



Manual No.194D1C
C925

FMC - 60

OPERATING HANDBOOK

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System Overview

The FMC-60 is a 16 direct (4-20mA) plus 64 addressable channel gas monitoring system which displays gas concentration and constantly checks for alarm conditions.

Each channel consists of a remote gas sensor located at the point where gas is to be measured. The direct sensor types are individually wired back to the FMC-60 whereas the addressable sensors can be connected to a shared CAN bus network minimizing cable requirements.

Each channel when connected becomes active and is recognised by the system and a fault would occur if it became disconnected. This allows a system to be activated on an individual sensor basis as commissioning takes place.

The gas types and alarm levels for Direct channels are set at the FMC-60 panel but addressable types transmit this information to the panel. However, alarm levels for addressable sensors can be altered at the FMC-60 panel or at the sensor itself. Alarms can be individually set to be latched (requires reset button to clear) or unlatched (self clearing)

The panel can be powered from mains or 24V dc input with battery backup terminals. An output 24V 250mA terminal is available to power user devices. The battery input and mains voltage is monitored and will create a fault if the voltage is too low but the user has the option to disable these faults .

The FMC-60 panel controls most actions and with a dimmable backlit LCD display is capable of indicating the state of gas measurements or fault conditions. Likewise, dimmable LEDs internal and external give additional status information.

Many parameters including a text description of the location of a sensor are programmable via user and engineers menus and retained when power is off. These parameters are reloaded at the next power up so that the system will perform as it did previously.

The FMC-60 panel also has two RS485 Modbus channels and can send data when requested to do so to a Modbus master controller thus allowing independent system management facilities. Engineering menus allow for diagnostic monitoring of the Modbus transmit and receive buffers.

A remote repeater can also be connected which allows the LCD, LEDs and buttons to be located elsewhere on a CAN bus as well as remaining functional on the main panel.

Two 4-20 outputs are available from the FMC-60 panel and these can be assigned to follow any of the 16 direct or 64 addressable sensor inputs.

A real time clock keeps track of time and this time value is displayed on the LCD and appended to any panel events such as alarm or fault etc.

These events are retained in a 99 event memory which can be viewed on the LCD or sent to a PC via the RS232 channel.

Likewise this RS232 channel can accept setup parameters from a PC and if needed can send the FMC-60 parameters to the PC as a simple text files which can be edited.

Text is sent out via the RS232 channel as an additional data logging facility. Events and gas level changes are the main types of data presented which the user can capture using HyperTerminal (or similar) on a PC. Additionally, using RS232 and windows software the system can be interrogated and displayed in a graphic form on a PC.

The current time is transmitted via the CAN bus and any addressable sensor will receive it. Those addressable sensors with a local LCD display will show this time in addition to the gas concentration data etc.

Button action on the FMC-60 panel can be protected by a Key lockout connection to prevent misuse. However, muting the buzzer which sounds if an event occurs can still be silenced by pressing the accept button (1).

On board relays with voltage free contacts indicate alarm and fault states and additionally 4 relays are dedicated to Option Voting whereby sensors can be grouped and the relay is activated when a number of sensors have gone into alarm. These groups can also be used for time weighted average alarms covering the requirements of 15 minute and 8 hour measurements. Additionally, all 8 onboard relays and the first 16 of the external relays have a programmable delay to de-energise parameter which for example allows for fan evacuation of a space containing detected gas. These relays and the first 16 relays on the remote relay board can be set to be normally energised or de-energised.

Front panel LEDs indicate the general state of the panel. The red alarm LED will flash for new alarms until accepted/muted when it stays on constantly until reset. The amber fault LED comes on if a fault is present. If any sensor channel is inhibited the amber inhibit LED will be on.

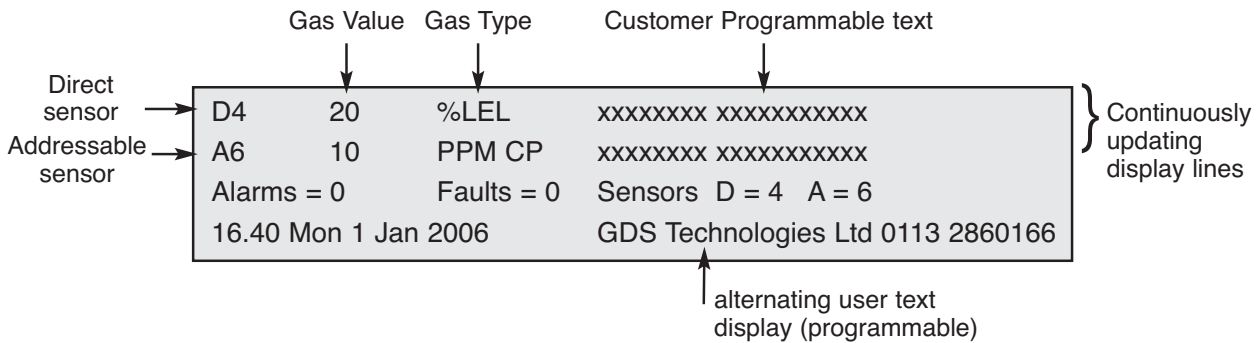
Additional reset and mute terminals are available to allow remote action in the event of an alarm or fault condition. Test facilities are included in engineering mode, which allow these relays to be manually activated during commissioning.

General Specification

Direct 4-20mA sensors	16 max
Addressable sensors	64 max (CAN bus)
Sensor types	Electrochemical - Infra Red - Pellister (see features)
Sensor cable	Addressable CAN bus, 4Core 1.5mm screened Direct 4-20 2/3 core 0.5mm screened
Power supply	230/115 AC 50/60Hz 24Vdc or Battery (external charger)
Consumption	Main processor board 5 watts
Indication	4 line 40 character LCD 3 panel LEDs for fault, alarm and sensor inhibit 5 internal PCB LEDs for Can, Modbus and RS232 11 internal PCB LEDs for DC fail, AC fail, sensor fail, CAN fail, modbus fail, mpu fail, system inhibit overrange, hi-alarm, lo-alarm power.
User interface	7 Buttons on main board and or repeater
Alarm settings	3 Alarm levels which are user selectable High, Low, and Over range Latching or Unlatching and direction 4 time weighted - unlatching
Outputs	24Vdc @ 250mA (none inductive loads) Specific end user voting relays RS232 data log, (up to 10 metre) CAN bus (up to 1Km) Modbus slave to an external Modbus Master (up to 1Km @ 9600 baud) 2 channel 4-20mA (source or sink) (assignable to any sensor) Relay card (up to 64 relays) Fault relay SPCO Common Low alarm relay - DPCO Common High alarm relay - DPCO Common Over Range alarm relay - SPCO Option 1 voting relay - SPCO Option 2 voting relay - SPCO Option 3 voting relay - SPCO Option 4 voting relay - SPCO
Relay rating	5A@250vac none inductive / capacitive
Audible	Buzzer on main processor and remote sounder
Dimensions	H 265mm x W 315mm x D100mm
IP rating	IP52 optional IP65
Enclosure	Mild steel powder coat BS00A01
Cable entry	Bottom / rear 20mm push-outs
Weight	5Kg
Terminals	Field terminals 2.5mm
Operating temperature	5 to 50 deg C
Features	Remote reset Keylock Remote repeater panel (option) operating distance 1km 16way 4-20mA catalytic converter panel (option)

LED and LCD indicators

A four line 40 character LCD displays a range of information typically shown below.



Line 1 Standard 4~20mA sensor, values and gas type and location

Line 2 Addressable sensor, values and gas type and location

Line 3 General information, Number of Alarms, Faults and Connected sensors

E.g. D=4 means 4 direct sensors connected

E.g. A=6 means 6 addressable sensors connected

Line 4 Date and Time alternating with user text.

The top line displays the direct 4~20 inputs indicated by D. This will cycle through all active sensors automatically but will hold on a specific sensor if it is in alarm.

Pressing + button (4) will stop the cycle on the current sensor for 999 seconds.

If a new alarm occurs, the display will show this sensor.

The type of gas and the text associated with this sensor is displayed.

To restart the cycle press the – button (2) or reset (7)

The second line displays addressable inputs indicated by A. this will cycle through all active addressable (CAN) sensors automatically but will hold on a specific sensor if it is in alarm. Pressing + button (4) will stop the cycle on the current sensor for 999 seconds.

If a new alarm occurs, the display will show this sensor.

The type of gas and the text associated with this sensor is displayed.

The third line displays the number of alarms and faults present in the FMC-60 system. Normally these are zero. Additionally, the number of 4-20 and Addressable sensors in the system are displayed.

The fourth line displays shows the internal clock reading together with the day and date. All internal events use this clock to record the time of event.

If an alarm or fault event occurs, the clock display is substituted with the text for this event and will alternate every second or so if the text is lengthy but will remain readable.

This text which describes the event (eg Modbus fail) is also the same text which is stored in the event log which can be viewed separately. (see Event Log).

This line also alternates with user text, eg company name and telephone number.

The **LEDs local to the panel** are as follows:

Alarm	Internal/ External	Colour	Description
Or Alarm	I	Red	on if any sensor currently has an over range alarm
Lo Alarm	I	Red	on if any sensor currently has a low alarm
Hi Alarm	I	Red	on if any sensor currently has a high alarm
DC fail	I	Amber	on if battery is low
AC fail	I	Amber	on if mains has failed
Sensor fail	I	Amber	on if any sensor has failed
CAN fail	I	Amber	on if any addressable sensor has stopped communicating
Modbus fail	I	Amber	on if the Modbus master has stopped communicating
System Inhibit	I	Amber	on if the system is not checking alarms
Sensor Inhibit	X	Amber	on if any sensor has been inhibited
MPU fail	I	Amber	on if the processor has had a watchdog reset
Power	I	Green	on if power applied
Fault	X		on if a fault exists
Alarm	X		on if alarm exists

(I = view internal X = view external)

If the fault or alarm LED is flashing, this indicates a new event and when accepted by pressing the up (1) button it remains on (not flashing).

Buttons and Lockout

7 user buttons are provided on the front to allow control and setting up of the FMC-60 system plus a PCB button. These buttons are also numbered and shown in brackets. E.g. button 3 is (3).

