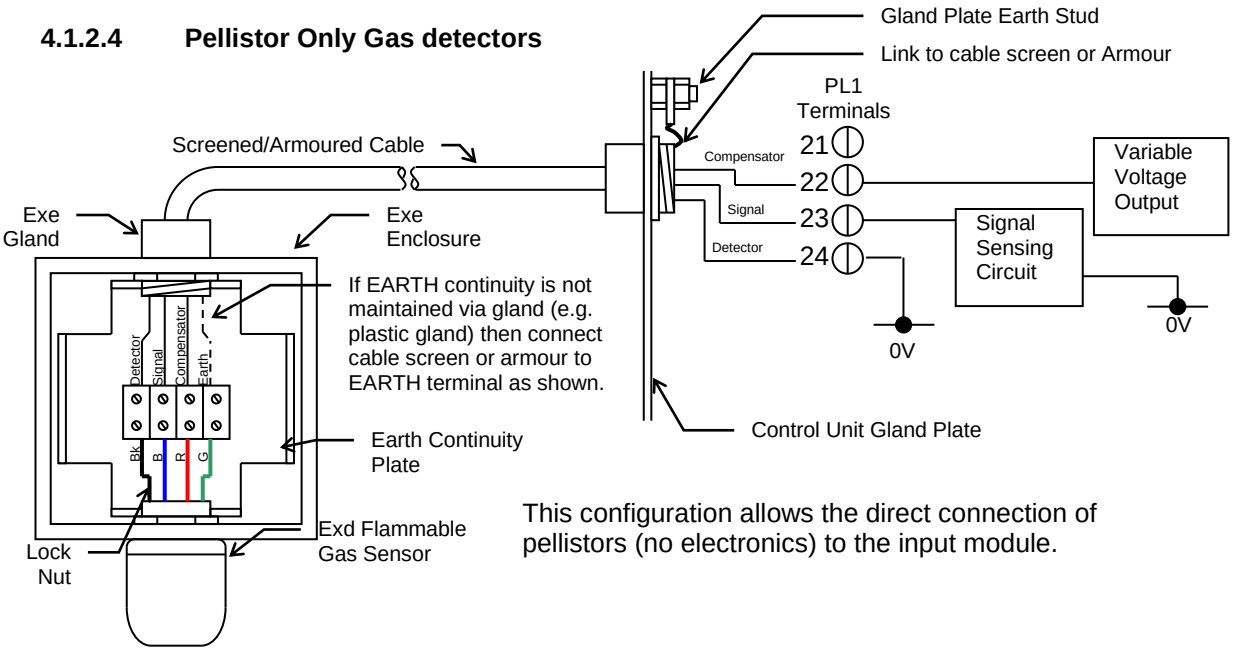
- Remove R16 and R18 (located above J13) from the input module.
- Fit conventional ¼watt resistors to positions SR1 and SR2 using values from the following table.

Voltage Input (max)	SR1	SR2
2.5V	18R	470R
5V	390R	330R
10V	1K5	470R
12V	1K8	390R
24V	12K	1K2

For alternative voltage inputs contact Status Scientific for appropriate resistor values.

- Connect the detector head to PL1 observing the above diagram.
- Connect power to the system.
- Refit grey protective cover.
- Perform software configuration (refer to 'MCU Software Configuration and System Calibration Manual').
- Perform system calibration. Refer to 'MCU Software Configuration and System Calibration Manual' and detector head manufacturers instructions.

4.1.2.4 Pellistor Only Gas detectors

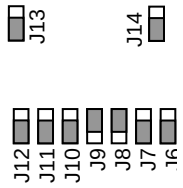


This configuration allows the direct connection of pellistors (no electronics) to the input module.

Connection Procedure

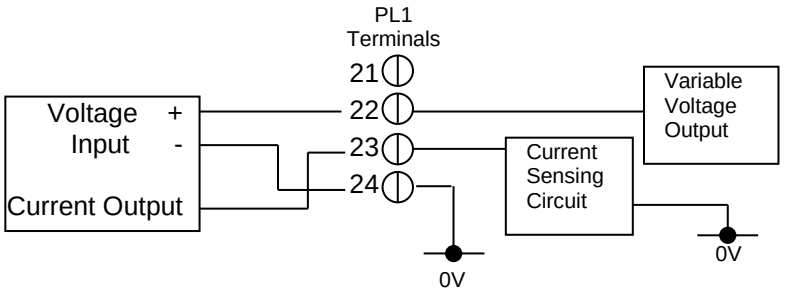
Note: For use in hazardous areas, the pellistors must be housed in an Exd enclosure mounted on an Exe terminal housing.

- **DO NOT** connect the pellistors at this time.
- Remove the grey protective cover from the appropriate input module.
- Configure the jumper switches as shown below (i.e. J8 & J9 switched ON, all others OFF)



- Connect a voltmeter between pins 22 (+V) and 24 (0V).
- Adjust VR1 and VR2 until the correct voltage can be measured for the pellistors being used (SSCL pellistors require 2.0V± 0.01V).
  VR1 & VR2 provide coarse and fine output voltage adjustment respectively.
  Note: Connecting a voltage of greater than 2.2V will 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 2.0V ± 0.01V, adjust if necessary.
  Note: Measure the voltage at the pellistors, not at the input module terminals.
- Refit the grey protective cover.
- Perform software configuration (refer to 'MCU Software Configuration and System Calibration Manual').
- Perform system calibration.

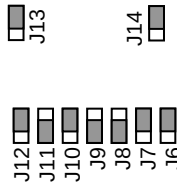
4.1.2.5 3-Wire Connection – (4-20mA Current Input and Separate Supply)



This configuration allows the connection of a detector head that provides a 4-20mA current output, and requires a separate power source, between 0-24V.

Connection Procedure

- Disconnect power from the system.
- Remove the grey protective cover from the appropriate input module
- Configure the jumper switches as shown below (i.e. J6, J7, J10, J12, J13 and J14 switched ON, all others OFF)



- Connect a voltmeter between pins 22 (+V) and 24 (0V).
- Connect power to the system.
- Adjust VR1 and VR2 until the correct voltage can be measured for the detector head being used.
- Disconnect power to the system.
- Connect the detector head to the input module observing the above diagram.
- Refit grey protective cover.
- Connect power to the system and confirm that the detector head operates.
- Perform software configuration (refer to 'MCU Software Configuration and System Calibration Manual').
- Perform system calibration. Refer to 'MCU Software Configuration and System Calibration Manual' and detector head manufacturers instructions.

