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    N.B: (#) is the System menu option number

SYSTEM OVERVIEW

Information within this manual relating to sensors will apply only to the specific direct or addressable sensor type.
Combi 80 - 64 Addressable + 16 direct sensor inputs.
Combi 64 (lite) - 64 Addressable sensors
Combi 16 - 16 direct sensor inputs

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 COMBI where as the addressable sensors can be connected to a shared CAN bus network minimizing cable requirements.

Each channel when connected becomes active and is recognized by the system and a fault occurs if it becomes 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 Combi panel but addressable types transmit this information to the panel. However, alarm levels for addressable sensors can be altered at the Combi 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 Combi panel controls most actions and its dimmable backlit LCD display is capable of indicating the state of gas measurements or fault conditions. Likewise, dimmable LED's internal and external give additional status information.

Many parameters including a text description of the location of a sensor are programmable via user and engineer's 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 Combi 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, LED's and buttons to be located elsewhere on a CAN bus as well as remaining functional on the main panel. A network controller can also be connected which appears as a repeater but to multiple panels connected to the CAN bus. 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 alarms or faults 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 Combi parameters to the PC as a simple text file 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.

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.

- If multiple panels are connected on CAN bus, then the panel with the lowest address will send the time to the other panels.

Sensors connected on the CAN bus can have their address changed using **ENGINEER'S** menu 27 (Described in appendix:1).

PLEASE NOTE:
Connected sensors are recorded as present by the panel.
If a sensor is removed, and then the panel is switched on, a fault will occur showing the missing sensor.
Use **ENGINEER'S** menu 16 to clear all addresses if required.

Button action on the Combi 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 these relays are used for voting whereby sensors can be grouped and the relay is activated when a number of sensors have gone into alarm. The last four relays labeled OPT5, 6, 7 and 8 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 LED's 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 the engineer's menu, which allow these relays to be manually activated during commissioning.

GENERAL SPECIFICATION

Direct 4-20mA sensors	16 Sensor Inputs (maximum) - source 2 Wire sensor Power = 0.6W 3 Wire sensor Power = 1.7W
Addressable sensors	64 Sensor inputs (maximum) (CAN network – 4 wire) end of line termination required. 1.7W per sensor
Internal Sensor Supply (Loading)	24V.DC – 3A / 70W Systems exceeding 70W sensor load should be powered from an external 24V power source. (See auxiliary power pack [260W] Price code: 200-003)
Sensor types	Electrochemical - Infra Red - Pellister
Sensor cable	Addressable CAN bus, 4 Core 1.5mm screened Direct 2/3 Core 0.5mm screened
Power supply	230/115Vac 50/60Hz +/-15% 24-28Vdc or Battery (external charger) Power Board = 6 Watts Main processor board = 5 Watts (See 1 and 2 for sensor loading)
Indication	4 line, 40 character LCD 3x Externally visible LEDs for 'Fault', 'Alarm' and 'Sensor Inhibit' PCB LED's include: 'DC Fail', 'AC Fail', 'Sensor Fail', 'CAN Fail', 'Modbus Fail', 'Watchdog', 'System Inhibit', 'O/R', 'Hi Alarm', CAN1/2, RS232, and 'Watchdog', 'System Inhibit', 'O/R', 'Hi Alarm', CAN1/2, RS232, and '24V'/'12V'/'5V' rails
User Interface	7 Buttons on main board and or repeater (Up, Down, -, +, Select, Dim, Reset)
Alarm settings	3 Alarm levels which are user selectable High, Low, and Over range
Combi Panel	RS232 data log, (up to 10 meter) CAN bus (up to 1Km) Modbus slave to an external Modbus Master (up to1Km @ 9600 baud) Optional Relay card (up to an additional 64 relays) Common Low alarm relay DPCO or 'Group 1' Common High alarm relay DPCO or 'Group 2' Common Over Range alarm relay SPCO or 'Group 3' Fault relay SPCO or 'Group 4' OPT G5 LTEL/STEL relay SPCO or 'Group 5' OPT G6 LTEL/STEL relay SPCO or 'Group 6' OPT G7 LTEL/STEL relay SPCO or 'Group 7' OPT G8 LTEL/STEL relay SPCO or 'Group 8' Sounder relay SPCO (Relays Lo, Hi and OR can be latched or unlatched) (Groups and LTEL/STEL relays can only be unlatched)
Relay rating	5A@250Vac none inductive / capacitive
Audible	Mutable Buzzer on both Motherboard and Front panel Remote sounder (optional)
Dimensions	(H) 265mm x (W) 315mm x (D) 100mm
IP rating	IP52 optional IP65
Enclosure	Mild steel powder coat BS00A01 IP52 (optional IP65)
Cable entry	Bottom / Rear 20mm push-outs
Weight	5Kg
Terminals	Field terminals 2.5mm
Operating temperature	5 to 40°C
Features	Remote reset Keylock Remote repeater panel (option) Operating distance 1km 16way 4-20mA catalytic converter panel (option) Multiple panels using the network controller 32 way CAN relay panel (option)

LED & LCD INDICATORS

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

Gas value   Gas type   Customer programmable text

Direct sensor →

Addressable sensor →

```
D4        20      %LEL        xxxxxxxx xxxxxxxxxxx
A6        10      PPM CP      xxxxxxxx xxxxxxxxxxx
Alarms =  0       Faults = 0   Sensors  D = 4  A = 6
12.24 Tue 31 Jul 2012          WatchGas Ltd 0113
```

} Continuously updating display lines

Alternating user text display (programmable)
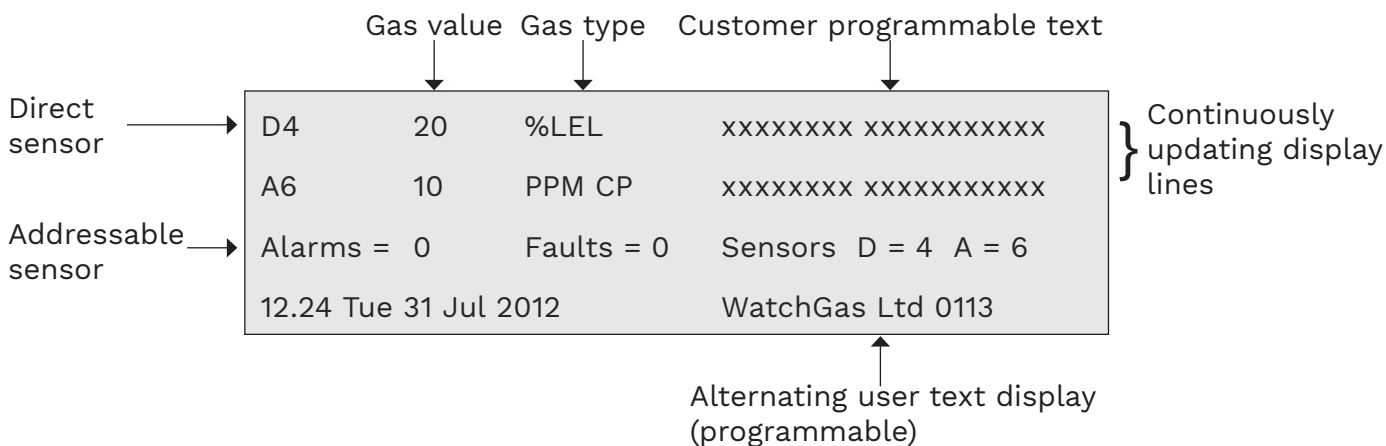
Line 1	Standard 4~20mA sensor, values and gas type and location
Line 2	Addressable sensor, values and gas type and location
Line 3	General information, Number of Alarms, Faults and Connected sensors
	E.g. D=4 means 4 direct sensors connected
	E.g. A=6 means 6 addressable sensors connected
Line 4	Date 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 Combi 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 (e.g. 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
Watchdog	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 Combi system plus there is an internal 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 engineer's 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, the engineer's menu is displayed in which sub-menus can be selected by pressing the **SELECT (3)** 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 engineer's menu.

Button 6 is the **DIM** button. It is used for dimming the LED's and LCD backlight and will toggle between full brightness and the dim level previously set in the engineer's 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 jumper 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 jumper removed for normal operation.

ENTERING A PASSWORD TO GET TO USER OR ENGINEER'S MENUS

To protect system parameters from being altered 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** menu and gives access to a limited set of menus, e.g. clock set, LED test etc. The second 4 button password is for the **ENGINEER'S** menu 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

The **USER** password is defaulted to **DOWN (5)** pressed 4 times.
The **ENGINEER'S** password is defaulted to **+ (4)** pressed 4 times (or as per customer requirement).
Changing the engineers password is described later.
The user password can also be changed.

COMBI SYSTEM MENU INDEX SEE APPENDIX 1 FOR FURTHER DETAILS.

NOTE: The items that appear in the user menu can be selected from the Engineer's menu by toggling the +(4) button. A '+' symbol will appear in the menu next to the item to indicate it is available in the user menu. Engineer's menu contains all items.

1	View Modbus Reg	21	4-20mA Alarm Levels
2	Set Clock*	22	Unlatched Alarms
3	Inhibit all Sensors	23	Event to Relay64
4	View Modbus txrx	24	Relay off Timers
5	Refresh Rate	25	Channel Voting
6	Edit Company Text	26	Seconds to Alarm
7	Lamp Test*	27	Setup Network
8	Relay Test	28	Event log to PC
9	Event Log to LCD*	29	Data PC to Panel
10	Add zero/span	30	Data Panel to PC*
11	LCD Led Bright*	31	Ltel Stel Alarm
12	Exit*	32	Default Section
13	Top of Engineers	33	Engineer Password
14	Inhibit Sensor*	34	Set Modbus Baud
15	Add Alarm Levels	35	Set Power Alarms
16	Clear All Addresses	36	Energised Relays
17	Alter Chan Text		
18	Alter Gas Type and Range		
19	View Add sensor status		
20	4-20mA Zero Span		

Items highlighted with a (*) appear in the user menu by default

DIRECT AND ADDRESSABLE LINE TEXT

The Combi 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 the engineer's menu, 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 **ENGINEER'S** 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)** enters the text editing mode for this channel. The **+ (4)** and **– (2)** buttons now move a cursor under the text and **UP (1)** and **DOWN (5)** alter the character at this cursor position.
When editing is finished for this channel, press **SELECT (3)** to exit the editing which returns to allow changes on another channel by pressing the **UP (1)** button again. Alternately pressing **SELECT (3)** 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 (3) when pressed will exit the manual mode and save the text changes in non volatile memory on the main PCB and return to the **ENGINEER'S** menu.

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

HOLDING THE DISPLAY

As the display cycles through the active sensors sequentially, 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 display continues it is sometimes 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$_{(7)}$ & RELAYS$_{(8)}$

To test all LED's and beep the buzzer, use menu number 7 and press **SELECT (3)** to make all LED's 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 LED's on the main PCB are not part of this test. In particular these are, Modbus, RS232 and CAN active. These LED's are only illuminated when transmitting data from the Combi panel.

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 (1)** and **DOWN (5)** buttons to choose a relay and then the **+ (4)** and **– (2)** buttons to energise or de-energise respectively.

When finished, use the **SELECT (3)** button to return to the **USER** menu.

INHIBITING A SENSOR(14/3)

During maintenance, it is sometimes required to inhibit the alarms on a particular sensor. A front panel LED will illuminate and inhibit relay will operate if any sensor or the system is inhibited (see appendix 1 numbers 3 and 14).

Choosing **ENGINEER'S** menu 14, the **UP (1)** and **DOWN (5)** 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 (3)** again returns to the **ENGINEER'S** 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 **ENGINEER'S** 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).

There are 8 user definable gases (61 to 68) available in the Gas Type library. When one of these is selected pressing **DIM (6)** allows the user to name the gas using **UP (1)** and **DOWN (5)** to sequentially change the alphanumeric characters and **+ (4)** and **− (2)** to move the cursor beneath the characters. Pressing **SELECT (3)** saves the name and returns to gas selection menu.

Pressing **RESET (7)** changes this menu to allow the maximum value of a gas to be changed.

The **+ (4)** and **− (2)** buttons will change the displayed value. Pressing **SELECT (3)** will return to the **ENGINEER'S** menu.
NOTE: that it is not possible to change the gas type for addressable sensors from the Combi panel. The gas type is set at the sensor itself and the Combi panel displays the information received from the sensor.

GAS TYPE LIBRARY

O_2	1	Oxygen 0-25% two falling alarms
CO_2	2	Carbon Dioxide 1000 ppm
CO_2b	3	Carbon Dioxide 0-30%V
CO_2a	4	Carbon Dioxide 0-2%V
H_2S	5	Hydrogen Sulphide 0-50 ppm
CO	6	Carbon Monoxide 0-250 ppm
SO_2	7	Sulpher Dioxide 0-10 ppm
NO	8	Nitrous Oxide 0-100 ppm
NO_2	9	Nitrogen Dioxide 0-10 ppm
Cl_2	10	Chlorine 0-10 ppm
H_2	11	Hydrogen 0-1000 ppm
HCN	12	Hydrogen Cyanide 0-25 ppm
HCL	13	Hydrogen Chloride 0-10 ppm
NH_3	14	Ammonia 0-100 ppm
O_3	15	Ozone 0-2 ppm
C_2H_4O	16	Ethyene Oxide 0-25 ppm
CH_4	17	Methane 0-1000 ppm
PH_3	18	Phosphene 0-2 ppm
LPG %Vol	19	Propane % volume
BUT %Vol	20	Butane % volume
FLAM %Vol	21	Flammable % volume
LPG %LEL	22	Propane % lel
BUT %LEL	23	Butane % lel
FLAM %LEL	24	Flammable % lel
WATER	25	0-100%
COb	26	Carbon Monoxide 0-1000 ppm
NH_3 ppm	27	Ammonia 1000 ppm
NH_3 %vol	28	Range 5.0% volume
HF	29	Hydrogen Flouride 0-10 ppm
Temp	30	Temperature -5 to +50°C
UgM_3	31	Microgram per metre cubed oil mist
B_2H_6	32	Diborane 0-1 ppm
SiH_4	33	Silane 0-5 ppm
Ph_3b	34	Phosphene 0-1 ppm
F_2	35	Flourine 0-5 ppm
NF_3	36	Nitrogen Triflouride 0-50 ppm
LEL%/M	37	LEL per metre, 0-5%
SW Input	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	0-1000 ppm refrigerant (e.g. R22)
benzine	40	Benzine 0-100% LEL
flame	41	flame detector 0-100%
fire	42	fire detector 0-100%
humid	43	humidity detector 0-100%
smoke	44	smoke detector 0-100%
callpoint	45	callpoint detector 0-100%
H_2	46	Hydrogen 0-2000 ppm

CS$_2$	47	Carbon Disulphide 0-100 ppm
H$_2$S	48	Hydrogen Sulphide 0-100 ppm
NH$_3$ 5000	49	NH$_3$ 5000 ppm
AcrylNitrile	50	Acryl Nitrile 0-25 ppm
HCL	51	Hydrogen Chloride 0-30 ppm
Sih$_4$	52	Silane 0-50 ppm
NH$_3$ 200	53	Ammonia 0-200 ppm
VOC20	54	0-20 ppm
VOC100	55	0-100 ppm
VOC1000	56	0-1000 ppm
H$_2$ %LEL	57	H$_2$ Flam 0-100% LEL
CO$_2$ 2000	58	CO$_2$ 0-2000 ppm
HEXNEPPM	59	0-1000 ppm
Usergas1	60-	
Usergas2	61-	
Usergas3	62-	
Usergas4	63-	
Usergas5	64-	
Usergas6	65-	
Usergas7	66-	
Usergas8	67-	
Temp	68	Temperature -20°C to +80°C
CO$_2$ 5%vol	69	Carbon Dioxide 0-5% VOL

EVENT TO REMOTE RELAYS(23)

The following events can be assigned to remote 1-64 relays by using **ENGINEER'S** menu 23.

4-20 direct	chan	fail
4-20 direct	chan	hialarm
4-20 direct	chan	loalarm
4-20 direct	chan	oralarm
CAN	chan	fail
CAN	chan	hialarm
CAN	chan	loalarm
CAN	chan	oralarm
COMM	fail a	larm
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 (6)** 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 LED'S (11)

The LED's 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 none volatile memory for future use and subsequent power ups. In addition to dimming the LED's, 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 or fault condition occurs the buzzer on the main processor board will sound.
By pressing the **ACCEPT** button **(1)** 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 near the buzzer on the PCB allows the buzzer to be isolated, this jumper should normally be fitted.

LOCAL & REMOTE RELAYS

Local relays are located on the main input PCB and are designated to specific conditions which exist within the Combi system and can be programmed to be normally energised.
Remote relays 4, 8 and 32 channel relay boards 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 (32 relay).
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 5 will energise if voting 5 conditions are met. S.P.C.O
Option 6 will energise if voting 6 conditions are met. S.P.C.O
Option 7 will energise if voting 7 conditions are met. S.P.C.O
Option 8 will energise if voting 8 conditions are met. S.P.C.O
Sounder Relay will energise if a new alarm occurs, and is de-energised when mute, **UP (1)**, is pressed
A small relay on the front panel energises if a sensor is inhibited.
This includes "power up inhibit" periods
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. Alternatively the first 16 relays can be programmed to use patterns. See **ENGINEER'S 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 Combi system is a SLAVE to the commands received from the master via two RS485 twisted pair communication cables. When a command is received on one of these cables, the reply is sent on the same cable thus giving rise to half duplex communication. For maintenance purposes, two LED's 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, both these LED's flash periodically to indicate successful communication. Once the communication has started, the Combi 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 Combi system has an internal address, which is used both for Modbus address and CAN bus address (see repeaters). This address and other parameters can be set using **ENGINEER'S** menu 27, Setup Network, and will be remembered at power up. 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 as the Combi system which supports 19200, 9600 (default) and 4800 baud 1 STOP bit no Parity.

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 Combi system and the Combi 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 **ENGINEER'S** 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, **ENGINEER'S** 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 Combi Modbus register definitions in the Appendix 3.
See C1148 for configuration.

SET UP NETWORK CONTROLLER (ON CAN2 ONLY)

IMPORTANT: When a Network Controller is present NO sensors or other peripheral equipment should be connected to CAN2 across the whole network of connected Combi's, (see C1148 in the appendix). Sensors, etc. should be on CAN1 only.

The addresses of the network sensors are 1-64 so it is normal to have the Combi main panel address above this, the default address is 201. Using **ENGINEER'S** menu 27 (Set up network controller), the address of the Combi 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 COMBI.

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 device is connected.

The following table shows what type of device each letter represents:
P = Combi Panel
C = CAN Sensor
R = Repeater or Network Controller
I = 8 Channel 4~20mA Output Module
T = 4 Relay + Sounder Module
Z = 32 Relay Module
D = 8 Channel 4~20mA I/P Module
M = CAN Status indicator
S = 8 way CAN relay module

If a repeater is detected, the letter R will appear together with a 'Y' or 'N', 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 back to no connection. When the repeater is connected, the Combi will send text and LED data to it and accept button presses from the repeater thus allowing remote operation of the combi panel. Pressing **SELECT (3)** again returns to the **ENGINEER'S** menu.

MODBUS BAUD RATE

Using **ENGINEER'S** 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 **ENGINEER'S** menu.

REPEATER (ON CAN2 ONLY)

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 Combi panel. In fact the data displayed on the repeater board is transmitted from the main panel.

Likewise, button pushes on the repeater are transmitted to the main panel and are used by the main panel as if they hadbeen pressed locally.

To ensure the correct operation of the repeater, it has to be set up in order to accept CAN 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.

A repeater and sensors may be used together on CAN2 lines.

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 as 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 address of the main panel 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 will display "awaiting data from address xxx" and will display an error if not received after 30 seconds. To initialise communication between the Combi main panel and the Repeater panel return to the main panel unit and follow the instructions in the Set up network controller section of this manual (p.14).

RS232 DATA LOG OUTPUT

In addition to Modbus, an additional data stream showing actions within the COMBI system is available via the RS232 output – micro USB or on earlier models as descibed below.

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 Combi system as follows.

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

Using Hyper-terminal on the PC set up at 2400 baud 8 bit no parity and no handshake, the data output should appear on the screen and consists of any text which is being recorded in the event log.

EVENT LOG (9)

The events listed in appendix 1 are logged internally in the COMBI 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 **ENGINEER'S** menu number 9, this event memory can be viewed one event at a time using the **UP (1)** and **DOWN (5)** 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 Combi 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 alphanumeric characters which can be edited using a simple text editor like Notepad which is also standard on a Windows PC.

This file can be created from scratch but it is simpler to create by sending the data already stored on the Combi panel to the PC again using Hyper-terminal.

This method is now described followed by how to reload the file back into the Combi main panel.

Using **ENGINEER'S** menu 30 (Data panel to PC) and the RS232 lead plugged into the PC COM port. On the PC, click (for Windows XP)
START -> PROGRAMS -> ACCESSORIES -> COMMUNICATIONS -> HYPERTERMINAL
and set the hyper-terminal to the active COM port, 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 Combi system. (Note it is easier to save this file to the desktop initially).

Using **ENGINEER'S** menu 30 (Data panel to PC) 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 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 up to 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 control panel.)
:HiAlarm 2,400	The high alarm point for direct sensor 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 sensor 1 low alarm point.

LINE	DESCRIPTION
:OrAlarm 3,998	Ditto for sensor 3 over range alarm
: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, *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 **ENGINEER'S** 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.

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 (5)** 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 unpowered 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 cyclical.

ENGINEER'S 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 **+ (4)** and **– (2)** buttons this rate can be set to fast '1' to slow '10' or any number in-between.

CHANGING ENGINEER'S PASSWORD

The passwords are present to prevent unauthorised button entry on the control panel, both user and **ENGINEER'S** password can be changed. Using **ENGINEER'S** menu 33 will allow you to enter a new engineer's password. You are prompted to re-enter the new password again as a check and if both are the same then this password is the new engineers password. You will then be prompted to change the user password. Follow same procedure as above.

CALIBRATING GAS SENSORS
(see setup procedure for sensors)

16 DIRECT 4-20MA GAS SENSORS – SOURCE MODE

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 Combi (see sensor data sheets C893 & C894). This signal input to the Combi would produce a 0 to 100% of the signal range but a further level of calibration trimming is possible at the Combi panel.

To assist in this process, **ENGINEER'S** menu 20 adjust 4~20mA zero/span will guide you through the stages of calibration for these direct sensors.

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

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 Combi panel to adjust thus allowing one engineer to set the 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

Use **ENGINEER'S** menu 10 (addressable zero span) on the Combi to calibrate the addressable sensors. The inhibit LED on all connected sensors will flash. Use the **UP (1)** and **DOWN (5)** buttons to look at all sensor addresses which are being zeroed and use the **+ (4)** or **– (2)** buttons on Combi to zero the reading on each sensor.

Press the **SELECT (3)** button on Combi to enter the span mode which gives plenty of time to visit each sensor. Gas each sensor with appropriate calibration span gas and return to the Combi panel.

Use the **UP (1)** and **DOWN (5)** buttons to view each sensor address and using the **+ (4)** or **– (2)** buttons, adjust the peak sensor reading to be that of the calibration gas. Press **SELECT (3)** 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.

CELL REPLACEMENT ON COMBI SENSORS

Should a sensor cell require to be replaced, the sensor should have its power removed before changing the cell itself. Flammable (Catalytic) and Toxic cells have colour coded wiring which is Pink, Yellow and White which should be connected correctly according to the markings on the PCB. See pages 49-69 for sensor setup procedures, when connected to Combi follow the above zero and span procedure.

SETTING THE TIME TO ALARM

Using **ENGINEER'S** menu 26, the time in seconds required to detect an alarm can be set to a maximum value of 255 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 **ENGINEER'S** menu after saving these times.

SETTING ALARM LEVELS

The high and low alarm points for the sensors can be set manually using **ENGINEER'S** menu 21 for direct 4-20 alarm levels and menu 15 for addressable alarm levels.

Menu 15 for addressable sensors
Use **UP (1)** and **DOWN (5)**, to choose a sensor which requires an alarm change.
Use **+ (4)** and **− (2)** to adjust the low 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.

SETTING NUMBER OF DECIMAL PLACES (18)

Using **ENGINEER'S** menu 18, the number of decimal places displayed by the 'Gas Value' can be set to 1 or 2. This is global command for direct sensors only. For addressable sensors the decimal places selection must be set individually at the sensor via PC hyper-terminal, (see Combi sensor datasheets C893 & C894).

The **RESET (7)** button changes this menu from the 'Alter Gas Type' screen to the 'Change Range' screen. On the Change Range screen use **RESET (7)** to switch between 'DP=1' and 'DP=2'. This toggles the displayed Gas Value between 1 and 2 decimal places respectively. Press **SELECT (3)** to return to the **ENGINEER'S** menu.

SETTING THE 4~20MA DEADBAND (18)

Using **ENGINEER'S** menu 18, the 4~20mA deadband can be switched ON or OFF.
This is a global command for direct sensors only. For addressable sensors this must be set individually at the sensor via PC hyper-terminal, (see Combi sensor datasheets C893 & C894).
The **RESET (7)** button changes this menu from 'Alter Gas Type' screen to the 'Change Range' screen.

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.

ENGINEER'S 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 to de-energise which has been energised by an event or pattern.
Pressing **SELECT (3)** will save the delay times in non volatile memory and return to the **ENGINEER'S** menu.

VOTING RELAYS

(**NOTE:** 4 of these relays are also used with time weighted alarms)

ENGINEERING menu 25 allows channels to be assigned to a group voting system.
8 relays on the main PCB will be activated according to the voting set up, and de-activated when the condition has subsided and after the relay off timer 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 activate. e.g. group 2 may have 5 sensors in its group and 3 alarms are required to activate relay called High (G2).

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 7 then the display would be -23---7-. 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 12345678.