Button 1 is the **Accept/Mute** and **UP** button. When in engineer's mode, it is used to increment parameters which are being modified. Also, it allows the displayed sensor to be moved onto the next active sensor.

Button 2 is the “-“ button. Used when decrementing items in engineers menu, also to escape from the engineers menu system when not in any specific menu.

Button 3 is the **SELECT** button. It is used to enter and exit many of the engineer's menus. Also when first pressed, it prompts the entry of an engineer's password. When correct, engineer's mode displays menus which can be selected by pressing the select button again.

Button 4 is the “+“ button. Pressing this allows the display to hold the automatic sequence of sensors being displayed for 999 seconds.

When in engineer's mode, it is used to increment parameters which are being modified.

Button 5 is the **DOWN** button. Used when decrementing items in the engineers menu.

Button 6 is the **DIM** button. It is used for dimming the LED and LCD backlight and will toggle between full brightness and the dim level previously set in the engineers menu. Dim can be used at any time except when doing an LED test whereby automatic dimming occurs to reduce current.

Button 7 is the panel **RESET** and is used to clear faults or alarms. It is generally active and will act regardless of entry of passwords.

To prevent unauthorised use of the buttons, Key lock input is provided on the main processor PCB, and the buttons are locked out of use when this terminal is connected to 0V (adjacent terminal) Even when locked, the buzzer can still be muted by pressing the accept button (1).

Processor reset button and a flash programming slide switch are situated directly on the PCB and are not accessible from the front panel.

This button when pressed will restart the processor as if just powered up and should only be used in the event of a system crash. The slide switch should be in the up position (run) for normal operation.

Entering a password to get to User or Engineer mode

System parameters can be altered but not by unauthorised people. Two passwords have to be entered to gain access to available menus which allow changes to be made.

The first 4 button password is the User mode and gives access to a limited set of menus, E.g. clock set, LED test etc. The second 4 button password is the Engineers mode which gives access to all menus including the users. A sequence of 4 buttons is accepted as the entry for a password.

To start the entry of the password, press SELECT (3).

The password display is shown on the LCD and each of the 4 buttons in sequence can now be pressed.

Default Passwords

Users password is defaulted to DOWN (5) pressed 4 times.

Engineer's password is defaulted to + (4) pressed 4 times.

Changing the user password is described later. The engineer's password cannot be changed.

This is the complete list of user and engineer menus.

See Appendix 1 for further details

1	View modbus re	}	USER
2	Set Clock		
3	Inhibit all Sensor		
4	View modbus txr		
5	Refresh rate		
6	Edit Company te		
7	Lamp Test		
8	Relay test		
9	Event log to Lcd		
10	Add zero/span		
11	Lcd Led Bright		
12	Exit		
13	Top of engineers	}	ENGINEER
14	Inhibit sensor		
15	Add alarm levels		
16	Adjust 4-20ma o		
17	Alter chan text		
18	Alter gas type		
19	Assign 420 out		
20	4-20mA zero spæ		
21	4-20alarm levels		
22	Unlatched alarm		
23	Event to Relay6		
24	Relay off timers		
25	Channel voting		
26	Seconds to alarr		
27	Setup Network		
28	Event log to PC		
29	Data PC to Pane		
30	Data Panel to P(
31	Ltel Stel alarm		
32	Default Sections		
33	Change User co		
34	Set Modbus bau		
35	Set Power Alarr		
36	Energised Relay		

Direct and Addressable Line text

The FMC-60 system measures data on all active sensors.

Direct sensors are done sequentially but addressable sensors send their data periodically when available (every few seconds).

Each sensor has a text description (stored on the main pcb, not in the sensor) which describes physically where it is in the system and this text appears on the LCD as the most recent measurement is displayed. Using Engineering mode, this text can be altered from the default text to something more meaningful.

Editing this text is either manual using buttons and the LCD or by sending a text file from the PC. The latter is much faster and is preferred. The manual mode is activated from Engineers menu 17 which presents the direct 4-20 channels text first followed by the Addressable text.

Pressing + (4) or - (2) changes which channel is to be altered and pressing UP (1) button enters the text editing mode for this channel. The + and - buttons now move a cursor under the text and UP and DOWN alter the character at this cursor position. When editing is finished for this channel, press SELECT to exit the editing which returns to allow changes on another channel by pressing the UP button again. Alternately pressing SELECT will exit the direct 4-20 channel text and enter the Addressable channel text selection. Again the buttons are used in exactly the same way to change the text description for networked Addressable sensors.

SELECT when pressed will exit the manual mode and save the text changes in non volatile memory on the main PCB and return to the Engineers menu.

See also DATA to and from a PC using HyperTerminal which allows a much quicker method of editing using a PC.

Holding the Display

As the sequence of displaying the gas occurs, it may be required to stop on a particular channel for maintenance.

This can be achieved using the + (4) button on the front panel which when pressed will hold the current sample for 999 seconds. A countdown is displayed on the LCD showing that hold is in progress. At the end of this time normal display sequencing will resume.

The gas values displayed on the LCD during hold are still the current live readings from the sensors.

Hold can be removed at any time by pressing the + (4) button for a second time.

As the sequence of displaying continues it is sometime required for maintenance to choose another sensor for display and this can be achieved using UP (1).

This button when pressed terminates the current display it moves to the next displayed channel and if pressed continuously, this button will step through all available sensors. When the desired channel is reached and the button released, press + (4) to hold this display for 999 seconds. Pressing + (4) will release the system back to normal.

Testing the LEDs (7) and Relays (8)

To test all LEDs and beep the buzzer, Use menu number 7 and pressing SELECT makes all leds illuminate in dimmed mode to see if they are functioning.

At the end of the test, the buzzer beeps twice to confirm its operation.

Note some diagnostic LEDs on the main PCB are not part of this test. In particular these are, Modbus, RS232 and CAN active.

When a remote relay board is present in the system, each of the 64 relays can be energised or de-energised using USER menu number 8.

When selected, use the UP and DOWN buttons to choose a relay and then the + and - buttons to energise or de-energise respectively.

When finished, use the SELECT button to return to the USER menu.

Inhibiting a sensor (14)

During maintenance, it is sometimes required to inhibit the alarms on a particular sensor. A front panel led will illuminate if any sensor is inhibited.

Choosing ENGINEERS menu 14, the UP and DOWN buttons select which of the direct 4-20 inputs will be inhibited. The + (4) and - (2) buttons are used to turn the inhibit on and off respectively.

Pressing SELECT (3) moves the selection to the CAN networked sensors and the buttons are used in the same way.

Pressing select again returns to the ENGINEERS menu.

Changing the direct gas type (18)

Each of the sixteen 4-20mA inputs can have a different gas type which can be changed using ENGINEERS menu 18.

When selected, buttons + (4) and - (2) change the channel number and UP (1) and DOWN (5) will change the gas type (according to the Gas Type library).

Pressing SELECT will return to the ENGINEERS menu.

Note that it is not possible to change the gas type for addressable sensors. This is because the sensor type is set by the sensor itself and the main FMC-60 panel will display the gas type according to the data received from the sensor.

Gas Type Library

O2FF	1	Oxygen 0-25% two falling alarms
O2RF	2	Oxygen 0-25% one falling one rising alarm
CO2_30	3	Carbon Dioxide 0-30%V
CO2_2	4	Carbon Dioxide 0-2%V
H2S	5	Hydrogen Sulphide 0-50ppm
CO	6	Carbon Monoxide 0-250ppm
SO2	7	Sulphur Dioxide 0-10ppm
NO	8	Nitrous Oxide 0-100ppm
NO2	9	Nitrogen Dioxide 0-10ppm
Cl2	10	Chlorine 0-10ppm
H2	11	Hydrogen 0-1000ppm
HCN	12	Hydrogen Cyanide 0-25ppm
HCL	13	Hydrogen Chloride 0-10ppm
NH3	14	Ammonia 0-100ppm
O3	15	Ozone 0-2ppm
C2H4O	16	Ethyene Oxide 0-25ppm
CH4	17	Methane 0-1000 ppm
PH3	18	Phosphene 0-2ppm
LPG_V	19	Propane %volume
BUT_V	20	Butane %volume
FLAM_V	21	Flammable %volume
LPG_LEL	22	Propane %lel
BUT_LEL	23	Butane %lel
FLAM_LEL	24	Flammable %lel
WATER	25	0-100%
O2RR	26	Oxygen 0-25% two rising alarms
NH3ppm	27	Ammonia 1000ppm
NH3%vol	28	Range 5.0%
HF	29	Hydrogen Flouride 0-10ppm
DewP	30	Dewpoint -50 to 100°C
UgM3	31	Microgram per metre cubed oil mist
B2H6	32	Diborane 0-1ppm
SiH4	33	Silane 0-50ppm
Ph3	34	Phosphene 0-1ppm
F2	35	Flourine 0-5ppm
NF3	36	Nitrogen Triflouride 0-50ppm
LELM	37	LEL per metre, 0-5%
Zone	38	Switch input 0-100% (Displays as SW input when not in Alarm, and SW Active when in Alarm. Note: use channel text to describe this switches function).
refrig	39	0-1000ppm refrigerant e.g. R-22
benzine	40	Benzine 0-100%
flame	41	flame detector 0-100%
fire	42	fire detector 0-100%
heat	43	heat detector 0-100%
smoke	44	smoke detector 0-100%
callpoint	45	callpoint detector 0-100%
H2	46	Hydrogen 0-2000ppm
CS2	47	Carbon Disulphide 0-100ppm

Event to remote relays (23)

The following events can be assigned to remote 1-64 relays by using ENGINEERS menu 23.

4-20 direct	chan	fail
4-20 direct	chan	hialarm
4-20 direct	chan	loalarm
4-20 direct	chan	hialarm
4-20 direct	chan	oralarm
CAN	chan	fail
CAN	chan	hialarm
CAN	chan	loalarm
CAN	chan	oralarm
COMM	fail	alarm
main power fail		
can bus fail		
Battery / Standby fail		

Pressing SELECT (3) moves to each of these event groups and using UP (1) and DOWN (5), the channel can be chosen and the + (4) and - (2) buttons decide which relay is to be operated. Note that it is possible to not drive any relay which is the default and this is indicated on the LCD as relay O.

