MCU Software Configuration and System Calibration
User Manual

List of Contents

The MCU manuals

The MCU range of environmental monitoring systems have a range of manuals covering various aspects of their operation:

- **MCU system installation and hardware configuration manual**
  This manual covers all of the hardware aspects of the MCU environmental monitoring systems. Each of the component parts of the system is discussed and hardware configuration is explained. Dimensional drawings are included of most of the MCU variations.

- **MCU software configuration and system calibration manual**
  The operation of the MCU system is discussed as well as the software configuration and calibration procedures.

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

Note:
This manual is a generic manual for the latest firmware that is currently in use. While very effort is made to maintain compatibility with older versions certain features and screen references may change when used in conjunction with different firmware versions.

The firmware version is displayed during power up and when the MENU key is pressed in later versions.

Version 4.x.x uses the Hitachi processor.

Version 5.x.x uses the Mitsubishi processor.

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

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

1   **Introduction**

The MCU range of environmental monitoring systems have been designed primarily with gas detection in mind. However, the versatility of the range extends its application to other aspects of industry where monitoring of remotely connected sensors is required. The specification allows the use of any sensor that can produce a voltage or current output within a specified range.

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

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

Care has been taken with the design of the MCU housings and internal chassis to facilitate ease of connection and wire termination. All on-site wiring to the system is via large removable screw terminal connectors.

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

1.1   **Software**

The firmware (software) within each of the control units has had to be carefully designed to allow the full potential of the system to be utilised. In many cases the software is identical between the different control units, but configuration changes have allowed the system to be used for completely different applications.

Incorrect configuration may cause the system to function unsatisfactorily and in extreme cases of poor configuration, alarms would not be raised. Analox Ltd are happy to offer advice when configuration changes become necessary to ensure a reliable and responsive system is maintained.

The MCU range consists of the following:

- **MCU3** control unit.

  The MCU3 can monitor up to eight channels.

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

The MCU3 is supplied with interchangeable gland plates located on its upper and lower face. The lower plate has seventeen hole suitable for 20mm compression glands, or ½" NPT conduit entries (other gland plate configurations are available on request), whilst the upper plate is blank.

- **MCU4** control unit

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

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

- **MCU5** control unit (flame/explosion proof unit).

This control unit is designed for siting use in areas having a potentially explosive gas environment and is available in two formats:

1. Unit incorporating external buttons allowing live calibrations and configuration changes to be made to the system. (pictured)

2. Unit that requires the front hinged panel to be opened during calibration and configuration changes. (As shown left but without the lower keypad unit.)

The MCU5 can monitor up to four channels.

Some of the features included within the MCU5 differ to the rest of the MCU range. This manual covers the MCU5 control unit but section **10** should be referred to for specific information.

- A compact version of the MCU chassis is available which allows the direct replacement of alternative suppliers' hardware. Consult Analox Ltd for further details.

- Alternative versions of the MCU system can be manufactured in accordance with customers' specific requirements. Consult Analox Ltd for further details.

- **SCM1** Single channel monitor

Analox Ltd also supply the SCM1. This is a low cost single channel monitor based on the technology of the MCU range.

The single channel monitor incorporates either an integral sensor (as shown) or a remote detector head.

The features included within the SCM1 differ to those of the MCU range. This manual should therefore not be referred to for information regarding the SCM1 control unit.

Please contact Analox Ltd for further details.

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2   Switch on.

Before connecting power to the system:
1.   Read: MCU system installation and hardware configuration manual
                    MCU software configuration and system calibration manual
2.   Ensure correct hardware configuration has been performed for each input module.
3.   Ensure the correct voltage setting has been selected at the power supply.

Switch on the power supply to the system. The firmware version and date of creation will appear for several seconds on the LCD graphical display. The display will then change to the System Default Screen, see section 3. This lists details associated with all configured channels. The systems network address will be visible in the top-right hand corner of the display.

3   Operation

Section **3** discusses the day-to-day operation of the MCU control unit and some of the features that the average user may wish to use or modify. For detailed software configuration please refer to section **6**.

Note 1:
This section assumes that all of the channels are correctly configured and are operating normally and all relays are enabled.

Note 2:
The buttons on the front of the MCU control unit are not numbered. They are numbered in this manual for identification purposes only.

During normal operation, the MCU control unit does not require user intervention to operate. It will continue to monitor and display readings for all configured channels. User intervention is only required when specific situations are encountered.

The 'ID: ' number displayed at the top right hand corner of the LCD display indicates the systems network address.

The inverted display, ie the first 9 characters on each line are taken from the channel location description. The default setting is CH1, CH2……..CH8. However the location description can be set by the user as described in section 4.1.5.

The following display shows that CH1 has been replaced by 'PUMP ROOM' text.

```
PUMP ROOM        0%LEL   FLAM              ID:      1
CH2              0PPM    H2S
CH3           20.9%VOL   O2



                                                  MENU
```

①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧
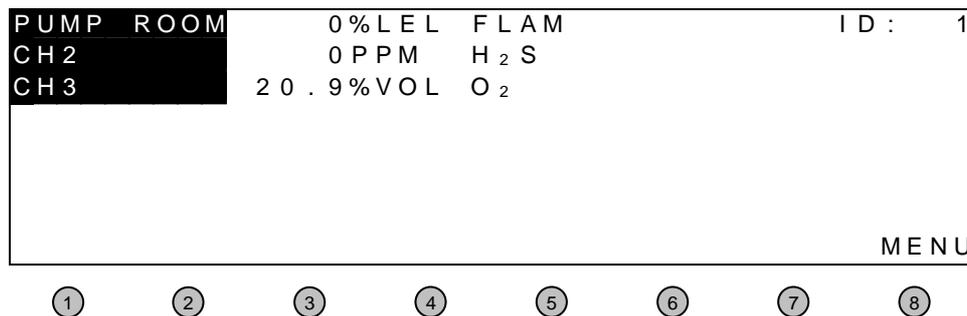
This screen shows a typical display for a MCU control unit monitoring three healthy channels. This screen will be referred to within this manual as the:
SYSTEM DEFAULT SCREEN.

3.1 Accessing the system configuration menu

All of the features provided by the MCU software are accessed from the system configuration menu.

To access the system configuration menu:
1. Press menu (from the system default screen).
2. The Password Entry screen will appear. Enter the correct password and press OK. The default password for the system is 1234 (If an incorrect password is entered the

```
SYSTEM  CONFIGURATION              07/06/2001
                                   09:32:12
CHANNEL          INHIBIT        DATA  LOGGING
ENGINEER         CLOCK          COMMON  RELAYS
DISPLAY          POWER          PASSWORD
NETWORK          TWA  TIME


PREV  NEXT                          EXIT   GO
```

①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧
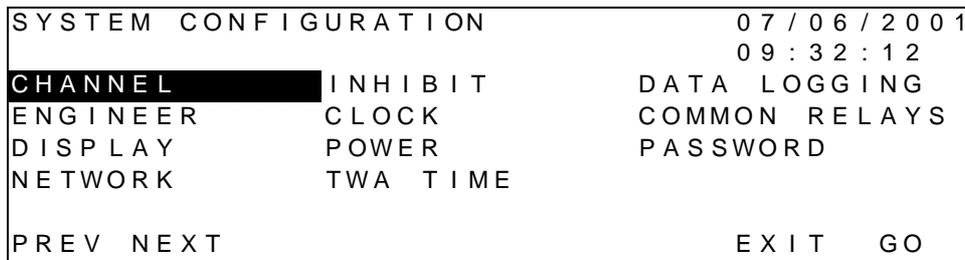
system will revert to the standard system default screen).
3. The system configuration menu will now be displayed.

4. Using the PREVious and NEXT buttons the required feature can be highlighted (indicated by inverse text). Select the highlighted option by pressing GO.
5. Pressing EXIT from this screen returns the display to the System Default Screen.

Note:
Certain menu options may not be available – depends upon firmware version programmed into processing unit.