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
(**NOTE:** This applies to opt5,6,7,8 relays)

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 (5,6,7,8) 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 must clearly be of the same type. If STEL or LTEL alarm level is set to a value greater than zero, then this voting group becomes a TWA (Time Weighted Average) group and the normal voting function is suppressed.

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 **ENGINEER'S** 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.

INSTALLATION

SITING THE SENSING HEADS

A key feature of the installation is the correct positioning of the sensor. 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.

MAINS OPERATED UNITS
- The equipment should be supplied from a 2A fused/switched spur.
- The spur unit should be identified and positioned locally to the equipment.
- To prevent lateral cable movement the mains cable within the enclosure should be restrained using a clamp.
- Earth leads within the enclosure should be a minimum of 300mm longer than the mains Live and Neutral cores

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. See Figures 2, 3 and 5 for connection details.

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.

The Type of cable which should be used is:
Addressable CAN bus: 4 core, 1.5mm screened
Direct: 2 or 3 core, 0.5mm screened

⚠️ **DO NOT POWER UP THE INSTALLATION PRIOR TO COMMISSIONING BY OUR ENGINEERING STAFF.**

For further information relating to the installation and maintenance of gas alarm systems refer to the IEC60079 series guidance documents.

Detector accessories must be selected to ensure suitability for operation in the environment: sun shades must be fitted if exposed to direct sunlight in hot countries, spray deflectors should be used in wet areas, collector cones can aid the detection of lighter than air gases.

COMBI SENSOR CABLE ROUTING

Addressable Sensors
Two sets of four way terminals for each of the two CAN channels, CAN1 and CAN2, are available for connection of addressable sensors and auxiliary equipment to the control panel. Connection of sensors to the control panel requires a 4 core 1.5 mm (minimum) screened cable, two of which supply the 24Vdc sensor supply with the remaining two used for the CAN communication between the sensors and control panel.

The addressable sensors should be connected to the two CAN channels in such a way that, the total numbers of end of line links does not exceed three on each of the two CAN channels. Spurs of four metres or less do not require an end of line link. The end of line link must be positioned on the very last sensor on each sensor cable run from the Combi.

Direct Sensors

Sixteen direct sensor inputs, each with three terminals, are available for terminating the two or three wire sensors (4-20mA devices) to the Combi. The sensors connected to these direct inputs must operate in source mode only. Combi panel will not work with sensors operating in sink mode.

Repeaters

Repeaters should be connected to CAN2 channel only.

Network Controllers

In networking mode the sensors must only be connected to CAN1 channel. CAN2 channel is used for networking the system only.
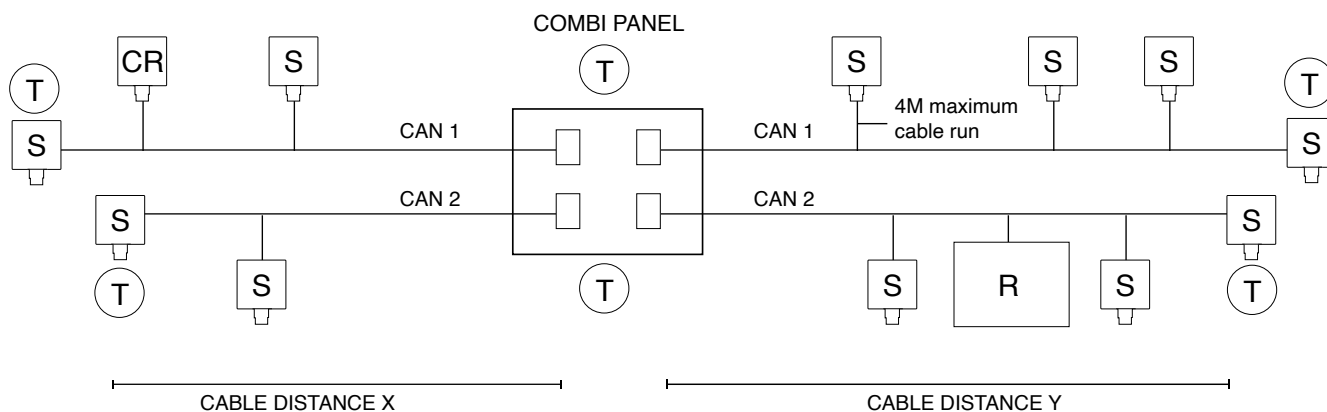
Maximum cable distance for CAN signal X+Y = 1km
Maximum distance for sensor voltage drop - minimum sensor operating voltage 17Vdc
R = Repeater Panel
S = Sensors
CR = CAN Relay
T = Fit terminator link on PCB

EQUIPMENT INSTALLATION GUIDELINES

Standards

Follow the correct electrical installation procedure and legislation (IEEE Regs)

Junction Boxes

DO check area classification for junction box suitability
DO use boxes appropriate to the environment
DO ensure correct IP rating for the environment
DO use adequate sizes of field junction boxes
DO allow for spare ways and future expansion
DO mount field junction boxes at working height
DO remember that water can't get OUT of weatherproof boxes once it is inside!
DO employ a weather resistant tag to identify the equipment
DO prevent water/product ingress through the cables/glands – enter box from side or bottom
DO plug all unused ports with appropriate stoppers
DO clean out the junction box after installation

Cables

DO check area classification for cable type
DO ensure cable runs and distances to sensors are as recommended by the manufacturer
of the equipment
DO document and record all cable routes
DO use the correct size and type of cable for the application – screened cable for instrumentation
DO keep signal cables away from power cables
DO ensure that loop resistance values are not excessive
DO ensure that the cable is of suitable quality for its intended environment
DO avoid major sources of electrical interference when planning cable runs, away from motors
etc.
DON'T exceed maximum cable parameters for IS systems
DON'T run the cable over sharp edges or around overly tight bends
DON'T overstress cable support cleats/ties

Glanding

DO check area classification for gland type
DO get it right first time. It is very difficult to correct it later
DO use the right type of gland for the application
DO leave generous service loops in the sensor cables
DO fit a sealing washer if required for weatherproofing
DO ensure that any RFI shield is properly isolated from safety earth metalwork and gland body
DO ensure that the SWA earthing is continuous and vibration proof
DO ensure that the cable sheath makes a weatherproof seal
DO fully tighten all fittings
DON'T use tape for weatherproofing
DON'T hide bad workmanship under shrouds

Terminations

DO terminate cables to the correct points to prevent damage to the system
DO sleeve and terminate earth wires correctly
DO remain consistent in the allocation of wire colours
DO remember to attach cable and termination markers to aid maintenance
DO ensure that cable insulation extends right up to the throat of the terminal
DO ensure that there are no bare wires or wire strands
DO use the correct tool for crimp connections
DO pull test every one before termination
DO use the correct width terminal screwdriver to avoid cracking terminal blocks
DO ensure that terminal screws are adequately tight

Earthing

DO maintain separation of Safety, Instrument and IS Earths
DO ensure that earth continuity is maintained through field junction boxes
DO ensure that metallic outer enclosures are adequately earthed for safety
DO allow for any IS Barriers in systems with earth fault monitoring

RFI Screening

DO use suitably screened instrument cable for sensor runs
DO maintain separation of safety earths and screening
DO connect screening as advised by equipment manufacturers
DO ensure continuity through junction boxes/equipment housings

Lightning
DO keep instrument cables away from susceptible power and earth cables
DO fit surge protectors in areas subject to severe electric storms

Equipment
DON'T power up until commissioning
DO check area classification for equipment suitability
DO ensure correct IP rating for the environment
DO check power requirements
DO power from a separate fused spur (AC)
DO locate away from sources of heat
DO mount gas sensors in accessible locations, at the correct height
DO note position of end of line addressable sensor
DO mount at accessible working height for ease of commissioning and maintenance
DO protect the equipment from paint/steam and other contaminants
DO ensure easy access to the interior of the equipment
DO mount within easy reach and audible distance of operating personnel
DO protect from vibration
DO employ a combination sun and rain shield in all outdoor locations
DO power from a clean adequately rated AC/DC supply (no inverters fed from the same supply)
DO run cable within equipment enclosure away from components and circuit boards
DO keep cables within the equipment enclosure as short as possible
DO keep operating manuals adjacent to the equipment

Testing
DO complete the cable installation testing BEFORE final termination at either end
DO record the cable loop resistance values to aid troubleshooting later

Documentation
DO record cable routing and equipment/junction box locations
DO track all changes by updating the system documentation
DO keep records adjacent to the equipment

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 should be paid 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 functions by number

1.   View Modbus Reg
This allows inspection of the 250 internal Modbus registers. Use **UP (1)** and **DOWN (5)** buttons to alter the register which is displayed in Decimal and Hexadecimal. **SELECT (3)** button will exit.

2.   Set Clock
Using **UP (1)** / **DOWN (5)** and **SELECT (3)** allows the date and time to be changed. Note, if the CAN communication connection is made to other Combi 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 (1)** and **DOWN (5)** 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 COMBI 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 (3)** to exit this menu.

5. Set Refresh Rate
Use **+ (4)** and **− (2)** 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 (3)** 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 LED's 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 **+ (4)** and **− (2)**. Pressing **SELECT (3)** allows the (64 (2x32) relay card) to be tested. Press **UP (1)** and **DOWN (5)** to choose external relays which of the 64 relays to test and the **+ (4)** button will energise it. The **− (2)** button will deenergise the relay. The state or the relay can be seen via individual LEDs on this board. **SELECT (3)** 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 occurence.
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.
e.g. 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 (1)** and **DOWN (5)** to choose which event to view.
SELECT (3) 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 (1)** and **DOWN (5)** buttons and the reading itself is adjusted by pressing **+ (4)** and **− (2)**.
This menu will timeout and the number of seconds left is displayed on the LCD.
SELECT (3) will exit the zero menu and present the span menu.
The channel is selected by using **UP (1)** and **DOWN (5)** buttons and the reading itself which is based on the peak readings is adjusted by pressing **+ (4)** and **− (2)**.
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's when dimmed is set using **UP (1)** and **DOWN (5)** buttons, **SELECT (3)** will exit the menu. The actual brightness is displayed on the LCD as a percentage and on the front panel LED's 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 the Engineer's 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 **+ (4)** and **– (2)** to toggle the state. The LCD indicates whether inhibited or not and the **UP (1)** and **DOWN (5)** buttons change the channel. Note that only channels with active sensors can be inhibited.
Pressing **SELECT (3)** 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 (3)** 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 **+ (4)** and **– (2)** to change the LOW level and the **UP (1)** and **DOWN (5)** buttons which alter the channel being changed
Pressing **SELECT (3)** moves to HIGH alarm
Pressing **SELECT (3)** moves to OVERANGE
Pressing **SELECT (3)** exits this menu.

16. Clear All Addresses
This menu option is used to clear currently unsued addresses that were previously connected to CAN devices without having to power off or reset the control unit. This will also clear direct sensors no longer connected. This is beneficial if devices such as warning alarms are connected to 'normally closed' relays.

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 (1)** and **DOWN (5)** to choose the line to be edited and then press **+ (4)** to go into edit mode.
A small cursor will appear below the text indicating that the character above it can be altered.
Use **+ (4)** and **– (2)** to change the character and use **UP (1)** and **DOWN (5)** to move the cursor to another character position.
SELECT (3) will complete the editing and return to choose another line.
SELECT (3) 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 and Range (direct sensors only)
The gas type, default range, number of decimal places and deadband can be selected using this menu.
Use **UP (1)** and **DOWN (5)** to choose the channel, and **+ (4)** and **– (2)** to change the gas type.
Press **RESET (7)** to change range using **+ (4)** and **– (2)**. Press **RESET (7)** to toggle between 1 and 2 decimal places. Press **DIM (6)** to toggle the deadband on and off.
Press **SELECT (3)** to exit this menu.

19. View Addressable Sensor Data
This menu allows the veiwing of data received from an indivdual CAN sensor for upto 24 hours.
Use the **UP (1)** and **DOWN (5)** buttons to choose the sensor channel to be displayed. The data displayed is as follows:

    Addr 00   Timeout in 00sec   Lowest=00
               ST1 00   ST2 00   Rstat 00
Pressing **SELECT (3)** again exits this menu.

20. Adjust 4~20mA Zero and Span

Normally a gas sensor will be calibrated as a separate item but minor adjustments to the readings of any of the 4~20 sensors can be made at the panel using this menu Use **UP (1)** and **DOWN (5)** initially to choose the gas sensor to be calibrated. Then press **SELECT (3)** and use **UP (1)** and **DOWN (5)** to alter the maximum value of the sensorif required. Then press **SELECT (3)** to start adjusting the zero for this sensor (with no gas present). **UP (1)** and **DOWN (5)** make minor adjustments and when reading of zero is achieved press **SELECT (3)** to move to a span adjustment (apply span gas). **UP (1)** and **DOWN (5)** will adjust the internal gain to make the reading correct according to the span gas applied.

Press **SELECT (3)** 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.

Use **+ (4)** and **– (2)** to select the sensor channel to be adjusted. Pressing **RESET (7)** will toggle between rising and falling alarms.

Adjustment of the low alarm is done using the **UP (1)** and **DOWN (5)** buttons

Pressing **SELECT (3)** again allows adjustment of the high alarm using the same buttons

Pressing **SELECT (3)** again allows adjustment of the over range alarm using the same buttons

Pressing **SELECT (3)** 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 **+ (4)** or **– (2)**. The sensor channel is selected by using the **UP (1)** and **DOWN (5)** buttons. Unlatching alarms will clear automatically when the gas level is below the alarm point. Pressing **SELECT (3)** 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 (1)** and **DOWN (5)** to choose the event (which is displayed on the LCD) and then use **+ (4)** and **– (2)** to choose which of the 64 relays to drive. The default is not to drive any relays.

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 **+ (4)** and **– (2)** buttons and **UP (1)** and **DOWN (5)** will set one and zero in the cursor position.

gfedcba987654321 represent the 16 relays. 1 = relay 1 and g = 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 (3)** will exit this menu.

Additionally, pattern 8765 321 can be redirected to 7 relays on the Combi input PCB. The fault relay 4 always remains as Fault but the remaining relays are assigned as remote relays 123 5678 respectively. This feature eliminates the need to fit a remote relay PCB for smaller installations.

Pressing **SELECT (3)** will exit this menu.

A second alternative relay option is available using the + and – buttons. Here, the 8 local relays Low, High, Overange, Flt, Opt1, Opt2, Opt3, Opt4 can be diverted to drive remote relays 1,2,3,4,5,6,7,8.

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 (1)** and **DOWN (5)** to select which of the 8 relays to set and then **+ (4)** and **– (2)** 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 (3)** 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 **+ (4)** and **– (2)** buttons. The maximum is 10 alarms. Use the **UP (1)** and **DOWN (5)** buttons to change the group number being set. Pressing **SELECT (3)** goes to the second part of this menu this sets which group the 4-20 direct channels are in followed by the addressable channels. The **+ (4)** and **– (2)** changes the group and **UP (1)** and **DOWN (5)** 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 7 the display would be   1 2 3 - - - 7 -
If a sensor channel is in no groups the display would be   - - - - - - - -
Pressing **SELECT (3)** 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 255 seconds. For 4-20 direct sensors first use **UP (1)** and **DOWN (5)** to change the channel and **+ (4)** and **– (2)** to alter the time in seconds. Pressing **SELECT (3)** presents the same choice for the addressable sensors. Pressing **SELECT (3)** 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 (1) and **DOWN (5)** change the displayed address which is common to both CAN1 bus and CAN2 bus. Pressing **SELECT (3)** 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, **+ (4)** toggles this connection. Once connected the buttons, LED's and LCD on the main panel and the repeater match in operation and display. The letter T would appear if a relay/sounder device is found.
The letter C will appear for a CAN sensor.
Pressing **SELECT (3)** will exit this menu.

Changing the address of devices on the CAN network

If a 'C' is detected an additional function is displayed. By pressing the **RESET (7)** button, the address can be changed to a new value using the **+ (4)** and **– (2)** button but only if an address link has been inserted. This link should be removed afterwards.
NOTE: If more than 1 device has a link inserted then all these will have their address change to the new one and will give rise to a duplicate error which must be resolved.
It may be required to use menu 16 which clears all unused sensor addresses from the panel (such as after disconnecting a sensor to allow that address to be available).

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, Gases, 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 (3)**.

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 (3)** 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 groups 5, 6, 7 and 8.

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 (3)** moves to the next option and pressing **+ (4)** 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 Engineer's Password
The engineer's password can be changed from this menu.you will be prompted to enter a new code twice via the buttons.
Pressing **SELECT (3)** will exit this menu.
NOTE: The user password can also be changed.

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 (1)** and **DOWN (5)** buttons, Pressing **SELECT (3)** 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 (3)** then the mains alarm. The **+ (4)** and **– (2)** buttons toggle whether or not each alarm is inhibited, this is displayed on the LCD. Pressing **SELECT (3)** will exit this menu.

36. Set Energised Relays

This menu allows relays to be set as normally energised (=1) or de-energised (=0). 8765FOHL represents the 8 on board relays gfedcba987654321 represents the first 16 external relays

Using **+ (4)** and **– (2)** 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 (1)** and **DOWN (5)** buttons.

Press **SELECT (3)** to exit this menu.

APPENDIX 2

Below is an example of a typical text file that can be sent to/from the COMBI system.

PLEASE NOTE:

1. ' : ' = Direct Sensor, ' * " = Addressable Sensor
2. Lines of the same command but different addresses have been deleted
3. The difference between patterns and groups is that there are 16 patterns, and 8 groups.
   Groups can only be used to control a single relay per event.
   Should the user require two or more relays to be activated by a single event, patterns MUST be used.
   Patterns primarily output to the first 16 relays on the 32 way relay card.
   We then tell the control unit to mimic 7 of these relays by
   • going into option #23 ("event to relay 64)
   • pressing 'select' 12 times so that "L,H,O,F,o1, o2, o3, o4" is displayed
   • exiting
   The Control unit is now setup to mimic 7 relays of the 32 way relay PCB

Combi Text File Command (Summarised)	Description
Data to PC from panel address 1 :=4-20 and *=Addr	
Note letters after : and * are case sensitive.	
:c,	Start of text file
NAME OF COMPANY Tel: # # # # # #	
:Seconds to alarm 1, 30,	x16) – the period of time that the sensor must detect the gas before it activates the control unit alarm
*Seconds to alarm 1, 5,	(x64) - the period of time that the sensor must detect the gas before it activates the control unit alarm
:Alarmdir LHO 1,RRR	(x16) – Alarm direction (Lo / Hi / OR). R=Rising, F=Falling
*Alarmdir LHO 1,RRR	(x64) - Alarm direction (Lo / Hi / OR). R=Rising, F=Falling
:a1,1	'Group' setup.
:a2,1	
:a3,1	
:a4,1	
:a5,1	
:a6,2	
:a7,1	
:a8,1	
Group87654321	CAN channel #1 is in group 1 also, and in group 4
:g01,00000001	
Group87654321	
*g01,00001001	
:T1,LEL.SENSOR.1........,	(x16) –Text for direct sensors connected. (E.g. this could represent the location of the sensor:
	- i.e. boiler house, pump room etc..)
*T1 ,O2.SENSOR.1.........,	(x64) - List of addressable sensors connected.
*T2 ,boiler room.......,	You can also set the name of the sensor: (ie boilerhouse, pump room etc..)
:G1,%LeL ,	(x16) – Direct Gas type
:unlatchedAlarm 1	(x16) Direct alarms – 'latchedalarm #' or 'unlatchedalarm #'
*unlatchedAlarm 1	(x64) Addressable alarms – 'latchedalarm #' or 'unlatchedalarm #'
:LoDirAlarm 1 ,200,	(x16) Direct 'Low' alarm level.
	Note: values are 1 significant figure – e.g '200' = '20.0' – (using list of direct sensors connected)
:HiDirAlarm 1 ,400,	(x16) Direct 'High' alarm level.
	Note: values are 1 significant figure – e.g '400' = '40.0'
:OrDirAlarm 1 ,999,	(x16) Direct 'Overrange' alarm level.
	Note: values are 1 significant figure – e.g '999' = '99.9'
*LoCanAlarm 1 ,190,	(x64) Addressable 'Low' alarm level.
	Note: values are 1 significant figure – e.g '190' = '19.0' (Oxygen would be 'FFR')
*HiCanAlarm 1 ,170,	(x64) Addressable 'High' alarm level.
	Note: values are 1 significant figure – e.g '170' = '17.0'
*OrCanAlarm 1 ,250,	(x64) Addressable 'High' alarm level. Note: values are 1 significant figure – e.g '250' = '25.0'
Event to Relay (Note keep in correct sequence)	Each event can drive 1 relay of the 64 external relay card.
Direct Chan 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Determines which relays activate for each direct channel on each of the 4 alarm types
:Fault 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	In this example, relay 4 will trigger if direct chan 1 goes into 'Lo' alarm, and relay 5 will trigger for channel 2
:first alrm 4, 5, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	Note this is where Voting can be introduced (described above)
:second alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	Note: no same relay can be used for two events
:third alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
Addres Chan 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	See above – but for addressable sensors 1-16
*Fault 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*first alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*second alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*third alrm , 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
Addres Chan 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32	
*Fault 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*first alrm 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,	
*second alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*third alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	
Addres Chan 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	See above – but for addressable sensors 33-48
*Fault 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*first alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*second alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*third alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
Addres Chan 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64	See above – but for addressable sensors 49-64
*Fault 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*first alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*second alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
*third alrm 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,	
	Defines the local relay number driven when these events occur
485Comms A/Cpower CanComms Battery	
:ev 0, 0, 0, 0,	

Combi Text File Command (Summarised)	Description
8 7 6 5 F O H L local energised relays	Default state of mainboard relays:
:E 0 0 0 0 0 0 0 0	0 = De-energised, 1= Energised
g f e d c b a 9 8 7 6 5 4 3 2 1 remote energised relays	Default state of the first external 16 way relay board relays:
:R 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 = Deenergised, 1= Energised
gfedcba987654321 Direct Fault relay patterns	
:h01,0000000000000000	(x16) these patterns are output to the first 16 of the external relays.
:h02,0000000000000000	See note 3 at start of appendix 2 pg 35 to see how to divert 7 of these relays.
gfedcba987654321 Direct Low Alarm relay patterns	(x16) As above but for Direct low alarms
:i01,1000000000000000	
:i02,0000000000000000	
gfedcba987654321 Direct High Alarm relay patterns	(x16) As above but for Direct High alarms
:j01,0000000000000000	
:j02,0000000000000000	
gfedcba987654321 Direct OverRange Alarm relay patterns	(x16) As above but for Direct Overrange alarms
:k01,0000000000000000	
:k02,0000000000000000	
gfedcba987654321 CAN Fault relay patterns	(x64) – As above but for CAN Fault relay patterns
*h01,0000000000000000	
*h02,0000000000000000	
gfedcba987654321 CAN Low Alarm relay patterns	(x64) – As above but for CAN Low Alarm relay patterns
*i01,0000000000000000	
*i02,0000000000000000	
gfedcba987654321 CAN High Alarm relay patterns	(x64) – As above but for CAN High Alarm relay patterns
*j01,0000000000000000	
*j02,0000000000000000	
gfedcba987654321 CAN OverRange Alarm relay patterns	(x64) – As above but for CAN OverRange Alarm relay patterns
*k01,0000000000000000	
*k02,0000000000000000	
gfedcba987654321 CAN bus Alarm relay patterns	As above but for CAN bus Alarm relay patterns
:n0000000000000000	
gfedcba987654321 Battery fail Alarm relay patterns	As above but for Battery fail Alarm relay patterns
:p0000000000000000	
gfedcba987654321 A/C fail Alarm relay patterns	As above but for A/C fail Alarm relay patterns
:q0000000000000000	
gfedcba987654321 485 bus Alarm relay patterns	As above but for 485 bus Alarm relay patterns
:r0000000000000000	
Delays for 16 remote relay patterns	Delay in seconds to de-activate on first 16 relays of the optional 32way relay card
:d 1, 2,	(NOTE: 0 must NEVER be used as there is potential for a conflict in code.
:d 2, 2,	'0' can either mean 0 seconds to transition in state energise / de-energise (depending on default state) ie instantaneous
:d 3, 2,	'0' also means'does not occur' – which means a change in state will never occur
:d 4, 2,	
:d 5, 2,	
:d 6, 2,	
:d 7, 2,	
:d 8, 2,	
:d 9, 2,	
:d10, 2,	
:d11, 2,	
:d12, 2,	
:d13, 2,	
:d14, 2,	
:d15, 2,	
:d16, 2,	
Delay for 8 local relays	Delay in seconds on the 8 local relays
:D 1, 1,	(NOTE: 0 must NEVER be used as there is potential for a conflict in code.
:D 2, 1,	'0' can either mean 0 seconds to transition in state energise / de-energise (depending on default state)
:D 3, 1,	ie instantaneous
:D 4, 1,	'0' also means'does not occur' – which means a change in state will never occur
:D 5, 1,	
:D 6, 1,	
:D 7, 1,	
:D 8, 1,	
:X,	End of text file.

APPENDIX 3

Modbus Register Specification for COMBI 16 channel +CAN system

COMBI is configured as a MODbus RTU slave, using an RS485 twin twisted wire communication network.

A MODbus MASTER can communicate to COMBI and request data and initiate limited control.

The address of the panel by default is 201 (C9 in hex) but remember the panel also has a CAN network and 201 is its CAN address.

This limits the possible addresses available for the panels and 201 to 209 are reserved for panels. Typically...

1-64 are CAN sensors / 65 – 128 are reserved / 129 – 200 and 210 – 255 are used for other CAN devices (eg relays ...)

Two independent channels are available and communicate at baud rates of 4800, 9600 (default) and 19200 bits per second 1 STOP BIT and NO PARITY is used. The two channels are sometimes referred to as DUTY and STANDBY in critical installations to cover the event of loss of 1 network.