Pressing DIM at this point allows relay patterns to be entered which will be output to the external relays if this event occurs.

Pressing SELECT (3) eventually returns to the ENGINEERS menu after saving the selections and these relays will now energise when the event occurs.

Dimming the LEDs (11)

The leds on the main processor board and the lcd display are normally bright but can be dimmed to give a more acceptable level of illumination in subdued control room conditions.

The DIM (6) button on the main panel when pressed will toggle the brightness between maximum and dimmed for both.

The level to which dimming occurs can be set via the User Menu number 11.

This shows the current brightness setting and then using the UP (1) and DOWN (5) buttons a new dim level can be set and this is shown on the LCD and on the leds themselves. This dim value is stored in non-volatile memory for future use and subsequent power ups. In addition to dimming the leds, the LCD backlight is also dimmed and to enable a balance between LCD brightness and led brightness, a pot on the main PCB (RV2) allows LCD backlight adjustment.

If a repeater is connected to the main panel then the dim levels are also activated using the same buttons on the repeater.

Mute the buzzer

When an alarm of fault condition occurs the buzzer on the main processor board will sound. By pressing the accept button (No1) on the front panel, the buzzer will become silent. Note:- even if the key lock terminal is active to prevent button entry, the mute function will still silence the buzzer.

A jumper (JP3) on the PCB allows the buzzer to be isolated, this jumper should normally be fitted.

Local and Remote relays

Local relays are located on the main input PCB and are designated to specific conditions which exist with the FMC-60 system and can be programmed to be normally energised.

Remote relays are located on one of two 32 channel relay boards and can be programmed to be operated according to detected events which occur such as alarms and faults. The first 16 relays can be programmed to be normally energised.

The local relays are as follows (all contacts are rated at 5A 250Vac)

Common Over range alarm will energise if any gas is over range.	S.P.C.O
Common High alarm will energise if any gas is in high alarm.	D.P.C.O
Common Low alarm will energise if any gas is in low alarm.	D.P.C.O
Fault will de-energise if any fault exists in the system.	S.P.C.O
Option 1 will energise if voting 1 conditions are met.	S.P.C.O
Option 2 will energise if voting 2 conditions are met.	S.P.C.O
Option 3 will energise if voting 3 conditions are met.	S.P.C.O
Option 4 will energise if voting 4 conditions are met.	S.P.C.O

The 64 additional remote relays which are S.P.C.O types can be programmed to operate on an event as an individual relay 1 to 64 OR as a pattern using the first 16 relays using engineers menu 23 Event to Relay.

Modbus set up and indicators

Modbus is a means of obtaining data from the gas detection system via a MODBUS master controller. The FMC-60 system is a SLAVE to the commands received from the master via the allocated RS485 twisted pair communication cables. When a command is received on the cable, the reply is sent on the same cable thus giving rise to a half duplex communication. For maintenance purposes, two LEDs situated on the main processor PCB close to the connectors show when a reply is being sent on that particular cable.

In a MODBUS system that makes use of both these cable (digitalsensor connected), both these LEDs flash periodically to indicate successful communication. Once the communication has started, the FMC-60 system will monitor how long since the last command was received and if this is greater than 50 seconds a communications failure (COMMS FAIL) alarm will occur.

Each FMC-60 system has an internal address, which is used for Modbus address.

This address and other parameters can be set and will be remembered at power up using engineers menu 27 Setup Network. The speed of communication (baud rate expressed in bits per second) is set using menu 34.

All communicating devices in a Modbus system should be set to the same baud rate and the FMC-60 system is capable of supporting 19200, 9600 and 4800 baud. 9600 is set by default.

Set up Network

The address of the network sensors are 1-64 so it is normal to have the FMC-60 main panel address above this, the default address is 201. Using ENGINEERS menu 27 (set up network), the address of the FMC-60 can be changed using UP (1) and DOWN (5) buttons. Pressing SELECT (3) saves this address and presents a view of all other devices connected to the FMC-60.

Using the UP (1) and DOWN (5) buttons each address in the system can be viewed and if a device exists, a letter will appear to tell you what it is. For instance, if a repeater is detected, the letter 'R' will appear and a Y or N as well, N means that you are not currently connected to the repeater. Pressing + (4) will change the N to a Y to indicate connection and - (2) will change a Y to an N to say not connected.

An 'S' shows that a sounder, relay device is present on the network. 'C' represents a can sensor.

The Y indicates to the FMC-60 that text and LED data should be sent to a repeater and also that button presses on that repeater should be accepted by this FMC-60.

Pressing SELECT (3) again return to the ENGINEERS menu.

Using ENGINEERS menu 34, the baud rate used by Modbus can be changed.

Pressing UP (1) and DOWN (5) will alter the baud rate. Pressing SELECT (3) returns you to the ENGINEERS menu.

The Modbus protocol for the data packets received from a master is usually a request for specific data to be sent back to the master. This protocol is covered in a separate document known as MODBUS RTU protocol. In its simple form, the master will ask for the data kept in any of the 250 registers located in the FMC-60 system and the FMC-60 will reply with the requested register data.

These registers are 16 bit numbers representing 0 to 65535 in decimal.

A view of these registers can be seen by using USER menu 1. UP (1) and DOWN (5) will display different register numbers with the data. It is useful when first setting up the system.

Additionally, USER menu 4 allows you to view the Modbus data packets received and transmitted. Again, this is used when first setting up the system and can diagnose requests and responses.

See FMC-60 Modbus register definitions in the appendix.

RS232 data log output

In addition to Modbus, an additional data stream showing actions within the FMC-60 system is available via the RS232 output.

This consists of a 3 wire interface which can connect directly into the serial port (RS232) connection on a PC which is a 9 way D-type female connector (not supplied). This should be wired to the FMC-60 system as follows.

D-type Pin	FMC-60 RS232 connector (Bottom left of PCB)
2	Tx
3	Rx
5	0V

Using HyperTerminal on the PC and set up at 2400 baud 8 bit no parity and no handshake, the data output should appear on the screen and consists of the following.

- 1) Time and date is sent every hour
- 2) Sensor gas values are sent if any of the gasses on any sample line have changed, together with the date and time of the change.

Event log (9)

The events listed in appendix 1 are logged internally in the FMC-60 system.

A total of 99 events can be stored and viewed later either on the LCD or on a PC using Hyper Terminal.

When this 99 event memory is full, the oldest event is replaced by the new event so this history of events always represents the last 99 incidents.

Using ENGINEERS menu number 9, this event memory can be viewed one event at a time using the UP and DOWN buttons to scroll through the sequence. Date and time of the event is also displayed.

With the RS232 cable connected to the PC and Hyper Terminal in use at 2400 baud the whole event log can be sent using ENGINEERING menu 28. using capture text in Hyper Terminal, this event log can be saved to a file for future examination or printing etc.

Data to and from a PC using hyperterminal

Within the FMC-60 system there are parameters which have to be set such as the text which describes the location of a particular sensor. Whilst these parameters can be set manually using the buttons, it is quicker and easier to send a text data file from a PC using the RS232 interface via Hyper Terminal (which is standard on a Windows XP PC).

The file which is sent is simple alphabetic characters which can be edited using a simple text editor like Notepad which is also standard on a Windows XP PC.

This file can be created from scratch but it is simpler to create it by sending the data already stored on the FMC-60 panel to the PC again using Hyper Terminal. This method is now described followed by reloading the file back into the FMC-60 main panel.

Using engineering menu 30 (Data panel to PC) and the RS232 lead plugged into the PC Com port 1 (for example).

On the PC, click

START
PROGRAMS
ACCESSORIES
COMMUNICATIONS
HYPERTERMINAL

and set the hyper terminal to COM1 at 8 data bits no parity 1 stop bit no handshake then select Transfer and Capture text, a filename is suggested to save the data to. You can change this filename as required and do take note of which directory it is going to be stored in, then press the start button and the PC is now waiting for data to be sent from the FMC-60 system. (Note it is easier to save this file to the desktop initially).

On the sampling system, using engineering menu 30 (Data panel to PC) now press select which should send data to the PC. This data can be seen on the PC screen as it is transferred. When it is complete, on the PC use

TRANSFER
CAPTURE
STOP

this saves the data onto the hard disk in the folder specified previously. Each line of text (shown in the table below) in this file forms particular data as follows:-

A line which does not start with a colon (:) or an asterisk (*) is ignored which allows you to add comments at any point in the text. Colon (:) indicates data for direct sensors, an asterisk (*) is used to indicate addressable sensors.

Line	Description
:T6, Port Hold 1	This line is the text for direct sensor 6 which will display on the LCD. For each direct input (16x) 20 characters can be assigned.
*T4, AccomBlock	This line is the text for addressable sensor 4 which will display on the LCD. For each of the 64 addressable sensors upto 20 characters can be assigned.
:G1,%LeL^ ,	This line selects a gas type for gas sensor 1 appropriate gas sensor must be fitted in the system. All 16 direct types can be selected (note this does not apply to CAN (addressable sensors) as they transmit their gas type to the sensor.)
:HiAlarm 2,400	The high alarm point for gas 2 is 400 divided by 10 (40.0). High alarms can be set according to the type of gas and the value represents 10 times the actual value. (this is to avoid decimal points in the data)
:LoAlarm 1,200	Ditto for gas 1 low alarm point.
:OrAlarm 3,998	Ditto for gas 3 over range alarm
:Maxval 4,999	The maximum scale value for gas 4 is 999 divided by 10 (99.9)
:X	This terminates the text transmission to the panel and should always be at the end of the text. (Note: with the exception of :X, using *T, *G, *H etc. sets the parameters for addressable sensors) Text lines after: X is ignored. If an “:X” is not included in the file then the panel will eventually time out but this may take a few minutes.

Having edited the text to suit the installation, it can now be sent back to the panel using engineers menu 29 Pc to panel.

Again, Hyper Terminal is used but this time the Transfer/send text file option is used.