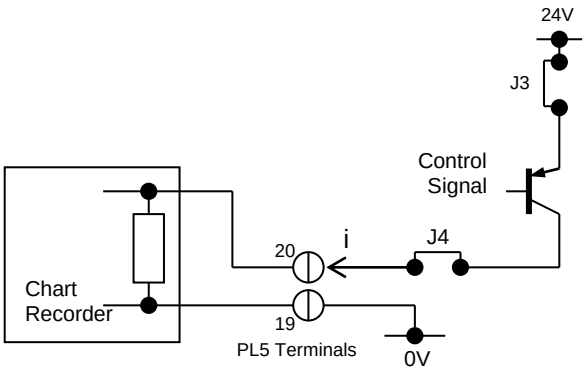
4.2 Analogue Output Configuration

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').

The analogue output options available are:

4.2.1 4-20mA Current Source

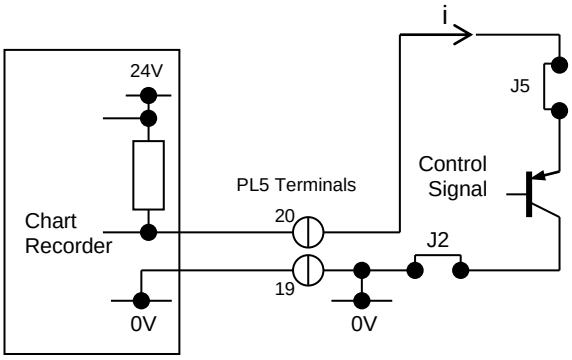


The Input Module sources current proportional to the detected gas level.
i.e. zero gas = 4mA
full scale = 20mA

The supply is taken from the internal PSU.

Notes
Switch ON J3 and J4

4.2.2 4-20mA Current Sink

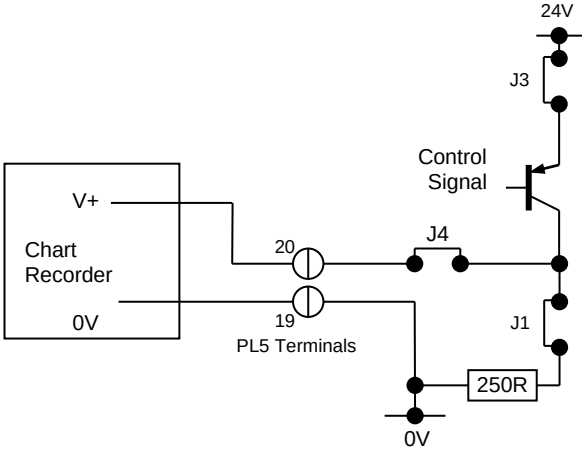


The Input Module can also sink current proportional to the detected gas level.
i.e. zero gas = 4mA
full scale = 20mA

The supply is derived from the external equipment.

Notes
Switch ON J2 and J5

4.2.3 1-5V Voltage Output



The SCM1 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.

Notes
Switch ON J1, J3 and J4.

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

4.3 Input Module Installation

The MCU system supplied by Status Scientific Controls will normally be delivered correctly configured for the detector heads that have been purchased. If an existing MCU system requires the addition of a monitoring channel, a kit of parts can be purchased from Status Scientific Controls. This includes:

Input Module
Terminal identification label.
Fitting Hardware (i.e. hex spacers, screws, washers etc…)

Tools Required:

5mm A/F Spanner Flat blade screwdriver

Install the input module as follows:

1. Switch OFF the power supply to the MCU system.
2. Locate the position within the control unit for the new channel. Unscrew the two knurled black thumbscrews that retain the grey protective cover.
3. Remove the two hexagonal spacers and associated washers that are revealed beneath the cover.
4. Locate the new input module over the protruding studs (at the appropriate position within the control unit) taking care to align the pins of the motherboard header plug with the corresponding circuit board sockets.
5. Fit the M3x8 screws with shakeproof washers into the two holes at the front of the circuit board. Place a shakeproof washer onto each of the studs that protrude through the input module. Replace the hex pillars onto the studs.
6. Take the transparent terminal identification label and attach it to the sloping front edge of grey protective cover (refer to input modules already installed for correct mounting position).
7. Configure the input module jumper switches for the detector head that is to be attached.
8. Refit the grey protective cover locating the black thumbscrew threads into the top of the hex pillars.
9. Connect the detector head to the output terminals of the input module following the appropriate installation diagrams (see section 3.3.1Error! Reference source not found.).
10. Calibrate the new channel.

When wiring to the input module connector, the use of bootlace ferrules is highly recommended.

5 DETECTOR HEAD OPERATION & CALIBRATION

For details regarding FGD detector head specifications consult section **1**.

5.1 Detector Head Variants

Status Scientific Controls manufacture detector heads for a wide variety of gases. The flexibility of the MCU systems has led to alternative heads being designed to monitor alternative parameters e.g. temperature (thermocouples), fire/smoke etc.

Status Scientific Controls can manufacture detector heads allowing the MCU system to monitor almost any measurable level (not necessarily related to environmental monitoring). Contact Status Scientific Controls for further details.

5.2 Operation

The FGD2 & FGD3 detector heads do not require user intervention during normal operation; however periodic inspection is advised (consult section **5.3**). The front panel LCD will always show the current levels of gas that the head is detecting. A Confidence LED located on the lower edge of the casing will flash periodically to indicate that the head is powered and the internal microcontroller is running.

5.2.1 Status Indications

5.2.1.1 FLT

The flammable gas detector heads incorporating pellistors will flash ‘FLT’ if they sense a fault with the pellistors fitted. This will coincide with them drawing less than 2.5mA from the control unit, thus ensuring the control unit is aware of the fault condition.

All other detector heads will flash FLT if they sense a gas concentration less than 10% of FSD below zero.

5.2.1.2 Calibration Mode

When the Detector head is placed in calibration mode, the display will flash the appropriate information.

5.2.1.3 HI

HI will flash on the display if the head detects a gas concentration greater than:

FSD + 10%.

e.g. A flammable head with a range of 0-100% LEL

10% of full scale is 100/10 = 10%

If the reading goes above fsd by 10% (i.e. 110% LEL), HI will flash on the display.

This condition will coincide with the head drawing a current of greater than 22mA, thus indicating to the MCU Control Unit of a HI condition.

5.3 Inspection and Maintenance

5.3.1 Calibration Intervals

Status Scientific Controls advise that calibrations should be performed at no longer than six monthly intervals (this can be arranged with Status Scientific Controls as part of a maintenance contract).

If a pellistor-based sensor is known to have been exposed to a poison (refer to section **5.5.1**) it must at least be recalibrated. However Status Scientific Controls strongly advise sensor replacement in these circumstances.