3.2   Alarm conditions

3.2.1   Gas level alarm

Gas level alarms can be of two types
1.   Instant alarms
2.   Time weighted alarms

3.2.1.1   Instant alarm

The MCU control unit has stored within its configuration, gas levels at which alarms should be raised.

e.g.   Channel 1 may be detecting Methane (0-100% LEL).
                      Alarm levels may be set as 5%, 15% and 25% LEL.

```
CH1       6 LEL  FLAMlel    ALARM
CH2       0PPM   H2S
CH3    20.9%VOL  OXYGEN




                                   MUTE    MENU
```
      ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

Each time a gas concentration is detected in excess of those set in the alarm levels configuration, the MCU control unit will raise an alarm. The way in which the alarm is raised will depend upon the system configuration and the ancillary sounders and beacons fitted to the system.
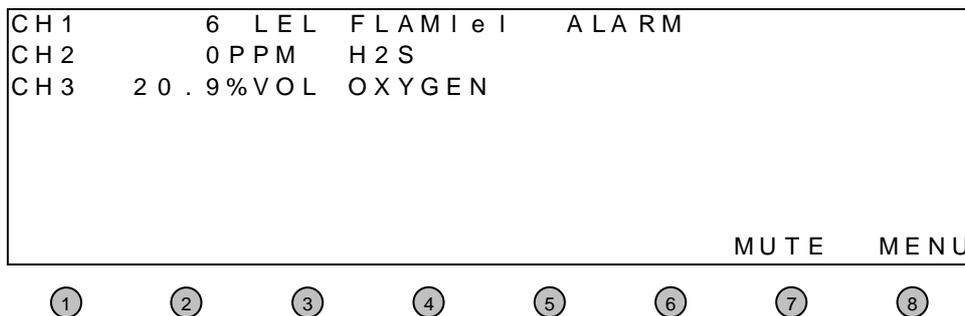
Note:
An alarm will be indicated on the display by the word ALARM appearing next to the channel in alarm when the display is in text mode, or the current gas reading will flash if bar graph mode is selected. The local Red LED will light to indicate an Alarm condition, regardless of the display mode selected.

3.2.1.2   TWA alarm

Time weighted alarms take the form of short term and long-term exposures.

The Short Time Exposure Level, STEL, is calculated by taking readings over a 15-minute time period and calculating the average exposure for that time period. This 15 minute time period is updated every minute and provides a calculation on the last 15 minutes only.

The Long Time Exposure Level, LTEL, is calculated by taking readings over a time period of up to 24 hours and calculating the average exposure for that time period as if it was 8 hours. The 8-hour LTEL is updated every minute and provides a calculation on all the readings in a 24-hour period. At the end of the 24-hour time period the readings are reset to zero ready for the next 24-hour period.

The user can set the start time at which point the LTEL calculations are made. This is carried out from the system menu, see section 3.2.1.3

The MCU control unit has stored within its configuration, gas levels at which alarms should be raised.

e.g.   Channel 2 may be detecting H2S (0-100ppm).
             Alarm levels may be set as 15ppm, 10ppm and 20ppm.

```
CH1        0  LEL  FLAMIel
CH2       16  PPM  H2S           STEL
CH3    20.9%VOL  OXYGEN




                                    MUTE     MENU
```
①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

Each time a gas concentration is detected in excess of those set in the alarm levels configuration, the MCU control unit will raise an alarm. The way in which the alarm is raised will depend upon the system configuration and the ancillary sounders and beacons fitted to the system.

Note:
An alarm will be indicated on the display by the word STEL, LTEL or INST appearing next to the channel in alarm when the display is in text mode, or the current gas reading will flash if bar graph mode is selected. The local Red LED will light to indicate an Alarm condition, regardless of the display mode selected.

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3.2.1.3   TWA start time

1.   From the system configuration menu select TWA TIME and press GO.
2.   The TWA START TIME menu will now be displayed. Use the NEXT button to select
      Hours or Minutes. Use the INC, DEC buttons to set the time at which the LTEL
      calculations will start.

```
┌─────────────────────────────────────────────────────────────┐
│ S E T   T W A   S T A R T   T I M E                           │
│                                                               │
│                                                               │
│                          T I M E                              │
│                     8 : 0 0 : 0 0                             │
│                                                               │
│                                                               │
│        N E X T                    I N C   D E C   E X I T   S E T │
└─────────────────────────────────────────────────────────────┘
```

  ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧
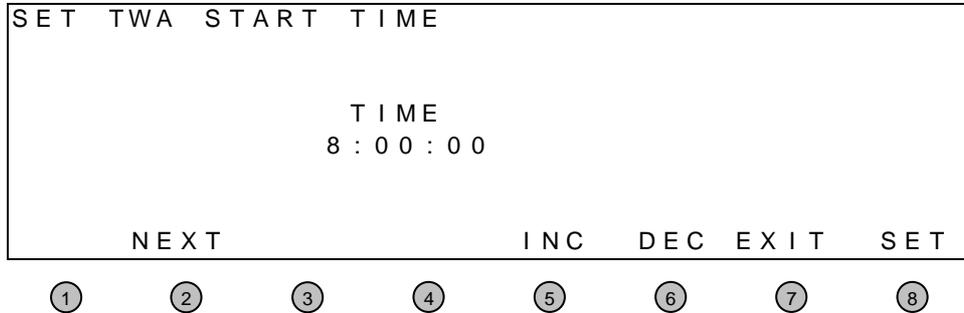
Note:
The calculated LTEL for the previous 24 hours will be discarded at this point.

Note:
This option is only available in certain firmware versions.

3.2.2   Fault alarm

The control unit will indicate a fault if a detector head draws a current of less than 2.5mA (i.e. below its minimum 4mA signal level).

Each time a fault is detected the MCU control unit will raise an alarm. The way in which the alarm is raised will depend upon the system configuration and the ancillary sounders and beacons fitted to the system.

Note:
Text mode: A fault will be indicated on the display by the word FAULT appearing next to the channel having the fault condition.

bar graph: The current gas reading will be replaced by the letters FLT.

The local yellow LED will light to indicate an alarm condition, regardless of the display mode selected.

3.2.3   Accepting the alarm

The two different types of alarm conditions are accepted in the same way. If an alarm condition is encountered and: -

The alarm relays (common relays and channel relays) are set as non-latching
MUTE will appear on the display above button 7. This will allow the sounder to be silenced.

When the alarm condition has passed, the relays will reset themselves to their healthy state.

Note:
If the mute button is not pressed, the sounder will cease when the alarm condition passes.

The alarm relays (common relays and channel relays) are set as latching
MUTE will appear on the display above button 7. This will allow the sounder to be silenced.
When pressed the word CLEAR will appear above button 7. This will allow the relays to be reset (only when alarm condition has passed).

For a more detailed explanation on the operation of channel relays and common relays refer to sections **4.1.4** and **4.4.1** respectively.

3.3 Viewing logged data

The MCU control units are provided with data logging as a standard feature. The logged data can be downloaded to a PC using an interface cable available from Analox Ltd for detailed analysis, or the data can be viewed directly on the LCD display of the control unit.

To view logged data:
1. From the system configuration menu select DATA LOGGING and press GO.
2. The data logging menu will now be displayed. Using the PREVious and NEXT buttons select VIEW GRAPH and press GO.
3. The channel selection screen will now be displayed. Using the PREVious and NEXT buttons select the appropriate channel and press GO.
4. A screen will now appear stating
   'PLEASE WAIT... PREPARING GRAPH DATA'
   The amount of time this screen will remain in view depends upon the amount of data stored within the MCU's data logging memory.
5. The Data Log viewing screen will now be displayed.

Note:

The cursor indicates at what point on the graph the readings along the top of the display are referring. The 'Alarm level 1' line allows at a glance recognition of periods where the first alarm level has been triggered.
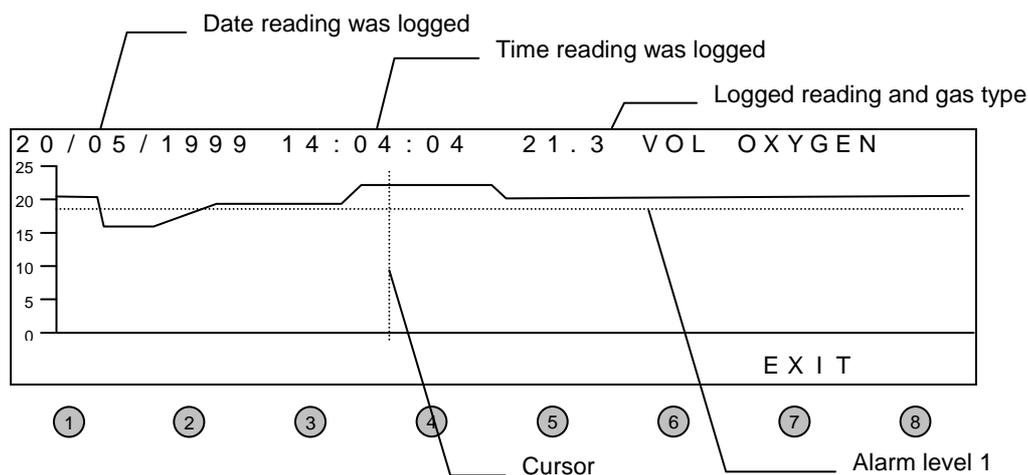
Using the < and > buttons, move the cursor along the graph. The date and time the reading was taken are displayed on the top left of the display, while the gas level reading and the gas type are displayed on the top right of the display. Alternatively the << and >> buttons can be used to advance through the graph a page at a time.

Pressing EXIT at any time will return the display to the previous screen. Repeated presses of EXIT will eventually return the system to its standard operating screen. Alternatively the system will return to its standard operating screen following a lack user intervention for a sustained period.