When prompted, choose your modified text file as the one to send and then the text should start to flow. The output seen on the Hyper Terminal screen consists of the command letters received so strings of T or H etc are seen which lets you know that all is well. The final letter seen will be an X and at this point the new data sent is stored in non volatile memory on the processor board.

4-20mA outputs

Two 4-20 mA output are provided at the FMC-60 and these can be assigned to represent any of the 16 direct or 64 CAN sensor readings.

Using ENGINEERING menu 19, use UP (1) and DOWN (5) to toggle between setting direct or CAN sensor channels and use + (4) and - (2) to change the sensor number assigned to 4-20 output 1.

Pressing SELECT (3) will repeat the same function for 4-20 output 2.

Real time clock

On the main processor board a real time clock chip keeps time and this can be set using USER menu 2 in conjunction with the UP (1) and DOWN (1) buttons and SELECT.(3)
To ensure that the clock keeps time when no power is applied, a large value capacitor on the PCB provides power to the clock for up to 24 hours.

If the processor board is un powered for longer than this, it is probable that the clock will have to be reset to local time before use.

It is important to keep the clock correct since this time is used when recording events in the event log and also for the RS232 output log to a PC.

Refresh Rate

The display of sensor gas levels on the display is cyclic with a period of time.

Menu 5 allows you to change the amount of time that data is displayed; slower refresh rates tend to be used when the number of sensors is small. Using + and – buttons this rate can be set to fast (1) to slow (10) or any number in-between.

Changing User password

The passwords are present to prevent unauthorised button entry on the sample system and whilst the engineers password is fixed, the user password can be changed.

Using ENGINEERS menu 33 will allow you to enter a new user password.

You are prompted to re enter the password again to check and if both are the same then this password is the new user password.

If this password has been forgotten, then simply change it to a new known password.

Calibrating Gas Sensors (see setup procedure for sensors page 39-42)

16 direct 4-20mA gas sensors

Each of the external gas sensor cards has to be periodically calibrated with its sensor to produce a 4-20mA signal to input to the FMC-60 (see sensor data sheet) This signal input to the FMC-60 would produce a 0 to 100% of the signal range but a further level of calibration trimming is possible at the FMC-60 panel.

To assist in this process, engineer menu 20 adjust zero/span will guide you through the stages of calibration for these direct sensors.

The first step is to select which of the 16 gasses is to be calibrated.

Pressing SELECT (3) moves to the next step which is -

Set the maximum value expected from the sensor e.g. flam is 99.9%

Pressing SELECT (3) moves to the next step which is -

Use the UP (1) and DOWN (5) buttons to adjust the zero on the LCD

Pressing SELECT (3) moves to the next step which is -

Apply span gas and use the UP (1) and DOWN (5) buttons to change the gain until the reading is correct on the LCD for the applied gas.

The gas values used in this case are the peak values from the sensors and this gives the ability to apply gas to a number of sensors before returning to the FMC-60 panel to adjust thus allowing one engineer to do Span. In this case, the zero on these sensors should be completed before span is performed.

This completes the calibration of the direct 4-20mA gas sensor.

64 Addressable gas sensors none displayed unit

Go into engineers mode on FMC-60 and select menu 10 (addressable zero span). The inhibit LED on all connected sensors will flash. Use the UP and DOWN buttons to look at all sensors addresses which are being zeroed and use the + or – buttons on FMC-60 to zero the reading on each sensor.

Press the SELECT button on FMC-60 to enter the span mode which gives plenty of time to visit each sensor. Gas each sensor with appropriate calibration span gas return to the FMC-60 panel and using the UP and DOWN buttons to view each sensor address and using the + or – buttons, adjust the peak sensor reading to be that of the calibration gas. Press SELECT to exit this menu when all sensors have been adjusted.

Note peak readings are lost when exiting from this menu. Re-enter the menu and use again to calibrate any missed sensors.

Setting the Time to Alarm

Using ENGINEERS menu 26, the time in seconds required to detect a direct 4-20 alarm can be set to a maximum value of 60 seconds. This is useful in certain installations where transient gas presence is allowed and gas detection alarms quickly become a nuisance.

The UP (1) and DOWN (5) buttons change the channel and the + (4) and - (2) buttons will alter the time in increments of 1 second.

Pressing SELECT (3) will present the same choice for the addressable channels.

Pressing SELECT (3) again returns to the ENGINEERS menu after saving these times.

Setting Alarm levels

The high and low alarm points for the sensors can be set manually using engineering menu 21 for direct 4-20 ALARM LEVELS and menu 15 for ADDR ALARM LEVELS.

Menu 21 for direct sensors

Use UP (1) and DOWN (5), to choose a sensor which requires an alarm change.

Use + (4) and - (2) to adjust the alarm point.

Pressing SELECT (3) will then request you to set the High alarm point.

Pressing SELECT (3) again allows the Over range alarm to be set.

Use the RESET button (7) to select RISING and FALLING alarm.

Pressing SELECT (3) again will exit the menu and save the parameters to memory.

Alarm relay off timers

The 8 relays on the PCB are allowed to take time to de-energise.

For example, this delay could be used to keep fans running for a longer period after the gas alarm to allow a larger area to be vented.

ENGINEERS menu 24 allows each of the 8 relays to be selected by using the UP (1) and DOWN (5) buttons and then for each relay use the +(4) and -(2) buttons to change the time for delay in increments of 1 second. The minimum time is 1 second.

Additionally, the first 16 external relays can also have a time delay for the pattern which has been output by an event.

Pressing SELECT (3) will save the delay times in non volatile memory and return to the ENGINEERS menu.

Voting relays

(Note these relays are also used with time weighted alarms)

ENGINEERING menu 25 allows channels to be assigned to a group voting system.

4 relays named OPTION 1-4 on the main PCB will be energised according to the voting set up and de-energised when the alarms have subsided and after the relay off timer (set earlier in section 24) has expired.

Using UP (1) and DOWN (5) to select the group, then use the + (4) and - (2) to select how many alarms have to be active in this group to cause a relay to energise.

E.g. group 2 may have 5 sensors in its group and 3 alarms are required to energise relay called OPTION2.

On entering menu 25, the direct 4-20 channels are displayed. UP (1) and DOWN (5) buttons will display which groups this channel is in whilst the + (4) and - (2) buttons change the channel being viewed. If a channel was in groups 1 and 3 then the display would be 1-3-. If it was in groups 2, 3 and 4 then the display would be -234.

Pressing UP (1) or DOWN (5) changes this selection so keep pressing until the correct grouping for your application appears. Any channel can be in all groups and this would be displayed as 1234.

Pressing SELECT (3) presents the Addressable channels for a repeat of the above.

Groups can contain a mix of sensors from 4-20 direct or Addressable channels.

Time weighted alarms

Two types of time weighted alarms can be set using menu 31. STEL is a short time exposure level which is a weighted average of gas level for the last 15 minutes. It is associated with one of the four groups of sensors. Each group may have any number of sensors within it and whichever is the highest reading in the group, this reading is used to formulate the value of STEL.

LTEL is a long time exposure level taken over 8 hours and calculated in the same way as STEL. Both STEL and LTEL have individual alarm settings but both act upon the same relay. These alarms are rising only. Each gas within one of these 2 groups must clearly be of the same type. If STEL or LTEL alarm level is set to a value greater than zero, then this group becomes a TWA (Time Weighted Average) group and the voting function is suppressed for that group.

Defaulting the panel

Individual sections of the panel can be defaulted rather than restoring all the defaults within the panel. This is useful when one particular section of retained data needs to be reset. See engineers menu 32 for details.

Default the whole panel from power up

At manufacture of a new processor board and possibly in service if a new set up is to be installed, it is necessary to clear all system parameters and load default settings.

This can be done by pressing and releasing the processor reset button on the PCB at the same time that the SELECT (3) button is pressed and held down. Release the SELECT (3) button when the LCD displays the message "Initialising NVRAM".

Clearly, this is only to be done if you are sure that a complete default is required. Always ensure that a copy of the old set up is available in a text file which could be reloaded if needed.

Repeater (on CAN2)

It may be required to have a duplicate console sited elsewhere, such as a control room or instrument room.

Using the CAN network, 4 core (2 data + 2 supply) cable, a repeater can be connected which gives a user interface identical to the main FMC-60 panel. In fact the data displayed on the repeater board is transmitted from the main panel.

Likewise, pushing buttons on the repeater are transmitted to the main panel and are used by the main panel as if they had been pressed locally.

To ensure the correct operation of the repeater, it has to be set up in order to accept CAN data FROM a main panel and also to know where to send its own CAN data. It is a requirement that the CAN2 bus is used for repeaters leaving CAN1 for sensors and other devices.

Sensors are able to use CAN2 at the same time as a repeater providing that the addresses are different.

From power up or by pressing the processor reset button on the repeater and pressing the SELECT (3) button at the same time the following sequence will occur on the LCD after releasing the select button.

Set THIS ADDRESS using the UP (1) and DOWN (5) buttons to choose a free address that the repeater will use at its own address. Note this has to be different from that of the main panel (which defaults to address 201)

Press SELECT (3)

Set FROM ADDRESS, this is the main panel address which will send LCD and LED data out to this repeater to be displayed.

Press SELECT (3), the two addresses will be stored.

The repeater is now awaiting data from the FROM ADDRESS and it will display an error after 30 seconds if data does not arrive.

Installation

SITING THE SENSING HEADS

A key feature of the installation is the correct positioning of the sensing head. Several considerations must be taken into account, the most important being the density of the gas.

Density (air = 1)			
Acetone	2.0	Hydrogen-Sulphide	1.18
Acetylene	0.91	Hydrogen	0.069
Ammonia	0.6	Methane	0.6
Benzene	2.8	n-Pentane	2.5
n-Butane	2.0	n-Propane	1.6
Carbon Dioxide	1.53	Town gas	0.4-0.7
Carbon Monoxide	0.96	Xylene	3.7

Under still air conditions, a lighter than air gas such as methane leaking from a small aperture at ground level, will rise in a plume the shape of which approximates an inverted cone. As the gas rises, it draws air from the surroundings and creates turbulence. Due to this rapid dilution of the gas occurs and, unless a sensor is positioned within the plume, there will be no initial indication of a leak.