5.3.2 Routine Inspection

The detector heads will provide accurate fault free service but they rely upon sensible housekeeping and regular calibrations. It is advisable to periodically inspect the detector head installation:

- Check cables to ensure no damage has occurred.
- Clean detector heads using a DAMP cloth.
- Inspect detector heads and ensure the sensor housing apertures are not obstructed.

The time interval between routine inspections will depend upon the area in which the head 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.

5.4 Calibration

In order to carry out calibration of the gas detector, refer to the relevant instruction manual for the product concerned.

5.5 Gas Detector Contaminants

The information provided in section **5.5** and its associated sub-sections is taken from the sensor manufacturers 'Product Data Handbook'.

5.5.1 Flammable Gas Detectors

Flammable gases can be detected by using either infrared or pellistor type gas detectors.

Infrared gas detectors have the advantage of being immune to chemical 'poisoning' and providing a long operational life. However, they will not detect Hydrogen.

Pellistor type gas detectors are relatively low cost but are prone to chemical 'poisoning' as detailed below.

The following information relates only to flammable gas detectors containing pellistors.

Certain substances are known to have a detrimental effect on gas detectors containing pellistors.

Poisons
Some compounds will decompose on the pellistor and form a solid barrier over its surface. This action is cumulative and prolonged exposure will result in an irreversible decrease in sensitivity. The most common of these substances are:

lead or sulphur containing compounds,
silicones, phosphates.

It may be possible to recalibrate a sensor that is known to have been exposed to a poison. However Status Scientific Controls strongly advise sensor replacement in these circumstances.

Inhibitors
Certain compounds (especially H_2S and halogenated hydrocarbons) are absorbed or form compounds that are absorbed by the pellistor. This absorption is so strong that reaction sites within the pellistor become blocked and normal reactions are inhibited. The resultant loss of sensitivity is temporary and in most cases a sensor will recover after a period of operation in clean air.

Pellistors will detect numerous flammable gases. The level at which they respond varies depending upon the flammable gas. Contact Status Scientific Controls for details regarding the cross sensitivity of flammable gases.

5.5.2 Oxygen Gas detectors

At very high levels (i.e. % levels), highly oxidising gases (e.g. ozone and chlorine) will interfere to the extent of their oxygen equivalent *, but most other commonly occurring gases will have no effect. For example:

Methane100%	0
Hydrocarbons 100%	0
Hydrogen 100%	< -2%
Carbon Monoxide 20%	< -0.5%

Acid gases such as CO_2 and SO_2 will be slightly absorbed by the electrolyte (within the oxygen sensor) and tend to increase the flux of oxygen to the electrode. This gives an enhanced oxygen signal of about 0.3% of signal per 1% CO_2. The oxygen gas detectors are not suitable for continuous operation in concentrations of CO_2 above 25%.

* Gas detectors should not be subjected to prolonged exposure to highly corrosive atmospheres as this will cause premature failure.

5.5.3 Toxic Gas Detectors

Toxic gas sensors are known to be cross sensitive to gases other than those for which they have been designed to detect. The amount of response observed by a sensor will vary depending upon the sensor type and the interfering gas.

For example:
This table shows the cross-sensitivity of the H_2S sensor fitted to the FGD2 and 3 Detector Heads. The table shows the typical response to be expected from a sensor when exposed to a given test gas concentration.

Gas	Concentration	Sensor Response
Carbon Monoxide	300ppm	≤ 6ppm
Sulphur Dioxide	5ppm	< 1ppm
Nitric Oxide	35ppm	0ppm
Nitrogen Dioxide	5ppm	≈ -1ppm
Chlorine	1ppm	≈ -0.1ppm
Hydrogen	10,000ppm	< 15ppm
Hydrogen Cyanide	10ppm	0ppm
Hydrogen Chloride	5ppm	0ppm
Ethylene	100ppm	0ppm

Contact Status Scientific Controls for further details regarding the cross-sensitivity of a particular sensor.

5.6 Sensor Disposal

All gas sensors should be disposed of according to local waste management requirements and environmental legislation. They should not be burnt since they may evolve toxic fumes. Status Scientific will accept sensors for disposal (by prior arrangement) contact Status Scientific Controls for further details.

5.6.1 Oxygen Sensors

Oxygen Sensors contain a 4-molar potassium acetate solution which is corrosive. They also contain small amounts of lead, lead oxide, platinum, silver, carbon and antimony, some of which are toxic and/or mutagenic. As these sensors contain some highly toxic compounds, irrespective of physical condition, they should be disposed of according to local waste management requirements and environmental legislation. They should not be burned as they may evolve toxic fumes.

5.6.2 Toxic Gas Sensors

The majority of toxic gas sensors contain a sulphuric acid electrolyte. They also contain platinum, ruthenium, gold, silver and carbon, some of which are toxic.

Several sensors contain a phosphoric acid electrolyte. And a select few also contain lithium chloride, sodium chloride and iodine which are toxic.

5.6.3 Flammable Gas Sensors

Pellistor based flammable gas sensors contain two pellistor beads known as the detector and the compensator. The pellistor bead of the detector element contains very small traces of toxic chemicals. The amounts involved are so small they do not represent any safety hazard. However they should still be disposed of in accordance with guidelines laid down by any relevant safety bodies as well as in accordance with local regulations.

6 TROUBLE SHOOTING

The MCU system is supplied fully tested, and it is unlikely that any apparent faults are as a result of faulty hardware. Most problems encountered are as a result of installation faults or incorrect software/hardware configuration.

6.1 Common Faults

Fault
The Detector head display is blank.

- Ensure the MCU has power connected.
- Ensure the current loop connections are correct at the detector head and at the MCU.
- Ensure all connectors within the detector head are attached.
- Ensure a voltage is present at the loop current connections at the detector head terminal block.
  Unless the detector head is mounted a significant distance from the MCU this voltage should be approaching 20V (7V minimum).
- Where an I.S. Barrier is fitted, check that the barrier fuse is intact.

Fault
A Flammable Head is attached to channel 1 but the reading on the Detector Head display is a high negative number (e.g. –60).

- Check that the pellistor supply is connected to the head.
  The flammable heads require a separate supply to provide the pellistors with current in excess of the 4-20mA available loop current.
- Check that the 'pwr' supply measures 3.5V – 4.5V at the detector head.
  The voltage supply for the pellistors is regulated within the detector head at a factory pre-set level (2.0V for VQ2 type pellistors). In order to provide a regulated supply at the correct voltage the detector head 'pwr' connection must receive a minimum of 3.5V.

Fault
The detector head displays a valid reading; however the MCU does not appear to be displaying the same, or any valid reading.

- Ensure that the channel has been enabled within the software.
- Ensure the channel setup is correct i.e. gas type, range
- Check that the jumper switch settings are correct. For all Status Scientific Detector Heads J6, J7 & J11 need to be switched ON.
- Calibrate channel.