3.4 Display settings

The LCD display can be configured to display the gas levels in text mode or in bar graph mode (the standard is text mode). The amount of time the backlight remains lit following a key press is also user configurable.

3.4.1   Text / bar graph mode

Text mode displays the channel number, current reading, units of measure and the gas type being monitored. ALARM will flash adjacent to the gas type should the detected gas exceed any of the alarm levels set for that channel. FAULT will flash should a fault be detected.

Bar graph mode displays the readings in a vertically growing bar graph, with the current gas reading being displayed at the bottom of the screen. The reading will flash should the detected gas exceed any of the alarm levels set for that channel. FLT will appear in place of the gas level reading should a fault be detected.

To change display mode:
1. From the system configuration menu select DISPLAY and press GO.
2. The display configuration screen will now be displayed. Using the TOGGLE button the display mode can be changed between TEXT DISPLAY and BAR GRAPH DISPLAY. Make your selection and press SET.
3. The system Warning screen will now appear warning you that you are making changes to the system configuration. Press YES to save the changes or press NO to abort the changes and return to the main system menu.

3.4.2   Backlight time

The LCD display is provided with backlight illumination following a key press. The default backlight-on time is 10 seconds. This time is user configurable between ALWAYS ON, ALWAYS OFF and any time up to 600 seconds.

To change the backlight time:
1. From the system configuration menu select DISPLAY and press GO.
2. The display configuration screen will now be displayed. Use the INCrease and DECrease buttons to adjust the backlight-on time. Attempting to decrease the backlight time below 1 second will provide the options of ALWAYS ON and ALWAYS OFF. Make your selection and press SET.
3. The system Warning screen will now appear warning you that you are making changes to the system configuration. Press YES to save the changes or press NO to abort the changes and return to the main system menu.

3.5 Setting the clock

The MCU system has its own 24Hr clock. The clock is provided with an independent back-up battery so that under conditions of the normal power sources failing, the clock can still maintain the correct date and time.

The MCU can be set such that any gain or loss in time, maximum of 20 seconds per day, can be automatically corrected.

To set or adjust the clock:
1. From the system configuration menu select CLOCK and press GO.
2. The system clock set up screen will now be displayed.

```
SYSTEM  CLOCK  SET  UP


DATE              TIME              OFFSET        FORMAT
07 / 0 6 / 0 1     1 0 : 5 9 : 2 5       3          DDMMYY


       N E X T                    I N C   D E C   E X I T   S E T
```

```
  1        2        3        4        5        6        7        8
```

3. Use the LEFT and RIGHT buttons to select the parameter that needs adjusting (indicated by inverse text). Adjust the value using the INCrease and DECrease buttons.
    The standard format for displaying the date is DD/MM/YY i.e. day/month/year. However the facility has been provided to allow alternative date formats. Highlight the DDMMYY text and press the INCrease and DECrease buttons until the desired format is displayed.
    The OFFSET value is used to make daily adjustments to the clock. This adjustment, in seconds, takes place in the first minute after midnight.
4. When all changes have been made, press SET. Before the system saves any new settings the system Warning screen will appear. Press YES to save settings, or NO to abandon changes.

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3.6   Changing the password

The System Configuration menu can only be accessed following correct password entry. The default password is '1234', however this can be changed.

To change the password:
1.   From the system configuration menu select PASSWORD and press GO.
2.   The password configuration screen will now appear.
3.   Enter the new password and press OK.
      The password can contain a maximum of ten numbers (a minimum of none).
      Note: Pressing EXIT at any time will cancel the current operation.
4.   You will then be prompted to confirm the new password. Re-enter the password and press OK.
      Note: If a different password is entered at this stage, no settings will be saved and the old password will remain active.
5.   The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.
6.   The display will now return to the system configuration menu.

4   Software configuration.

The compatibility of this system with many of the sensor types available, and the wide variety of applications for which this system is suitable have required the software configuration to be as flexible as possible. Many options are included within the software to allow the system to be fine tuned to a particular application, and these options may require changing as the system develops (e.g. addition of a sensing channel, change in alarm triggering level).

Before attempting to configure the system ensure:
1.   All input modules have the correct hardware configuration.
2.   The detector heads have been correctly connected to the appropriately configured input module.

Refer to the '**MCU system installation and hardware configuration manual**'

Most of the features available within the MCU system are configurable in software via the front panel display and keypad. Pressing the 'MENU' button (as indicated by the display) provides access to these features following correct password entry.

This diagram shows the position of each of the menus available within the MCU software.

Access can only be gained to the various menus by correct entry of a password.

Note:
The buttons on the front of the MCU Control Unit are not numbered. They are numbered in this manual for identification purposes only.

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4.1 Channel

Each sensing channel has several configurable options available to it. These can be accessed via the CHANNEL option in the system configuration screen:
- Gas Type (e.g. oxygen, carbon monoxide etc…)
- Range of sensor (zero and full scale, and units)
- Alarm levels
- Relays 1,2 & 3 alarm set point for low, medium and high alarms
  - Each relay can be set to alarm on rising or falling gas levels
  - Each relay can be set as normally energised or de-energised
  - Each relay can be enabled or disabled
  - Each relay can be set for latching/non-latching operation.
- Retransmitted signal output calibration.

It is advisable to have available a list of all requirements for a particular channel (record the required configuration for future reference). This will enable the channel to be configured correctly first time. However all configuration parameters can be modified at a later time if required.

4.1.1 Sensor type

This option allows the user to change the type of gas each channel is monitoring (as a result of sensor change). Any change in settings using this menu option must be followed by a calibration.

From the system configuration menu, select CHANNEL and press GO.
Select the appropriate channel number and press GO (Selecting ALL gives access to multiple channel calibrations only, global configuration changes can not be made).
From the Channel Options screen select SENSOR TYPE and press GO.
A Sensor Selection screen will be displayed. Select the appropriate sensor type and press SET.

Note: Pressing exit at any time will return the display to the system configuration menu.

The Sensor Scale screen will now be displayed. This screen allows the user to choose the operating range of the sensor. The default values for the sensor will be displayed.

Important: It is vital that the ZERO and FSD values selected at the control unit are identical to that of the detector head. The ZERO value is the reading that corresponds to the head drawing a current of 4mA, whilst the FSD value is the reading that corresponds to the head drawing a current of 20mA.

Press OK once the correct sensor range has been selected.
The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.
The display will now return to the System Configuration menu.
A calibration must now be performed.

Note:
If the gas type selected is FLAM then an additional screen will now be displayed giving the user the option to choose which flammable gas the channel is detecting.
It is possible to have a detector head calibrated to methane, while actually using it to detect a different flammable gas (e.g. butane).

Select the correct options on this screen dependent upon the calibration gas used:
If the detector head is calibrated to the same flammable gas to which it is detecting, set the CROSS REF option to OFF. Select the gas type to be monitored using the UP & DOWN buttons.
If the detector head is calibrated to methane, but a different flammable gas is to be detected, set the CROSS REF option to ON. Select the gas type to be monitored using the UP & DOWN buttons.

Press OK once the correct selections have been made. The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.
The display will now return to the System Configuration menu.
Calibrate the channel at the control unit.

Button 4, has the option CLEAR displayed above its position. This provides the facility to clear the sensor location stored within the MCU. Setting of a new location requires the 'Mentor PC Software' and is discussed in the associated manual.

Note:
If the sensor type cannot be found in the above list select USER then change the sensor details, see following section 4.1.2, to match the actual type used.

4.1.2 Sensor details

This function allows the user to customize the sensor type when the sensor type is not in the pre-set list. In order to set up a sensor the following data must be supplied:

1. type — text description, NO_2, FLOW, FLAM etc
2. units — engineering units, PPM, L/M, LEL etc
3. range — sensor range, 0-20, 0-10, 0-100 etc
4. precision — number of digits after decimal point, 1=x.x, 2=x.xx etc

Note:
If any of the above parameters are changed then the channel must be fully calibrated and the data logging cleared.

4.1.2.1 Sensor type

Each sensor has a text description field of 4 characters for the TYPE of sensor. This field can be edited via the menu system as follows:

1. From the system configuration menu, select CHANNEL and press GO.
2. Select the appropriate channel number and press GO (Selecting ALL gives access to multiple channel calibrations only, global configuration changes can not be made).
3. From the channel options screen select SENSOR DETAILS and press GO.
4. The Edit SENSOR DETAILS screen will now be displayed.
5. Select TYPE and press GO.