Function code 03 used to access 16 bit unsigned registers held within COMBI memory.

Function code 08 is used to poll COMBI at its address to check that it is connected.

Function code 06 is used to remotely control a limited set of panel button operations. (MODbus 1 only)

Any other function codes sent to COMBI will respond with illegal function (01).

Requests for Register address requests greater than those listed below will respond with illegal address (02).

The maximum number of registers that can be requested in one transmission is 20, otherwise an illegal address response [02] will occur

To give time for COMBI to respond, a delay between Modbus Master requests for data should be 250ms or greater.

The registers listed below are shown starting at zero (default) but some MODbus masters require these to be at other values starting at hexadecimal locations. Typically 4000 hex is used but COMBI can set any offset eg 1000 hex, 2000 hex up to E000 hex.

Register zero is a watchdog register which is incrementing every 250 microseconds and is a good register to request at the start of commissioning a new MASTER/SLAVE connection since it should always be changing its value.

	Register	Definition	Data	Units	
	0	watchdog counting	Integer	none	int 250 usec counter
4-20 chan	1 to 16	integer	Gas value * 10	as per 17 to 32	
4-20 chan	17 to 32	gas 1-16 units	see gas number table	units	will have zero for unused
4-20 chan	33	low alarm bits	1-16 channel	1=alarm (bit 0 is chan 1 etc)	
4-20 chan	34	high alarm bits	1-16 channel	1=alarm (bit 0 is chan 1 etc)	
4-20 chan	35	overange alarm bits	1-16 channel	1=alarm (bit 0 is chan 1 etc)	
4-20 chan	36	Sensor fail	1-16 channel	1=alarm (bit 0 is chan 1 etc)	
Can Chan	40 to 104	integer	Gas value * 10	as per 105 to 168	
Can Chan	105 to 168	gas 1-64 units	see gas number table	units will have zero for unused	
Can Chan	169	low alarm bits	1-16 channel	1=alarm (bit 0 is chan 1 etc)	
Can Chan	170	low alarm bits	17-32 channel	1=alarm (bit 0 is chan 17 etc)	
Can Chan	171	low alarm bits	33-48 channel	1=alarm (bit 0 is chan 33 etc)	
Can Chan	172	low alarm bits	49-64 channel	1=alarm (bit 0 is chan 49 etc)	
Can Chan	173	high alarm bits	1-16 channel	1=alarm (bit 0 is chan 1 etc)	
Can Chan	174	high alarm bits	17-32 channel	1=alarm (bit 0 is chan 17 etc)	
Can Chan	175	high alarm bits	33-48 channel	1=alarm (bit 0 is chan 33 etc)	
Can Chan	176	high alarm bits	49-64 channel	1=alarm (bit 0 is chan 49 etc)	
Can Chan	177	over range alarm bits	1-16 channel	1=alarm (bit 0 is chan 1 etc)	
Can Chan	178	over range alarm bits	17-32 channel	1=alarm (bit 0 is chan 17 etc)	
Can Chan	179	over range alarm bits	33-48 channel	1=alarm (bit 0 is chan 33 etc)	
Can Chan	180	over range alarm bits	49-64 channel	1=alarm (bit 0 is chan 49 etc)	
Can Chan	181	Sensor fail/timeout	1-16 channel	1=alarm (bit 0 is chan 1 etc)	
Can Chan	182	Sensor fail/timeout	17-32 channel	1=alarm (bit 0 is chan 17 etc)	
Can Chan	183	Sensor fail/timeout	33-48 channel	1=alarm (bit 0 is chan 33 etc)	
Can Chan	184	Sensor fail/timeout	49-64 channel	1=alarm (bit 0 is chan 49 etc)	
Service Days	185	Service days remaining	Integer	Days	
4-20 Chan	191	Inhibit	1-16		
CAN Chan	192	Inhibit	1-16		
CAN Chan	193	Inhibit	17-32		
CAN Chan	194	Inhibit	33-48		
CAN Chan	195	Inhibit	49-64		
	222	System status	bit 0 = global sensor fail		
			bit 1 = spare		
			bit 2 = system fault		
			bit 3 = battery power lost		
			bit 4 = main power lost		
			bit 5 =		
			bit 6 =		
			bit 7 =		
			bit 8 = modbus comms fail		
			bit 9 = l		
			bit 10 = CAN bus fail		
			bit 11 = spare		
			bit 12 = spare		
			bit 13 = spare		
			bit 14 = spare		
			bit 15 = spare		

WATCHGAS COMBI 16/64/80

Example: (xx = data) (byte is 8 bits) (16 bits represented by 2 bytes)

Modbus Protocol Bytes sent (in HEX) from Master to read a group of 4 registers starting at register 1

Address	C9	
Function	03	read register
Register Address	00	00 for Combi
Register Address	01	register 1 which is 16 bits (2 Bytes)
How many registers	00	most significant byte
How many registers	04	least significant byte
CRC	xx	
CRC	xx	

Reply from Combi		
Address	C9	Combi repeats address
Function	03	and the function
How many bytes	08	number of bytes to follow before the CRC
MS register 1	xx	register 1 most significant byte
LS register 1	xx	register 1 least significant byte
MS register 2	xx	register 2 most significant byte
LS register 2	xx	register 2 least significant byte
MS register 3	xx	register 3most significant byte
LS register 3	xx	register 3 least significant byte
MS register 4	xx	register 4 most significant byte
LS register 4	xx	register 4 least significant byte
CRC	xx	LS 16bit cyclic redundancy check byte
CRC	xx	MS 16bit cyclic redundancy check byte

```
1-Rx C9  03  00  01  00  01  94  42  00  00  00  00
1-Tx C9  03  02  0F  2E  DC  78  00  00  00  00  00
 -Tx 00  00  00  00  00  01  00  00  00  00  00  00
 -Tx 00  00  00  00  00  01  00  00  00  00  00  00
```

(only available on modbus 1)

	Byte 1 Decimal Combi Adddress	Byte 2 Function Code	Byte 3 ascii symbol direct/ addr/panel	Byte 4 detector	Byte 5 Spare	Byte 6 ascii command	Byte 7 CRC	Byte 8 CRC	Definition
From Modbus Master	201	6	*	1 to 64	0	D	xx	xx	disable addressable detector 1 to 64
	201	6	*	1 to 64	0	E	xx	xx	enable addressable detector 1 to 64
	201	6	:	1 to 16	0	d	xx	xx	disable direct 4-20mA detector 1 to 16
	201	6	:	1 to 16	0	e	xx	xx	enable direct 4-20mA detector 1 to 16
	201	6	*	1 to 64	0	I	xx	xx	inhibit addressable detector 1 to 64
	201	6	*	1 to 64	0	N	xx	xx	NOT inhibit addressable detector 1 to 64
	201	6	:	1 to 16	0	i	xx	xx	inhibit direct 4-20mA detector 1 to 16n
	201	6	:	1 to 16	0	n	xx	xx	NOT inhibit direct 4-20mA detector 1 to 16
	201	6	!	0	0	R	xx	xx	Reset Panel
	201	6	!	0	0	A	xx	xx	Accept alarm (buzzer off)
Reply from Combi	201	6	repeat	repeat	0	repeat	xx	xx	Command accepted
	201	2	0	crc	crc				Detector out of range
	201	1	0	crc	crc				illegal command

NOTE: Combi default address is 201 (C9 hex)

BYTE 6 uses Ascii uppercase is used for panel control and addressable detectors commands.

Similar commands for a direct 4-20mA detector use Ascii lower case.

E.g. (D for addressable / d for direct) disable sensor

APPENDIX 4

Event numbers are as follows:
chanfail   0-15
chanhialarm   16-31
chanloalarm   32-47
chanoralarm   48-53
Canchanfail   54-69
Canchanhialarm   68-83
Canchanloalarm   84-99
Canchanoralarm   100-115
main_power_alarm   117
can_bus_alarm   118
battery_alarm   119
clear_event_log   120
panelreset   121

APPENDIX 5

Fuse ratings
F1 – Mains input   1A – Anti-Surge

FIG. 1
PC adapter (converts sensor data output to RS232 for PC – micro USB or on earlier models as descibed below).
The 9 Way D-type plugs into the PC com port and the pre-wired sensor connector is inserted into J3 on the Combi Flam PCB and J3 on the Combi Tox PCB. When Hyper-terminal on the PC set at 4800 baud (no handshake) and connected to the com port, the PC should now display the continuous sensor output.
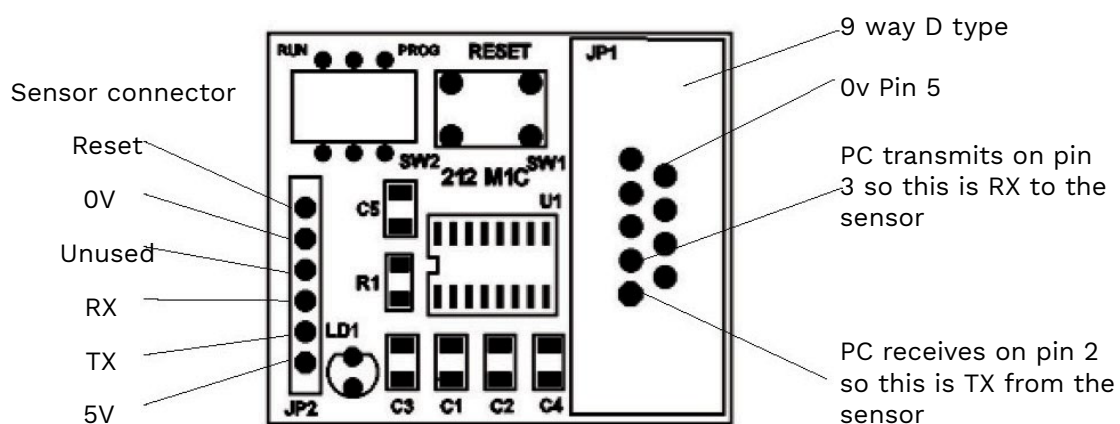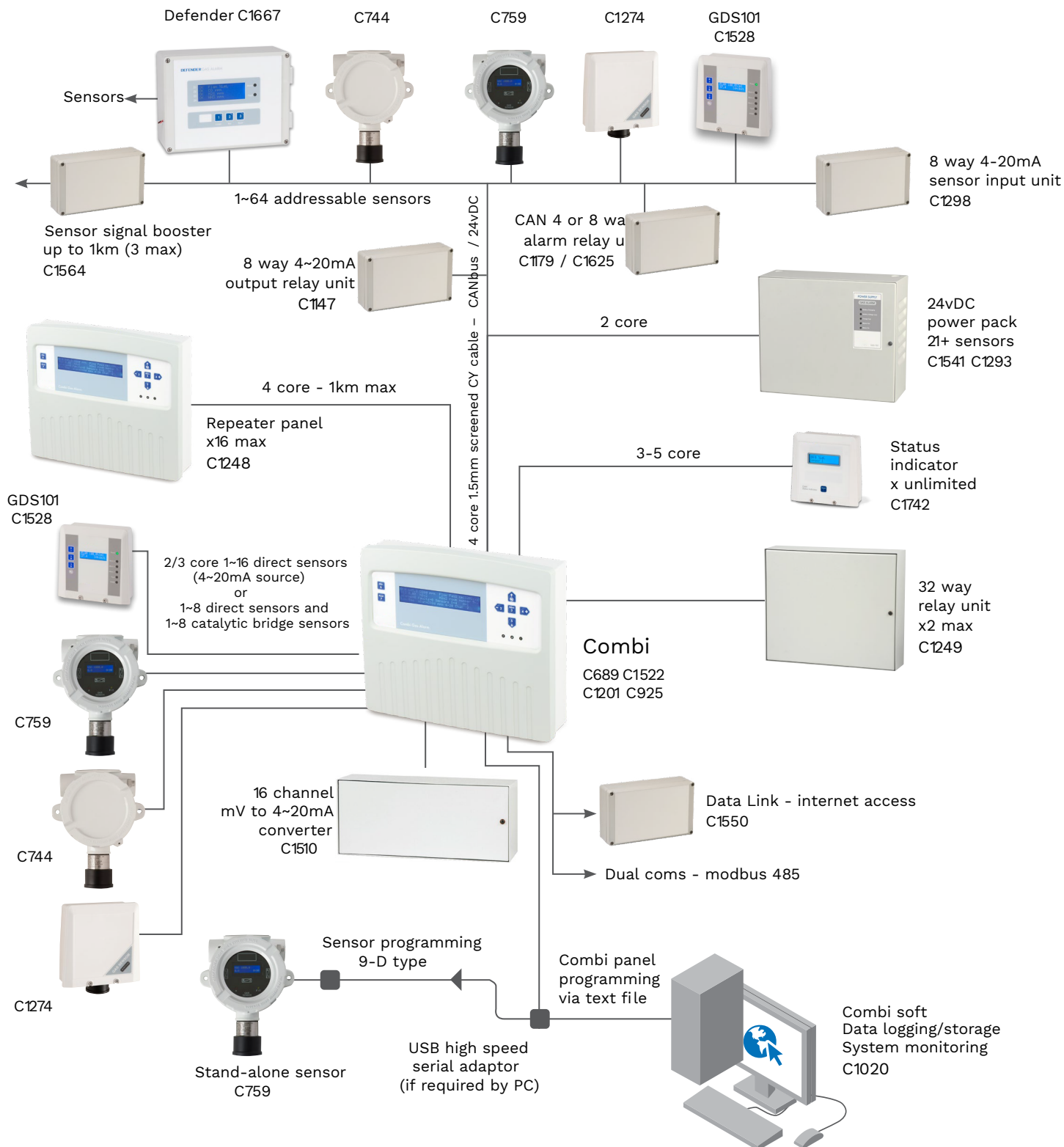

When programming the sensor processor, the Run and Prog slide switch SW2 is set to Prog but under normal circumstances, this switch should be in the Run position. The Reset push button SW1 when pressed gives a hardware reset to the sensor processor. This can be pressed at any time and the sensor reacts in the same way as if it had reset itself.
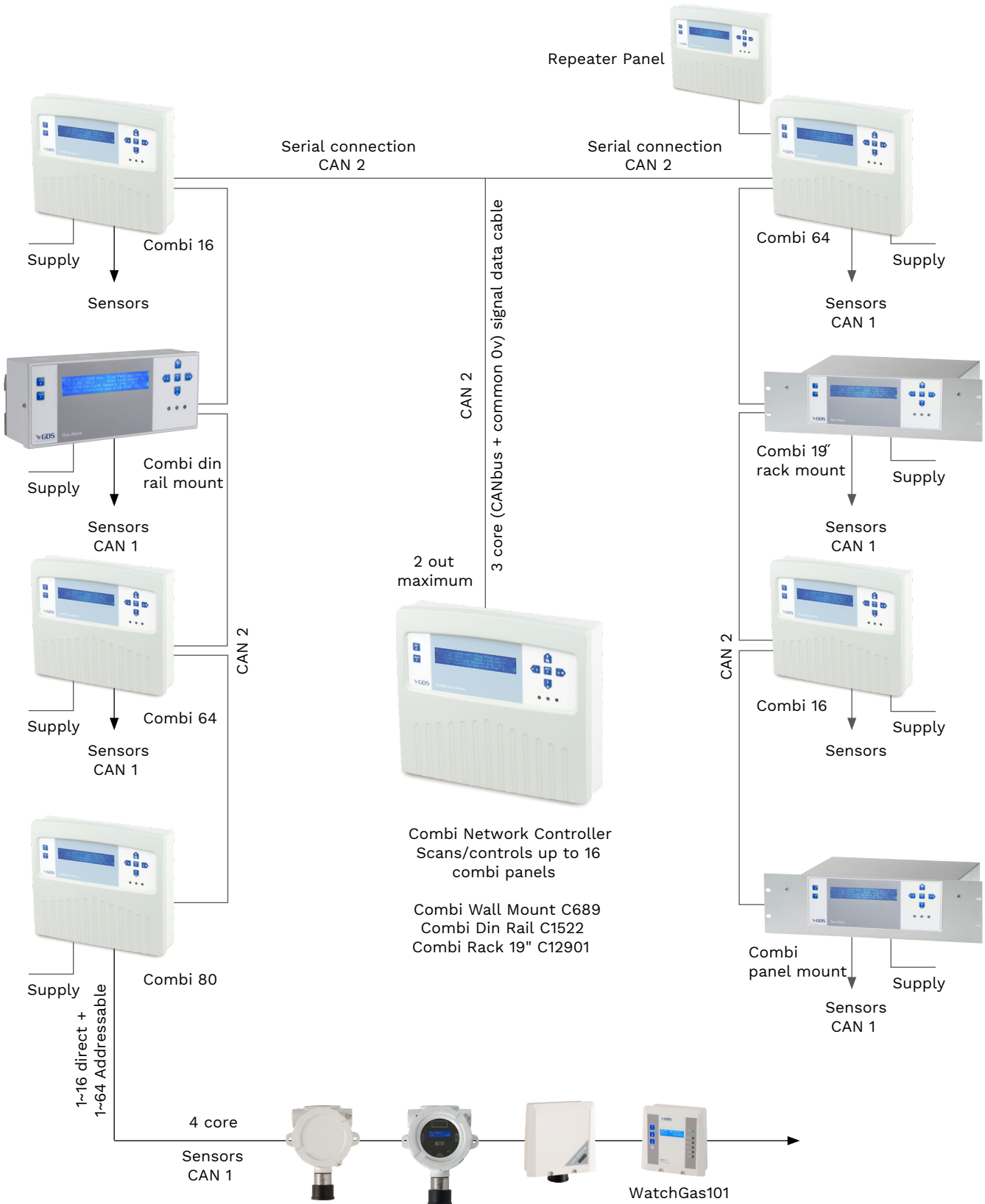
COMBI 80

CONTROLLER CONFIGURATION | Data Sheet ref C1046 Gv3

Defender C1667

C744

C759

C1274

GDS101
C1528

Sensors

8 way 4-20mA
sensor input unit
C1298

1~64 addressable sensors

Sensor signal booster
up to 1km (3 max)
C1564

CAN 4 or 8 way
alarm relay unit
C1179 / C1625

8 way 4~20mA
output relay unit
C1147

4 core 1.5mm screened CY cable – CANbus / 24vDC

2 core

24vDC
power pack
21+ sensors
C1541 C1293

4 core - 1km max

Repeater panel
x16 max
C1248

3-5 core

Status
indicator
x unlimited
C1742

GDS101
C1528

2/3 core 1~16 direct sensors
(4~20mA source)
or
1~8 direct sensors and
1~8 catalytic bridge sensors

Combi

C689 C1522
C1201 C925

32 way
relay unit
x2 max
C1249

C759

C744

16 channel
mV to 4~20mA
converter
C1510

Data Link - internet access
C1550

Dual coms - modbus 485

C1274

Sensor programming
9-D type

Combi panel
programming
via text file

Combi soft
Data logging/storage
System monitoring
C1020

Stand-alone sensor
C759

USB high speed
serial adaptor
(if required by PC)

This document is not contractual and the equipment specification maybe modified at any time without prior notice.

COMBI

NETWORK CONTROLLER CONFIGURATION | Technical Sheet ref C1148D

Repeater Panel

Serial connection CAN 2

Serial connection CAN 2

3 core (CANbus + common 0v) signal data cable

CAN 2

Supply

Combi 16

Sensors

Combi 64

Supply

Sensors CAN 1

Supply

Combi din rail mount

Supply

Sensors CAN 1

Combi 19″ rack mount

Supply

Sensors CAN 1

Supply

Combi 64

Sensors CAN 1

CAN 2

2 out maximum

CAN 2

Combi 16

Supply

Sensors

Supply

Combi 80

1~16 direct + 1~64 Addressable

Combi Network Controller
Scans/controls up to 16 combi panels

Combi Wall Mount C689
Combi Din Rail C1522
Combi Rack 19" C12901

Combi panel mount

Supply

Sensors CAN 1

4 core

Sensors CAN 1

WatchGas101

For individual controller configuration see C1046

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FIG. 4 CIRCUIT BOARD DETAILS

Combi 80

FIG. 4 CIRCUIT BOARD DETAILS

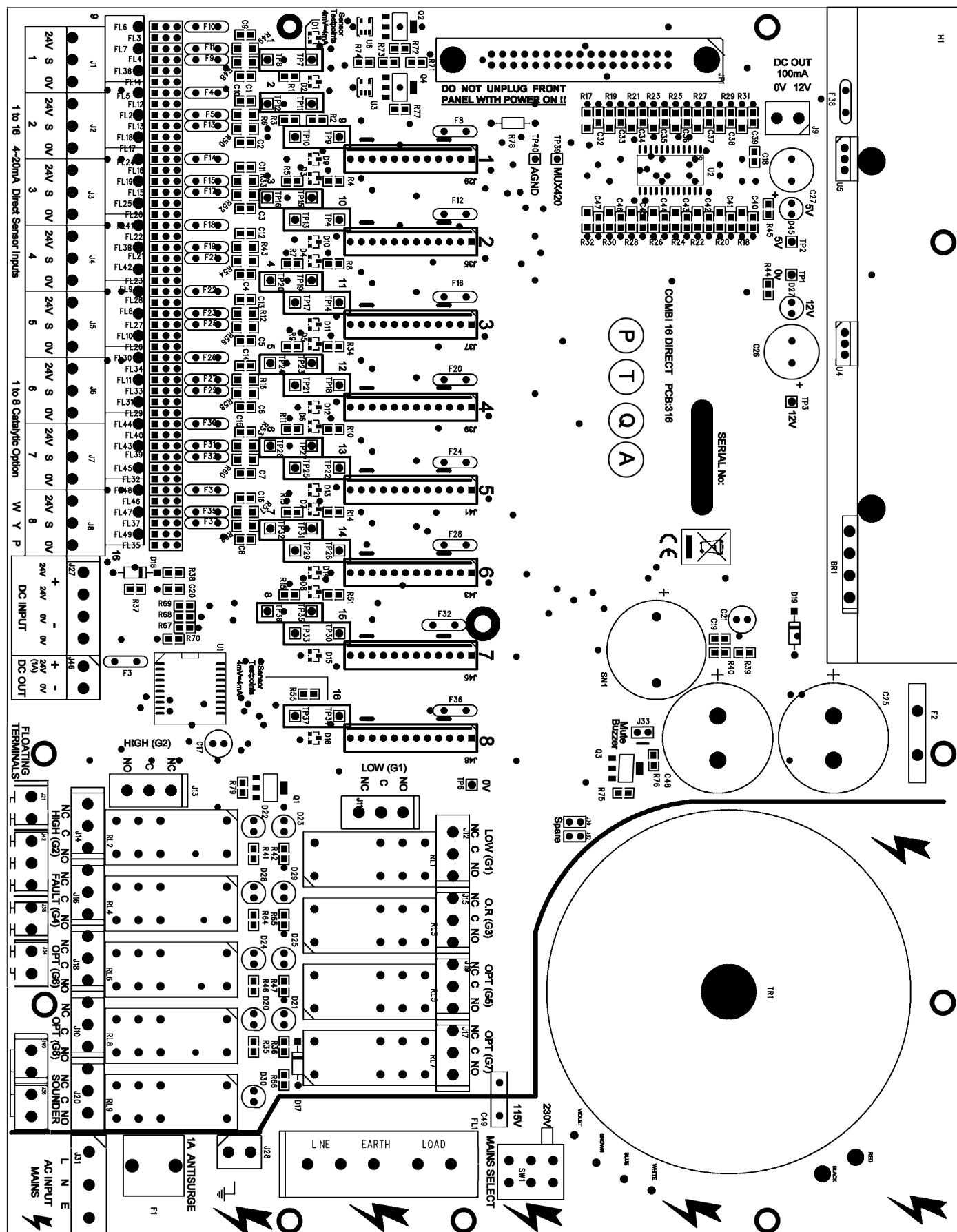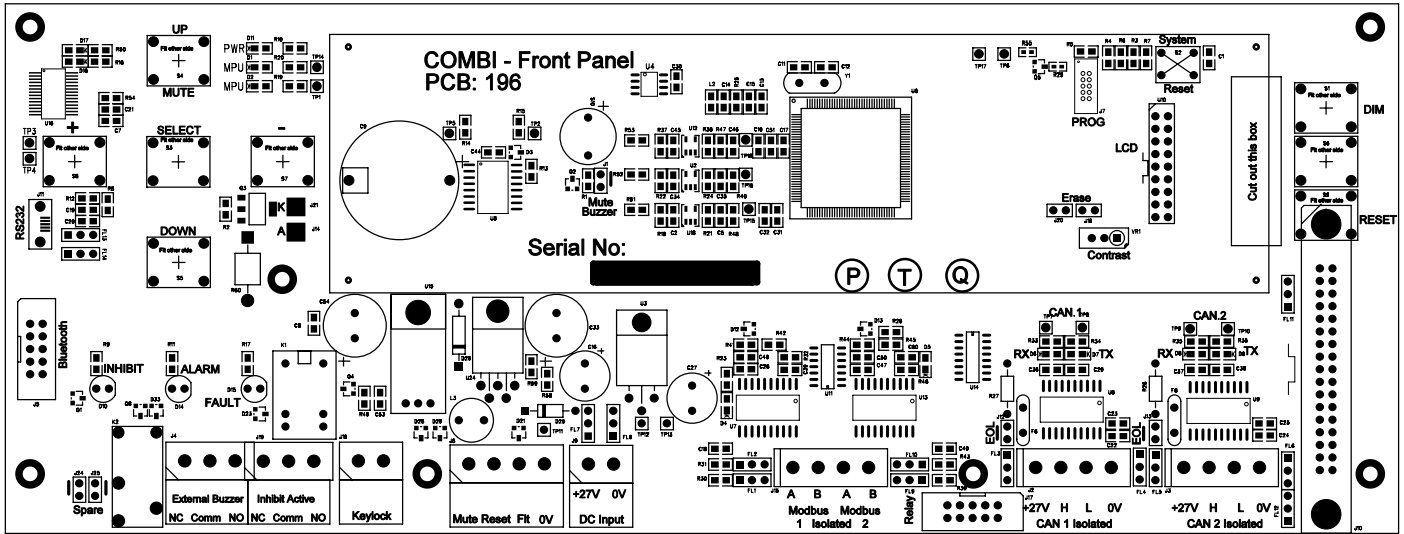Combi 64