Fault
The MCU does not appear to communicate with channels five to eight.

- Ensure interconnecting cable is correctly attached between upper and lower platforms within the control unit.
- Ensure relevant channels are enabled within the software.

7 SERVICE

7.1 Warranty

The quality of design and manufacture included in all Status Scientific Controls Instruments ensure a long and trouble free life.

In the unlikely event of a piece of our equipment failing within the first twelve months following delivery, Status Scientific will repair or replace any faulty parts, free of charge, providing that the equipment has not been misused.

7.2 Commissioning and Service

The MCU and FGD Sensor Heads 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.

Commissioning involves:
- Testing of all system wiring
- Software configuration for each channel
- Calibration of all channels and detector heads
- Operational checks on all detecting channels used.

7.3 Sensor Replacement

Sensors have a finite life; Pellistors have an expected life span in excess of two years, whilst electrochemical sensors have an expected life span of approximately two years.

All of the Status Scientific detector heads have push-fit sensors to aid on-site replacement. The different sensor designs dictate mounting orientations to minimise possibilities of incorrect installation.

Sensor Removal and Refitting

a) Inhibit the channel at the MCU (performed from the keypad).
b) Disconnect power to the head by unplugging the screw terminal connector on the Input Module associated with that channel (within the MCU control unit).
c) Release the grub screw situated on the stainless steel sensor housing.
d) Unscrew the sensor housing cover.
e) Unplug the sensor assembly and ensure the new assembly is identical.
f) Push in the new sensor assembly.
g) Refit the sensor housing cover and tighten the grub screw.
h) Allow the sensor to stabilise (1-2 hours for toxic, 1-2 mins for flammable).
i) **Calibrate the head.**
j) Enable the channel at the MCU.

7.4 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.

7.4.1 Routine Inspection

It is advisable to periodically inspect the MCU 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.

8 APPENDIX

8.1 Installation of Safe Area Sounders and Beacons

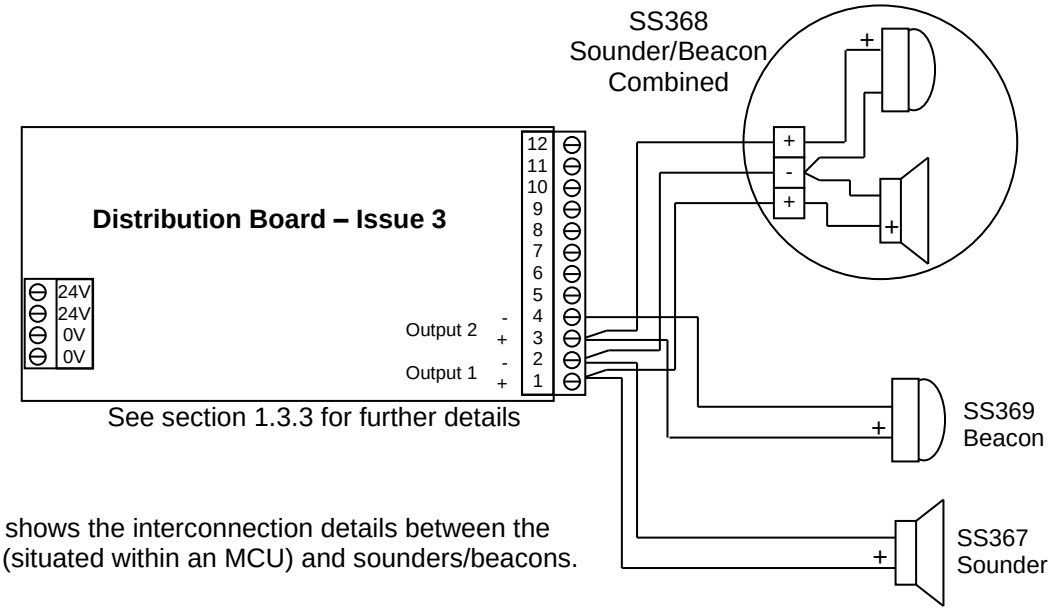
MCU Control Units have three outputs that are intended for switching alarm sounders and/or beacons (the MCU4 has six outputs). These alarms take their power from the MCU system, whereas alarms triggered by the various relays are more suited to supply from external power sources.

Cable Specification:

1mm conductors should be used between the MCU and sounder/beacon.

Sounder/Beacon Specification:

All Status Scientific sounders and beacons are suitable for internal/external use.
Rated to IP65 Supply Voltage 24V



See section 1.3.3 for further details

Terminations:

This wiring diagram shows the interconnection details between the Distribution Module (situated within an MCU) and sounders/beacons.