Note:
Pressing Exit at any time will return the display to the System Configuration menu.

```
EDIT  SENSOR  TYPE  CHANNEL  1

CLO2

0123  4567  89  ,  #'°-  +./[  ]<>_  234@
ABCD  EFGH  IJKL  MNOP  QRST  UVWX  YZ*!

PREV  TEXT    0    1    2    3    EXIT  NEXT
 1     2     3     4     5     6     7     8
```

6. Using the TEXT button select the block of characters that you require, buttons 3 to 6 will mimic the selected block. Now press the desired text button to enter the required character. Note at this point the single highlighted character in the TYPE text field is advanced automatically.
7. Press the NEXT/PREV buttons to set the location of the text to be changed.
8. Press TEXT to alternate between the available characters.
9. Press EXIT once the sensor TYPE details have been entered.
10. The system warning screen will now appear. Press YES to save settings, or NO to abandon changes.
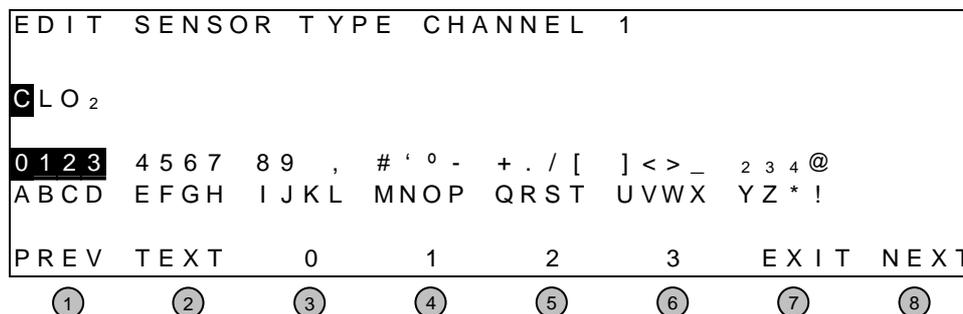
4.1.2.2   Sensor units

Each sensor has a text description field of 4 characters for the UNITS of sensor. This field can be edited via the menu system as follows:

    1   From the system configuration menu, select CHANNEL and press GO.
    2   Select the appropriate channel number and press GO (Selecting ALL gives access to multiple channel calibrations only, global configuration changes can not be made).
    3   From the channel options screen select SENSOR DETAILS and press GO.
    4   The Edit SENSOR DETAILS screen will now be displayed.
    5   Select UNITS and press GO.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

```
EDIT  SENSOR  UNITS  CHANNEL  1


P P B


0 1 2 3   4 5 6 7   8 9   ,   # ' º -   + . / [   ] < > _   2 3 4 @
A B C D   E F G H   I J K L   M N O P   Q R S T   U V W X   Y Z * !


PREV  TEXT      0        1        2        3        EXIT  NEXT
  1         2        3        4        5        6        7        8
```

    6   Using the TEXT button select the block of characters that you require, buttons 3 to 6 will mimic the selected block. Now press the desired text button to enter the required character. Note at this point the single highlighted character in the TYPE text field is advanced automatically.
    7   Press the NEXT/PREV buttons to set the location of the text to be changed.
    8   Press TEXT to alternate between the available character
    9   Press EXIT once the sensor TYPE details have been entered.
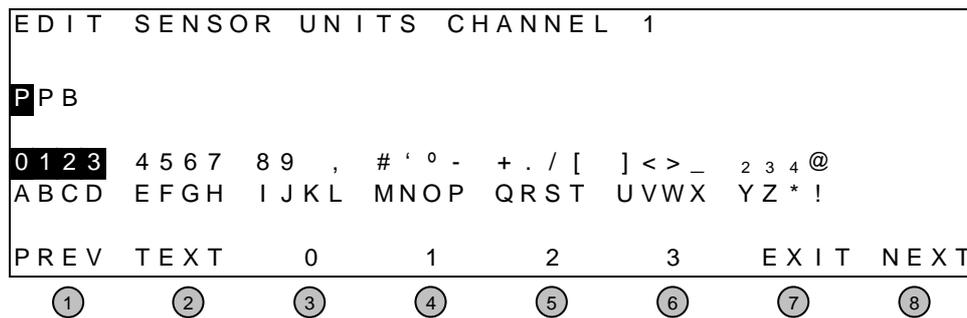   10   The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.

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4.1.2.3   Sensor range

Each sensor has a text description field of 4 characters for the UNITS of sensor. This field can be edited via the menu system as follows:

1   From the system configuration menu, select CHANNEL and press GO.
2   Select the appropriate channel number and press GO (Selecting ALL gives access to multiple channel calibrations only, global configuration changes can not be made).
3   From the channel options screen select SENSOR DETAILS and press GO.
4   The Edit SENSOR DETAILS screen will now be displayed.
5   Select RANGE and press GO.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

```
SENSOR  SCALE  OPTION



        ZERO                FSD
          0                 10

        INC   DEC         INC   DEC   OK
```
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

6   Using the INC/DEC button set the ZERO and FSD values as required.
7   Press OK once the sensor range has been entered.
8   The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.

4.1.2.4   Sensor precision

Each sensor has an operating range for the minimum reading (ZERO) and maximum reading (FSD). These fields can be edited via the menu system as follows:

1   From the system configuration menu, select CHANNEL and press GO.
2   Select the appropriate channel number and press GO (Selecting ALL gives access to multiple channel calibrations only, global configuration changes can not be made).
3   From the channel options screen select SENSOR DETAILS and press GO.
4   The Edit SENSOR DETAILS screen will now be displayed.
5   Select PRECION and press GO.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

```
EDIT  SENSOR  PRECISION  CHANNEL  1

DECIMAL  PLACES          3

DISPLAY  EXAMPLE    1.234      PPB  CLO₂


                          INC   DEC  EXIT    SET
```

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

6   Press INCrease or DECrease until the desired PRECISION is displayed.
7   Press SET once the sensor PRECISION has been entered.
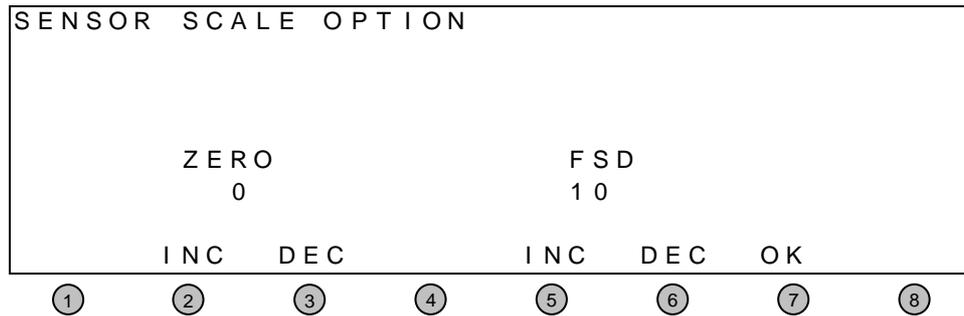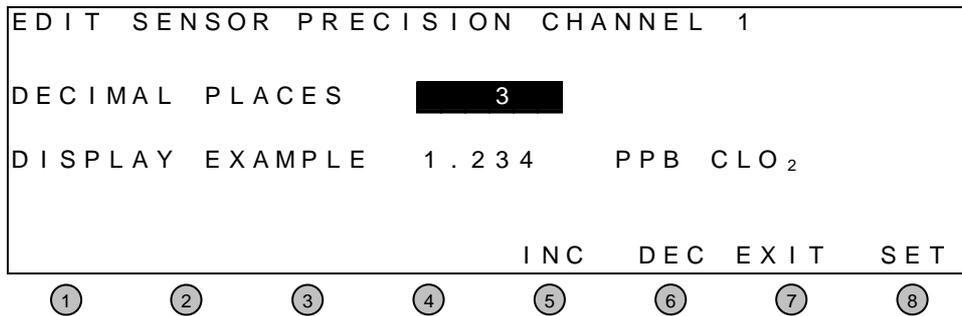8   The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.

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4.1.3   Alarm levels

Each channel (and associated input module) has three user configurable alarm levels. Each alarm level has a relay associated with it located on its input module. Each relay operates when gas levels are encountered in excess of those set using the Alarm Levels configuration screen. A 'Level 1' alarm will cause relay 1 to operate, a 'Level 2' alarm will cause relay 2 to operate etc.

4.1.3.1   Instant

1.   From the system configuration menu, select CHANNEL and press GO.
2.   Select the appropriate channel number and press GO (Selecting ALL gives access to multiple channel calibrations only, global configuration changes can not be made).
3.   From the channel options screen select ALARM LEVELS and press GO.
4.   The Alarm Levels configuration screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

```
ALARM  LEVELS  CHANNEL  1

LEVEL  1    20.0    RISING    RELAY  1  INSTANT
LEVEL  2    40.0    RISING    RELAY  2  INSTANT
LEVEL  3    60.0    RISING    RELAY  3  INSTANT


 TOG        NEXT            INC   DEC   EXIT  SET
```
①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

5.   Using the UP and DOWN buttons select the alarm level requiring adjustment.
6.   Press INCrease or DECrease until the desired alarm level is displayed. Press TOGGLE as required to set the alarm as RISING or FALLING. Repeat this for all levels.