FIG. 4 CIRCUIT BOARD DETAILS

Combi 16
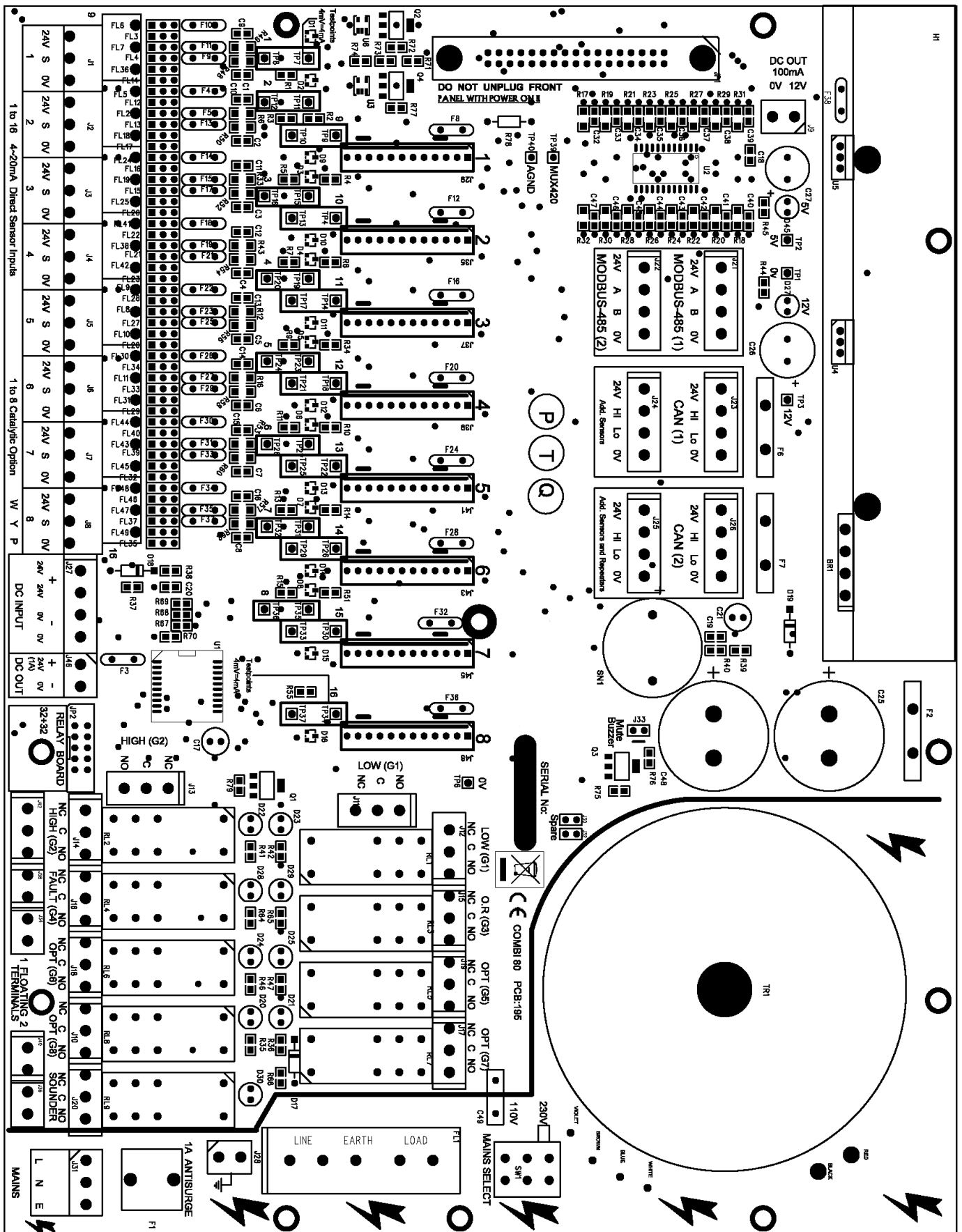
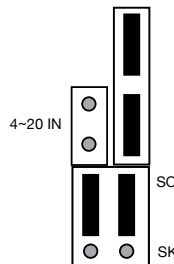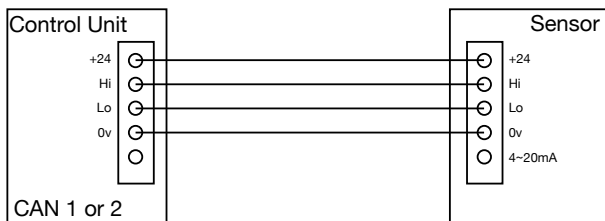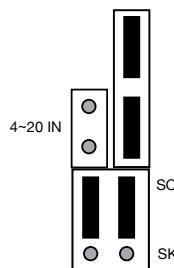# FIG. 4 CIRCUIT BOARD DETAILS
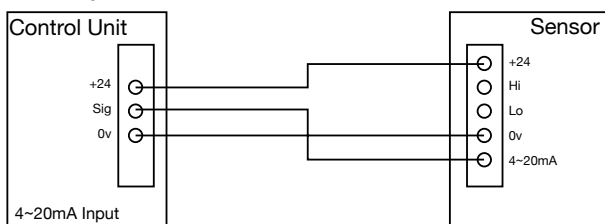

Front Panel PCB

FIG. 5 SYSTEM WIRING

Mainboad to Sensor wiring

Sensor Jumper configuration for TOX Board

Addressable

Control Unit / Sensor — CAN 1 or 2
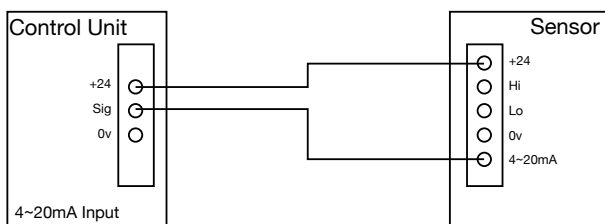
3-Wire Direct
4~20mA Signal

Control Unit / Sensor — 4~20mA Input

2-Wire Direct
4~20mA Signal

Control Unit / Sensor — 4~20mA Input
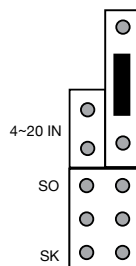
Controller to sensor wiring

FIG. 5 SYSTEM WIRING

Mainboad to Auxiliary Equipment and Sensor wiring

Main Panel

CAN(2)

| 24V | HI | LO | OV | 24V | HI | LO | OV |

Repeater Panel

24V
High   CAN 1
Low
0V
24V
Hi   CAN 2
Low
0V

Wiring of Combi repeater panel
Repeater on CAN2 ONLY

CAN (1)

| 24V | HI | LO | 0V | 24V | HI | LO | 0V |

Cable Screen

| 24V | HI | LO | 0V | 4-20 mA |

Can Sensor

| 24V | HI | LO | 0V | 4-20 mA |

Can Sensor

| 24V | HI | LO | 0V | 4-20 mA |

Can Sensor

NOTE
End of line (EOL) must be in position at main panel and last sensor on each line

Wiring of CAN (Addressable) sensors to the Combi control panel

Sounder Beacon

+
−

| N.O | C | N.C |

Low or High alarm relay contacts or Sounder relay contacts.

DC Out

| + | − |

Wiring of an external mutable sounder beacon to Combi control panel

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XDI (WIN)–15/30J (WIN)
FLAMMABLE – TRANSMITTER (PCB326)
Catalytic / Semiconductor / PID cells
Technical Sheet ref C1883Av.1

POWER SUPPLY
15 to 30Vdc 24v nominal

OUTPUTS
3 wire 4~20mA (Direct) / 4 wire CANbus (Addressable)
Relays   Low alarm   SPCO
             High alarm   SPCO   0–5A @ 30Vdc
             Fault alarm   SPCO
             Inhibit option during servicing
Logging   Intervals – variable time
             Roll over/stop
             Storage – 2,880 readings
Requires   USB A to USB Micro B Cable
             PC or laptop (dedicated)
             WatchGas Terminal
             (download from WatchGas website)

SET UP PROCEDURE

New sensors are supplied ready to connect to the system. The following procedure is for full set up and where the sensor cell has been replaced - only sections 4, 5, 7, 11 and 13 need to be carried out.

1. Insert jumpers J10 and J9 position SO for 4-20mA source output.
2. Turn sensor voltage potentiometer anti-clockwise (minimum voltage).
3. Connect sensor to J14 terminal W-white Y-yellow P-pink.
4. Connect 24V + and 0V to J2, short the 4~20mA terminal by inserting test link at J1.
5. Measure the sensor voltage at TP5 (0v) and TP8 (SV) and adjust by turning the 'Sensor Voltage' pot for the correct reading
   a. (Standard Sensor – Prime 1/2/3 = 4Vdc) **DO NOT EXCEED THE REQUIRED VOLTAGE OTHERWISE PERMANENT DAMAGE WILL OCCUR)**
   b. See sensor supply table
6. Rotate Gain pot fully anti-clockwise (minimum span.)
7. When in clean air the sensor bridge is zeroed by adjusting zero pot until LED D9 is Green
8. Connect PC to sensor via WatchGas terminal using USB-A to USB Micro-B cable at 4800 baud connected to J11. The terminal output screen shows continuous data output/ commands and allows input from the PC keyboard.
9. Select COM Port – Note each new sensor connected to requires a new COM Port to be connected to.
10. Press 'Space Bar' loads sensor information. Ensure jumper J12 is fitted before programming and initialise the sensor using (C) calibration mode.
11. Using a digital mV meter measure across test pins TP2/3 and adjust Zero pot until LED D9 goes green for 4mA (zero) = 4mV.
12. Then press (Z) on the PC to zero the reading.
13. Apply a known test gas to the sensor (56% LEL = 2.5% vol methane) for 1 minute at a flow rate of 1 litre to give a 13mA = 13mV across test pins TP2/3, adjust gain pot for correct mV reading.
14. When using a PC press (S) to enter span mode and using (H) or (L) adjust the reading to 56% LEL. Note – This adjusts the mA reading on TP2/3 when adjusted.
15. Press (space) to exit span and then (X) to exit the calibration mode.

An example of continuous data output to the PC from a Flammable sensor is shown below and is the format for all gas types.

```
Flam %LEL
O H L D F I
^^v
-*--*-Gas val = 35.6
```

O, **H** and **L** represent the Over Range High and Low alarms respectively.
D indicates if a duplicate address is detected
F indicates a fault present **I** shows that this sensor has its alarms inhibited under the **O H L** the ^ ^ v represent the direction of the alarms. **L** is falling and **H** and **O** are rising.
A(*) under the letter(s) OHLDFI represents a detected state so in this example the sensor would be in high alarm and a fault present. 'Gas val 35.6' represents the value of the gas present at the sensor head. Pressing (R) on the PC causes a reset to occur. Gas type with address and serial number are then output to the PC together with alarms and calibration date. A full command list via PC is available by pressing the letter (P) which will relist on the PC.

COMMAND	USE
A = Set CAN address	Sets the CAN address
G = Select gas type	Select the gas type from a list
Z = Zero	Press when no gas on sensor to give zero
S = Span	Use when calibration gas applied, H and L change reading
D = Enter calibration date	Enter the calibration date
Y = Toggle auto zero	Auto zero is ON or OFF, small drift is cleared
H = Set high alarm	Sets the high alarm threshold
L = Set low alarm	Sets the low alarm threshold
O = Set over range alarm	Sets the over range alarm threshold
P = List command	List these commands on screen
X = Exit calibration mode	Exit this PC mode
$ = Initialise this sensor	Use on new PCB to set gas type to Flam
U = Alarm direction	Sets rising or falling alarms
R = Range	Allows a change in maximum value
N = Decimal points	Toggles between 1 and 2 decimal places
E = Edit user gas text	Choose gas description
B = Toggle deadband	Deadband of 2.5% can be on or off
F = Toggle fault Input	External fault input contact can be disabled
# = Normally energised	Low /high alarm relays and fault relay can be made normally energised
V = View gas log	From current log, display how many historical readings to display, up to 2880
% = Clear gas log	Set all 2880 log readings to 0.00
I = Log interval log	Choose how many seconds between each reading and whether the log will roll over or stop at 2880 (60 second interval and 2880 readings = 48 hours)
Space Bar = Enters Data	
W = Set 4-20mA output	
* = Toggle Baud Rate 20kBits/40Kbits	

16. Connect the sensor to a Combi alarm panel and ensure that it reports in correctly. Note: Fit the end of line (EOL) link J3 if the sensor is to be installed at the end of the sensor cable.
17. If front panel display board is fitted via connector J5 and U12 adjust contrast for LCD contrast.
18. Remove J1 test link for normal operation, (this does not need to be removed when used as an Addressable sensor)
19. Ensure J12 address link is removed (this is only used when changing address from the alarm panel).
20. On completion and when used as an addressable sensor, future calibrations may be carried out at the Combi alarm panel.

USING MAGNETS (SET UP)

The Combi sensors which have an LCD display fitted also incorporate 3 reed switches which can be activated using external magnets through the glass window of the flameproof XDIwin enclosure. **These magnets do not act instantly and have to be in close proximity to L, M and R on the front display for a few seconds to activate a software setup function.**

The left magnet enters the Auto zero ON or OFF menu. This allows small drift changes in the sensor to be compensated for but is not operational when the sensor readings are greater than 5% of full scale. Therefore auto zero is inactive when a larger gas reading is present. When the remove magnets message appears, move the left magnet away and then the display shows if auto zero is ON or OFF. The left magnet puts auto zero ON and the right magnet turns it OFF. With no magnets present, the display will return to normal after a few seconds timeout.

The right magnet allows the CAN address of the sensor to be changed. When the ADDRESS menu is displayed with a prompt to remove the magnet, and then the display shows the address and that the right magnet decreases it whilst the left magnet will increase it. This is then stored in internal non volatile memory and the display will automatically revert to normal operation.

The centre magnet is used to inhibit the sensor. As with the left and right magnet functions the display requests that you remove the magnet and then the state of the inhibit appears on the LCD. The left magnet then puts the sensor into inhibit whilst the right magnet removes it. An amber LED on the front panel under the LCD flashes when the sensor is inhibited. When all magnets are removed, the display will revert to normal operation.

The left and right magnets together allow the calibration menu to be used.

Removing both magnets as instructed on the LCD presents the first part of this multi menu which is ZERO. With no gas present use the left magnet to increase the reading and the right magnet to decrease to achieve a zero reading on the display. A timer is displayed on the LCD and when this reaches 0, the next menu is displayed. This timer is 15 seconds approximately and is reset back each time a magnet is near, timeout can be speeded up by placing a magnet near to the centre position.

SPAN is the next part of the menu and gas should be applied to the sensor at this time.

The left magnet increases the gain and the right magnet reduces gain. The actual sensor value can be seen on the display to rise or fall respectively.
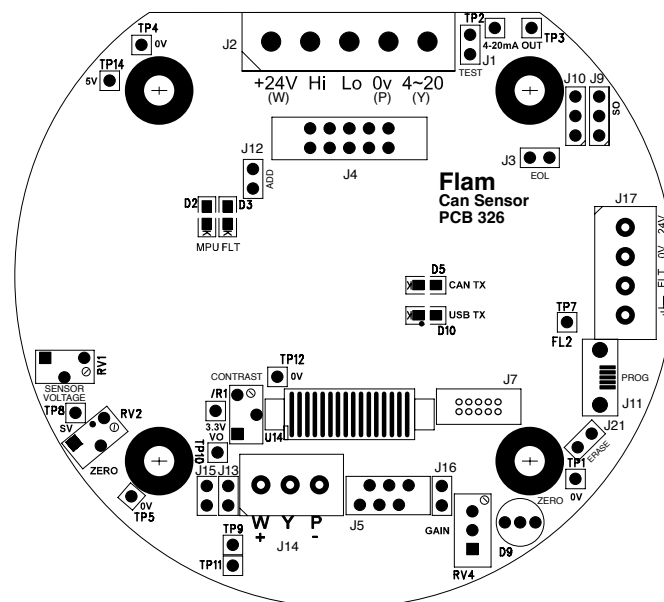
LOW ALARM is the next menu and left and right magnets increase and decrease this value.

HIGH ALARM is next followed by OVER RANGE alarm.

The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.

SENSOR CELL SUPPLY TABLE

CAT300A	2v/300mA
CAT170A	2v/175mA
SEM−1	4v/170mA
WATCHGAS PRIME	4v/70mA
CAT335C	2.5v/335mA
THE300A	2v/300mA
SS10	2v/175mA
CAT335A	2.5v/335mA
CAT335B	2.5v/335mA
CAT100A	2v/100mA
CAT165	2.2v/165mA
PID	5.0V

Fig.2 — Addressable Control Unit / Sensor wiring

Fig.3 — 3-Wire Direct 4~20mA Signal wiring

Flam Can Sensor PCB 326
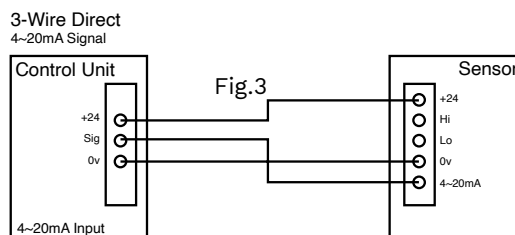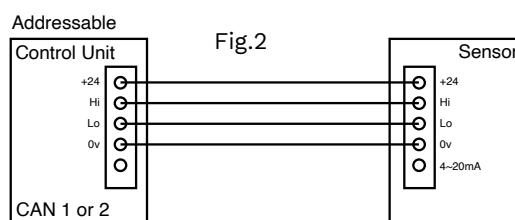
XDI-XDIWIN – 15/30J
FLAMMABLE – ADDRESSABLE/DIRECT SENSOR)
Technical Sheet ref C893 Sv.14 198D1C

POWER SUPPLY
15 to 30Vdc 24v nominal

OUTPUTS
3 wire 4~20mA (Direct) / 4 wire CANbus (Addressable)

Relays	Low alarm	SPCO
(when fitted)	High alarm	SPCO 0–5A @ 30Vdc
	Fault alarm	SPCO
	Inhibit option during servicing	
Logging	Intervals – variable time	
	Roll over/stop	
	Storage – 2,880 readings	
Requires	RS232 lead – see 8	
	PC or laptop (dedicated)	
	Hyperterminal (download from WatchGas website)	

SET UP PROCEDURE

New sensors are supplied ready to connect to the system. The following procedure is for full set up, where the sensor cell has been replaced - only sections 5, to 11 need to be carried out. Voltage measurements are made wrt AG unless otherwise specified.

1. Insert jumpers J9 and J10 position SO for 4-20mA source output.
2. Turn sensor voltage potentiometer anti-clockwise (minimum voltage).
3. Connect sensor to J5 terminal W-white Y-yellow P-pink.
4. Connect 24V + and 0V to J4, short the 4~20mA terminal by inserting test link at J1.
5. Measure the sensor voltage at SV (TP8) and 0v (TP5) adjust by turning sensor volts pot for the correct reading. (standard sensor CAT300 = 2Vdc.) **DO NOT EXCEED THE REQUIRED VOLTAGE OTHERWISE PERMANENT DAMAGE WILL OCCUR.** See sensor cell supply table.
6. Rotate 20mA pot fully anti-clockwise (minimum span.)
7. When in clean air the sensor bridge is zeroed by adjusting zero pot until the dual colour LED D1 is off.
8. Connect PC hyper terminal using Connect RS232 micro USB or for earlier models Combi adapter (part no. 160-510) and lead (part no. 160-515) at 4800 baud connected to J3. Ensure jumper J29 is fitted before programming and initialise the sensor using (C) calibration mode, then shift + ($) command from the keyboard.
9. Using a digital mV meter measure across test pins TP8/9 and adjust 4mA pot for 4mA (zero) = 4mV
10. Then press (Z) on the PC to zero the reading.
11. Apply a known test gas to the sensor (56% LEL = 2.5% vol methane) for 1 minute at a flow rate of 1 litre to give a 13mA = 13mV across test pins TP8/9, adjust 20mA pot for correct mV reading.
12. When using a PC press (S) to enter span mode and using (H) or (L) adjust the reading to 56% LEL.
13. Press (space) to exit span and then (X) to exit the calibration mode. An example of continuous data output to the PC from a Flammable sensor is shown below and is the format for all gas types.

O, **H** and **L** represent the Over Range High and Low alarms respectively.
D indicates if a duplicate address is detected **F** indicates a fault present I shows that this sensor has its alarms inhibited under the **O H L** the ^ ^ v represent the direction of the alarms. **L** is falling and **H** and O are rising. A(*) under the letter(s) OHLDFI represents a detected state so in this example the sensor would be in high alarm and a fault present. 'Gas val 35.6' represents the value of the gas present at the sensor head. Pressing (R) on the PC causes a reset to occur. Gas type with address and serial number are then output to the PC together with alarms and calibration date. A full command list via PC is available by pressing the letter (P) which will relist on the PC.

```
Flam %LEL
O H L D F I
^^v
-*--*-Gas val = 35.6
```

COMMAND	USE
A = Set CAN address	Sets the CAN address
G = Select gas type	Select the gas type from a list
Z = Zero	Press when no gas on sensor to give zero
S = Span	Use when calibration gas applied, H and L change reading
D = Enter calibration date	Enter the calibration date
Y = Toggle auto zero	Auto zero is ON or OFF, small drift is cleared
H = Set high alarm	Sets the high alarm threshold
L = Set low alarm	Sets the low alarm threshold
O = Set over range alarm	Sets the over range alarm threshold
P = List command	List these commands on screen
X = Exit calibration mode	Exit this PC mode
$ = Initialise this sensor	Use on new PCB to set gas type to Flam
U = Alarm direction	Sets rising or falling alarms
R = Range	Allows a change in maximum value
N = Decimal points	Toggles between 1 and 2 decimal places
E = Edit user gas text	Choose gas description
B = Toggle deadband	Deadband of 2.5% can be on or off
F = Toggle fault Input	External fault input contact can be disabled
# = Normally energised	Low /high alarm relays and fault relay can be made normally energised
V = View gas log	From current log, display how many historical readings to display, up to 2880
% = Clear gas log	Set all 2880 log readings to 0.00
I = Log interval log	Choose how many seconds between each reading and whether the log will roll over or stop at 2880 (60 second interval and 2880 readings = 48 hours)

14. Connect the sensor to a Combi alarm panel and ensure that it reports in correctly. **NOTE:** Fit the end of line (EOL) link J1 if the sensor is to be installed at the end of the sensor cable.
15. If front panel display board is fitted via connector J5 and U12 adjust contrast for LCD contrast.
16. Remove J9 test link for normal operation.
17. Insert link J12 to enable the bridge fault detection. (4-20mA output falls to 2mA in fault).
18. Ensure J29 address link is removed (this is only used when changing address from a Panel).

WATCHGAS COMBI 16/64/80

USING MAGNETS (SET UP)

The Combi sensors which have an LCD display fitted also incorporate 3 reed switches which can be activated using external magnets through the glass window of the flameproof XDIwin enclosure. **These magnets do not act instantly and have to be in close proximity to L, M and R on the front display for a few seconds to activate a software setup function.**

The left magnet enters the Auto zero ON or OFF menu. This allows small drift changes in the sensor to be compensated for but is not operational when the sensor readings are greater than 5% of full scale. Therefore auto zero is inactive when a larger gas reading is present. When the remove magnets message appears, move the left magnet away and then the display shows if auto zero is ON or OFF. The left magnet puts auto zero ON and the right magnet turns it OFF. With no magnets present, the display will return to normal after a few seconds timeout.

The right magnet allows the CAN address of the sensor to be changed. When the ADDRESS menu is displayed with a prompt to remove the magnet, and then the display shows the address and that the right magnet decreases it whilst the left magnet will increase it. This is then stored in internal non volatile memory and the display will automatically revert to normal operation.

The centre magnet is used to inhibit the sensor. As with the left and right magnet functions the display requests that you remove the magnet and then the state of the inhibit appears on the LCD. The left magnet then puts the sensor into inhibit whilst the right magnet removes it. An amber LED on the front panel under the LCD flashes when the sensor is inhibited. When all magnets are removed, the display will revert to normal operation.

The left and right magnets together allow the calibration menu to be used.

Removing both magnets as instructed on the LCD presents the first part of this multi menu which is ZERO. With no gas present use the left magnet to increase the reading and the right magnet to decrease to achieve a zero reading on the display. A timer is displayed on the LCD and when this reaches 0, the next menu is displayed. This timer is 15 seconds approximately and is reset back each time a magnet is near. Waiting till timeout is acceptable but this timeout can be speeded up by placing a magnet near to the centre position.

SPAN is the next part of the menu and gas should be applied to the sensor at this time.

The left magnet increases the gain and the right magnet reduces gain. The actual sensor value can be seen on the display to rise or fall respectively.

LOW ALARM is the next menu and left and right magnets increase and decrease this value.

HIGH ALARM is next followed by OVER RANGE alarm.

The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.