As gas continues to escape, the diluted methane rises to ceiling level and begins to layer. In time the concentration at ceiling level will increase and this, in turn will displace air downwards.

Dangerous concentrations will therefore, tend to occur at ceiling level and the thickness of this layer will increase with the passage of time.

Ventilation of the room will of course alter the situation significantly but it should be remembered that if the ventilator is not at ceiling level, a dangerous concentration can still occur between the top of the ventilator and the ceiling.

For heavier than air gases such as propane or butane, the formation of dangerous layer occurs at ground level. These gases tend to behave like water and will run down gradients and pool at the lowest point.

The number of heads required in individual rooms is determined by the number of possible hazards in the vicinity.

Gas leakages may occur around valves, flanges and wherever gas pipes are jointed. It may be possible to cover several probable gas leaks in one room by the careful siting of a single head. Cable ducts, trenches and manholes are also likely places where a build up of heavy gases may occur.

When siting a head in such places it is important to ensure that there is no likelihood of flooding by water, or excessive dust which may block the sintered disc and prevent gas from reaching the sensor.

When monitoring gases outside, those lighter than air will be quickly dispersed, but gases heavier than air will tend to form in layers and again cause a dangerous hazard. When siting heads outdoors prevailing winds must be taken into consideration and adequate

protection given against wind and rain by the use of weather or collector cones.

The control unit is designed for installation in a safe area only. Positioning of the instruments should be chosen with regard to the following points:

- Away from sources of local heat with room for adequate ventilation
- Within easy reach and audible distance of operating personnel
- Convenient to a separately fused power supply
- Incoming sensor cables and outgoing alarm annunciation
- Sensor cables to be electrically shielded, steel wire armoured or screened cable
- Sensor cables to be run separately from power cables.

Field cables which are terminated within the control unit enclosure should be kept as short as possible and not allowed to cross over electronic components or the ribbon cable.

To prevent any effect from earth currents the cable shielding should be grounded at the equipment end only.

The instrumentation should be subjected to a minimum of vibration and shock.

Ascertain the voltage rating of the power supply to which the instrument will be connected.

Service – routine attention

The owner or occupier of the premises should place the supervision of the system in the charge of a responsible executive, whose duty it should be to ensure the day to day operation of the system and to lay down the procedure for dealing with a gas alarm, (see below) or fault warning. To ensure reliability an agreement should be negotiated for regular servicing. When a service contract cannot be arranged an employee with suitable experience of electrical equipment should be trained to deal with the simpler servicing and instructed not to attempt to exceed the scope of such training.

Liaison should be established with those responsible for maintenance of the building fabric or redecoration etc. to ensure that their work does not cause a fault or otherwise interfere with the operation of the alarm installation. Particular attention appertaining to the Detector Head.

The operating instructions should be kept available with the control unit; all faults service tests and routine attention given should be recorded.

DAILY: A check should be made that any fault condition which may be indicated is in fact being attended to and that all other indicators are normal.

TWICE YEARLY MAINTENANCE SCHEDULE

1. All zeros at the control unit to be checked logged and aligned.
2. Each detector to be gas tested and reading logged (sensitivity checked).
3. Field indicators to be tested.
4. All alarm set points checked and re-aligned.
5. Lamp Test.
6. All faulty parts replaced where required.
7. All filter elements checked and replaced as necessary.
8. Power supply – complete functional check.
9. Visual inspection made to confirm that all cabling fitting and equipment is secure, undamaged and adequately protected.

ACTION TO BE TAKEN IF THE APPARATUS ALARM SOUNDS:-

- A. Extinguish all naked flames, including smoking materials.
- B. Turn off all gas appliances.
- C. Do not switch on or off any electrical lights or appliances.
- D. Turn off the gas supply at the gas emergency control and/or (with L.P.G supply) the storage tank.
- E. Open doors and windows to increase ventilation.

If the alarm continues to operate, even after an alarm re-setting action where appropriate, and the cause of the leak is not apparent and/or cannot be corrected, vacate the premises and immediately notify the maintenance engineers / safety officers / emergency services or gas supplier and/or the gas emergency 24 hour service in order that the installation may be tested and repair work carried out in order to make the installation safe.

Appendix 1

Menu details by number

1] View Modbus Reg

This allows inspection of the 250 internal MODbus registers.

Use UP and DOWN buttons to alter the register which is displayed in Decimal and Hexadecimal. SELECT button will exit.

2] Set Clock

Using UP / DOWN and SELECT allows the date and time to be changed.

Note, if the CAN communication connection is made to other FMC-60 panels, the time from the lowest address panel will impose itself onto higher panels. So this means that the time should only be adjusted on the lowest address panel and then this new time will appear on other higher address panels.

3] Inhibit all Sensors

Using UP and DOWN buttons, the direct or addressable sensors can be inhibited.

4] View Modbus TXRX

As a diagnostic tool for Modbus communications, this display shows the data packets received from a Modbus master (RX) and the reply sent back from the FMC-60 panel (TX)

This display is in Hexadecimal and to understand the meaning, the Modbus data packet protocol has to be analysed. This menu is generally used when first getting the Modbus system running. Use SELECT to exit this menu.

5] Set Refresh Rate

Use + and – to change the display refresh rate for sensor data on lines 1 and 2 of the LCD 1 is fastest and 10 is slowest. Pressing SELECT will exit this menu.

6] Edit Company Text

The fourth line of the LED display alternates between time and company text. This text can be edited to show the site or installer details.

7] Lamp Test

This menu will illuminate all front panel LEDs on the main PCB and those on the remote LED board when connected.

When complete, the PCB buzzer will sound and the menu exits.

Note that the LED test is done with DIM active to save excessive current from the PSU.

8] Relay Test

The local group of 8 relays can be energised or de-energised using + and -. Pressing SELECT allows the 64 (2x32) relay card to be tested. UP and DOWN choose which of the 64 relays to test and the ENTER button will energise it. The SCROLL button will de-energise the relay. The state of the relay can be seen via individual LEDs on this board. SELECT will exit the menu.

9] Event Log to LCD

The internal 99 event log can be viewed on the LCD display one event at a time.

Each line of the display indicates the following

Line 1 shows the type of event with the time of occurrence.

Types are	FLT	is a fault such as sensor 1 fail
	Hi Alrm	is high alarm
	Lo Alrm	is low alarm
	SYS	is a system event such as a panel reset

Line 2 and 3 show text relating to the event.

Line 4 shows which event is being displayed and how many events are logged.

Eg 3 of 76 events means that the display is showing event 3 and 76 events are logged.

76 is the oldest event and 1 is the latest event.

Use UP and DOWN to choose which event to view.

SELECT will exit the menu.

10] Addressable Zero and Span

The first part of this menu allows you to zero an addressable CAN channel.

The channel is selected by using UP and DOWN buttons and the reading itself is adjusted by pressing + and -.

This menu will timeout and the number of seconds left is displayed on the LCD.

SELECT will exit the zero menu and present the span menu.

The channel is selected by using UP and DOWN buttons and the reading itself which is based on the peak readings is adjusted by pressing + and -.

This menu will timeout and the number of seconds left is displayed on the LCD.

Because peak readings are used, a number of sensors can be spanned at the same time.

11] Set LCD backlight and Led Dimmer

The value of brightness for the LCD/led when dimmed is set using UP and DOWN buttons and

SELECT will exit the menu. The actual brightness is displayed on the LCD as a percentage and

on the front panel leds themselves whilst adjusting. This level of brightness will be used in normal mode when the DIM button is pressed.

12] Is an Exit Point

13] Is top of Engineers Menu

14] Inhibit a Sensor

During maintenance, individual sensors can be inhibited so that false alarms are not indicated.

A front panel led illuminates to indicate that at least one sensor has been inhibited in the system.

The first part of this menu allows a direct sensor to be inhibited using the + and – to toggle the

state. The LCD indicates whether inhibited or not and the UP and DOWN buttons change the

channel. Note that only channels with active sensors can be inhibited.

Pressing **SELECT** or timeout will move to the second part of this menu which allows addressable CAN sensors to be inhibited in the same way.

Pressing **SELECT** will exit this menu.

15] Addressable Alarm Levels

The alarm levels for can sensors can be changed in this menu

Three levels are presented, LOW, HIGH and OVER RANGE

Use + and – to change the LOW level and the UP and DOWN buttons which alter the channel being changed

Pressing SELECT moves to HIGH alarm

Pressing SELECT moves to OVERANGE

Pressing SELECT exits this menu.

16] Adjust 4-20 mA Outputs

The FMC-60 has two 4-20 outputs which can be assigned to follow individual sensors.

The zero point (ie 4mA) and full span point (ie 20mA) have to be electronically set within FMC-60 and this menu allows this adjustment.

The first part of this menu allows channel 1 output 4ma to be set by measuring this current as millivolts across a 1 ohm resistor between TP1 and TP2 on the pcb.

The 4-20 output terminals can be shorted or wired to a load for this.

Use + and – buttons to adjust the reading to 4 millivolts.

Pressing UP moves to channel 1 20mA output which again can be adjusted.

Pressing UP again moves to channel 2 4mA which can be adjusted.

And finally pressing UP again moves the adjustment to channel 2 20mA.

Pressing SELECT at any time will exit this menu.

17] Alter Channel Text

Each sensor has text associated with it to describe its location.

This text can be altered manually if required using this menu.

Use UP and DOWN to choose the line to be edited and then press ENTER to go into edit mode.

A small cursor will appear below the text indicating that the character above it can be altered. Use ENTER and SCROLL to change the character and use UP and DOWN to move the cursor to another character position.

SELECT will complete the editing and return to choose another line.

SELECT again at this point will exit the menu.

Note using PC to PANEL allows this text to be loaded from a PC which is much quicker.

18] Alter Gas Type

Up to four gasses can be measured and the gas type can be selected using this menu.

Use UP and DOWN to choose which of the four gasses to change and then use ENTER and SCROLL to change the gas type. The default alarm levels are displayed which will be used if the gas is changed to a new type.

Note that most alarms are rising but in the case of oxygen, three alarm options are possible indicated by the v and ^ characters.