Note:
RISING and FALLING refers to the triggering condition for the relay. A flammable head will read 0%LEL under normal conditions, and we would therefore need to be alerted if the gas levels <u>rise</u> above predetermined levels. In this instance we would set all alarms as RISING alarms. If we consider an oxygen head that would normally indicate oxygen levels of 20.9% we may need to be alerted if the oxygen levels <u>fall</u> below 19.5%, in this instance we would set the alarm as FALLING.

7.   Press SET once the alarm levels have been selected.
8.   The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.
9.   The display will now return to the System Configuration menu.

4.1.3.2   Time weighted averages

Pressing the TYPE button toggles between time-weighted average alarms and instant alarms.

```
┌─────────────────────────────────────────────────────────┐
│ A L A R M   L E V E L S   C H A N N E L   1               │
│                                                           │
│ L E V E L   1    ▐20 . 0    R I S I N G    R E L A Y  1  S T E L │
│ L E V E L   2      40 . 0    R I S I N G    R E L A Y  2  L T E L │
│ L E V E L   3      60 . 0    R I S I N G    R E L A Y  3  I N S T A N T │
│                                                           │
│                                                           │
│  T O G          N E X T   T Y P E    I N C   D E C    E X I T   S E T │
└─────────────────────────────────────────────────────────┘
   (1)      (2)      (3)     (4)     (5)     (6)     (7)      (8)
```

Note:
Falling alarms cannot be used for time-weighted average alarms (STEL, LTEL).

Note:
This option is only available in certain firmware versions.

4.1.4   Relay options

Each of the three relays located on the input modules has user configurable options available to them.

1.   From the system configuration menu, select CHANNEL and press GO.
2.   Select the appropriate channel number and press GO (Selecting ALL gives access to multiple channel calibrations only, global configuration changes can not be made).
3.   From the channel options screen select RELAY OPTIONS and press GO.
4.   The relay options configuration screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

```
C H A N N E L   1   R E L A Y   O P T I O N S

R E L A Y      M O D E       E N A B L E D   L A T C H     C O U N T
     1          N / D         Y E S          N O             1
     2          N / D         Y E S          Y E S           1
     3          N / E         Y E S          Y E S           1

      N E X T                          T O G     I N C   E X I T   S E T
```

①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

5.   Using the NEXT button select the setting requiring adjustment. Press TOGGLE to alternate between the available settings (use INCrease to alter the COUNT reading between 1 and 10).
6.   Press SET once the channel relays have been correctly configured.
7.   The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.
8.   The display will now return to the System Configuration menu.

The relay options are:

MODE (N/D or N/E)
> This refers to the state of the relay under normal (no-alarm) conditions.
> i.e.   N/D   Normally de-energised.
>   N/E   Normally energised.

ENABLED (YES or NO)
> Refers to whether the relay will change state if an alarm condition is encountered.

LATCH (YES or NO)
> Latching/non-latching refers to how the relay reacts to an alarm condition. If a relay is set as non-latching, the relay will operate when an alarm condition is encountered and the relay will return to its normal state once the condition has passed. If the relay is set as latching then the relay will not return to its normal state until the alarm condition has passed AND the alarm has been accepted at the MCU keypad.

COUNT
> Each relay has a parameter called COUNT associated with it. This parameter refers to the number of program cycles that a channel must encounter an alarm signal before the system actually registers the alarm. The maximum COUNT value is 10. A program cycle is typically 1 second.
> If COUNT = 2 a channel must indicate an alarm condition for more than 2 seconds before the system will operate alarm relays. This can eliminate spurious alarms.
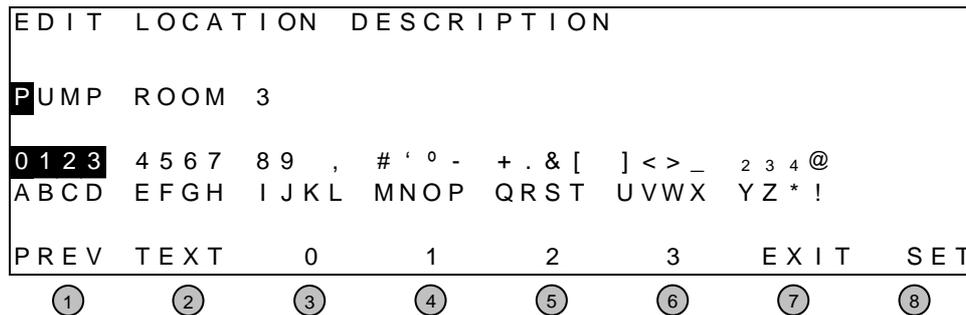
4.1.5   Channel location

Each channel has a text description field of 40 characters. This field can be edited via the menu system as follows:

11. From the system configuration menu, select CHANNEL and press GO.
12. Select the appropriate channel number and press GO (Selecting ALL gives access to multiple channel calibrations only, global configuration changes can not be made).
13. From the channel options screen select LOCATION and press GO.
14. The edit location description screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

```
E D I T   L O C A T I ON    D E S C R I P T I ON


P UMP   R OOM   3

0 1 2 3    4 5 6 7    8 9    ,     # ' º -    + . & [    ] < > _    2 3 4 @
A B C D    E F G H    I J K L    MNOP    QR S T    U VWX    Y Z * !


P R E V    T E X T        0        1        2        3        E X I T        S E T
```
    ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

15. Using the TEXT button select the block of characters that you require, buttons 3 to 6 will mimic the selected block. Now press the desired text button to enter the required character. Note at this point the single highlighted character in the location text field is advanced automatically.
16. Press TEXT to alternate between the available settings.
17. Press SET once the channel location has been entered.
18. The system warning screen will now appear. Press YES to save settings, or NO to abandon changes.

Note:
This option is only available in certain firmware versions.

The first 9 characters are displayed on the LCD module to give the user the ability to uniquely identify each channel. The above display would result in the display showing PUMP ROOM at the start of the channel display.

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4.2   Inhibit

The inhibit function allows channels to be disabled. Channels may require disabling for several reasons e.g. a fault occurring on a channel, to allow sensor replacement within the detector head, to allow detector head calibration.
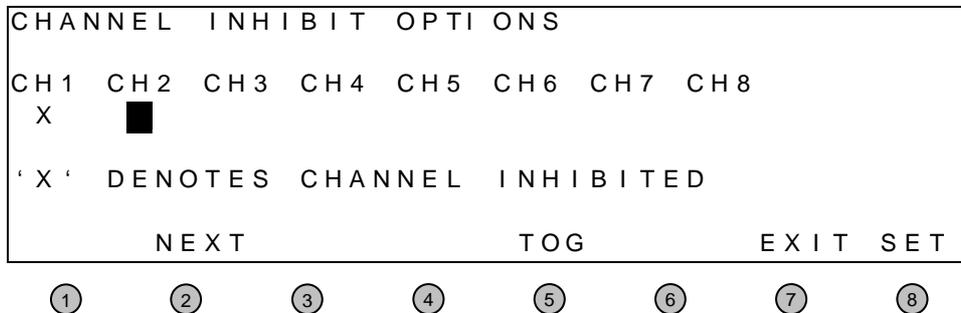
A disabled channel entering into a fault or alarm condition will result in no action being taken i.e. no relays will operate. The disabled channel will appear on the System Default screen with 'OFF' flashing next to the current reading. The current reading is still displayed to assist with fault finding. All other active channels will continue to operate normally.

The analogue output from the inhibited channel will go into fault mode.
i.e. output will equal <2mA or <0.5V depending on mode

1.   From the system configuration menu, select INHIBIT and press GO.
2.   The inhibit options screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

```
CHANNEL  INHIBIT  OPTIONS

CH1  CH2  CH3  CH4  CH5  CH6  CH7  CH8
 X   ■

'X' DENOTES CHANNEL INHIBITED

      NEXT                TOG        EXIT  SET
```

 ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

3.   Using the NEXT button select the first channel to be inhibited, press TOGGLE. An 'X' will appear below that channel indicating selection. Select any additional channels that require inhibiting.
4.   Press SET when all of the channels requiring inhibiting have been selected.
5.   The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.
6.   The display will now return to the system configuration menu.

Important:
Do not forget to enable the channel once fault rectification or sensor replacement has been performed.

4.3   Data logging

Options available via the DATA LOGGING option in the System Configuration menu are:
- View graph (discussed in section **3.3**)
- Channel configuration
- Clear
- General configuration

4.3.1   Channel configuration

This screen allows the configuration of channel-specific features.

1. From the system configuration menu, select DATA LOGGING and press GO.
2. The data logging options screen will now be displayed. Select CHANNEL CONFIG and press GO.
3. Select the appropriate channel number and press GO.
4. The data logging configuration screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

5. Press NEXT to select the parameter requiring adjustment.
6. Press INCrease and DECrease to adjust the displayed value.
7. Press SET when all adjustments have been made.
8. The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.
9. The display will now return to the data logging options menu.