SENSOR CELL SUPPLY TABLE

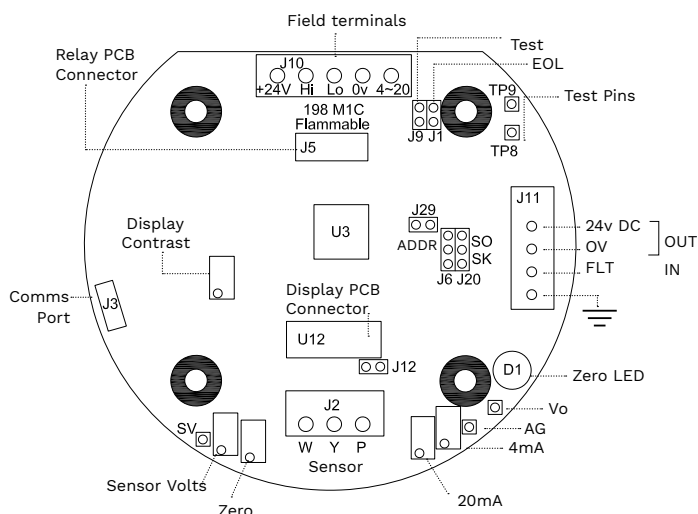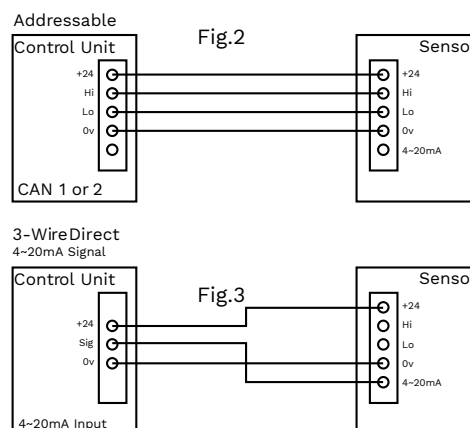|	
CAT300A	2v/300mA
CAT170A	2v/175mA
SEM−1	4v/170mA
WATCHGAS PRIME	4v/70mA
CAT335C	2.5v/335mA
THE300A	2v/300mA
SS10	2v/175mA
CAT335A	2.5v/335mA
CAT335B	2.5v/335mA
CAT100A	2v/100mA
CAT165	2.2v/165mA

Fig.1

Fig.2

Fig.3

XDI-XDIWIN – 15/30J
TOXIC/OXYGEN – TRANSMITTER (PCB 337)
Technical Sheet ref C1882A

Electrochemical cells
POWER SUPPLY
15 to 30vDC 24v nominal

OUTPUTS
2 wire 4~20mA output only
3 wire 4~20mA output +
4 wire CANbus

Relays	Low alarm	SPCO
	High alarm	SPCO 0–5A @ 30v DC
	Fault alarm	SPCO
	Inhibit option during servicing	
Logging	Intervals – variable time	
	Roll over/stop	
	Storage – 2,880 readings	
Requires	USB-A to USB Micro B cable	
	PC or laptop (dedicated)	
	WatchGas Terminal	
	(download from WatchGas website)	

SET UP PROCEDURE

Direct Sensor – 3 wire - 4~20mA
New sensors are supplied ready to connect to a system with all jumpers inserted. This procedure shows how to recalibrate as part of routine maintenance or cell replacement.
The first part is to set up the 4-20mA section which is produced by the CELL circuit. Note some cells take time to stabilise. If used as 3 wire, only steps 1 to 5 are required.

1. Connect the cell to terminal J14 and use +24V, 0V and 4~20mA connections on terminal J2 for 3 wire.
2. Measure the output current mV=mA at test pins TP2/TP3 and adjust reading to 4mA using the Zero pot. LED D9 will go green.
3. Apply span gas to cell and adjust Gain pot to give correct mV reading at test pins TP2/TP3. **NOTE:** at 50% span gas, the mV reading at TP2/TP3 should be 12mV.
4. Remove the span gas and re-adjust Zero pot to 4mV if required.

4 wire CANbus / 3 wire 4~20mA with processor communication
5. With power applied ensure that MPU led is flashing and the CAN led is on or flashing.
6. Connect USB-A to USB Micro B lead to J11 connector and to a PC running WatchGas Terminal at 4800 baud. Ensure jumper J17 is fitted before programming.
7. The terminal output screen shows continuous data output/ commands and allows input from the PC keyboard.
8. Select COM Port – Note each new sensor connected requires a new COM Port to be connected to.
9. Press 'Space Bar' loads sensor information.
10. Press 'C' enters calibration mode
11. Press 'G' to change the gas type to match the cell being used. **NOTE:** the range of the new gas has a default value but can be changed by pressing 'R'.
12. Press 'A' to change the address of this sensor if required.
13. Press 'N' to select the number of decimal places to 1 or 2, (ie: dp=1 or dp=2)
14. When in clean air, the sensor is zeroed by adjusting 'Zero' pot until LED 'D9' goes green, 4mA should be present on 'TP2' and 'TP3'.
15. Then apply span gas and press 'S' to enter span mode, obtain correct mV reading for test gas used by adjusting 'Gain Pot'. The displayed reading can be made HIGHER by pressing 'H' LOWER by pressing 'L' NOTE – this changes the mA reading on TP2/TP3. E.g. half range calibration gas = 12mV on TP2/3.
16. Pressing 'SPACE BAR' will exit the span mode
17. Press 'V' to view log of sensor readings if required
18. Pressing 'X' will exit the calibration mode. **NOTE:** Oxygen cells only use the P+ and Y terminals J14. To adjust for "zero" it is normal practice to disconnect the green connector on J14 and adjust the Zero pot until LED D9 is green and 4mA across TP2/TP3. When the cell is reconnected in air at 20.9% oxygen the span can be adjusted for 17.4mA reading across the same test pins using gain pot. If an LCD option is fitted then calibration and other settings using magnets instead of a PC can be achieved – see over.
19. On completion and when used as an addressable sensor, future calibrations may be carried out at the Combi alarm panel.

COMMAND	USE
A = Set CAN address	Sets the CAN address
G = Select gas type	Select the gas type from a list
Z = Zero	Press when no gas on sensor to give zero
S = Span	Use when calibration gas applied, H and L change reading
D = Enter calibration date	Enter the calibration date
Y = Toggle auto zero	Auto zero is ON or OFF, small drift is cleared
H = Set high alarm	Sets the high alarm threshold
L = Set low alarm	Sets the low alarm threshold
O = Set over range alarm	Sets the over range alarm threshold
P = List command	List these commands on screen
X = Exit calibration mode	Exit this PC mode
$ = Initialise this sensor	Use on new PCB to set gas type to Flam

COMMAND	USE
U = Alarm direction	Sets rising or falling alarms
R = Range	Allows a change in maximum value
N = Decimal points	Toggles between 1 and 2 decimal places
E = Edit user gas text	Choose gas description
B = Toggle deadband	Deadband of 2.5% can be on or off
F = Toggle fault Input	External fault input contact can be disabled
# = Normally energised	Low / high alarm relays and fault relay can be made normally energised
V= View gas log	From current log, display how many historical readings to display, up to 2880
% = Clear gas log	Set all 2880 log readings to 0.00
I = Log interval	Choose how many seconds between each reading and whether the log will roll over or stop at 2880 (60 second interval and 2880 readings = 48 hours)
W = Set 4~20mA output	
* Toggle Baud Rate 20kBits/40Kbits	

USING MAGNETS (SET UP)

The Combi sensors which have an LCD display fitted also incorporate 3 reed switches which can be activated using external magnets through the glass window of the flameproof XDIwin enclosure. **These magnets do not act instantly and have to be in close proximity to L, M and R on the front display for a few seconds to activate a software setup function.**

The left magnet enters the Auto zero ON or OFF menu. This allows small drift changes in the sensor to be compensated for but is not operational when the sensor readings are greater than 5% of full scale. Therefore auto zero is inactive when a larger gas reading is present. When the remove magnets message appears, move the left magnet away and then the display shows if auto zero is ON or OFF. The left magnet puts auto zero on and the right magnet turns it off. With no magnets present, the display will return to normal after a few seconds time out.

The right magnet allows the CAN address of the sensor to be changed. WHEN the ADDRESS menu is displayed with a prompt to remove the magnet, and then the display shows the address and that the right magnet will decreases it whilst the left magnet will increase it. This is then stored in internal non volatile memory and the display will automatically revert to normal operation.

The centre magnet is used to inhibit the sensor. As with the left and right magnet functions the display requests that you remove the magnet and then the state of the inhibit appears on the LCD. The left magnet then puts the sensor into inhibit whilst the right magnet removes it. An amber LED on the front panel under the LCD flashes when the sensor is inhibited. When all magnets are removed, the display will revert to normal operation.

The left and right magnets together allow the calibration menu to be used.

Removing both magnets as instructed on the LCD presents the first part of this multi menu which is ZERO. With no gas present use the left magnet to increase the reading and the right magnet to decrease to achieve a zero reading on the displays. A timer is displayed on the LCD and when this reaches 0, the next menu is displayed. This timer is 15 seconds approximately and is reset back each time a magnet is near. This timeout can be speeded up by placing a magnet near to the centre position.

SPAN is the next part of the menu and gas should be applied to the sensor at this time.

The left magnet increases the gain and the right magnet reduces gain. The actual sensor value can be seen on the display to rise or fall respectively.

LOW ALARM is the next menu and left and right magnets increase and decrease this value.

HIGH ALARM is next followed by over range alarm.

The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.

XDI-XDIWIN – 15/30J
TOXIC/OXYGEN SENSOR
General Data Sheet: 204D1C Issue Tv4

Technical Sheet ref C894Tv.5

POWER SUPPLY
15 to 30vDC 24v nominal

OUTPUTS
2 wire 4~20mA output only

3 wire 4~20mA output +

4 wire CANbus

Relays	Low alarm	SPCO
	High alarm	SPCO	0–5A @ 30v DC
	Fault alarm	SPCO
	Inhibit option during servicing
Logging	Intervals – variable time
	Roll over/stop
	Storage – 2,880 readings
Requires	RS232 lead – see 7
	PC or laptop (dedicated)
	Hyperterminal (download from WatchGas website)

SET UP PROCEDURE:
Direct 4~20mA 2/3 wire (no processor)
New sensors are supplied ready to connect to a system with all jumpers inserted. This procedure shows how to recalibrate as part of routine maintenance or cell replacement.

The first part is to set up the 4–20mA section which is produced by the CELL circuit. Note some cells take time to stabilise. If used as 2 or 3 wire then only steps 1 to 5 are required.

1. Connect the cell to terminal J2 and use +24V, 0V and 4~20mA connections on terminal J10 for 3 wire (or +24V and 4~20mA for 2 wire – see note)
2. Measure voltage across test pins AG to Vo and adjust reading to zero mV using offset potentiometer
3. Measure the output current mV=mA at test pins TP1/TP2 and adjust reading to 4mV using 4mA pot
4. Apply span gas to cell and adjust 20mA pot to give correct mV reading at test pins TP1/TP2. NOTE: at 50% span gas, the mV reading at TP1/TP2 should be 12mV and the voltage across test pins AG and Vo should not exceed 1 volt so that 100% of range is achievable.
5. Remove the span gas and re–adjust 4mA pot to 4mV if required.

4 wire CANbus / 3 wire 4~20mA with processor communication

6. With power applied ensure that MPU led is flashing and the CAN led is on or flashing.
7. Connect RS232 micro USB or for earlier models Combi adapter (part no. 160-510) and lead (part no. 160-515) to J3 connector and to a PC running HyperTerminal at 4800 baud. Ensure jumper J29 is fitted before programming.
8. The terminal output screen shows continuous data output/commands and allows input from the PC keyboard. Pressing 'C' enters calibration mode
   a. Press 'SHIFT $' to initialise the sensor and reset to default "Flam 100% LEL" setting.
   b. Then press 'G' to change the gas type to match the cell being used. **NOTE:** the range of the new gas has a default value but can be changed by pressing 'R'.
   c. Press 'A' to change the address of this sensor if required
   d. Press 'N' to select the number of decimal places to 1 or 2, (ie: dp=1 or dp=2)
   e. With no gas applied and 4mV measured at test pins TP8/TP9 press 'Z' to zero the gas reading/see note.
   f. Then apply span gas and press 'S' to enter span mode, optain correct mV reading for test gas used by adjusting 20mA pot. The displayed reading can be made HIGHER by pressing 'H' or lower by pressing 'L'
   g. Pressing 'SPACE BAR' will exit the span mode
   h. Press 'V' to view log of sensor readings if required
   i. Pressing 'X' will exit the calibration mode.

NOTE: Oxygen cells only use the P+ and Y terminals J2. To adjust for "zero" it is normal practice to disconnect 1 wire from the cell and adjust the 4mA pot for a 4mV reading across test pins TP8/TP9 FOR 3 wire sensors, or for 2 wire sensors use TP1/TP2. When the cell is reconnected in air at 20.8% oxygen the span can be adjusted for 17.3mV reading across the same test pins using 20mA pot.

If an LCD option is fitted then calibration and other settings using magnets instead of a PC can be achieved – see over.

COMMAND	USE
A = Set CAN address	Sets the CAN address
G = Select gas type	Select the gas type from a list
Z = Zero	Press when no gas on sensor to give zero
S = Span	Use when calibration gas applied, H and L change reading
D = Enter calibration date	Enter the calibration date
Y = Toggle auto zero	Auto zero is ON or OFF, small drift is cleared
H = Set high alarm	Sets the high alarm threshold
L = Set low alarm	Sets the low alarm threshold
O = Set over range alarm	Sets the over range alarm threshold
P = List command	List these commands on screen
X = Exit calibration mode	Exit this PC mode
$ = Initialise this sensor	Use on new PCB to set gas type to Flam

COMMAND	USE
U = Alarm direction	Sets rising or falling alarms
R = Range	Allows a change in maximum value
N = Decimal points	Toggles between 1 and 2 decimal places
E = Edit user gas text	Choose gas description
B = Toggle deadband	Deadband of 2.5% can be on or off
F = Toggle fault Input	External fault input contact can be disabled
# = Normally energised	Low / high alarm relays and fault relay can be made normally energised
V= View gas log	From current log, display how many historical readings to display, up to 2880
% = Clear gas log	Set all 2880 log readings to 0.00
I = Log interval	Choose how many seconds between each reading and whether the log will roll over or stop at 2880 (60 second interval and 2880 readings = 48 hours)

USING MAGNETS (SET UP)

The Combi sensors which have an LCD display fitted also incorporate 3 reed switches which can be activated using external magnets through the glass window of the flameproof XDIwin enclosure. **These magnets do not act instantly and have to be in close proximity to L, M and R on the front display for a few seconds to activate a software setup function.**

The left magnet enters the Auto zero ON or OFF menu.
This allows small drift changes in the sensor to be compensated for but is not operational when the sensor readings are greater than 5% of full scale. Therefore auto zero is inactive when a larger gas reading is present. When the remove magnets message appears, move the left magnet away and then the display shows if auto zero is ON or OFF. The left magnet puts auto zero on and the right magnet turns it off. With no magnets present, the display will return to normal after a few seconds timeout.

The right magnet allows the CAN address of the sensor to be changed. WHEN the ADDRESS menu is displayed with a prompt to remove the magnet, and then the display shows the address and that the right magnet will decreases it whilst the left magnet will increase it. This is then stored in internal non volatile memory and the display will automatically revert to normal operation.

The centre magnet is used to inhibit the sensor. As with the left and right magnet functions the display requests that you remove the magnet and then the state of the inhibit appears on the LCD. The left magnet then puts the sensor into inhibit whilst the right magnet removes it. An amber LED on the front panel under the LCD flashes when the sensor is inhibited. When all magnets are removed, the display will revert to normal operation

The left and right magnets together allow the calibration menu to be used.

Removing both magnets as instructed on the LCD presents the first part of this multi menu which is ZERO. With no gas present use the left magnet to increase the reading and the right magnet to decrease to achieve a zero reading on the display. A timer is displayed on the LCD and when this reaches 0, the next menu is displayed. This timer is 15 seconds approximately and is reset back each time a magnet is near. Waiting till timeout is acceptable but this timeout can be speeded up by placing a magnet near to the centre position.

SPAN is the next part of the menu and gas should be applied to the sensor at this time.

The left magnet increases the gain and the right magnet reduces gain. The actual sensor value can be seen on the display to rise or fall respectively.

LOW ALARM is the next menu and left and right magnets increase and decrease this value.

HIGH ALARM is next followed by OVER RANGE alarm.

The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.
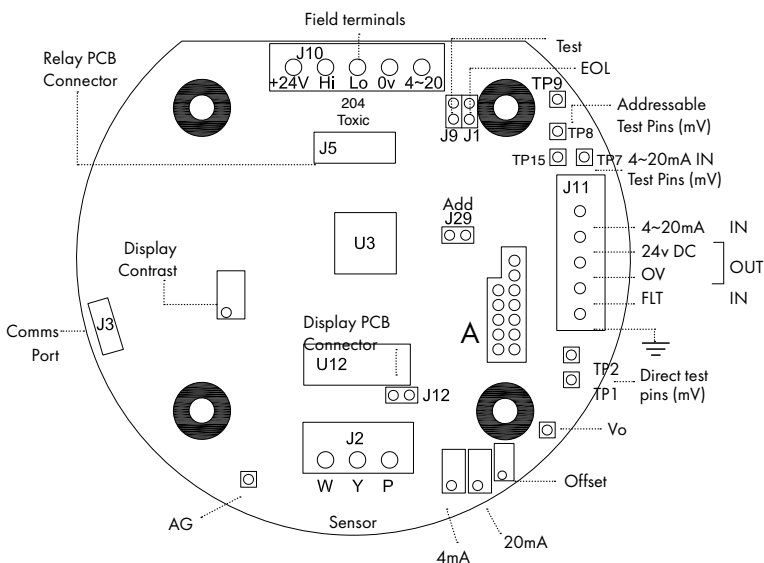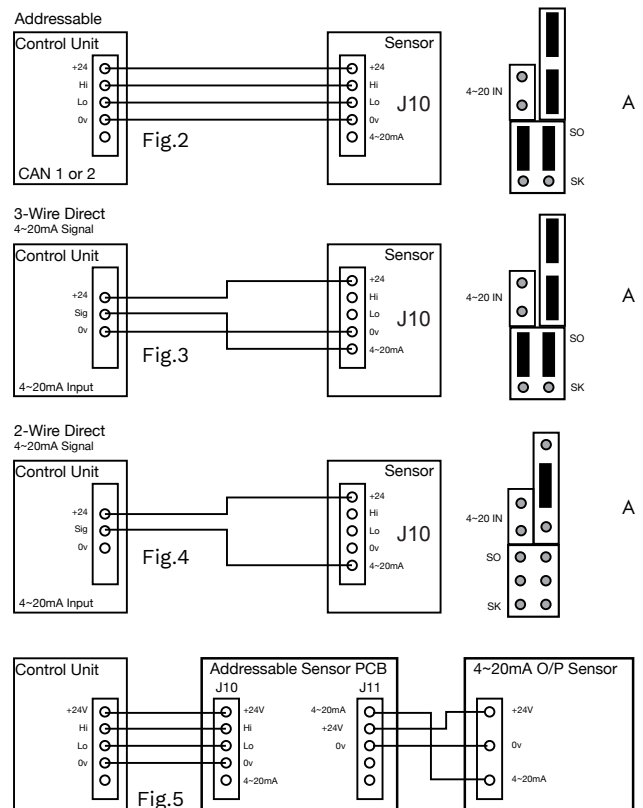

Fig.1

Fig.2

Fig.3

Fig.4

Fig.5

This document is not contractual and the equipment specification may be modified at any time without prior notice.

XDI-XDIWIN – 15/30J
4~20MA INPUT
Technical Sheet ref C1180Tv.5 204D2C

NEW UNITS ARE SUPPLIED READY TO CONNECT TO A SYSTEM. THE FOLLOWING PROCEDURE MAY NEED TO BE CARRIED OUT FOLLOWING CHANGES TO THE SYSTEM:

1. Insert J8 jumper to receive signal from external 4~20mA source (Fig.3)
2. Connect external 4~20mA source to the 4~20mA input terminal (J11) on the right hand side of the board.
3. Connect terminal J10 as shown in Fig.2
4. Connect DVM (mV range) across TP7 + TP15 to measure current supplied by 4~20mA device (mV = mA)
5. Ensure that the CAN LED is ON and flashing occasionally.
6. Connect RS232 pod to connector J3 and to a PC running HyperTerminal at 4800 baud.
7. The HyperTerminal display shows a continuous data output and allows input from the PC keyboard.
   a. Press C to enter calibration mode
   b. Press shift $ to initialise the memory if new PCB (defaults to Flam %LEL)
   c. Press G to change gas/signal to the type required for the cell/unit in use. (NOTE: When using a 'user gas' press 'E' to edit name after using 'G' to select. Also make sure to select a vacant user gas number, 61–68, as the address-able sensor will overwrite data entered at the Combi panel.
   d. The range of the gas/signal selected will have a default setting which can be changed by pressing 'R'
   e. Press A and enter CAN address of this sensor
   f. Press N to toggle the number of decimal places between 1 and 2 (i.e. dp=1 or dp=2)
   g. Press B to toggle the deadband ON and OFF
   h. Press F to toggle the external fault option ON or OFF (only available when external source has local fault indication)
   i. With input signal reading 4mA press Z to zero the reading.
   j. Press S to span the reading. Apply gas / signal from external source and press H or L to adjust the reading.
   k. Press space to exit the span.
   l. Press X to exit the calibration mode.
8. Connect to a combi panel and ensure that the sensor reports in correctly. **NOTE:** that if this sensor is at the end of the communication wires then it will need terminating by inserting jumper J1(EOL). The continuous data output when connected to HyperTerminal is the same format as for the Flammable sensor. The software used is identical.

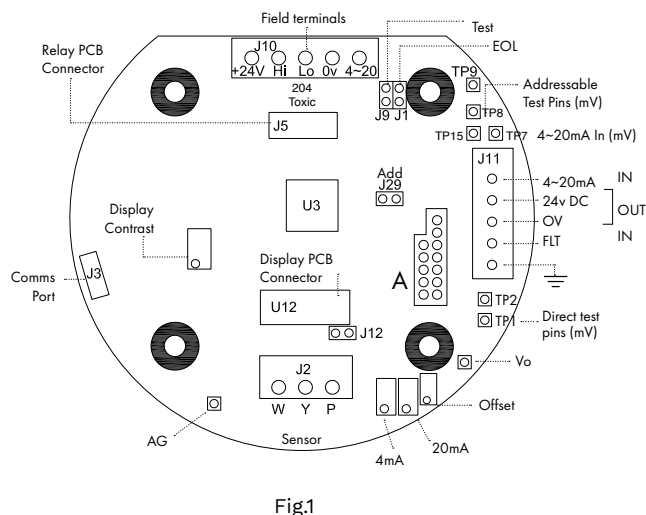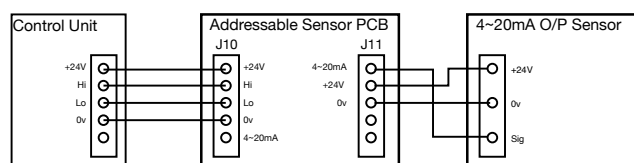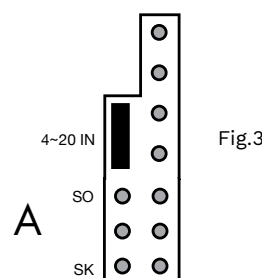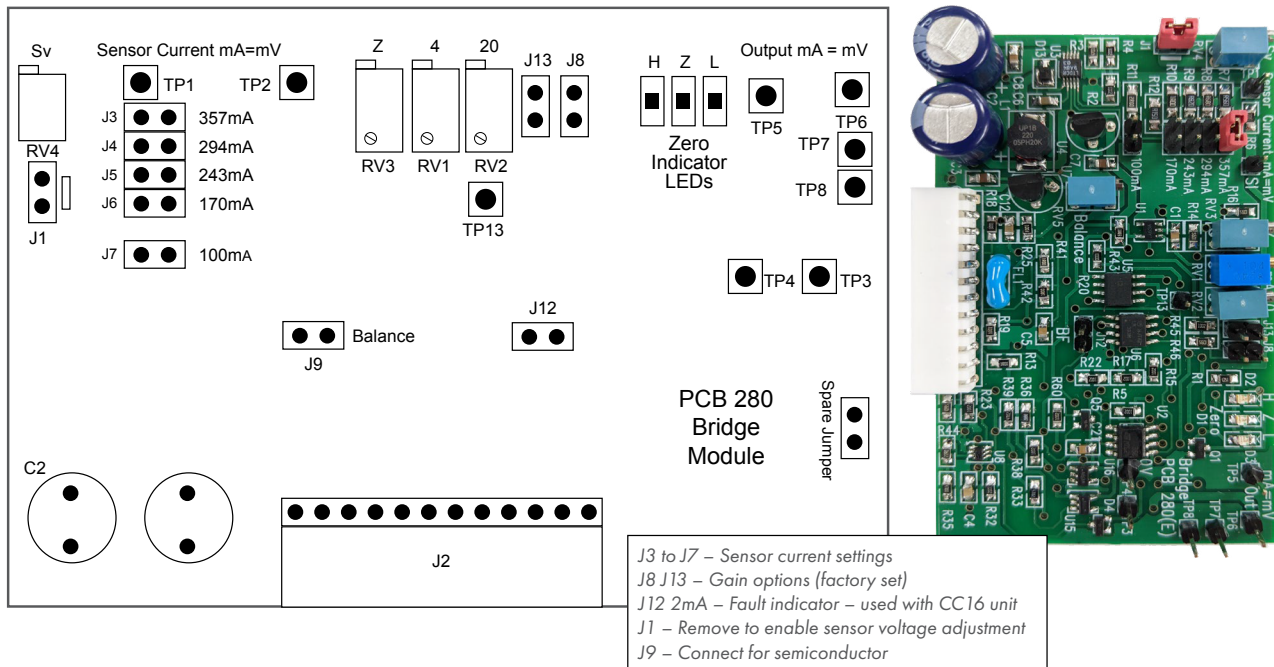| COMMAND	USE
A = Set CAN address	Sets the CAN address
G = Select gas type	Select the gas type from a list
Z = Zero	Press when no gas on sensor to give zero
S = Span	Use when calibration gas applied, H and L change reading
D = Enter calibration date	Enter the calibration date
Y = Toggle auto zero	Auto zero is ON or OFF, small drift is cleared
H = Set high alarm	Sets the high alarm threshold
L = Set low alarm	Sets the low alarm threshold
O = Set over range alarm	Sets the over range alarm threshold
P = List command	List these commands on screen
X = Exit calibration mode	Exit this PC mode
$ = Initialise this sensor	Use on new PCB to set gas type to Flam
U = Alarm direction	Sets rising or falling alarms
R = Range	Allows a change in maximum value
N = Decimal points	Toggles between 1 and 2 decimal places
E = Edit user gas text	Choose gas description
B = Toggle deadband	Deadband of 2.5% can be on or off
F = Toggle fault Input	External fault input contact can be disabled
# = Normally energised	Low /high alarm relays and fault relay can be made normally energised
V = View gas log	From current log, display how many historical readings to display, up to 2880
% = Clear gas log	Set all 2880 log readings to 0.00
I = Log interval	Choose how many seconds between each reading and whether the log will roll over or stop at 2880 (60 second interval and 2880 readings = 48 hours)