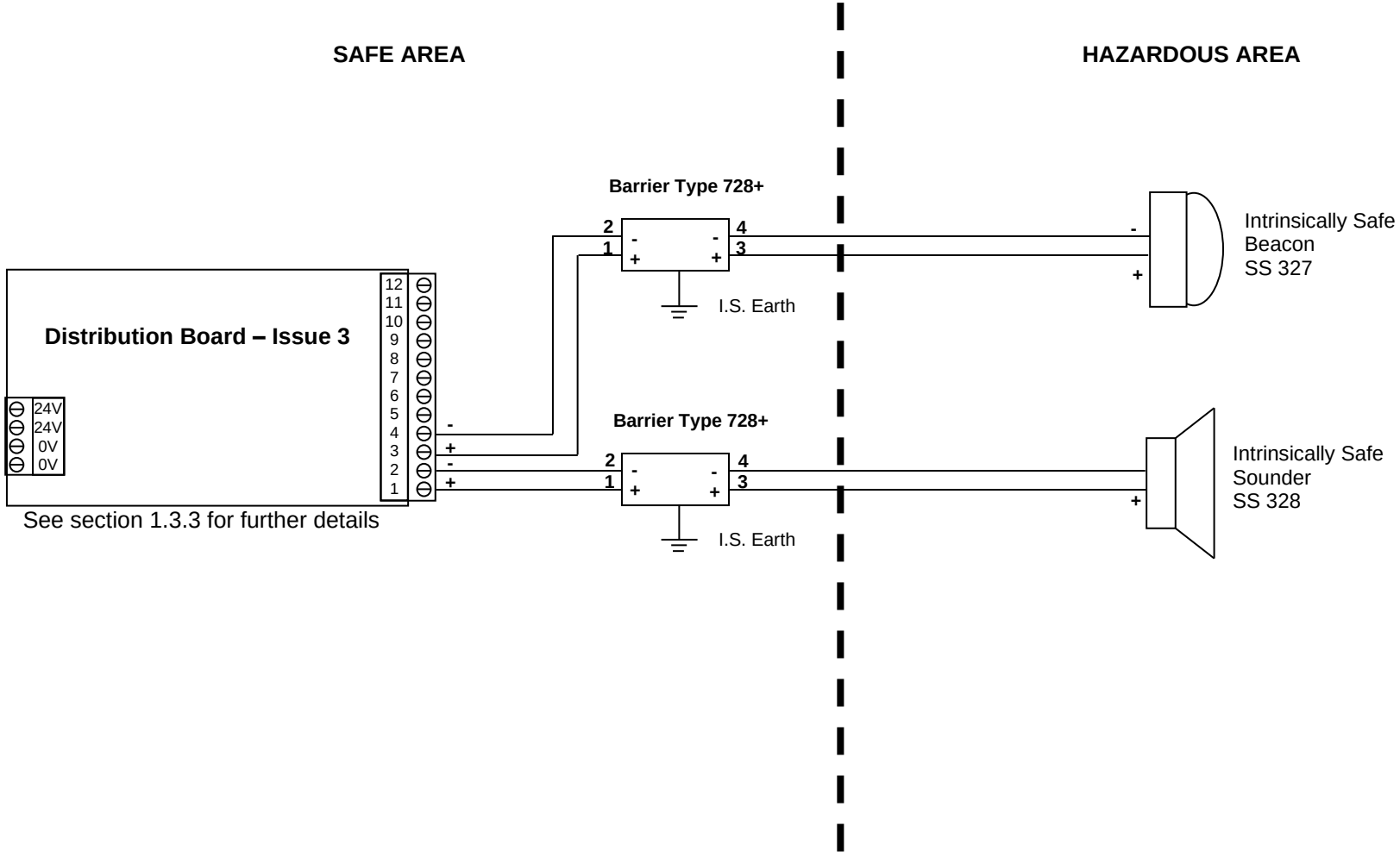
Notes

(a) The alarms should only be connected to the Distribution Board with the MCU isolated from the mains supply.
(b) The maximum number of sounder/beacon units that can be connected to the panel outputs is two (two sounders and two beacons).
(c) Outputs 1 & 2 of the distribution module are capable of supplying an absolute maximum of 200mA each.

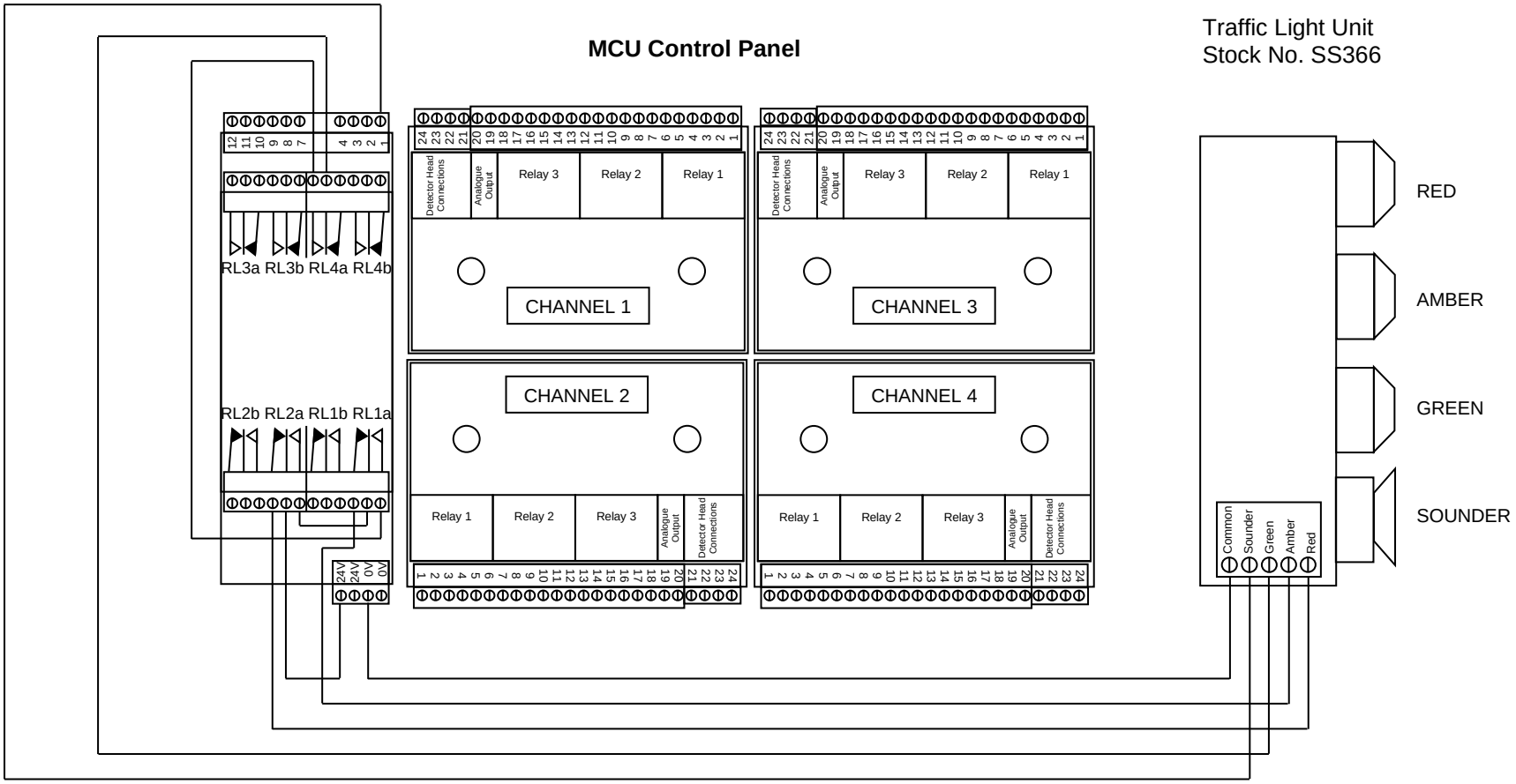
Part Numbers:

SS-367	24V DC Sounder
SS-368	24V DC Sounder/Beacon Combined
SS-369	24V DC Beacon

8.2 Installation of Intrinsically Safe Sounders and Beacons

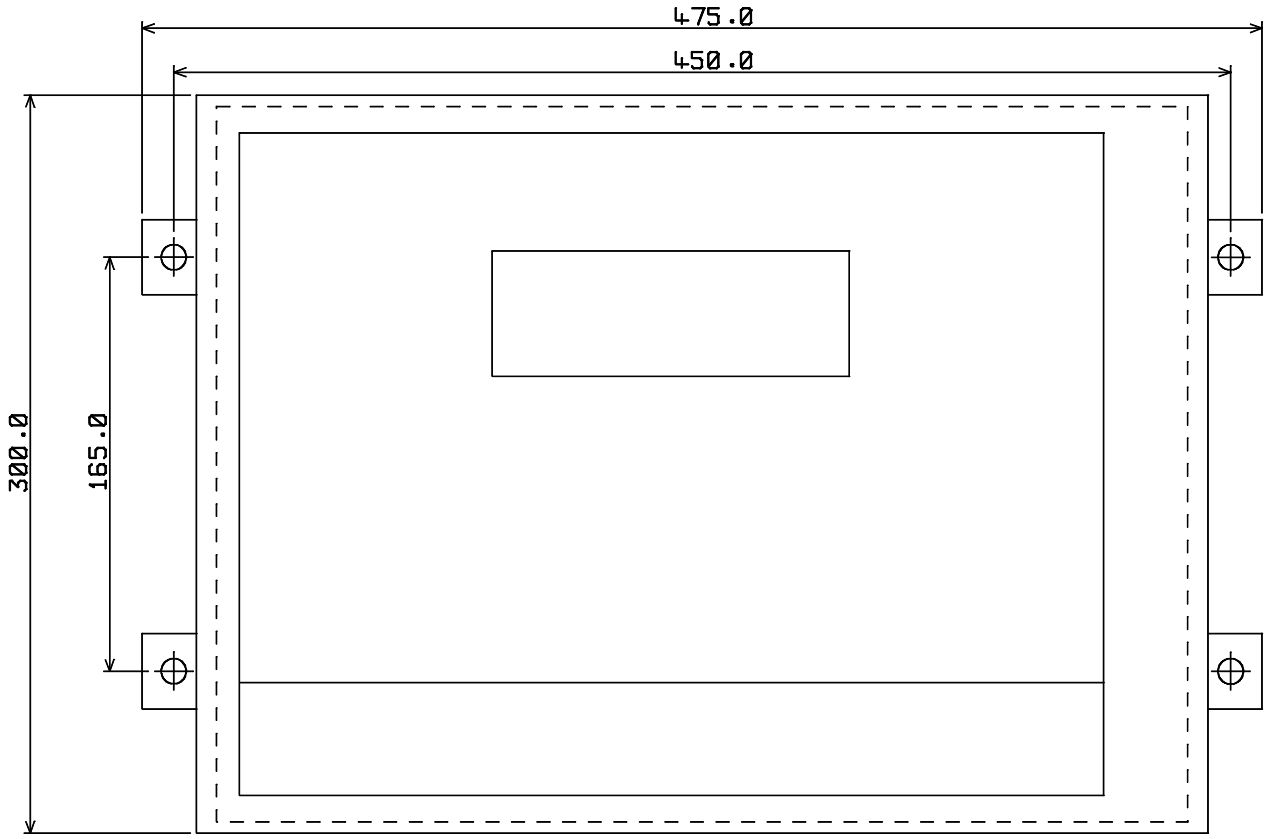


8.3 Example of Connection to a Status Scientific Controls Traffic Light Unit



The above example shows the MCU being used to control a traffic light unit that for example, may be used outside the entry door of a building. This configuration uses the common alarm level relay contacts for alarm levels 1 & 2 such that if any channel reaches an alarm level then either the Amber or Red light is illuminated and the sounder operated. The relays are configured to be energised in the healthy state. The green light is illuminated via the normally open contacts of RL1a, RL2a and the Fault relay contacts RL4a.

8.4 Mounting Details for MCU3 Control Unit



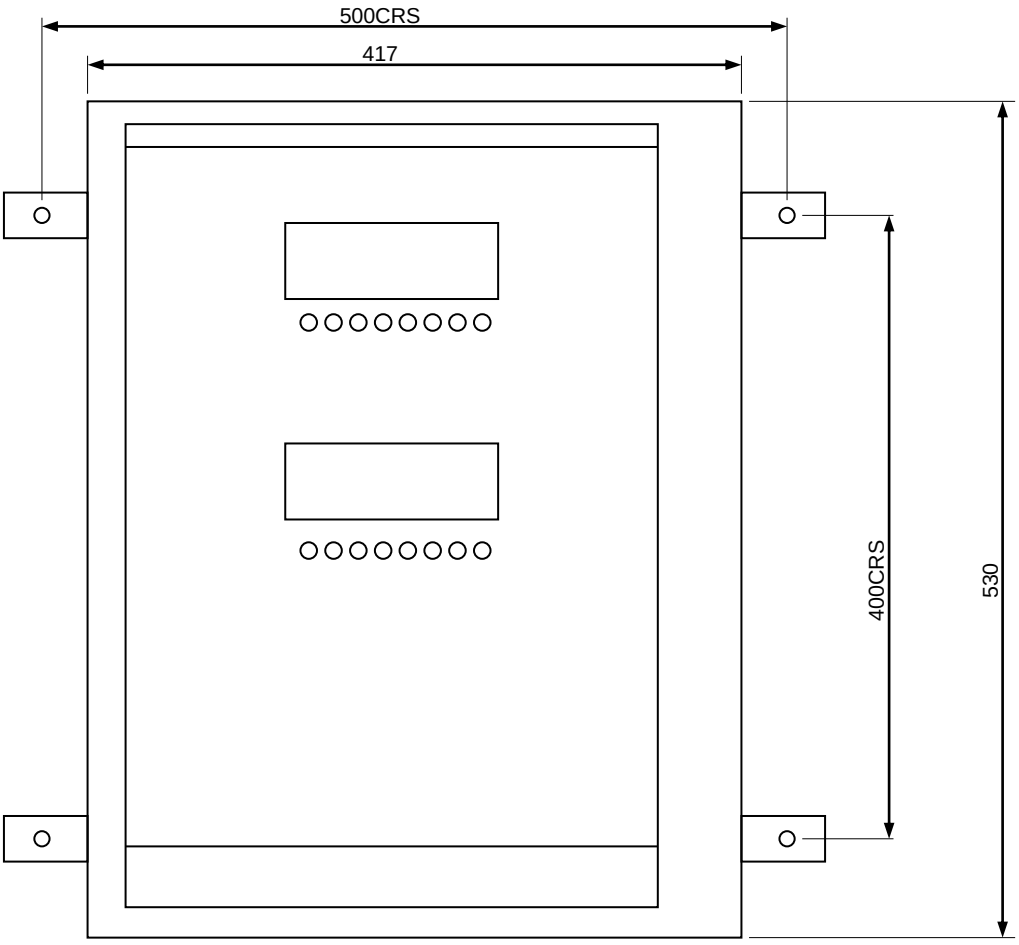
Note: The front panels of the MCU Control Units open to allow access to the screw terminals situated inside. Sufficient space should be allowed around the mounting position so that this action is not restricted.