The data logging configuration options are:

4.3.1.1   Decimal places
This sets the number of decimal places readings will be logged to.

Important:
Do not change the value that is set at the factory prior to delivery.

4.3.1.2   Percent & minimum
These options allow us to specify the conditions that must be met before a new entry is made into the data log.

PERCENT
        Indicates to what percentage the reading must have changed from its previous logged reading.

MINIMUM
        Indicates the minimum change in gas level that must be encountered.

Note:
Both conditions must be met for a new entry to be made.

These settings override those set in the GENERAL CONFIG screen.

4.3.2   Clear

This option allows the data log memory to be cleared.

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Important:
Once cleared the data can not be retrieved, viewed or downloaded to a PC

4.3.3   General configuration

This screen allows the configuration of system data logging features.

1. From the system configuration menu, select DATA LOGGING and press GO.
2. The data logging options screen will now be displayed. Select GENERAL CONFIG and press GO.
3. The data logging configuration screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

4. Press NEXT to select the parameter requiring adjustment.
5. Press INCrease and DECrease to adjust the displayed value.
6. Press SET when all adjustments have been made.
7. The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.
8. The display will now return to the data logging options menu.

4.3.3.1   Memory size

This sets the amount of memory available for use by the MCU micro controller.
Important:

Do not change the value that is set at the factory prior to delivery.

4.3.3.2   Frequency

The GENERAL CONFIG screen allows us to set how often a reading will be stored in the data log regardless of whether it has changed from the previous stored reading. The figure set here applies to all configured channels.

4.3.3.3   Devices fitted

This figure is set by the MCU system automatically and can not be changed. It refers to the number of memory chips installed into the system (the maximum is 4 for M16C CPU processors and 8 for H8 processors).

4.4   Common relays

Common relays – standard configuration:
Common relays 1 to 3 are designated as low, medium and high alarm relays. Common relay 1 (low level alarm) will operate if a low alarm relay on any input module operates, common relay 2 (medium level alarm) will operate if a medium level alarm relay on any module operates etc.

Common relay 4 operates if any fault is detected.

There are two sub-menus of the common relays menu:
Relay options and voting options.

4.4.1   Relay options

1. From the system configuration menu, select COMMON RELAYS and press GO.
2. From the common relays configuration screen select RELAY OPTIONS and press GO.
3. The relay options configuration screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

```
COMMON
RELAY      MODE        ENABLED   LATCH
   1       N / E        YES        YES
   2       N / E        YES        YES
   3       N / E        YES        YES
   4       N / E        YES        YES

LEFT   RIGHT  UP    DOWN    TOG          EXIT  SET
```
(1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)

4. Using the LEFT, RIGHT, UP and DOWN buttons, select the setting requiring adjustment. Press TOGGLE to alternate between the available settings.
5. Press SET once the relays have been correctly configured.
6. The system warning screen will now appear. Press YES to save settings, or NO to abandon changes.

The display will now return to the system configuration menu.

Configurable relay options are:

MODE   N/D or N/E
        Select whether each relay is normally de-energised (N/D) or normally energised (N/E) under 'no alarm' conditions.

Enabled   Yes or No
        The relay can be disabled so that it does not respond to an alarm signal.

LATCH   Yes or No
        The relay can be latching. This means that when an alarm condition is encountered the relay operates and will not reset until

        1. the alarm condition no longer exists and
        2. the ACCEPT button has been pressed.

        If the relay is set as non-latching, the relay will reset once the alarm condition no longer exists.

4.4.2   Voting options

1. From the system configuration menu, select COMMON RELAYS and press GO.
2. From the common relays configuration screen select VOTING OPTIONS and press GO.
3. The Voting Options configuration screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the system configuration menu.

```
                    V O T I N G   O P T I O N S
C O M M O N    C H 1   C H 2   C H 3   C H 4   C H 5   C H 6   C H 7   C H 8
R E L A Y      1 2 3   1 2 3   1 2 3   1 2 3   1 2 3   1 2 3   1 2 3   1 2 3
      1    &    X       X               X
      2    O R  X       X                                       X
      3    O R                  X               X       X               X

L E F T   R I G H T    U P   D O W N    T O G    &O R   E X I T    S E T
```

①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

4. Using the LEFT, RIGHT, UP and DOWN buttons, select the setting requiring adjustment. Press TOGGLE to change its setting.
5. Press SET once the voting options have been correctly configured.
6. The system warning screen will now appear. Press YES to save settings, or NO to abandon changes.

The Voting options allows us to set which channel relays will cause the common relays to operate.

Rows relate to common relays, whilst columns relate to the channel relays. An 'X' marked at the intersection between row and column indicates a triggering parameter.

Each of the common relays can be assigned an AND (&) or an OR function. This relates to the condition that must be encountered for the common relay to operate. For example the settings shown above indicate that:

Common relay 1   Relay 1 on channels 1,2 & 4 must operate simultaneously before common relay 1 will operate.

Common relay 2   Any relay 2 on channel 1, 2, OR 7 operating will result in common relay 2 also operating.

Common relay 3   Any relay 3 on channel 3, 5, 6, OR 8 operating will result in common relay 3 also operating.

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4.5   Power

This screen allows us to instruct the MCU system to ignore any readings taken following the transition between battery and mains power (between 0 and 180 seconds).

1. From the system configuration menu, select POWER and press GO.
2. The power supply interruption delay timer screen will now be displayed.
    Note: Pressing Exit at any time will return the display to the System Configuration menu.
3. Select the desired timer delay using the INCrease and DECrease buttons.
7. Press SET once adjustment has been made.
4. The system warning screen will now appear. Press YES to save settings, or NO to abandon changes.

4.6   Network

This screen allows the network address of the MCU system to be changed (between 1 and 126).

1. From the system configuration menu, select NETWORK and press GO.
2. The etwork address screen will now be displayed.
3. Press INCrease and DECrease to adjust the systems address.
4. Press SET when all adjustments have been made.
5. The system warning screen will now appear. Press YES to save settings, or NO to abandon changes.

The network address is only important when the system is networked. In these circumstances the system should be given any number that is not already allocated to another system.

5   Engineer

This menu is provided to allow Analox Ltd personnel or trained personnel to verify the correct operation of the hardware. This option is accessed via the ENGINEER option in the main menu screen. An additional password is required to enter this menu option.
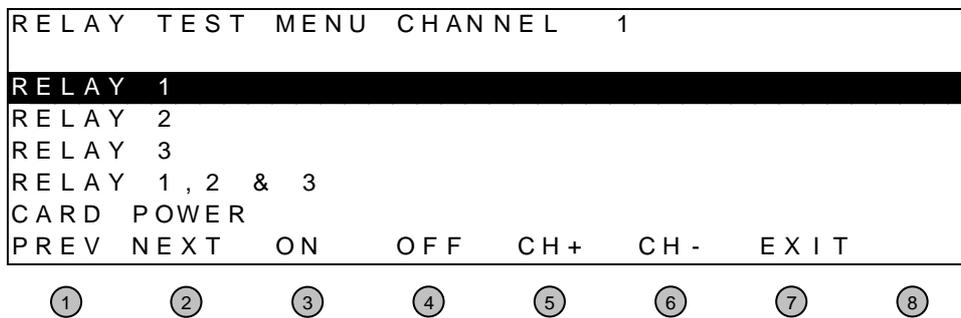
5.1.1   Card relay

This option is used to allow the user to verify that the I/O card is operating correctly.

1) From the ENGINEER menu, select card relay and press GO.
2) The relay test menu screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the ENGINEER ACCESS menu.

```
RELAY  TEST  MENU  CHANNEL   1

RELAY  1
RELAY  2
RELAY  3
RELAY  1 , 2  &  3
CARD  POWER
PREV  NEXT   ON    OFF   CH+   CH-   EXIT
```

  ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

3) Use the PREV, NEXT buttons to set the desired relay, power option.
4) Use the CH+, CH- buttons to select the channel.
5) Use the ON, OFF buttons to activate, deactivate the selected option.
6) Press EXIT when the tests have been completed.
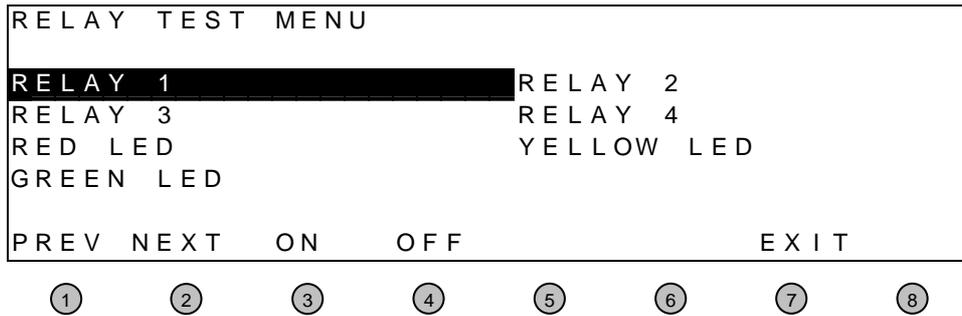7) The display will now return to the ENGINEER ACCESS menu.