Fig.1

Fig.2

Fig.3

CC-1 BRIDGE MODULE
PLUG-IN MV TO 4~20MA CONVERTER
Technical Sheet C1579Dv.2

mV sensor input to 4~20mA signal output

J3 to J7 – Sensor current settings
J8 J13 – Gain options (factory set)
J12 2mA – Fault indicator – used with CC16 unit
J1 – Remove to enable sensor voltage adjustment
J9 – Connect for semiconductor

- Connect sensor cell directly to the sensor input terminal P (-) Y (Signal) W (+).
- Select the catalytic sensor constant current supply, 100, 170, 243, 294, 375mA. This can be checked by measuring across TP1 and TP2 using DVM on mV range mV=mA measured across a 1 ohm resistor.
- Insert the plug-in bridge module to the selected channel. (Combi Unit – remove the two red link jumpers).
- For infrared and semiconductor sensors remove jumper J1 and adjust RV4 for the required sensor voltage across sensor field terminals P (-) and W (+).
- Adjust the Zero (RV3) potentiometer until the green LED (Zero) turns ON, red/amber LED off (bridge balance), adjust the 4mA (RV1) output potentiometer to obtain a 4mV (4mA) reading across TP5 and TP6.
- Apply test gas and adjust the 20mA (RV2) potentiometer for the required (mA) reading at TP5/6.
- When used with the Combi 16, 80 all further calibrations may be carried out as described in the equipment handbook.
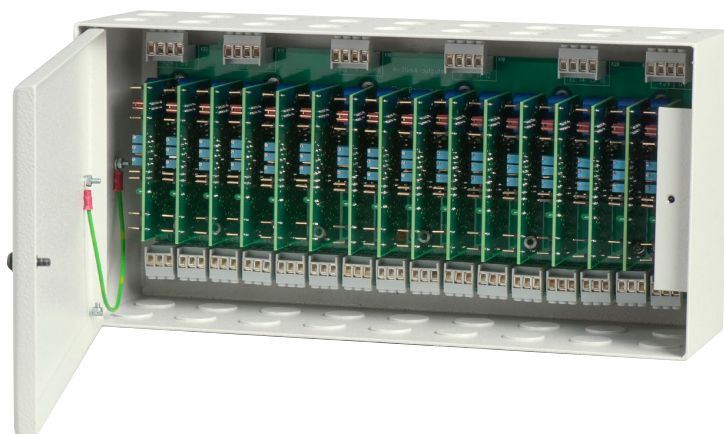
CC-16
Multi Bridge Module Unit
Specification Sheet C1510

Sensor cable 1.5mm screened, maximum loop resistance 200 ohm's (1km)

XDI-XDIWIN – 15/30J
PRIME TRANSMITTER (PCB326)
Technical Sheet ref C1884A

Infra red cells

POWER SUPPLY
15 to 30Vdc 24v nominal

OUTPUTS
3 wire 4~20mA (Direct) / 4 wire CANbus (Addressable)

Relays   Low alarm   SPCO
               High alarm   SPCO   0–5A @ 30Vdc
               Fault alarm   SPCO
               Inhibit option during servicing

Logging   Intervals – variable time
               Roll over/stop
               Storage – 2,880 readings

Requires   USB A to USB Micro B Cable
               WatchGas Terminal
               (download from WatchGas website)

SET UP PROCEDURE
New sensors are supplied ready to connect to the system.
The following procedure is for full set up and where the sensor cell has been replaced - only sections 4, 5, 7, 11 and 13 need to be carried out.

1. Insert jumpers J10 and J9 position SO for 4-20mA source output.
2. Turn sensor voltage potentiometer anti-clockwise (minimum voltage).
3. Connect sensor to J14 terminal W-white Y-yellow P-pink.
4. Connect 24V + and 0V to J2, short the 4~20mA terminal by inserting test link at J1.
5. Measure the sensor voltage at TP5 (0v) and TP8 (SV) and adjust by turning the 'Sensor Voltage' pot for the correct reading. (Standard Sensor – Prime 1/2/3 = 4Vdc) **(DO NOT EXCEED THE REQUIRED VOLTAGE OTHERWISE PERMANENT DAMAGE WILL OCCUR)**
6. Rotate Gain pot fully anti-clockwise (minimum span.)
7. To Zero a Prime 1 (%LEL sensor) when in clean air the sensor bridge is zeroed by adjusting the 'Zero' pot until LED 'D9' is green (4mA should be on TP2 and TP3 at this stage). To Zero a Prime 2/3 (%Vol CO2) apply a known test gas e.g. 100%Vol Nitrogen for 1 minute to ensure no CO2 is present, adjust the 'Zero' pot until LED 'D9' is green (4mA should be on TP2 and TP3 at this stage).
8. Connect PC to sensor via WatchGas terminal using USB-A to USB Micro-B cable at 4800 baud connected to J11. The terminal output screen shows continuous data output / commands and allows input from the PC keyboard.
9. Select COM Port – Note each new sensor connected to requires a new COM Port to be connected to.
10. Press 'Space Bar' to load sensor information. Press 'C' to enter Calibration Mode. Note if you wish to initialise the sensor ensure Jumper J12 is fitted.
11. Using a digital mV meter measure across test pins TP2/3 and adjust the 'Zero' pot until LED 'D9' goes green for 4mA (zero) = 4mV. Note for Prime 2/3 ensure 100%Vol Nitrogen is applied before setting the Zero.
12. Then press (Z) on the PC to zero the reading.
13. Apply a known test gas to the sensor (e.g. 1%Vol CO₂ test gas for 0-2%Vol range) for 1 minute at a flow rate of 1 litre/minute to give a 12mA=12mV reading across TP2/3, adjust the 'Gain' pot for correct mV reading.
14. Press 'S' to enter the span mode and using 'L' (Lower) and 'H' (Higher) adjust the reading to 1%Vol. **NOTE**: This adjusts the mA reading on TP2/3 when adjusted.
15. Press (space) to exit span and then (X) to exit the calibration mode.

An example of continuous data output to the PC from a Flammable sensor is shown below and is the format for all gas types.

O, **H** and **L** represent the Over Range High and Low alarms respectively.

D indicates if a duplicate address is detected

F indicates a fault present

I shows that this sensor has its alarms inhibited under the **O H L** the ^ ^ v represent the direction of the alarms. **L** is falling and **H** and **O** are rising. A(*) under the letter(s) OHLDFI represents a detected state so in this example the sensor would be in high alarm and a fault present.

'Gas val 35.6' represents the value of the gas present at the sensor head. Pressing (R) on the PC causes a reset to occur. Gas type with address and serial number are then output to the PC together with alarms and calibration date.

A full command list via PC is available by pressing the letter (P) which will relist on the PC.

```
Flam %LEL
O H L D F I
^^v
-*--*-Gas val = 35.6
```

COMMAND	USE
A = Set CAN address	Sets the CAN address
G = Select gas type	Select the gas type from a list
Z = Zero	Press when no gas on sensor to give zero
S = Span	Use when calibration gas applied, H and L change reading
D = Enter calibration date	Enter the calibration date
Y = Toggle auto zero	Auto zero is ON or OFF, small drift is cleared
H = Set high alarm	Sets the high alarm threshold
L = Set low alarm	Sets the low alarm threshold
O = Set over range alarm	Sets the over range alarm threshold
P = List command	List these commands on screen
X = Exit calibration mode	Exit this PC mode
$ = Initialise this sensor	Use on new PCB to set gas type to Flam
U = Alarm direction	Sets rising or falling alarms
R = Range	Allows a change in maximum value
N = Decimal points	Toggles between 1 and 2 decimal places
E = Edit user gas text	Choose gas description
B = Toggle deadband	Deadband of 2.5% can be on or off
F = Toggle fault Input	External fault input contact can be disabled
# = Normally energised	Low /high alarm relays and fault relay can be made normally energised
V = View gas log	From current log, display how many historical readings to display, up to 2880
% = Clear gas log	Set all 2880 log readings to 0.00
I = Log interval log	Choose how many seconds between each reading and whether the log will roll over or stop at 2880 (60 second interval and 2880 readings = 48 hours)
Space Bar = Enters Data	
W = Set 4-20mA output	
* = Toggle Baud Rate 20kBits/40Kbits	

16. Connect the sensor to a Combi alarm panel and ensure that it reports in correctly. **NOTE:** Fit the end of line (EOL) link J3 if the sensor is to be installed at the end of the sensor cable.
17. If a display PCB is fitted to the sensor, adjust the contrast by turning pot 'U14'.
18. Remove J1 test link for normal operation, (this does not need to be removed when used as an Addressable sensor)
19. Ensure J12 address link is removed (this is only used when changing address from the alarm panel).
20. On completion and when used as an addressable sensor, future calibrations may be carried out at the Combi alarm panel.

USING MAGNETS (SET UP)

The Combi sensors which have an LCD display fitted also incorporate 3 reed switches which can be activated using external magnets through the glass window of the flameproof XDIwin enclosure. **These magnets do not act instantly and have to be in close proximity to L, M and R on the front display for a few seconds to activate a software setup function.**

The left magnet enters the Auto zero ON or OFF menu. This allows small drift changes in the sensor to be compensated for but is not operational when the sensor readings are greater than 5% of full scale. Therefore auto zero is inactive when a larger gas reading is present. When the remove magnets message appears, move the left magnet away and then the display shows if auto zero is ON or OFF. The left magnet puts auto zero on and the right magnet turns it off. With no magnets present, the display will return to normal after a few seconds time out.

The right magnet allows the CAN address of the sensor to be changed. When the ADDRESS menu is displayed with a prompt to remove the magnet, and then the display shows the address and that the right magnet will decreases it whilst the left magnet will increase it. This is then stored in internal non volatile memory and the display will automatically revert to normal operation.

The centre magnet is used to inhibit the sensor. As with the left and right magnet functions the display requests that you remove the magnet and then the state of the inhibit appears on the LCD. The left magnet then puts the sensor into inhibit whilst the right magnet removes it. An amber LED on the front panel under the LCD flashes when the sensor is inhibited. When all magnets are removed, the display will revert to normal operation.

The left and right magnets together allow the calibration menu to be used.

Removing both magnets as instructed on the LCD presents the first part of this multi menu which is ZERO. With no gas present use the left magnet to increase the reading and the right magnet to decrease to achieve a zero reading on the displays. A timer is displayed on the LCD and when this reaches 0, the next menu is displayed. This timer is 15 seconds approximately and is reset back each time a magnet is near. This timeout can be speeded up by placing a magnet near to the centre position.

SPAN is the next part of the menu and gas should be applied to the sensor at this time.

The left magnet increases the gain and the right magnet reduces gain. The actual sensor value can be seen on the display to rise or fall respectively.

LOW ALARM is the next menu and left and right magnets increase and decrease this value.

HIGH ALARM is next followed by over range alarm.

The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.
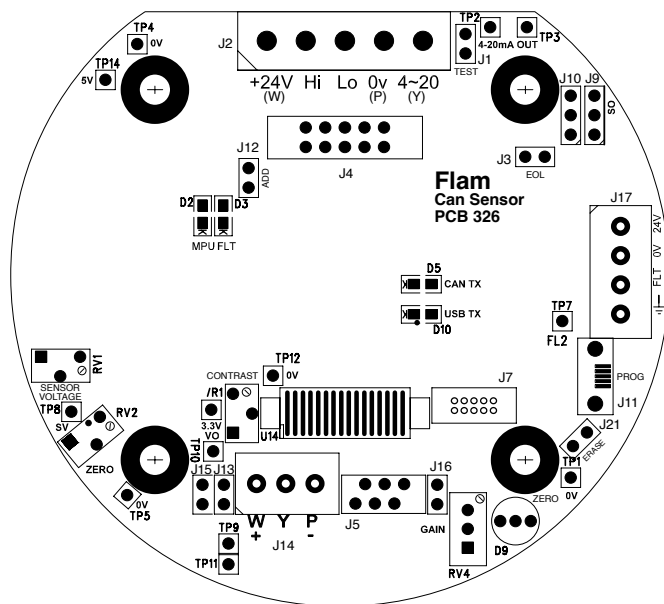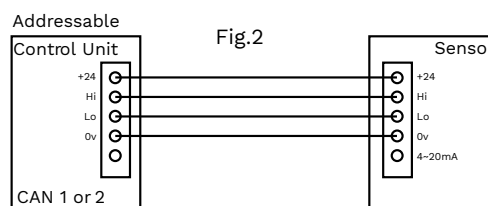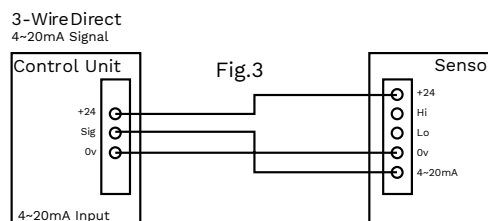

Fig.1

Fig.2

Fig.3

XDI-XDIWIN – 15/30J
PRIME – INFRA RED ADDRESSABLE / DIRECT SENSOR
Technical Sheetref C1698 Bv.5

POWER SUPPLY
15 to 30Vdc 24v nominal

OUTPUTS
3 wire 4~20mA (Direct) / 4 wire CANbus (Addressable)

Relays	Low alarm	SPCO
(when fitted)	High alarm	SPCO 0–5A @ 30Vdc
	Fault alarm	SPCO
	Inhibit option during servicing	
Logging	Intervals – variable time	
	Roll over/stop	
	Storage – 2,880 readings	
Requires	RS232 lead – see 8	
	PC or laptop (dedicated)	
	Hyperterminal (download from WatchGas website)	

SET UP PROCEDURE
New sensors are supplied ready to connect to the system. The following procedure is for full set up, where the sensor cell has been replaced - only sections 5, to 11 need to be carried out. Voltage measurements are made wrt AG unless otherwise specified.

1. Insert jumpers J20 and J6 position SO for 4-20mA source output.
2. Turn sensor voltage potentiometer anti-clockwise (minimum voltage).
3. Connect sensor to J2 terminal W-white Y-yellow P-pink.
4. Connect 24V + and 0V to JP10, short the 4~20mA terminal by inserting test link at J9.
5. Measure the sensor voltage at SV and adjust by turning sensor volts pot for the correct reading 4Vdc. **DO NOT EXCEED THE REQUIRED VOLTAGE OTHERWISE PERMANENT DAMAGE WILL OCCUR.**
6. Rotate 20mA pot fully anti-clockwise (minimum span).
7. When in clean air the sensor bridge is zeroed by adjusting zero pot until the dual colour LED D1 is off.
8. Connect PC hyper terminal using RS232 micro USB or for earlier models Combi adaptor (part no. 160-510 and lead (part no. 160-515) at 4800 baud connected to J3 and initialise the sensor using (C) calibration mode, then shift + ($) command from the keyboard.
9. Using a digital mV meter measure across test pins TP8/9 and adjust 4mA pot for 4mA (zero) = 4mV
10. Then press (Z) on the PC to zero the reading.
11. Apply a known test gas to the sensor (50% F.S.D.) for 1 minute at a flow rate of 1 litre to give a 12mA = 12mV across test pins TP8/9, adjust 20mA pot for correct mV reading.
12. When using a PC press (S) to enter span mode and using (H) or (L) adjust for the correct reading.
13. Press (space) to exit span and then (X) to exit the calibration mode.

An example of continuous data output to the PC from a Flammable sensor is shown below and is the format for other gas types.
O, **H** and **L** represent the Over Range High and Low alarms respectively.
D indicates if a duplicate address is detected
F indicates a fault present
I shows that this sensor has its alarms inhibited under the **O H L** the ^ ^ v represent the direction of the alarms.
L is falling and **H** and **O** are rising. A(*) under the letter(s) OHLDFI represents a detected state so in this example the sensor would be in high alarm and a fault present.
'Gas val 35.6' represents the value of the gas present at the sensor head. Pressing (R) on the PC causes a reset to occur. Gas type with address and serial number are then output to the PC together with alarms and calibration date.
A full command list via PC is available by pressing the letter (P) which will relist on the PC.

```
Flam %LEL
O H L D F I
^^v
-*--*-Gas val = 35.6
```

COMMAND	USE
A = Set CAN address	Sets the CAN address
G = Select gas type	Select the gas type from a list
Z = Zero	Press when no gas on sensor to give zero
S = Span	Use when calibration gas applied, H and L change reading
D = Enter calibration date	Enter the calibration date
Y = Toggle auto zero	Auto zero is ON or OFF, small drift is cleared
H = Set high alarm	Sets the high alarm threshold
L = Set low alarm	Sets the low alarm threshold
O = Set over range alarm	Sets the over range alarm threshold
P = List command	List these commands on screen
X = Exit calibration mode	Exit this PC mode
$ = Initialise this sensor	Use on new PCB to set gas type to Flam
U = Alarm direction	Sets rising or falling alarms
R = Range	Allows a change in maximum value
N = Decimal points	Toggles between 1 and 2 decimal places
E = Edit user gas text	Choose gas description
B = Toggle deadband	Deadband of 2.5% can be on or off
F = Toggle fault Input	External fault input contact can be disabled
# = Normally energised	Low /high alarm relays and fault relay can be made normally energised
V = View gas log	From current log, display how many historical readings to display, up to 2880
% = Clear gas log	Set all 2880 log readings to 0.00
I = Log interval log	Choose how many seconds between each reading and whether the log will roll over or stop at 2880 (60 second interval and 2880 readings = 48 hours)

14. Connect the sensor to a Combi alarm panel and ensure that it reports in correctly. **NOTE:** Fit the end of line (EOL) link J1 if the sensor is to be installed at the end of the sensor cable.
15. If front panel display board is fitted via connector J5 and U12 adjust contrast for LCD contrast.
16. Remove J9 test link for normal operation.
17. Insert link J12 to enable the bridge fault detection. (4-20mA output falls to 2mA in fault).
18. Ensure J29 address link is removed (this is only used when changing address from a Panel).

USING MAGNETS (SET UP)

The Combi sensors which have an LCD display fitted also incorporate 3 reed switches which can be activated using external magnets through the glass window of the flameproof XDIwin enclosure. **These magnets do not act instantly and have to be in close proximity to L, M and R on the front display for a few seconds to activate a software setup function.**

The left magnet enters the Auto zero ON or OFF menu.
This allows small drift changes in the sensor to be compensated for but is not operational when the sensor readings are greater than 5% of full scale. Therefore auto zero is inactive when a larger gas reading is present. When the remove magnets message appears, move the left magnet away and then the display shows if auto zero is ON or OFF. The left magnet puts auto zero ON and the right magnet turns it OFF. With no magnets present, the display will return to normal after a few seconds timeout.

The right magnet allows the CAN address of the sensor to be changed. When the ADDRESS menu is displayed with a prompt to remove the magnet, and then the display shows the address and that the right magnet decreases it whilst the left magnet will increase it. This is then stored in internal non volatile memory and the display will automatically revert to normal operation.

The centre magnet is used to inhibit the sensor. As with the left and right magnet functions the display requests that you remove the magnet and then the state of the inhibit appears on the LCD. The left magnet then puts the sensor into inhibit whilst the right magnet removes it. An amber LED on the front panel under the LCD flashes when the sensor is inhibited. When all magnets are removed, the display will revert to normal operation.

The left and right magnets together allow the calibration menu to be used.

Removing both magnets as instructed on the LCD presents the first part of this multi menu which is ZERO. With no gas present use the left magnet to increase the reading and the right magnet to decrease to achieve a zero reading on the display. A timer is displayed on the LCD and when this reaches 0, the next menu is displayed. This timer is 15 seconds approximately and is reset back each time a magnet is near. Waiting till timeout is acceptable but this timeout can be speeded up by placing a magnet near to the centre position.

SPAN is the next part of the menu and gas should be applied to the sensor at this time.

The left magnet increases the gain and the right magnet reduces gain. The actual sensor value can be seen on the display to rise or fall respectively.

LOW ALARM is the next menu and left and right magnets increase and decrease this value.

HIGH ALARM is next followed by OVER RANGE alarm.

The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.
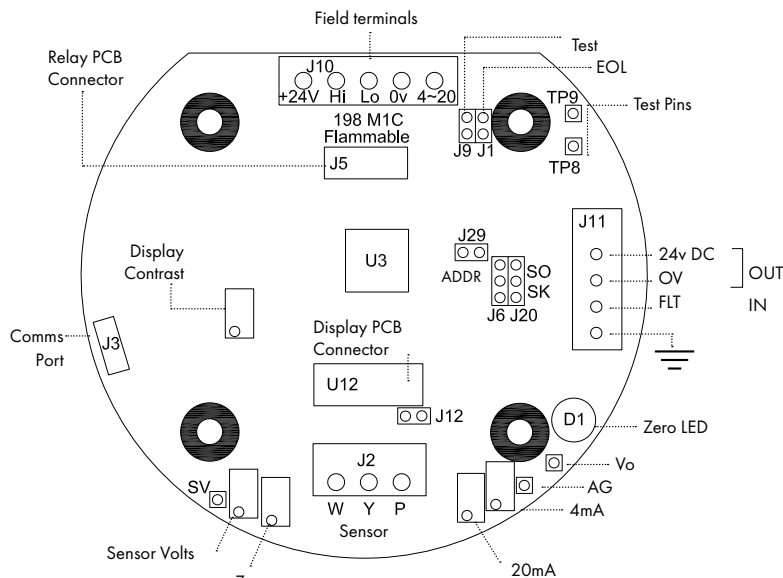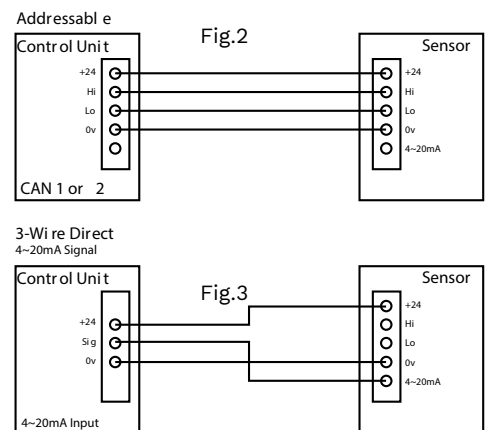

Fig.1

Fig.2

Fig.3

This document is not contractual and the equipment specification may be modified at any time without prior notice.

XDI-XDIWIN – 15/30J
SEMICONDUCTOR SENSOR
Technical Sheet ref C1519Bv.4 292 D7C

NEW SENSORS ARE SUPPLIED READY TO CONNECT AND GO BUT NEED 15 MINUTES POWER STABILISATION. The following procedure is for full set up using a PC but onsite calibration without PC/LCD requires only sections 18 & 19.
NOTE: If a new cell is fitted then full calibration is required.

PC SETUP
This sensor will linearise 2 points, zero and mid-scale with an optional full scale point when using a PC.

Gas values below the mid-scale point are not as accurate because the sensor is none linear.

The Zero adjust is continuous during power up inhibit time and PCB fault LED flashes to indicate this, do not apply any gas at this time because Zero adjust will try to offset the measurement. Thereafter Zero adjusts 1 second every minute. D1 flickers orange at the zero point.