Four mounting holes are provided each having a diameter of 11mm.

Fixings Required:

4 off M10 Fasteners
(Rawl Bolts or similar dependent on mounting wall construction)

8.5 Mounting Details for MCU4 Control Unit



Four mounting holes are provided each having a diameter of 11mm.

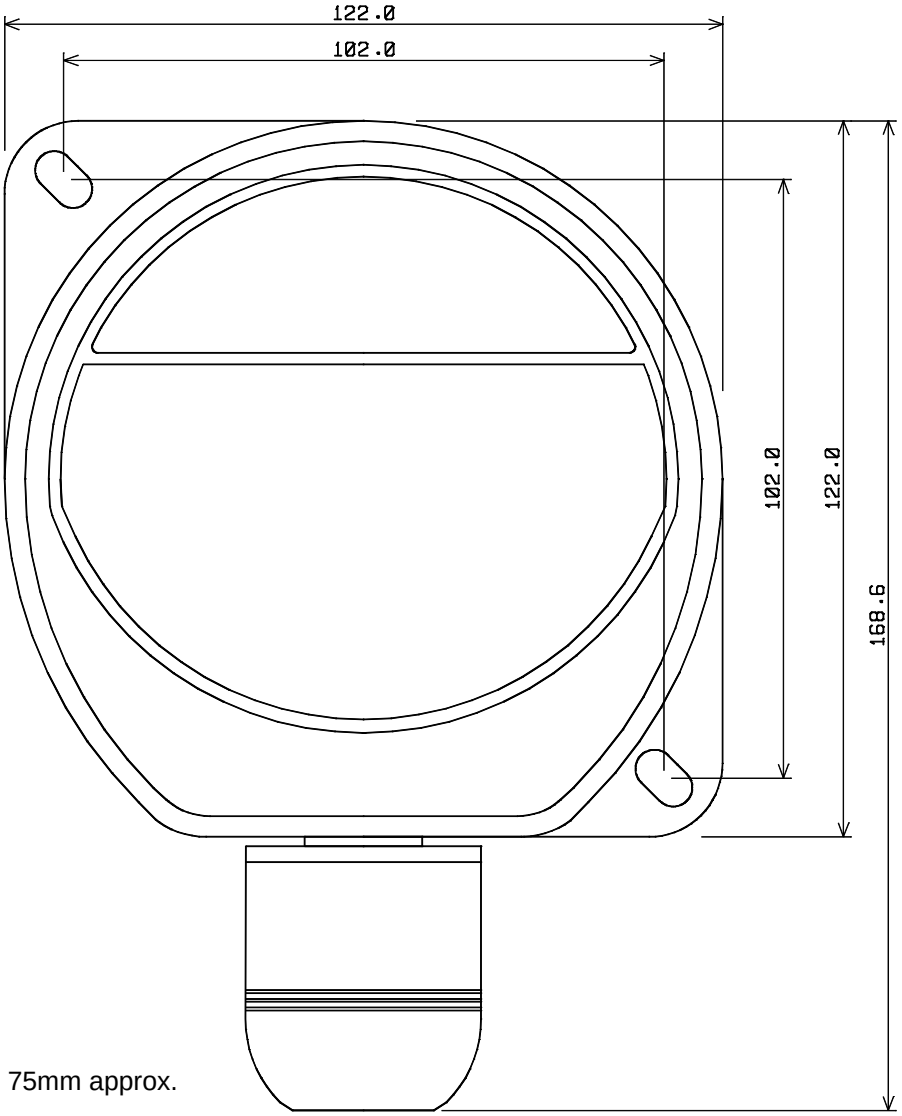
Fixings Required:

4 off M10 Fasteners

(Rawl Bolts or similar dependent on mounting wall construction)

8.6 Mounting Details for FGD2 Detector Heads

The diagram below shows the mounting centres for the Status Scientific Controls FGD2 Detector Heads.



Depth = 75mm approx.

All dimensions are in ‘mm’ and are approximate only.

Note: The front panel/lid of the detector head opens to allow access to the screw terminals situated inside. Sufficient space should be allowed around the mounting position so that this action is not restricted.

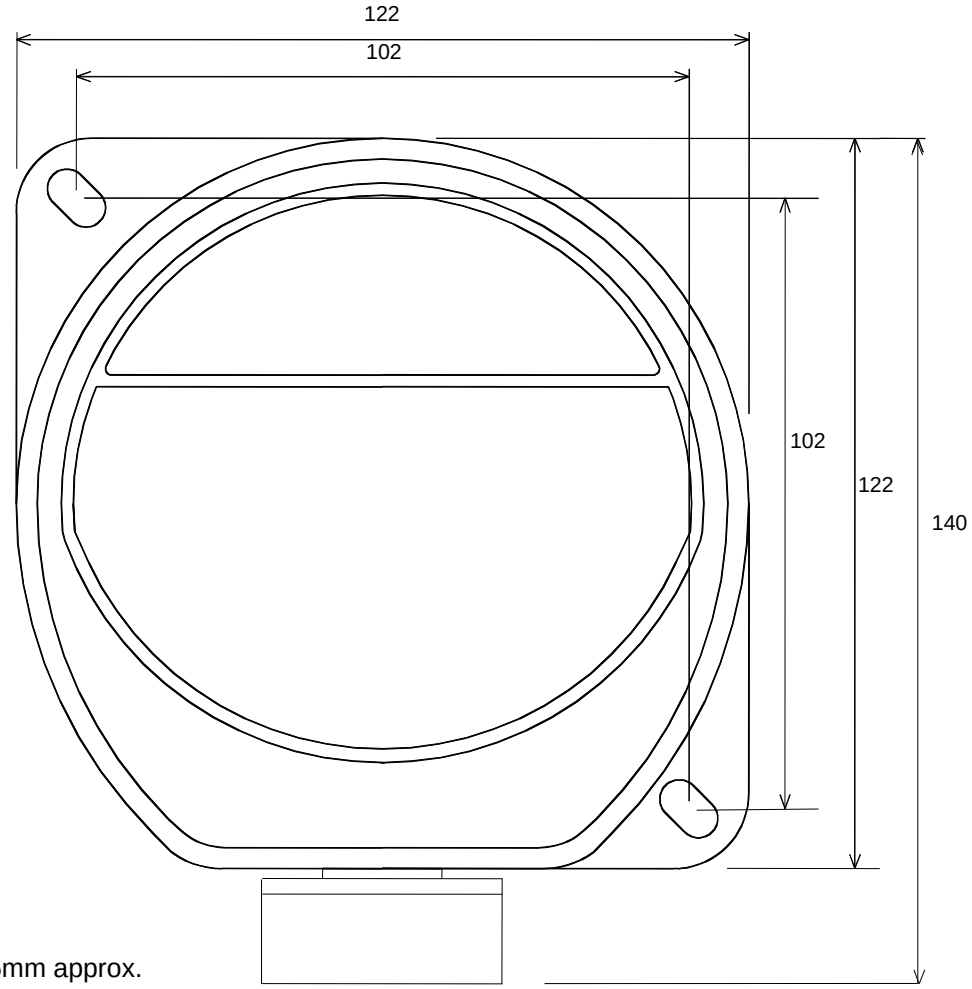
Two mounting slots are provided, suitable for M6 fasteners.