5.1.2   Common relay

This option is used to allow the user to verify that the common relays and MCU LEDs are operating correctly.

1) From the ENGINEER menu, select COMMON RELAY and press GO.
2) The relay test menu screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the ENGINEER ACCESS menu.

```
RELAY  TEST  MENU

RELAY  1                    RELAY  2
RELAY  3                    RELAY  4
RED  LED                    YELLOW  LED
GREEN  LED

PREV  NEXT    ON    OFF                 EXIT
```
   ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

3) Use the PREV, NEXT buttons to set the desired relay, led.
4) Use the ON, OFF buttons to activate, deactivate the selected option.
5) Press EXIT when the tests have been completed.
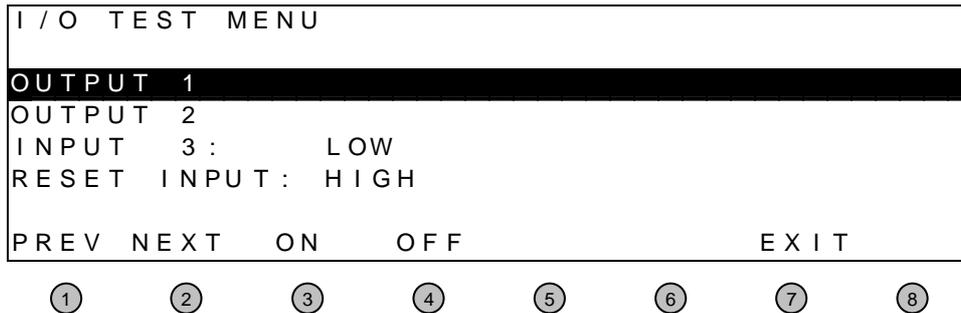6) The display will now return to the ENGINEER ACCESS menu.

5.1.3   Output common

This option is used to allow the user to verify that the outputs associated with the audible and visual indicators together with the two user inputs.

1) From the ENGINEER ACCESS menu, select OUTPUT COMMON and press GO.
2) The relay test menu screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the ENGINEER ACCESS menu.

```
I / O   T E S T   M E N U

O U T P U T   1
O U T P U T   2
I N P U T     3 :         L OW
R E S E T   I N P U T :   H I G H

P R E V   N E X T     O N       O F F                       E X I T
```
①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

3) Use the PREV, NEXT buttons to set the desired output.
4) Use the ON, OFF buttons to activate, deactivate the selected option.
5) Press EXIT when the tests have been completed.
6) The display will now return to the ENGINEER ACCESS menu.

Note:
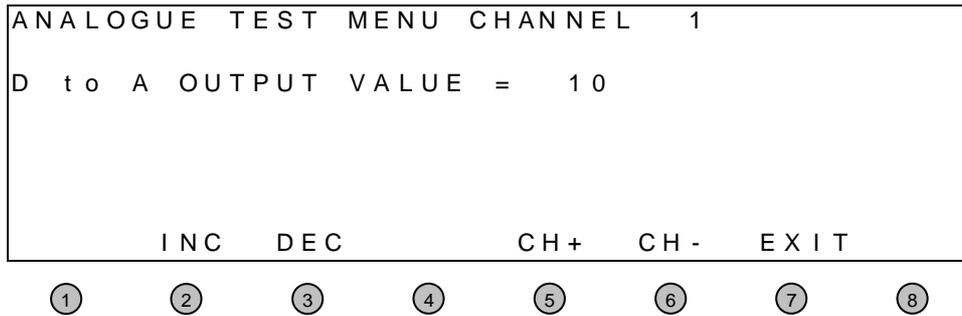The inputs will reflect the state of the input connections.

5.1.4   Analogue output

This option is used to allow the user to verify that the analogue output on the I/O card is working correctly.

1) From the ENGINEER menu, select ANALOGUE OUTPUT and press GO.
2) The relay test menu screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the ENGINEER ACCESS menu.

```
A N A L O G U E   T E S T   M E N U   C H A N N E L    1

D  t o  A   O U T P U T   V A L U E  =    1 0




          I N C     D E C           C H +    C H -    E X I T
```
　①　　　②　　　③　　　④　　　⑤　　　⑥　　　⑦　　　⑧

3) Use the CH+, CH- buttons to select the channel.
4) Use the INC, DEC buttons to increase, decrease the analogue output level.
5) Press EXIT when the tests have been completed.
6) The display will now return to the ENGINEER ACCESS menu.

5.1.5   Sounder set up

This option is used to allow the user to verify that the internal sounder is operational and if necessary adjust its sound level bay modifying its frequency of operation.

1) From the ENGINEER menu, select SOUNDER SETUP and press GO.
2) The sounder setup menu screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the ENGINEER ACCESS menu.

```
SOUNDER  Frequency = 3000  hZ




RESET          INC   DEC              EXIT    SET
```
① ② ③ ④ ⑤ ⑥ ⑦ ⑧
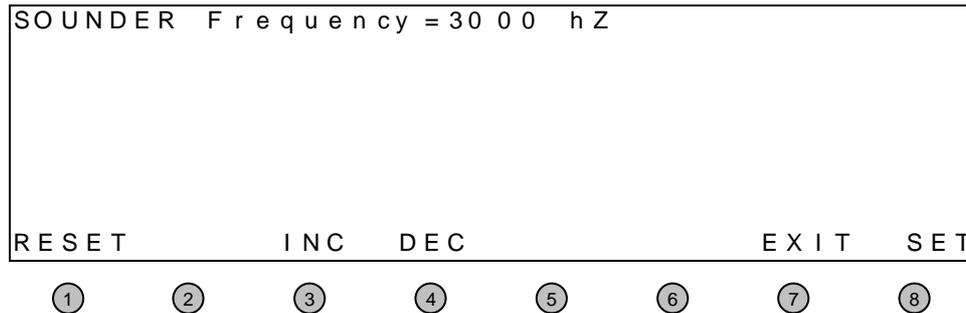
3) Use the RESET button to restore the frequency to the factory default setting.
4) Use the INC, DEC buttons to select the frequency.
5) Use the SET button to save the desired setting.
6) Press EXIT leave the setting as it was.
7) The display will now return to the ENGINEER ACCESS menu.

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5.1.6   Input simulation

This option is used to allow the user simulate a sensor output under normal operation.
Note: if the simulated sensor output rises above an alarm set point then the system will generate alarm etc as per the system configuration.

1) From the ENGINEER menu, select INPUT SIMULATION and press GO.
2) The relay test menu screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the ENGINEER ACCESS menu.

```
ANALOGUE  INPUT  SIMULATION

CH  1        0   %LEL  FLAM




              CH+   CH-   INC   DEC   EXIT  MUTE
```
① ② ③ ④ ⑤ ⑥ ⑦ ⑧
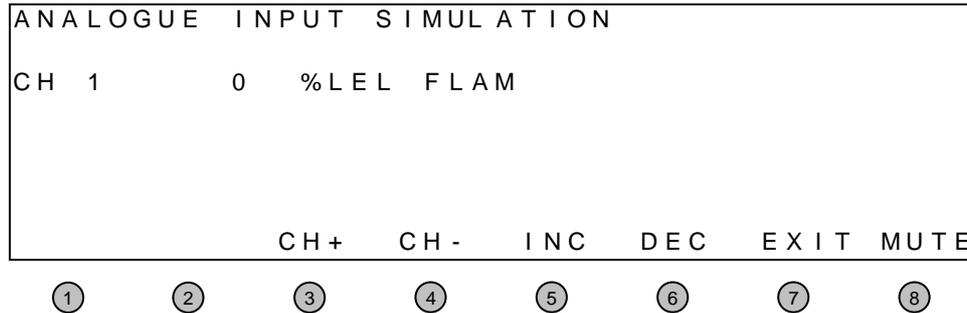
3) Use the CH+, CH- buttons to select the channel.
4) Use the INC, DEC buttons to increase, decrease the sensor level.
5) If an alarm has been generated then the MUTE button can be used to silence the audible alarm.
6) Press EXIT when the tests have been completed.
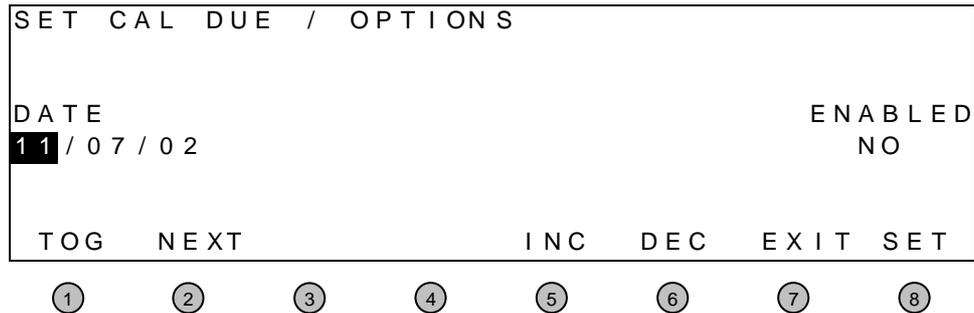7) The display will now return to the ENGINEER ACCESS menu.