Voltage measurements are made wrt AG unless otherwise specified.
1. Insert jumpers J20 and J6 position SO for 4-20mA source output
2. Turn sensor voltage potentiometer RV4 fully anticlockwise (minimum voltage)
3. Connect sensor to J2 terminal (W) white (P) pink (Y) yellow
4. Connect 24v + and 0V to J10, short the 4~20mA terminal by inserting test link at J9
5. Set the sensor voltage to 5.0V (4.0 for NH3)measured at SV and 0V, adjust by turning RV4 clockwise. **DO NOT EXCEED THE RE-QUIRED VOLTAGE OTHERWISE PERMANENT DAMAGE WILL OCCUR**
6. Insert jumper G2 for a nominal gain value (G1 is lowest gain, G5 is highest or a combination G1 to G5)
7. Connect a PC to RS232 port using a micro USB lead or for earlier models Combi adaptor (part no. 160510 and lead (part no. 160515) and Hyperterminal 4800/1stop/8bit and initialise the sensor using (C) calibration mode, then shift + ($) command from the keyboard. The default gas is Ammonia 1000 ppm
8. The typical Hyperterminal display is (also see appendix 1)
   27 Ammonia 1000.0ppm
   O H L D F I
   ^ ^ ^
   - - - - - - PPM= 0 A=80 R=80 Adj=497 PInh=52 adj=4 CG=314.0 CGADC=385

   PPM is the gas value
   A is the processor raw measurement (0 to 1000)
   R is the zero point of the sensor (100 +/-2)
   Adj is the adjustment value to autozero 0 to 1000 but 500 is ideal.
   Pinh is the number of seconds left of powerup inhibit (autozero is active during this time)
   adj is the number of seconds until a 1 second autozero will occur.
   CG is the calibration gas value PPM.
   CGADC is the number A must reach to display the value CG as the correct PPM gas reading

9. Sensor Zero is true when D1 flashes orange and potentiometer VR2 is adjusted to ensure Adj is between 400 and 600. VR2 clockwise will increase Adj. (Note pressing (R) or J28 short will reset sensor and give 1 min adj time)
10. Press F to adjust the 4mA output by measuring the mV across TP8 and TP9. Press H and L to set and then press SPACE to exit.
11. Press T to adjust the 20mA output by measuring the mV across TP8 and TP9. Press H and L to set and then press SPACE to exit.
12. Before using span gas, ensure that an Autozero is not about to take place, indicated by the fault LED not flashing. The fault led on the PCB will flash during Power up but also when there is less than 30 seconds to an autozero.
13. Apply a test gas to the sensor (mid-range 500ppm is preferred) for 2 minutes at a flow rate of 1 litre/min. Use the UP and DOWN buttons on the PCB to give correct 4-20mA level. (ie 12mA for 500ppm). Remove gas and wait 5 minutes. If a maximum range gas is available, apply for 2 minutes and note the value of A. This can then be entered using Hyperterminal using the M command giving better accuracy above the mid calibration gas level. Remove gas and wait 5 minutes.
14. Connect the sensor to a Combi alarm panel and ensure that it reports in correctly. **NOTE:** Fit the end of line (EOL) link J1 if the sensor is to be installed at the end of the sensor cable.
15. If front panel display board is fitted via connector J5 and U12 adjust VR1 for LCD contrast.
16. Remove J9 test link for normal operation.
17. Ensure J29 address link is removed (this is only used when changing address from a Panel)

MANUAL CALIBRATION (WITHOUT PC OR LCD)
Auto zero is operating
18. Zero - with no gas applied, auto zero is in operation and LED D should be flashing orange. Check the voltage between Ag and S16 to be 450mv approx. With J9 test link inserted the 4-20mA output signal measured at TP8 to TP9 should be 4mV.
19. Span - ensure that auto zero is not within 30 seconds indicated by the MPV LED short flash, then apply test gas (typically 50%) for 2 minutes and use the UP and DOWN buttons to adjust the 4-20mA output current to the correct value, eg 50% gas would give 12mv. Remove gas and ensure output current falls to 4mA. Note this may take some time as the semiconductor returns to normal. Remove test link J9.

USING MAGNETS (SET UP)
WIN versions of the sensor have an LCD display which shows the Gas and range together with the sensor address and a display of the number of seconds until an autozero will occur. Also incorporated are 3 reed switches which can be activated using external magnets through the glass window of the flameproof XDIwin enclosure. These magnets do not act instantly and have to be in close proximity

to L, M and R on the front display for a few seconds to activate a software setup function.

The right magnet allows the CAN address of the sensor to be changed. When the address menu is displayed with a prompt to remove the magnet, and then the display shows the address and that the right magnet will decreases it whilst the left magnet will increase it. This is then stored in internal non-volatile memory and the display will automatically revert to normal operation.

The centre magnet is used to inhibit the sensor. As with the left and right magnet functions the display requests that you remove the magnet and then the state of inhibit appears on the LCD.
The left magnet then puts the sensor into inhibit whilst the right magnet removes it. The amber LED on the front panel under the LCD flashes when the sensor is inhibited. When all magnets are 63 removed, the display will revert to normal operation. The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.

The left and right magnets together allow the calibration menu to be used. Removing both magnets as instructed on the LCD presents the first part of this multi menu which is ZERO. With no gas present the display shows the PPM value but also typically [0.02] This number between the square brackets shows how close the autozero has achieved. [0.00] is defi nite zero and the PCB led D1 will be flickering orange.

A 15 second timer is displayed and is reset back each time a magnet is near. Waiting till timeout is acceptable but this timeout can be speeded up by placing a magnet near to the centre position.

SPAN is the next part of the menu and gas should be applied to the sensor at this time. A 2 minute counter is displayed before the next part of span is displayed. The left magnet now increases the PPM reading and the right magnet reduces. The actual sensor value can be seen on the display to rise or fall respectively. The magnets are the equivalent of the PCB UP and DOWN push buttons.

LOW ALARM is the next menu and left and right magnets increase and decrease this value.

HIGH ALARM is next followed by OVER RANGE alarm.

The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.

APPENDIX 1
Hyperterminal Display **OHLDFI**
- **O H** and **L** represent the Over Range, High and Low alarms respectively ^^v shows the direction of alarms
- **D** indicates if a duplicate address is detected
- **F** indicates a fault
- **I** indicates alarms inhibited

Pressing **(R)** when in normal runtime display causes a sensor reset to occur. Gas type with address and serial number are then output to the PC together with alarms and calibration date, etc. This also starts 1 minute autozero, which is useful when adjusting VR2 zero potentiometer.
Pressing **(C)** on the PC will list the available commands
(V) Allows a view of the gas log taken at one minute intervals over 48 hours
(A) To set the sensor address
(G) Select gas type Select the gas type from a list
(Z) Prompts to use the zero potentiometer
(S) Prompts to use the PCB buttons
($) Initialise the sensor
(%) Clear the log of sensor readings, (this takes a minute to perform)
(U) Alarm directions, Rising or falling
(D) Enter calibration date
(R) Enter the range of the gas x 10
(F) Set 4mA level Use H and L and space
(T) Set 20mA level Use H and L and space
(O) (H) (L) set over, high and low alarm levels x 10
(M) Set the value of full range raw processor measurement value when maximum gas was applied
(E) Allows the editing of the 8 character user gas description
(X) Exit to normal display

XDI-XDIWIN – 15/30J
SEMICONDUCTOR SENSOR – AMMONIA
Technical Sheet ref C1519Bv.4 292 D7C

APPENDIX 2
The semiconductor sensor can react to gas flow and humidity. When gas is removed from the sensor, the displayed PPM gas value may rise and take some time to return to normal. Autozero is therefore delayed by 2 minutes after the reading has fallen below 5% of range.

Figure 1

Figure 2

Figure 3

This document is not contractual and the equipment specification may be modified at any time without prior notice.

XDI-XDIWIN / 30J
PID SENSOR
Technical Sheet ref C1518C v.2 292 D6C

NEW SENSORS ARE SUPPLIED READY TO CONNECT AND GO BUT NEED 15 MINUTES POWER STABILISATION.
The following procedure is for full set up using a PC but onsite calibration without PC/LCD requires only sections 18, 19, 20.
NOTE: If a new cell is fitted then full calibration is required. PID lamp has an approximate lifetime of 12 months. Replacement bulb and extractor tool can be purchased using part numbers 010-644 and 010-647 respectively.

PC SETUP
The auto zero adjust is continuous during power up inhibit period and PCB fault LED flashes to indicate this, do not apply any gas at this time because zero adjust will try to offset the measurement. Thereafter zero is adjusted every 60 seconds. D1 flickers orange at the zero point. This function can be toggled on/off by using command 'Y' in hyperterminal. 'Auto zero' is only active if gas reading is below 5% of full scale.

1. Insert jumpers J20 and J6 position SO for 4-20mA source output
2. Turn sensor voltage potentiometer RV4 fully anticlockwise (minimum voltage)
3. Connect sensor to J2 terminal (W) white (P) pink (Y) yellow
4. Connect 24v + and 0V to J10, insert test link at J9 to bypass 4-20mA terminal
5. Set the sensor voltage to 5.0V measured across SV and 0V, adjust by slowly turning RV4 clockwise. **DO NOT EXCEED THE REQUIRED VOLTAGE OTHERWISE PERMANENT DAMAGE WILL OCCUR**
6. Insert jumper G2 for a nominal gain value (G1 is lowest gain, G5 is highest or a combination G1 to G5)
7. Connect a PC RS232 port using a micro USB lead or for earlier models a sensor programming module and a USB to RS232 converter (part no. 160510 and (part no. 160520) use hyperterminal set to 4800/1stop/8bit and initialise the sensor using (C) calibration mode, then shift + ($) command from the keyboard. The default gas is Isobutylene 200ppm.
8. The typical hyperterminal display is (also see appendix 1)
   60 C4H8 200ppm
   O H L D F I
   ^ ^ ^
   - - - - - - PPM=0 A=010 R=010 Adj=500 Pinh=0 adj=4 CG=100 CGADC = 222

   PPM is the gas value
   A is the processor raw measurement
   R is the zero point of the sensor (10 +/-2)
   Adj is the adjustment value to autozero 0 to 1000 but 500 is ideal.
   Pinh is the number of seconds left of powerup inhibit (autozero is active during this time)
   adj is the number of seconds until a 1 second autozero will occur.
   CG is the calibration gas value PPM.
   CGADC is the number A must reach to display the value CG as the correct PPM gas reading

9. Sensor Zero is true when D1 flashes orange and potentiometer VR2 is adjusted to ensure Adj (screen text) is between 400 and 600. Turning VR2 clockwise will increase Adj. Note: pressing (R) or J28 short will reset sensor and give 1 min adj time (when in clean air).
10. Press F to adjust the 4mA output by measuring the mV across TP8 and TP9. Press H or L to adjust then press SPACE to set and exit.
11. Press T to adjust the 20mA output by measuring the mV across TP8 and TP9. Press H or L to adjust and then press SPACE to set and exit.
12. Before using span gas, ensure that an autozero is not about to take place. This is indicated by the MPU LED flashing at 1 Hz. The MPU LED on the PCB will flash normally at 1 Hz but when there is less than 30 seconds to an autozero flash rate will increase to 2Hz i.e faster flash.
13. Apply a test gas to the sensor (typical - 100ppm Isobutylene) for 1 minute at a flow rate of 1 litre/min. Use the UP and DOWN buttons on the PCB to give correct 4-20mA level. (ie. 5.6mA for 100ppm). Remove gas and wait 5 minutes. If a maximum range gas is available, apply for 1 minute and note the value of A. This can then be entered via Hyperterminal using the M command giving better accuracy across the range. Remove gas and wait 2 minutes.
14. Connect the sensor to a Combi alarm panel and ensure that it reports in correctly. **NOTE:** Fit the end of line (EOL) link J1 if the sensor is to be installed at the end of the sensor cable.
15. If a display board is fitted via connector J5 and U12 adjust VR1 for LCD contrast.
16. Remove J9 test link for normal operation.
17. Ensure J29 address link is removed (this is only used when changing address from a panel)

MANUAL CALIBRATION (WITHOUT PC OR LCD)
18. Zero - with no gas applied, measure between Ag and Sig (Y) and adjust VR2 to give 50mv. With J9 test link inserted, check the 4-20mA output to be 4mA as measured at TP8 to TP9 = 4mV
19. Span - apply test gas (typical 50% of range) and use UP and DOWN buttons on the PCB to give correct 4-20mA output. (50% gas = 12mA).
20. Remove gas and ensure the output returns to the 4mA level and then remove the J9 test link

SETUP USING MAGNETS - LCD
WIN versions of the sensor have an LCD display which shows the Gas and range together with the sensor address and a display of the number of seconds until an autozero will occur.
Also incorporated are 3 reed switches which can be activated using external magnets through the glass window of the flameproof XDIwin enclosure. These magnets do not act instantly and have to be in close proximity to L, M and R on the front display for a few

seconds to activate a software setup function.

The right magnet allows the CAN address of the sensor to be changed. When the address menu is displayed with a prompt to remove the magnet, and then the display shows the address and that the right magnet will decreases it whilst the left magnet will increase it. This is then stored in internal non-volatile memory and the display will automatically revert to normal operation.

The centre magnet is used to inhibit the sensor. As with the left and right magnet functions the display requests that you remove the magnet and then the state of inhibit appears on the LCD. The left magnet then puts the sensor into inhibit whilst the right magnet removes it. The amber LED on the front panel under the LCD flashes when the sensor is inhibited. When all magnets are removed, the display will revert to normal operation. The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.

The left and right magnets together allow the calibration menu to be used. Removing both magnets as instructed on the LCD presents the first part of this multi menu which is ZERO. With no gas present the display shows the PPM value but also typically [0.02] This number between the square brackets shows how close the autozero has achieved. [0.00] is definite zero and the PCB led D1 will be flickering orange.

A 15 second timer is displayed and is reset back each time a magnet is near. Waiting till timeout is acceptable but this timeout can be speeded up by placing a magnet near to the centre position.

SPAN is the next part of the menu and gas should be applied to the sensor at this time (recommended - 100ppm Isobutylene - see WatchGas application notes C645). A 2 minute counter is displayed before the next part of menu is activated. The left magnet now increases the PPM reading and the right magnet reduces.

The actual sensor value can be seen on the display rising or falling respectively. The magnets are the equivalent of the PCB UP and DOWN push buttons.

LOW ALARM is the next menu and left and right magnets increase and decrease this value.

HIGH ALARM is next followed by OVER RANGE alarm.

The direction of the alarms is displayed as ^ for rising and v for falling but these can be changed using left and right magnets together.

APPENDIX 1
Hyperterminal Display **OHLDFI**
- **O H** and **L** represent the Over Range, High and Low alarms respectively ^^v shows the direction of alarms
- **D** indicates if a duplicate address is detected
- **F** indicates a fault
- **I** indicates alarms inhibited

Pressing **(R)** when in normal runtime display causes a sensor reset to occur. Gas type with address and serial number are then output to the PC together with alarms and calibration date, etc. This also starts 1 minute autozero, which is useful when adjusting VR2 zero potentiometer.
Pressing **(C)** on the PC will list the available commands
(V) Allows a view of the gas log taken at one minute intervals over 48 hours
(A) To set the sensor address
(G) Select gas type Select the gas type from a list
(Z) Prompts to use the zero potentiometer
(S) Prompts to use the PCB buttons
($) Initialise the sensor
(%) Clear the log of sensor readings, (this takes a minute to perform)
(U) Alarm directions, Rising or falling
(D) Enter calibration date
(R) Enter the range of the gas x 10
(F) Set 4mA level Use H and L and space
(T) Set 20mA level Use H and L and space
(O) (H) (L) set over, high and low alarm levels x 10
(M) Set the value of full range raw processor measurement value when maximum gas was applied
(E) Allows the editing of the 8 character user gas description
(X) Exit to normal display

WATCHGAS COMBI 16/64/80

APPENDIX 2

The PID sensor can react to gas flow and humidity. When gas is removed from the sensor, the displayed PPM gas value may rise and take some time to return to normal. Autozero is therefore delayed by 2 minutes after the reading has fallen below 5% of range.
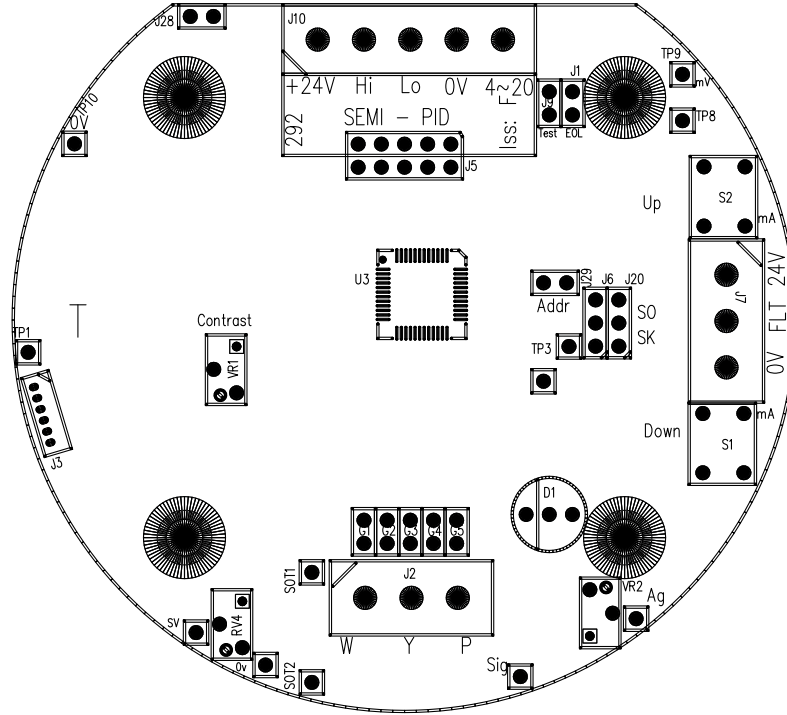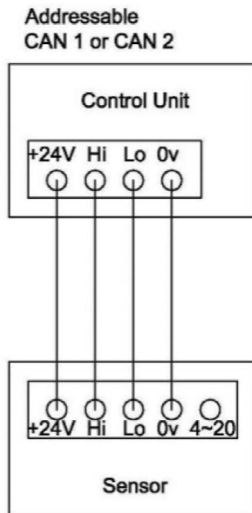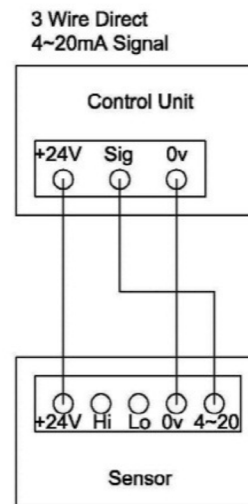
Figure 1

Figure 2

Figure 3

MAINTENANCE, CLEANING AND CALIBRATION OF PIDS

The cell manufacturer's application note explains when and how to maintain, clean and calibrate your PID. The electronics in the PID-A1 and PID-AH sensor, designed to be maintenance-free, are not accessible. Periodic sensor maintenance is required for the electrode stack and lamp.

HOW OFTEN DOES THE PID REQUIRE MAINTENANCE?
This depends on the environment you are measuring: if you are measuring indoor air quality with the PID-AH, where the VOC concentrations are low and there are few particulates, a monthly or even less frequent calibration may be adequate. However, if you are measuring high VOC concentrations with the PID-A1 and particulates are present in high concentrations, check calibration frequently and when the PID has lost sensitivity, change the stack as explained below.
You can tell when the PID needs maintenance:
• If the baseline is climbing after you zero the PID – replace electrode stack
• If the PID becomes sensitive to humidity – replace electrode stack
• If the baseline is unstable or shifts when you move the PID – replace electrode stack
• If sensitivity has dropped too much (note the change required when checking calibration) – clean the lamp

WHEN DO I CLEAN THE PID LAMP?
Cleaning of the PID lamp is recommended as the first action when presented with a PID that needs maintenance. Use the procedure described below. It is recommended that a PID cell is recalibrated after lamp cleaning.

WHEN DO I REPLACE THE PID ELECTRODE STACK?
The PID electrode stack can last the lifetime of the PID if used in clean environments, or may only last a month if used in heavily contaminated sites. The electrode stack is a disposable item, so always hold a spare electrode stack if you are working in a dirty environment. If the PID cell shows signs of contamination after the lamp window has been cleaned, or is known to have been subjected to severe contamination, it should be replaced.
It is recommended that the PID is recalibrated after the stack is replaced. Instructions for replacing the electrode stack are below.

WHEN DO I REPLACE THE PID LAMP?
A PID lamp will last a long time – typically ten thousand hours and is warranted for 12 months. The sensitivity of the PID is in direct proportion to the lamp light intensity, so as a lamp ages and loses intensity, the response to a particular, low gas concentration becomes more noisy.

REMOVING THE ELECTRODE STACK AND LAMP

⚠️ Always use the Electrode Stack Removal Tool to remove the electrode stack; any other tools may damage your PID and invalidate your warranty

1. Gently remove the sensor from equipment.
2. Place the PID, pellet side down, onto a clean surface.
3. Locate electrode stack removal tool into the two slots on the sides of the PID and squeeze together until electrode stack and lamp are released.
4. Carefully lift the PID body away from the pellet and lamp.
5. Occasionally the lamp may be temporarily lodged in the cell and will need to be freed carefully with tweezers.
6. Occasionally the small spring behind the lamp will come out when the lamp is removed from the sensor. Simply replace it into the sensor house.

CLEANING THE PID LAMP

Inspection of the lamp may reveal a layer of contamination on the detection window that presents itself as a 'blue hue.' To check for contamination, hold the lamp in front of a light source and look across the window surface. Only clean the lamp using our recommended lamp cleaning kit and detailed instructions. To avoid contaminating the sensor and affecting accuracy, do not touch the lamp window with bare fingers. You may touch the body of the lamp with clean fingers.

PID LAMP CLEANING KIT

The vial of cleaning compound contains alumina
(CAS Number 1344-28-1) as a very fine powder.
A full material safety data sheet MSDS is available on request.
Key safety issues are identified below:
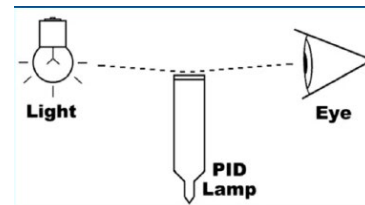
HAZARD IDENTIFICATION: May cause irritation of respiratory tract and eyes
STORAGE: Keep container closed to prevent water adsorption and contamination
HANDLING:

• Do not breathe in the powder. Avoid contact with skin, eyes and clothing
• Wear suitable protective clothing
• Follow industrial hygiene practices: Wash face and hands thoroughly with soap and water after use and before eating, drinking, smoking or applying cosmetics
• The powder carries a TVL(TWA) limit of 10 mg/m3

USE OF PID LAMP CLEANING KIT

1. Open the container of alumina polishing compound.
2. With a clean cotton bud, collect a small amount of the powder.
3. Use this cotton bud to polish the PID lamp window. Use a circular action, applying light pressure to clean the lamp window.
   Do not touch the lamp window with fingers.
4. Continue polishing until an audible "squeaking" is made by the cotton bud moving over the window surface. (usually within 15 seconds)
5. Remove the residual powder from the lamp window with a clean cotton bud. Care must be taken not to touch the tips of cotton buds that are to be used to clean the lamps as this may contaminate them with finger oil.
6. Ensure the lamp is completely dry and remove any visible signs of contamination before re-fitting.

DISCARDING THE PID ELECTRODE STACK

The electrode stack does not have any toxic components, however, if it has been contaminated by toxic materials, show due care when disposing.

RE-FITTING THE PID ELECTRODE STACK AND LAMP

⚠ **WARNING:**
Never refit a damaged lamp.

1. Place the lamp inside the O-ring seal in the pellet as illustrated. Twisting the lamp slightly during insertion will help to ensure the lamp window is snug against the electrode stack's front electrode. The lamp should be freely supported by the O-ring.
2. Continuing to hold the electrode stack between forefinger and thumb, carefully insert the lamp into recess in the sensor ensuring that the lamp remains in position. Press the electrode stack firmly, to ensure that the electrode stack wing clips are engaged, and the top faces of the electrode stack and sensor house are flush.
3. Refit the sensor into the sensing equipment.
4. Re-calibrate the gas detector in accordance with manufacturer's instructions.

COMBI 32 WAY RELAY UNIT
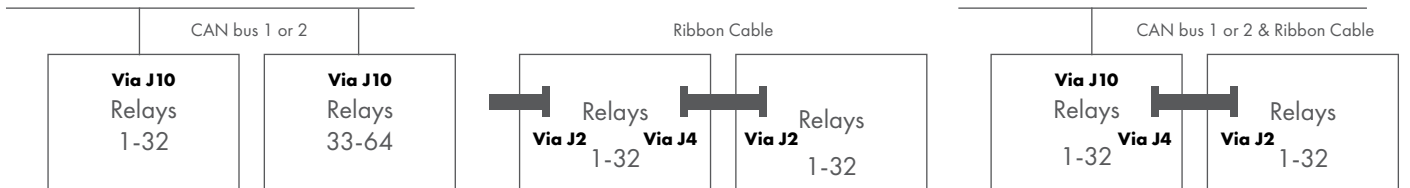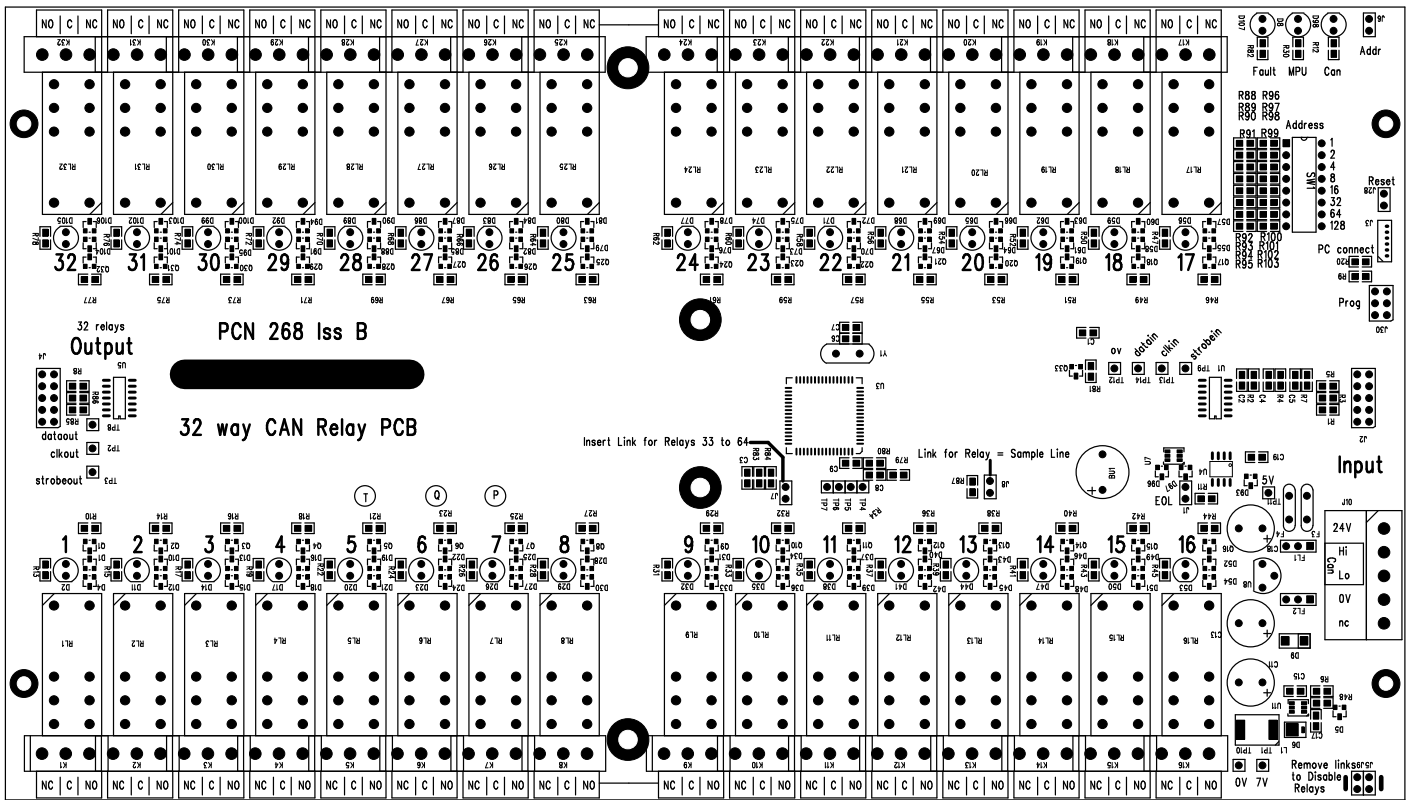Specification Sheet ref C1249B v3

The 32 way relay panel accepts relay data from the combi control unit. It must have a unique address between 128 and 255. This can be selected using the SW1 binary address switch (see example). Ensure that its address does not conflict with another CAN bus device.