Fixings Required:

2 off M6 Fasteners
(Rawl Bolts or similar dependent on mounting wall construction)

8.7 Mounting Details for FGD3 Detector Heads

The diagram below shows the mounting centres for the Status Scientific Controls FGD3 Detector Heads.



Depth = 75mm approx.

All dimensions are in ‘mm’ and are approximate only.

Note: The front panel/lid of the detector head opens to allow access to the screw terminals situated inside. Sufficient space should be allowed around the mounting position so that this action is not restricted.

Two mounting slots are provided, suitable for M6 fasteners.

Fixings Required:

2 off M6 Fasteners
(Rawl Bolts or similar dependent on mounting wall construction)

8.8 FGD Detector Head Calibration 'Look-up' Table

Each time a calibration is performed on a detector head, the user will be displayed a zero and a span factor (refer to section **5.4** for calibration instructions). The values given for these factors should be compared to the table below to determine the serviceability of the sensor.

Status Scientific Controls strongly advise that sensors providing zero and span factors that do not correspond to those listed as acceptable must not be used. A new sensor MUST be fitted in the detector to allow continued accurate and reliable readings to be made (refer to section 7.3 for sensor replacement instructions).

Sensor	Zero			Span		
	Min	Typ	Max	Min	Typ	Max
LEL CH_4	50	300	600	200	320	960
O_2	0	5	20	350	450	1300
H_2S	350	500	600	100	n/d	1500
CO	350	500	600	100	n/d	1500
CL_2	350	500	600	100	n/d	1500
NO_2	350	500	600	100	n/d	1500

n/d : no data.
This data is unavailable at time of printing. Please contact Status Scientific Controls for updated table.

Note:
Contact Status Scientific Controls for details regarding any sensor not listed.

9 SPECIFICATIONS

9.1 MCU3 & 4 Control Units

Note:
MCU1 and MCU2 now obsolete.

	MCU3	MCU4
Size (nominal) 'mm'	475 x 300 x 208	475 x 538 x 208
Weight (approx)	16Kg	30Kg
Operating Temp	-10ºC to +50ºC	
Storage Temp	-20ºC to +50ºC	
Humidity Range	0 to 95% R.H. Non-condensing	
Input Voltage	24V DC, or 120/230V AC 50/60 Hz Tolerance ± 10%	
Environmental Rating	IP65	

Note:
For compliance with UL3101-1 and CSA22.2 No 1010.1, the following environmental conditions apply:
Indoor use; Altitude up to 2000m.
Temperature 0 to 40°C.
Maximum relative Humidity 80% decreasing linearly to 50% relative humidity at 40°C.
Installation Category (Over Voltage Category) II.
Pollution Degree 2.

User Interface

Display	Backlit 240 x 64 dot Liquid Crystal Display (LCD)	
Keyboard	8 button multifunction keypad	
LED Indications	Red Green Yellow	Indicates alarm condition. Indicates power ON (flashes when powered from int. batteries) Indicates fault condition.

Input Modules

Number of channels	8 max	16 max
Signal Inputs	4-20mA Current Loop from 24V source. 4-20mA Current Loop sink to 0V. 3-Wire Pellistor Systems. DC Voltage Input.	
Analogue Output	4-20mA Current source proportional to detected signal. 4-20mA Current sink proportional to detected signal. 1-5V Voltage output proportional to detected signal.	
3 – Relays Contacts Rating	1 relay assigned to each alarm level (low, medium and high). Double Pole Changeover Contacts (voltage free). 5A 240V AC.	

Distribution Module

3 – Common Outputs	For specification of common outputs, refer to section 1.3
External Reset	Connection for normally open switch contacts (5V max present at terminals).

Common Relay Module

4 – Common Relays	1 Relay assigned to each alarm level (low, medium, high). 1 Relay designated as fault relay. Double Pole Changeover Contacts (voltage free). 5A 240V AC.

	MCU3	MCU4
Power Supply		
Fuse 1 (Mains Input)	T1.0A	T1.0A
Fuse 2 (Internal 24V)	T2A	T2A
Fuse 3 (Com. Outputs)	F1A	F1A
Fuse 4 (Battery fuse)	F2A	F2A
Batteries	2 x 12V 1.2AHr	2 x 12V 1.2AHr
Sealed Lead Acid Battery Type: YUASA NP1.2-12		

9.2 I.S. Barrier Type FGDIO

Output Terminals 1 & 2: 28V DC
0.112 Amps
0.8 Watts
Internal Resistance = 270Ω ±5%

Output Terminals 3 & 4: 7.5V DC
0.66 Amps
1.24 Watts
Internal Resistance = 12Ω ±5%

9.3 Specification for FGD Detector Heads

9.3.1 FGD Flammable Heads

Operating voltage	7-30vDC	(for 4-20mA Signal)
	4-7.5V	(for sensor supply)
Temperature	-20 - +40°C	
Humidity range	0-95% RH non-condensing	
Operating pressure	Ambient + or – 10%	
Cable loop resistance	Signal	: 560 Ohms at nominal 24v
	Sensor	: 19 Ohms at 7.5V DC
Degree of protection	IP66	
Explosive protection	Intrinsically safe circuitry	
	Flameproof sensor protection (Exd)	
Safety certificate no	BAS01ATEX2300	
Approval code	EEx iad IIC T4	
Zones	1 or 2	

9.3.2 FGD O_2/Toxic Heads

Operating voltage	7-30vDC	(for 4-20mA Signal)
Temperature	-20 - +40°C	
Humidity range	0-95% RH non-condensing	
Operating pressure	Ambient + or – 10%	
Cable loop resistance	560 Ohms at nominal 24v	
Degree of protection	IP66	
Explosive protection	Intrinsically safe	
Safety certificate no	BAS01ATEX2300	
Approval code	EEx ia IIC T4	
Zones	0, 1 or 2	