19] Assign 4-20 Outputs

Any of the sensors whether direct or addressable can be assigned to one of two 4-20 output channels. This menu allows you to choose which sensor is assigned to the first output and then the second output. Use the UP and DOWN buttons to choose the sensor channel and + and – select whether it is addressable or direct.

Pressing SELECT moves to the second channel.

Pressing SELECT again exits this menu.

Note that it is possible to assign the same sensor channel to both 4-20 outputs.

20] Adjust Zero and Span

Normally a gas sensor will be calibrated as a separate item but minor adjustments to the readings of any of the four gasses can be made at the panel using this menu

Use UP and DOWN initially to choose the gas sensor to be calibrated.

Then press SELECT and use UP and DOWN to alter the maximum value of the sensor if required.

Then press SELECT to start adjusting the zero for this sensor (with no gas present).

UP and DOWN make minor adjustments and when reading of zero is achieved press SELECT to move to a span adjustment (apply span gas). UP and DOWN will adjust the internal gain to make the reading correct according to the span gas applied.

Press SELECT to exit this menu.

21] Set 4-20 direct Alarm Levels

Alarms occur when the gas values for each sensor are above or below these alarm levels (Oxygen can be below) and the level can be adjusted using this menu.

Additionally, the low and high alarms can be latched or unlatched and on entering this menu, you have to select whether low alarms are latched. Pressing ENTER will toggle between latched and unlatched.

Pressing SELECT requests the same choice for the high alarm.

Pressing SELECT again allows adjustment of the low alarm using the UP and DOWN buttons

Pressing SELECT again allows adjustment of the high alarm using the UP and DOWN buttons

Pressing SELECT again allows adjustment of the over range alarm using the UP and DOWN buttons

Pressing SELECT again will exit the menu.

22] Unlatched Alarms

Each sensor channel can have latched or unlatched alarms. This menu shows the current state of this feature and can be toggled by pressing + or –. The sensor channel is selected by using the UP and DOWN buttons. Unlatching alarms will clear automatically when the gas level is below the alarm point. Pressing SELECT will exit this menu.

23] Event to relay 64

Each event which is stored in the 99 event log can also activate a relay. Use this menu to choose which relay. Use UP and DOWN to choose the event (which is displayed on the LCD) and then use SCROLL and ENTER to choose which of the 64 relays to drive. The default is not to drive any relay.

Also, each event can drive the first 16 relays as a pattern which is ORed in. This means that patterns which overlap will mix together and effectively create a group action. Each event has its own individual pattern of 16 bits where 1 = relay active and these can be edited using the display where a cursor is moved using + and - buttons and UP and DOWN will set one and zero in the cursor position.

hgfdcba987654321 represent the 16 relays. 1 relay=relay 1 and h=relay 16.

With so many events needing patterns, it is usual to download these patterns from a PC using menu number 29. Note that if a relay is normally energised (menu 36) then the effect of a 1 will turn the relay off. Pressing SELECT will exit this menu.

Additionally, pattern 8765 321 ca be redirected to 7 relays on the FMC-60 input pcb. The fault relay (4) always remains as Fault but the remaining relays are assigned as follows:

Low High Overrange Opt1 Opt2 Opt3 Opt4 will mimic remote relays 1235678 respectively. This feature eliminates the need to fit a remote relay pcb for smaller installations. Note: the relay off timers are not operational with this feature and these relays are cleared by pressing the front panel Reset button.

Pressing SELECT will exit this menu.

24] Relay off Timers

Each of the 8 relays on the main PCB can have delayed de-energise times and this menu allows you to set the delay in seconds. Use Up and DOWN to select which of the 8 relays to set (described in words) and then + and – to alter the time. The minimum time is 1 second and the maximum is 255 seconds. This feature is extended to the first 16 relays which have a pattern output created by an event. Select will exit this menu.

25] Channel Voting

There are 4 groups of sensors which drive 4 option (voting) relays. This menu allows you to set how many alarms in a group are required before its relay will energise and then which sensors are in the group. Sensors can be in any group or multiple groups or no groups.

The first part of this menu enables you to set the number of alarms by using + and – buttons. The maximum is 10 alarms. Use the UP and DOWN buttons to change the group number being set. Pressing SELECT goes to the second part of this menu this sets which group the 4-20 direct channels followed by the addressable channels are in. The + and – changes the group and UP and DOWN changes the channel.

If a sensor channel is in group 1 the display would be	1 - - -
If a sensor channel is in group 3 the display would be	- - 3 -
If a sensor channel is in group 1 and 3 the display would be	1 - 3 -
If a sensor channel is in group 1, 2, 3 and 4 the display would be	1 2 3 4
If a sensor channel is in no groups the display would be	- - - -

Pressing SELECT will exit this menu.

26] Seconds to Alarm

When an alarm condition exists it is possible to delay the response and if the alarm still exists at the end of this delay then a normal alarm condition is recognised. This menu allows you to set this delay to a maximum of 60 seconds. For 4-20 direct sensors first use UP and down to change the channel and + and – to alter the time in seconds. Pressing SELECT presents the same choice for the addressable sensors. Pressing SELECT again will exit this menu.

27] Setup Network

Both Modbus and CANbus require that this panel has a communication address and this can be set using this menu. UP and DOWN change the displayed address which is common to both CAN1 bus and CAN2 bus. Pressing SELECT changes the display to view of all CANbus devices currently connected to this panel. The purpose of this is to find an address which has a repeater panel and then to decide if this panel should be connected to it. The address is displayed together with the type of device seen. A ? is displayed if nothing is present at the displayed address. The letter P would appear if another panel was seen. The letter R would appear for a repeater and The Y/N letter states whether this panel is currently connected to it, ENTER toggles this connection. Once connected the buttons, LEDs and LCD on the main panel and the repeater match in operation and display. The letter S would appear if a relay / sounder device is found. Pressing SELECT will exit this menu.

28] Event log to PC

It is possible to send the event log to a PC for storage etc. Using HyperTerminal on the PC set to 2400 baud, 8bit, no parity, no flow control the events are sent one by one in ASCII characters to the PC using the RS232 connection. The HyperTerminal can be set to capture text and then save it .The file sent is text only and can be printed or edited as required. This menu will exit automatically when all data is sent.

29] Data PC to Panel

To get data from a PC to this panel to set up Text, Gasses, Alarms, etc this menu prompts you to set up HyperTerminal on your PC and then waits for data to be sent in a prescribed format ending in “:x”. When the text has been sent, any valid data is stored. Bad data and comments are ignored. Valid command letters only are echoed to the PC screen. This menu will drop out if data is not sent in 60 seconds and also can be aborted by pressing SELECT.

30] Data Panel to PC

The panel may already have Text Gas and Alarm data stored and you may wish to have a copy held on the PC for future backup. This menu allows you to send this data and the PC will receive it in HyperTerminal using the Capture text function. When saved on the PC, this text can then be edited using a simple text editor (such as Notepad) and then sent back to the panel if required. Pressing SELECT starts sending the data to the PC and when finished, this menu will exit automatically.

31] LTEL, STEL Alarms

This menu allows you to set the time weighted average alarms for 4 groups.

32] Default Sections

Sometimes it is required to default part of the data in the panel and this menu allows you to do this. (Some options are repeats of other menus) Pressing SELECT moves to the next option and pressing + defaults the option displayed.

The options are:-

Clear event log	Clears all events in the 99 event log
Default Modbus/Canbus	Defaults baud rate to 9600 and address 1
Default gas type to Flam	All sensors become FLAM type
Default Line text	Defaults to 4-20 text or can text
Default event to relay	All events do not drive any of the 64 remote relays

33] Change User Code

The user password code can be changed. This menu prompts you to enter a new code twice via the buttons, this menu changes that code. The Engineers code can't be changed. Pressing select will exit this menu.

34] Set Modbus Baud

This menu allows you to change the Baud rate used by the Modbus (default is 9600). The options are 19200, 9600, 4800 bits per second and these are altered using the UP and DOWN buttons, Pressing SELECT will exit from this menu.

35] Set Power Alarms

The panel detects both mains power and battery/DC power. When only one power source is in use it is convenient to disable the loss detection of the other source so that the panel is not in continuous fault. This menu allows you to inhibit the battery alarm first and by pressing SELECT then the mains alarm. The + and – buttons toggle whether or not each alarm is inhibited, this is displayed on the LCD. Pressing SELECT will exit this menu.

36] Set Energised Relays

This menu allows relays to be set as normally energised (=1) or de-energised (=0).

4321FOHL represents the 8 on board relays.

L = Low alarm

H = High alarm

O = Over range alarm

F = Fault relay

1,2,3,4, = the 4 option relays used in groups 1 to 4

Using + and - buttons, the small cursor moves along a pattern of ones and zeros which represent the normally de-energised or energised setting and this can be changed using the UP and DOWN buttons.

Press SELECT to exit this menu.