The selected address will be recognised by the combi control unit automatically on power up. This can be checked in engineers menu 27 'setup network', by pressing the select button until the top line reads 'view device on net & connect to repeater', using the down arrow hold until it arrives at the address selected on SW1 address switch. A 'Z' will appear next to your address selected when both the 32 way relay and combi control unit are communicating. Any number of relay panels may be connected together or with other CAN bus devices, but only 64 relay commands can be programmed. Each relay panel can be programmed to accept commands for relays 1-32 or 33-64, this option is selected by J7 jumper (insert link for relays 33 to 64) see diagram or jumper section for more details.
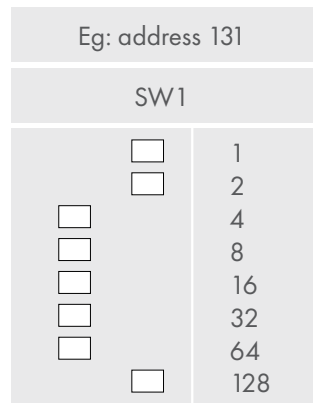
During system testing all relay actions may be disabled by removing jumpers J5 and J7, however relay indicator Led's 1 to 32 remain functional and the sounder becomes operational when in this state. After testing J5 and J7 must be reinserted for normal operation.

Relays	32-SPCO @ 8A/24vDC
Enclosure	(H) 265mm x (W) 315 mm x (D) 95mm Mild steel powder coat BS 00A01 (IP52)
Cable Entry	Bottom / Rear 20mm
Connectivity	CAN addressable on CAN bus 1 or 2 (4Core) 24v, Hi, Lo, 0v Via J10 Ribbon cable (10 core) Via J2
Power Consumption	All relays normally de-energised 0.13w All relays normally energised 17w
Weight	5Kg
Operating Temperature	-10°C to +50°C
LED's	Fault (D107) – On when fault is present MPU (D8) – Flashes when processor is active CAN (D98) – Flashes when transmitting CAN data
Jumpers	Relay select (J7) – Link off relays register as 1-32 – Link on relays register as 33-64 OPT (J8) – Link on for relays to indicate active sample line when used with WatchGas 305 flow sample system EOL (J1) – Link on if 32 way relay board is at the end of the system field cable run Reset (J28) – Short pins to reset processor Addr (J6) - Unused
Ribbon Cable	Input (J2) and output (J4) connectors can be used in conjunction with or as an alternative to CAN bus
Switches	Address (SW1) – Binary switch

Order Code: 007-613

32 way CAN Relay PCB

PCN 268 Iss B

32 relays
Output

dataout
clkout
strobeout

Input

Insert Link for Relays 33 to 64

Link for Relay = Sample Line

Remove links to Disable Relays

Fault   MPU   Can

Addr

Address

Reset

PC connect

Prog

24V   Hi   Lo   0V   nc

CAN bus 1 or 2		Ribbon Cable		CAN bus 1 or 2 & Ribbon Cable	
Via J10 Relays 1-32	**Via J10** Relays 33-64	**Via J2** / **Via J4** Relays 1-32	**Via J2** Relays 1-32	**Via J10** Relays 1-32 / **Via J4**	**Via J2** Relays 1-32

Eg: address 131

SW1

	1
	2
	4
	8
	16
	32
	64
	128

CAN RELAY UNIT
4 WAY REMOTE CAN RELAY
Technical Sheet ref C1179D v4

CANBUS ADDRESSING SWITCHES (S3)
To allow the 4 CAN relays to communicate with the Combi unit it must have a unique address between 240 and 255. This can be selected using the address switches. The selected address will be recognised by the Combi system automatically on power up. This can be checked in engineers menu 27 'Setup Network'.

RELAY OPTION SWITCHES (S2)
The CAN board must be set up to copy a group of 4 relays on one of the two 32 way external relay boards. **S2** should be used to select which group of 4 they will copy. To test relays link across **J11** (Test), remove after test.

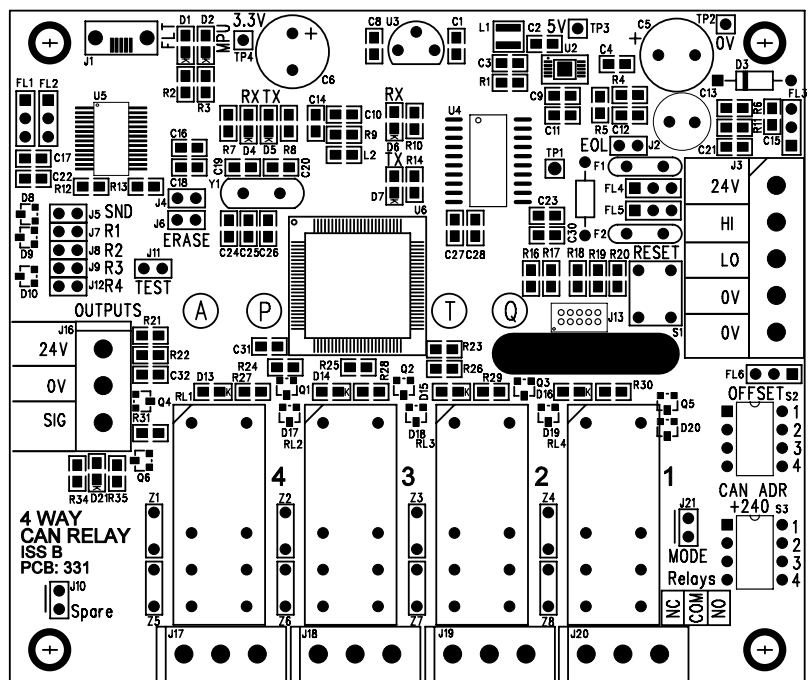## RELAYS
x4 – volt free – SPCO 3A/230vAC

OUTPUT TERMINALS
24vDC @300mA
SIG Sounder driver (mutable) global
or relay follower 1–4
EOL (end of line jumper) – select **J2**

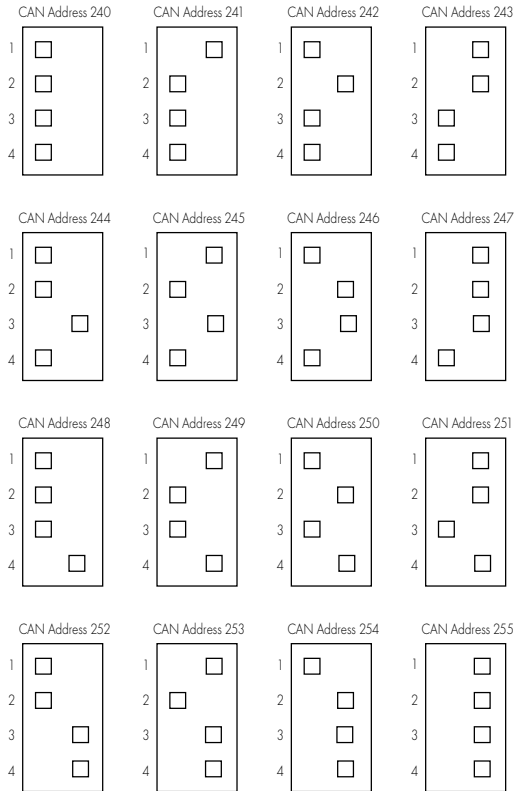## ENCLOSURE
Polycarbonate IP65 – 200 x 120 x 56mm

ORDER CODE
160–205

CAN RELAY UNIT
4 WAY REMOTE CAN RELAY
Technical Sheet ref C1179D v4

CAN ADDRESS ON S3 SWITCHES

CAN Address 240	CAN Address 241	CAN Address 242	CAN Address 243
CAN Address 244	CAN Address 245	CAN Address 246	CAN Address 247
CAN Address 248	CAN Address 249	CAN Address 250	CAN Address 251
CAN Address 252	CAN Address 253	CAN Address 254	CAN Address 255

4 RELAYS COPY EXTERNAL 32+32 RELAY PCB IN GROUPS OF 4 USING S2 SWITCHES

RELAYS 1–4	RELAYS 5–8	RELAYS 9–12	RELAYS 13–16
RELAYS 17–20	RELAYS 21–24	RELAYS 25–28	RELAYS 29–32
RELAYS 33–36	RELAYS 37–40	RELAYS 41–44	RELAYS 45–48
RELAYS 49–52	RELAYS 53–56	RELAYS 57–60	RELAYS 61–64
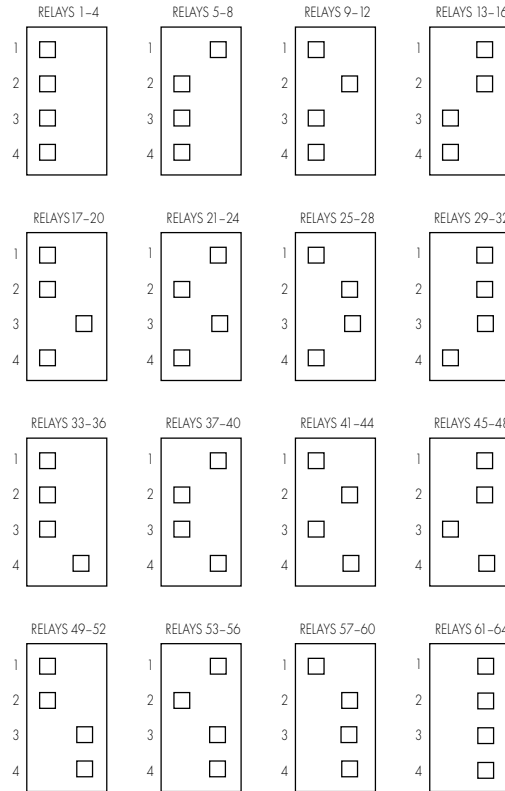
SIG OUTPUT SELECTION – J16

J5 Jumper
Sig output
with controller sounder

J7 Jumper
Sig output
with Relay 1

J8 Jumper
Sig output
with Relay 2

J9 Jumper
Sig output
with Relay 3

J12 Jumper
Sig output
with Relay 4

These can be used individually or in combination.

This document is not contractual and the equipment specification may be modified at any time without prior notice.

CAN RELAY UNIT
8 WAY REMOTE CAN RELAY
Technical Sheet ref C1625 Issue A v4

RELAYS
x8 – volt free – SPCO 3A/230vAC

INPUT TERMINALS
Alarm / Fault – short to 0v

OUTPUT TERMINALS
24vDC @300mA
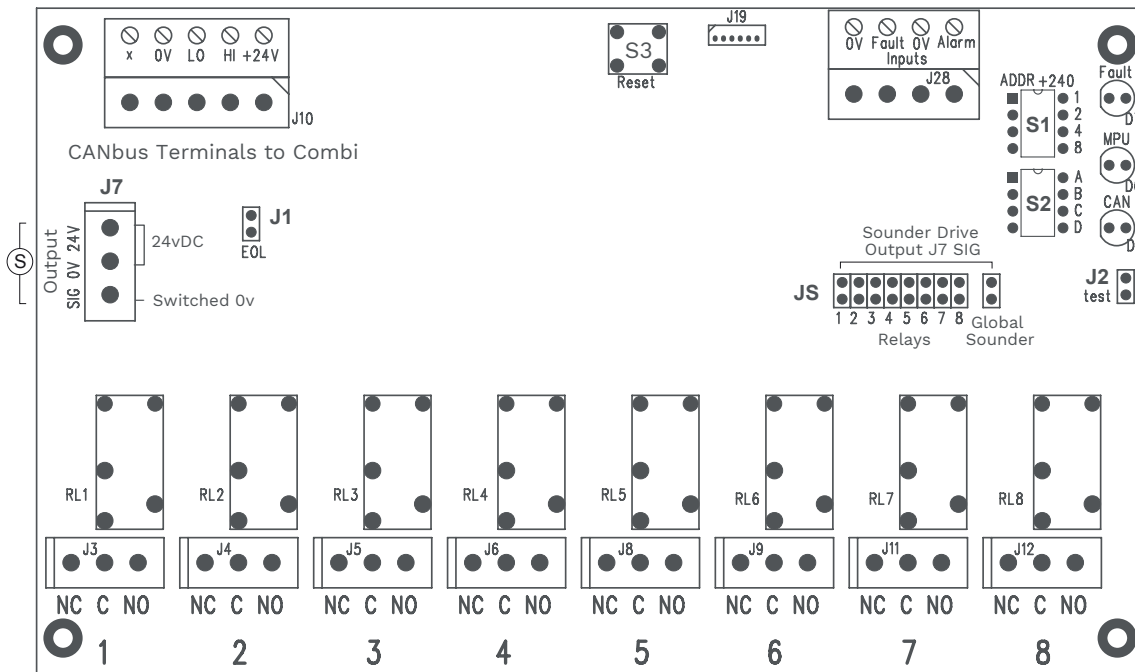SIG sounder driver (mutable) global or relay follower 1–8, see **JS** jumper selection
EOL (end of line jumper) – select **J1**

ENCLOSURE
Polycarbonate IP65 – 200 x 150 x 80mm

ORDER CODE
160–206

WATCHGAS COMBI 16/64/80

CAN RELAY UNIT
8 WAY REMOTE CAN RELAY
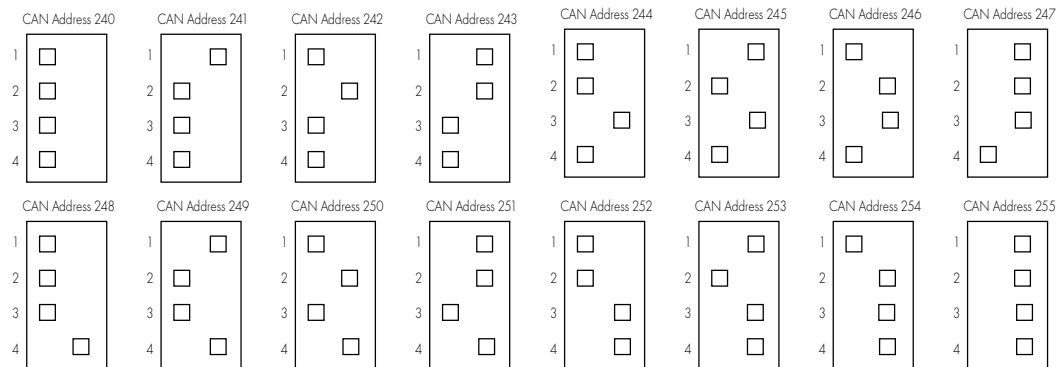Technical Sheet ref C1625 Issue A v4

CANBUS ADDRESSING SWITCHES (S1)
To allow the 8 relays to communicate with the Combi unit it must have a unique address between 240 and 255. This can be selected using the S1 address switches. The selected address will be recognised by the Combi system automatically on power up. This can be checked in engineers menu 27 'Setup Network'.
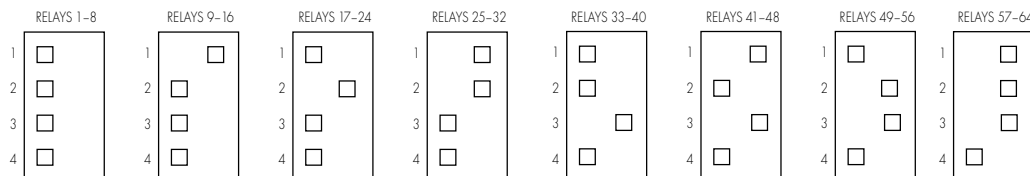
RELAY OPTION SWITCHES (S2)
The 8 CAN relays must also be set up to copy a group of 8 relays on one of two 32 way external relay board patterns. S2 switches are used to select which group of 8 relays they will copy.

CAN Address on S1 switches

CAN Address 240 | CAN Address 241 | CAN Address 242 | CAN Address 243 | CAN Address 244 | CAN Address 245 | CAN Address 246 | CAN Address 247

CAN Address 248 | CAN Address 249 | CAN Address 250 | CAN Address 251 | CAN Address 252 | CAN Address 253 | CAN Address 254 | CAN Address 255

RELAY OPTION SWITCHES
8 relays copy external 32+32 relay PCB in groups of 8 using S2 switches

RELAYS 1–8 | RELAYS 9–16 | RELAYS 17–24 | RELAYS 25–32 | RELAYS 33–40 | RELAYS 41–48 | RELAYS 49–56 | RELAYS 57–64

This document is not contractual and the equipment specification may be modified at any time without prior notice.
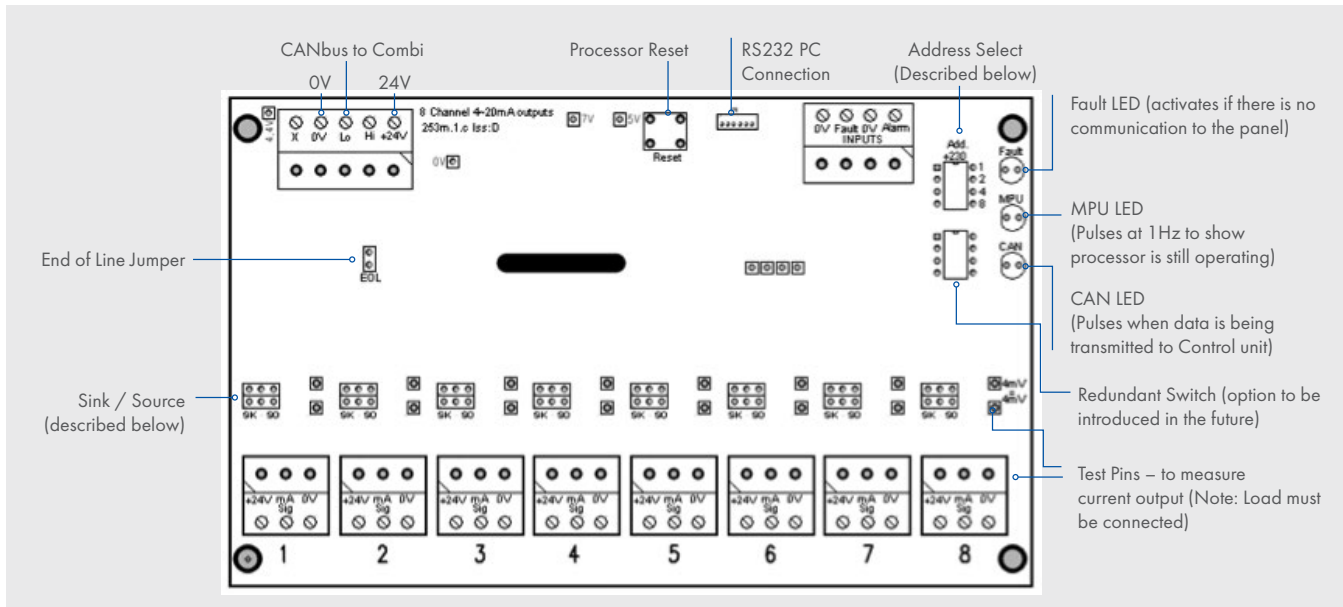
CA8
4~20mA OUTPUT MODULE
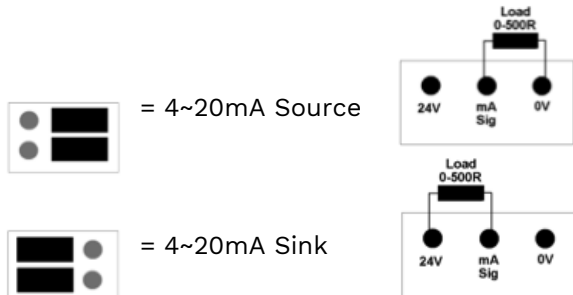Technical Sheet ref C1147E v1

The eight channel 4~20mA signal output module allows signals in either sink or source mode to be synchronised with the Combi's 64 addressable and 16 direct sensors. By address selection on "S2", the eight outputs can be selected for combinations of Combi sensors as detailed below.

The Combi detects the address being used on this card when connected to the CAN-bus. According to the address, the outputs represent the following:

- = Address: 230 = Direct sensors 1 - 8
- = Address: 231 = Direct sensors 9 - 16
- = Address: 232 = CAN sensors 1 - 8
- = Address: 233 = CAN sensors 9 - 16
- = Address: 234 = CAN sensors 17 - 24
- = Address: 235 = CAN sensors 25 - 32
- = Address: 236 = CAN sensors 33 - 40
- = Address: 237 = CAN sensors 41 - 48
- = Address: 238 = CAN sensors 49 - 56
- = Address: 239 = CAN sensors 57- 64
- = Address: 240 = Highest in group 1 - 8

Jumper configurations for Sink / Source mode:

- = 4~20mA Source
- = 4~20mA Sink

Enclosure: Polycarbonate - IP65

Dimensions: L 200mm W 120mm H 77mm

This document is not contractual and the equipment specification may be modified at any time without prior notice.

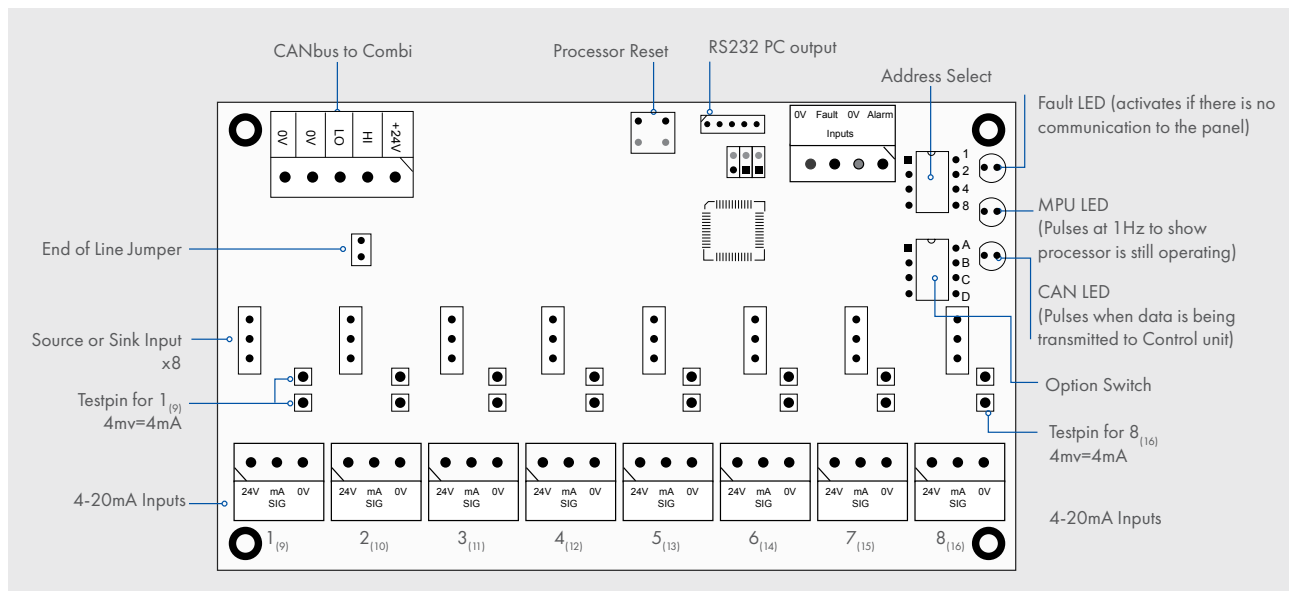## CC8
8 WAY 4~20mA SENSOR SIGNAL INPUT MODULE
Specification Sheet ref C1298Av.3

The eight channel 4~20mA signal input module allows up to 8 signals in either sink or source mode to be addressed on CANbus to the Combi as replacement direct inputs, either channels 1-8 or 9-16.

The Combi detects the address being used on this card when connected to the CANbus. This can be checked in engineers menu 27 setup network, the address should be set using the address select switch 220-230.

= Address: 220

= Address: 221

= Address: 222

= Address: 223

= Address: 224

= Address: 225

= Address: 226

= Address: 227

= Address: 228

= Address: 229

= Address: 230

Jumper configurations for Sink / Source mode:

Source current to PCB

Sink current away from PCB

Optional linearisation for known pre-defi ned curves using options switch A-D.

Hyperterminal connection via RS232 shows 8 channel 4~20mA levels as a percentage.

Full fault monitoring of all 8 sensors.

Enclosure: ABS - IP65

Dimensions: L200mm W150mm H80mm

Operating Temperature: -10˚C to 50˚C

Power Consumption: 4.5W - no sensors

C1123

Main Controller					Serial No.				
						Relay programmed or used			
Sensor No	Add	Direct I/P	Gas Type	Location		Common	CAN Relay	32 Way	Group
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
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