Appendix 2

A typical text file that can be sent to the FMC-60 system. Remember lines starting with “:” are for direct sensors and * are for CAN sensors:

Settings.txt

```
Data to PC from panel address 2
:T1, Hold 3
:T2, Bridge
:T16, Boiler room

*T1, Gantry 1
*T2, Corridor 3
*T64, Flare stack

:G1, %LeL^ ,
:G2, %LeL^ ,
:G3, %LeL^ ,
:G4, %LeL^ ,

:HiAlarm 1,400
:HiAlarm 2,400
:HiAlarm 3,400
:HiAlarm 4,400

:LoAlarm 1,200
:LoAlarm 2,200
:LoAlarm 3,200
:LoAlarm 4,200
:OrAlarm 1,998
:OrAlarm 2,998
:OrAlarm 3,998
:OrAlarm 4,998
:Maxval 1,999
:Maxval 2,999
:Maxval 3,999
:Maxval 4,999

Event to Relay
Direct Chan
:Fault 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
:first alm 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32
:second alm 33, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 34
:third alm 35, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 36

Address Chan
*Fault 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
*first alm 37, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 38
*second alm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
*third alm 0, 0, 39, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
485Comms A/Cpower CanComms Battery
:ev 1, 2, 3, 4,

4321FOHL Local energised relays
:E00000001

hfedcba987654321 Remote energised relays
:R0000000000000011

hfedcba987654321 Direct fault relay patterns
:h01, 0100000000000001
:h16, 1000000000000000

hfedcba987654321 Direct low alarm relay patterns
:i01, 1000000000000000
:i16, 0000000000000001

hfedcba987654321 Direct high alarm relay patterns
:j01, 0000000000000011
:j16, 0000001110000000

hfedcba987654321 Direct overrange alarm relay patterns
:k01, 1000000000000001
:k16, 1000000000000001

hfedcba987654321 CAN fault relay patterns
*h01, 1010101010101010
*h64, 0101010101010101

hfedcba987654321 CAN low alarm relay patterns
*i01, 1111111110000000
*i64, 1111111110000000

hfedcba987654321 CAN high alarm relay patterns
*j01, 0011001100110011
*j64, 1100110011001100

hfedcba987654321 CAN overrange alarm relay patterns
*k01, 000011111110000
*k64, 1111000000001111

hfedcba987654321 CAN bus alarm relay patterns
:m0000000000000000

hfedcba987654321 Battery fail alarm relay patterns
:n0010101010101010

hfedcba987654321 A/C fail alarm relay patterns
:p000001110000111

hfedcba987654321 485 bus alarm relay patterns
:q011110000111000

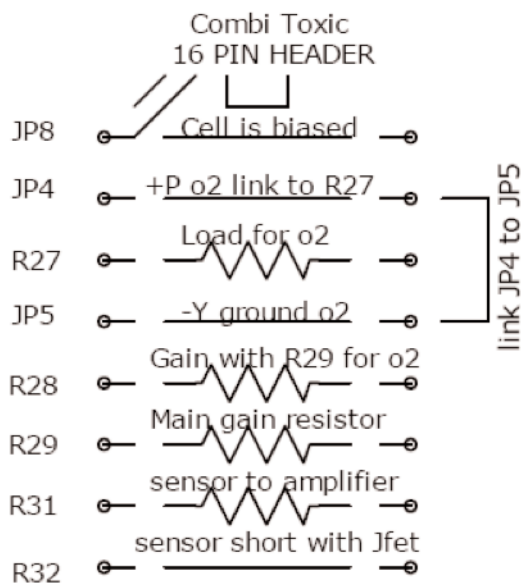
Delays for 16 remote relay patterns
:d 1, 6,
:d 2, 3,
:d 16, 5,

Delay for 8 local relays
:D 1, 4,
:D 2, 2,
:D 8, 9,
:X,
```


Appendix 5

Toxic DIL header configurations

These links configure the electrochemical cell and the table below show some typical values used

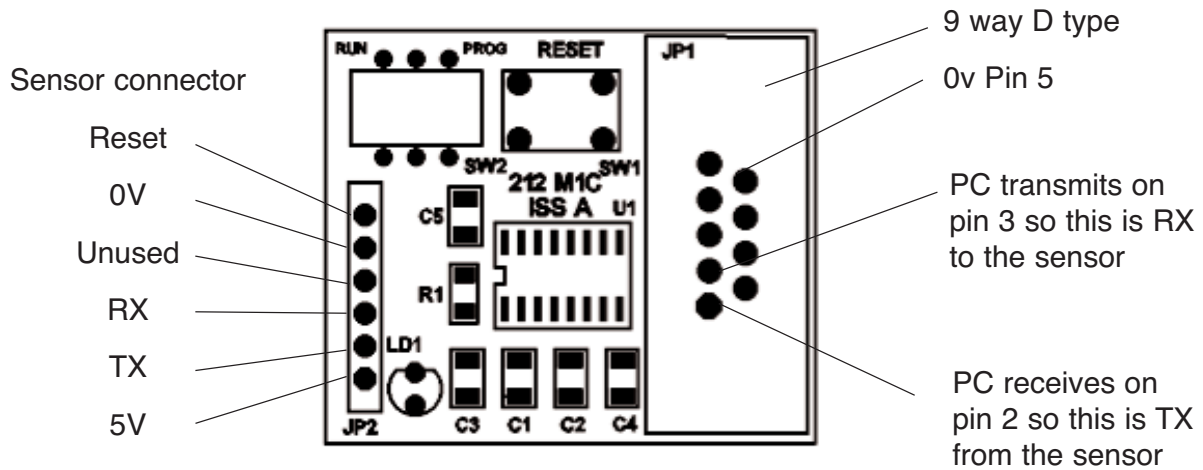


A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
1	COMBI TOXIC CELL CIRCUIT VARIAT PCN204B														
2	A.K.V Feb 2008 issue H														
3	Cell type	GAS	PPM	uA per ppm	Bias Reqd	US pint V	R29 K	R31	R28	R27	R32 Short	JP8	JP5	JP4	link JP4 to JP5
4															
5	7E&7F CITICEL	CARBON MONOXIDE	1000	0.1	no	2.2	22	10R	X	10R	Y	N	N	N	
6	7E&7F CITICEL	CARBON MONOXIDE	250	0.1	no	2.05	32	10R	X	10R	Y	N	N	N	
7	4CL CITICEL	CHLORINE	10	0.6	no	2.6	360	33R	X	33R	Y	N	N	N	
8	4S CITICEL	SULPHUR DIOXIDE	20	0.5	no	2.2	220	10R	X	10R	Y	N	N	N	
9	4HS CITICEL	HYDROGEN SULPHIDE	100	0.7	no	2.1	30	10R	X	10R	Y	N	N	N	
10	4NT CITICEL	NITRIC OXIDE	250	0.4	Yes	2.2	22	10R	X	10R	Y	Y	N	N	
11	4CO&4CF CITYC	CARBON MONOXIDE	500	0.07	no	2.07	42	10R	X	10R	N	N	N	N	
12	COBF ALPHASEM	CARBON MONOXIDE	500	0.1	no	2.35	47	33R	X	X	30R	N	Y	X	
13	7HL citicel	Hydrogen Chloride	100	0.75	yes	2.25	30	10R	X	10R	Y	Y	N	N	
14	7AM citicel	Ammonia	50	0.12	yes	2.6	360	10R	X	10R	Y	Y	N	N	
15	7ETO citicel	Ethylene oxide	20	2.75	yes	2.45	39	10R	X	10R	Y	N	N	N	
16	H2S-A1 alpha	hydrogen sulphide	100	0.7	no	2.31	33	10R	X	10R	Y	N	N	N	
17	9O2BF alpha	sulphur dioxide	100	0.37	no	2.294	62	10R	X	10R	Y	N	N	N	
18	4ND city	nitrogen dioxide	20	0.6	no	2.36	100	10R	X	10R	Y	N	N	N	
19	7NH city	ammonia	250	0.12	yes	1.968	32	10R	X	10R	Y	Y	N	N	
20	CO-AF alpha	carbon monoxide	1000	0.07	no	2.1	30	10R	X	10R	Y	N	N	N	
21	H2S-BH alpha	hydrogen sulphide	50	1.7	no	2.295	27	10R	X	10R	Y	N	N	N	
22	NO-B1 alpha	nitric oxide	50	0.53	no	2.172	32	10R	X	10R	Y	N	N	N	
23	7NDH city	nitrogen dioxide	20	14	no	2.772	330	Z	100	33R	Y	N	N	N	yes
24	7CLH city	chlorine	20	1	no	2.2	110	10R	X	10R	Y	N	N	N	
25	4H city	hydrogen cyanide	50	0.1	no	1.95	390	10R	X	10R	Y	N	N	N	
26	9O2-AE alpha	sulphur dioxide	2000	0.067	no	2.01	35	10R	X	10R	Y	N	N	N	
27	Nemoto NT-CO-U	Carbon monoxide	1000	0.05	no	2.35	47	10R	X	10R	N	N	N	N	
28	Nemoto NT-CO-LI	Carbon monoxide	30	0.05	no	1.5	1000	10R	X	10R	N	N	N	N	
29															
30	OXYGEN IS SPECIAL CASE U4 , R17,C12,R18,R19,R21,R20,R22,Q1,R32, NOT FITTED														
31	Cell type	Oxygen	Range	uA in air	Bias Reqd	US pint V	R29 K	R31	R28 K	R27	R32 Short	JP8	JP5	JP4	
32	4C CITICEL	Oxygen	25%	245	no	1.274	51	Z	1	100	N	N	Y	Y	
33	4O2(2) CITICEL	Oxygen	25%	100	no	1.21	520	Z	1	100	N	N	Y	Y	
34	7OX CITICEL	Oxygen	25%	200	no	7.82	390	Z	1	100	N	N	Y	Y	
35	4O2(1) CITICEL	Oxygen	25%	100	no	1.60	51	Z	1	100	N	N	Y	Y	
36	OO-A2 Alpha	Oxygen	25%	100	no		520	Z	1	100	N	N	Y	Y	
37															
38															

Fig. 1

PC adapter (converts sensor data output to RS232 for PC)

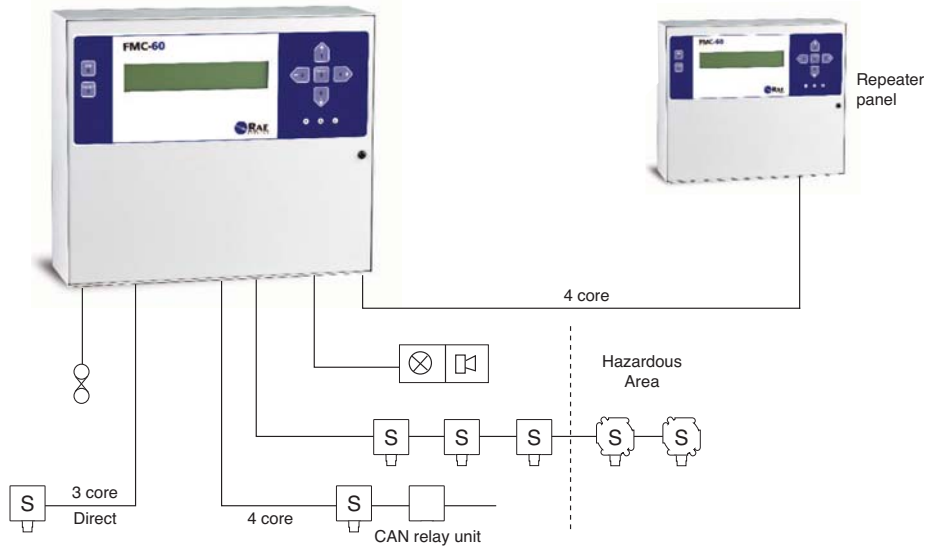
The 9 Way D-type plugs into the PC com port and the pre wired sensor connector is inserted into J1 on the sensor PCB. When HyperTerminal on the PC set at 4800 baud (no handshake) and connected to the com port, the PC should now display the continuous sensor output .



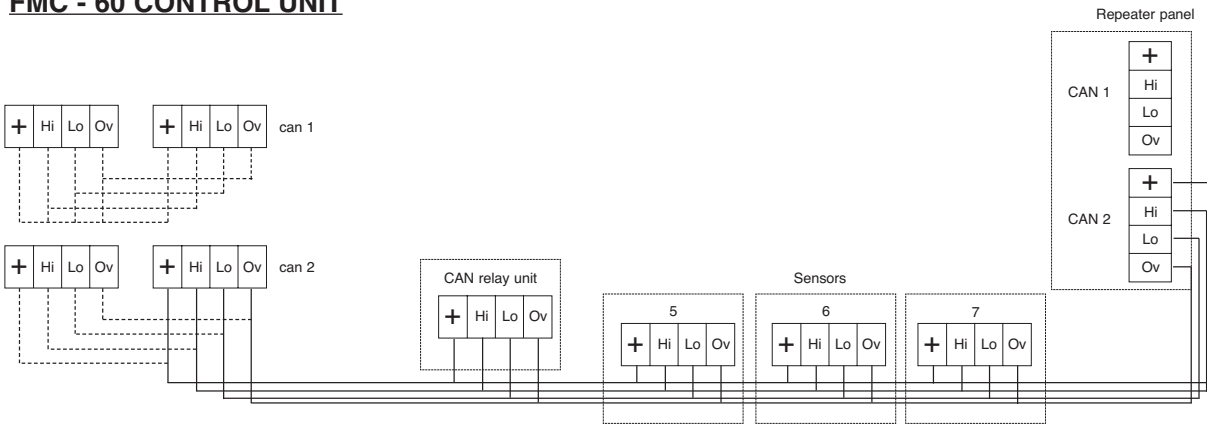
When programming the sensor processor, the Run and Prog slide switch SW2 is set to Prog but under normal circumstances, this switch should be in the Run position.

The Reset push button SW1 when pressed gives a hardware reset to the sensor processor. This can be pressed at any time and the sensor reacts in the same way as if it had reset itself.

Fig. 2 System Configuration



FMC - 60 CONTROL UNIT



Note:- Any of the sensor terminals can be selected to run out to the sensors

SENSOR CONNECTIONS

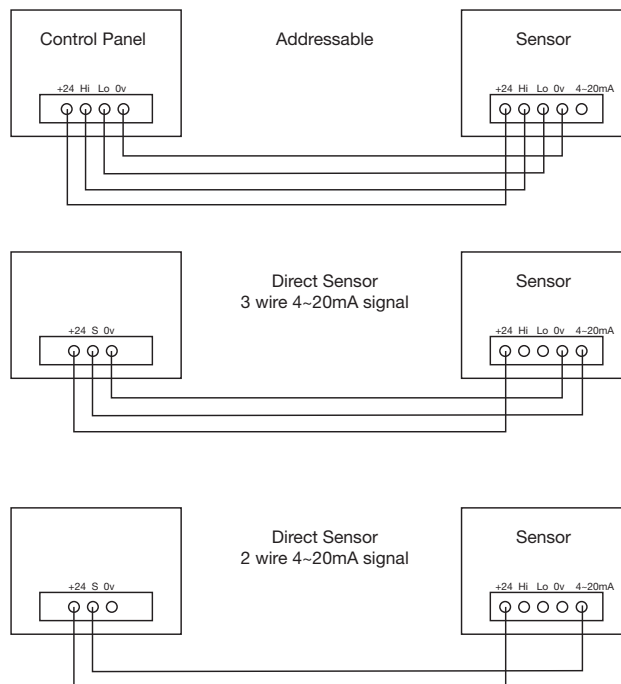
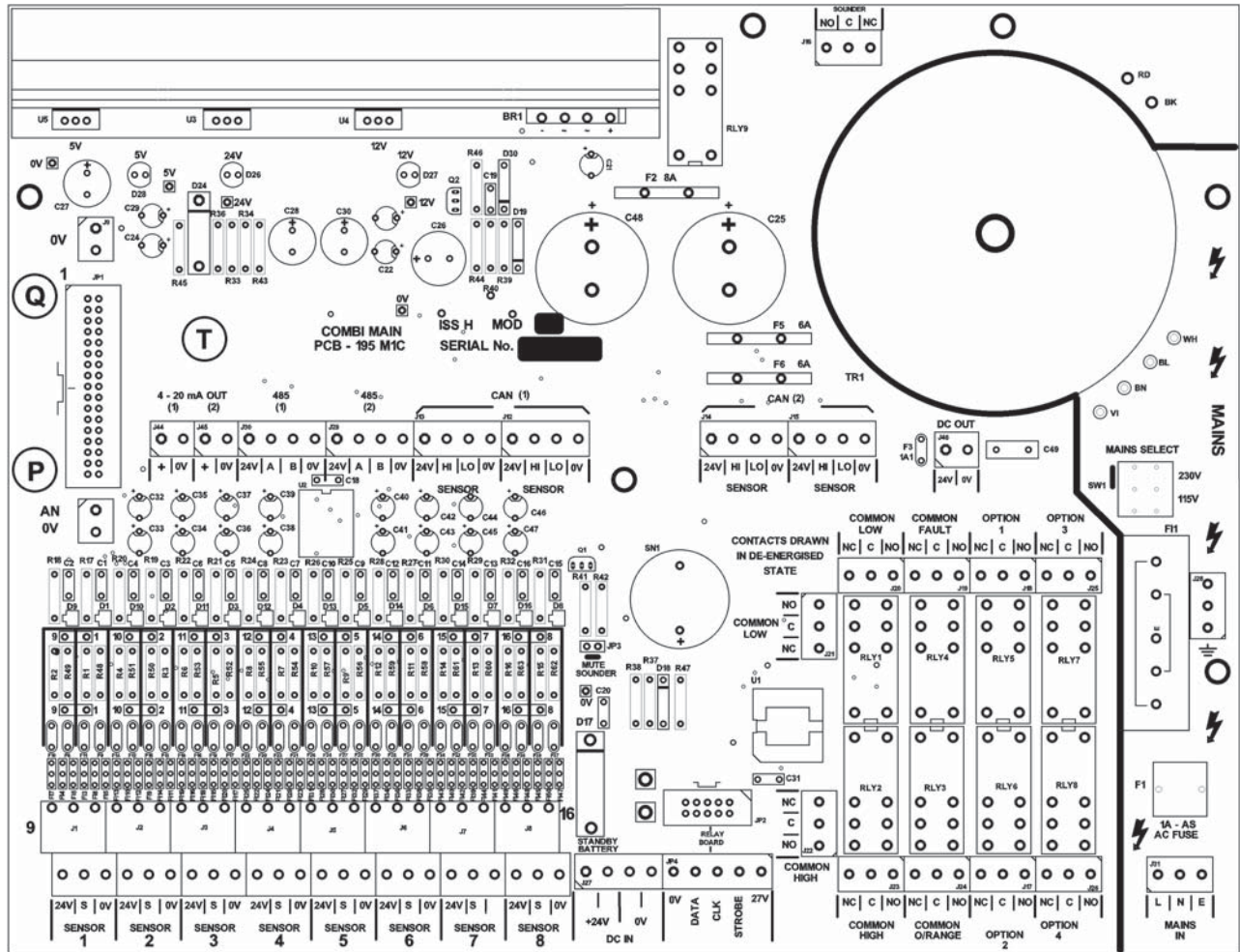


Fig. 3 Circuit Board details

Power supply and Input / Outputs



Processor PCB

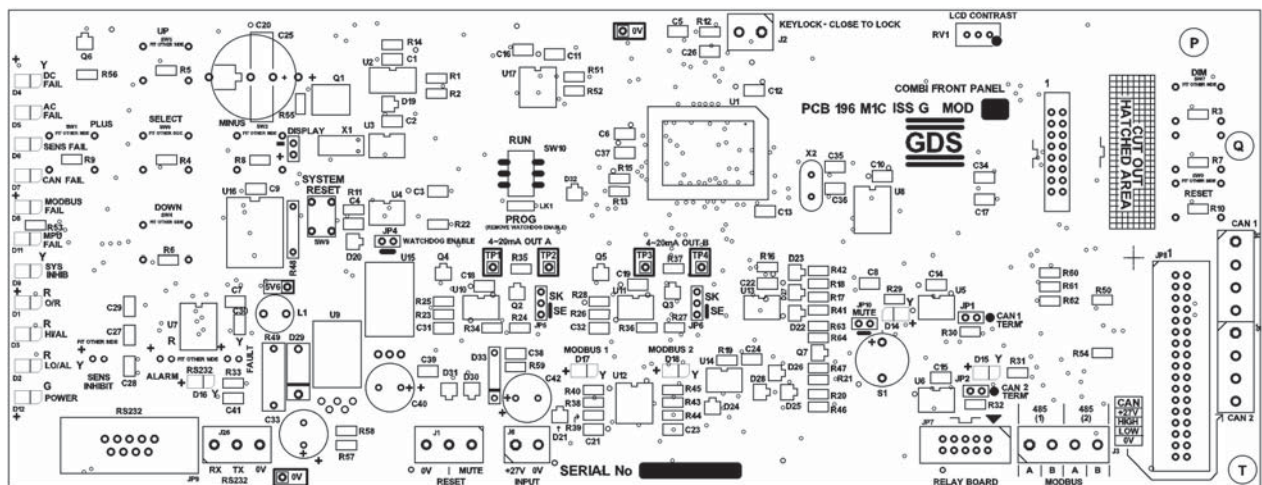


Fig. 4 Enclosure Detail