5.1.7   Cal due date

This option is used to allow the user to set a calibration due date whereby the user is informed that a system calibration is now due. The feature can be enabled or disabled depending upon the user's preference.

1) From the ENGINEER menu, select CAL DUE DATE and press GO.
2) The relay test menu screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the ENGINEER ACCESS menu.

```
SET  CAL  DUE  /  OPTIONS


DATE                                           ENABLED
11 / 0 7 / 0 2                                      NO


   TOG    NEXT                    INC   DEC   EXIT  SET
```

    ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

3) Use the NEXT buttons to select the day, month, year option.
4) Use the INC, DEC buttons to change the day, month, year.
5) Use the TOG button enable, disable the cal due feature.
6) Press SET to store the current settings.
7) Pressing EXIT will result in the current settings being ignored.
8) The display will now return to the ENGINEER ACCESS menu.

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5.1.8   Reset config

This option is used to allow the user to restore all the configuration data to the factory default values:
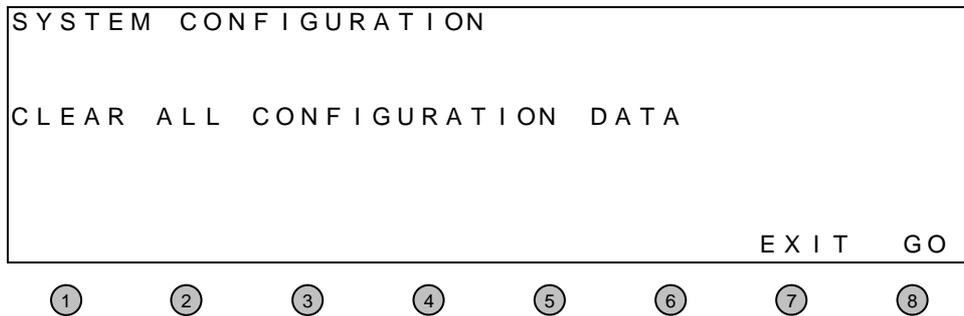
Note:
Use this feature with extreme caution, all the current configuration will be lost and every channel will have to be configured and calibrated.

1.   From the ENGINEER menu, select RESET CONFIG and press GO.
2.   The RESET CONFIGURATION menu screen will now be displayed.

Note:
Pressing Exit at any time will return the display to the ENGINEER ACCESS menu.

```
S Y S T E M   C O N F I G U R A T I ON


C L E A R   A L L   C O N F I G U R A T I ON   D A T A



                                        E X I T    G O
```
①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

3.   Press EXIT to abort the operation and leave the system intact.
4.   Press GO to clear all the data. The user is then prompted if the change is to be made or not.
5.   The system will reset if the user has elected the clear all the data after which the system will have to be configured and calibrated.

5.1.9   View data log

This option is only suitable for Analox Ltd personnel, and is used to verify the correct operation of the data logging feature

6   System reset

The system may be reset by removing power waiting for 20 to 30 seconds then re-applying power.

Note:
If the system has battery back up then the battery fuse will have to be removed then refitted.

6.1.1   Manual reset using the Hitachi processor (V4.x.x).

In order to perform a manual reset the user has to gain access to the processor PCB and press the reset button, which is available through a small hole in the protective cover.

6.1.2   Manual reset using the Mitsubishi processor (V5.x.x).

In order to perform a manual reset the user has to press a combination of keys on the front panel. Press buttons 5 & 7 together then press Button 1 at the same time.

6.2   Firmware update

From time to time it may be necessary to update the system firmware. The update method depends upon which processor PCB is used.

6.2.1   Hitachi processor (V4.x.x).

Special hardware is required and as such is usually only carried out by Analox Ltd personnel. However the processor is mounted in a holder and can be replaced by competent users.

6.2.2   Mitsubishi processor (V5.x.x).

This can only be carried out using purpose designed PC software and a suitable serial comms cable.

Perform a manual reset by pressing buttons 5 & 7 together. While buttons 5 & 7 are being pressed press button 1 at the same time. Immediately release Key button 1 and press buttons 5,6 & 7 together.
The system will now be placed in programming mode as indicated by the ed, yellow and green LED's flashing.

Attach the serial cable then run the PC programming software.

See beginning of section 3 for position of buttons.

7   Calibration

Analox Ltd service personnel are best equipped to perform the relevant tests and commissioning of the system after installation. Commissioning includes a full system calibration. Contact Analox Ltd for further details.

7.1   Initial calibration

Before continuing with the initial system calibrations ensure:
  (a)   All used channels are enabled in software.
  (b)   All used channels have the correct configuration settings (hardware and software).
  (c)   The detector heads used have been calibrated.
         (Analox Ltd calibrate all of their detector heads prior to delivery)
  (d)   The detector heads are connected to the channels with which they will be used.

There are two calibration functions that need to be performed on each channel when the system is powered for the first time.
  1.   The detector head connected to the channel needs to be placed in 'CAL X' mode. This instructs the head to sink 4mA. The MCU then has its zero point set for the associated channel.

Important:
Detector heads must only be placed into CAL X mode in a zero gas environment.

  2.   The detector head is then placed in 'CAL X' mode. This instructs the head to sink 20mA. The channel then has its full-scale point set for the associated channel.
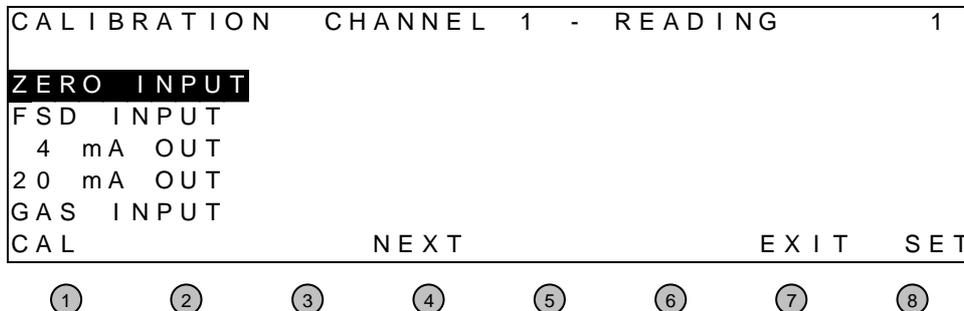
Note:
'CAL X' mode refers to the calibration modes available with Analox Ltd FGD1, 2 & 3 Detector Heads. For details of entering CAL modes on the FGD detector heads refer to the relevant operating manuals. Where alternative heads are used consult the manufacturers data for details.

In addition any input module using its analogue output feature for external equipment must have this feature calibrated also. Refer to section 7.1.4 for calibration details.

7.1.1   MCU calibration – single channel

1. From the system configuration menu, select CHANNEL and press GO.
2. Select the appropriate channel number and press GO (Selecting ALL gives access to multiple channel calibrations.
3. From the channel options screen select CALIBRATION and press GO.
4. A channel calibration screen will now be displayed.

```
CALIBRATION    CHANNEL  1  -  READING          1

ZERO  INPUT
FSD  INPUT
  4  mA  OUT
20  mA  OUT
GAS  INPUT
CAL                   NEXT                    EXIT    SET
```

①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

5. Refer to the appropriate gas detector operating Instructions, and select the "4-20mA ZERO" mode on the gas detector. The head will now sink a current of 4mA simulating a zero gas environment.
6. Using the NEXT button at the Control Unit, select ZERO INPUT and press CAL. The reading should now read 0.
7. Exit the ZERO mode at the detector head.
8. Refer again to the appropriate gas detector operating Instructions, and select the "4-20mA SPAN" mode on the gas detector. This instructs the head to sink a current of 20mA simulating a full-scale gas environment.
9. Using the NEXT button at the Control Unit select FSD INPUT and press CAL. The reading should now read 100 (assuming 100 is the FSD value).
10. Return the gas detector to its normal operating mode.
11. Press SET at the control unit to save the calibration data.
12. The system warning screen will now appear. Press YES to save settings, or NO to abandon changes.

This procedure should be repeated for all of the active channels in the system.

7.1.2   MCU calibration – multiple channel.

1. From the system configuration menu, select CHANNEL and press GO.
2. Select ALL and press GO.
3. A menu screen will then appear (only one option currently available) press SET.
4. The multiple channel calibrations screen will now be displayed.

```
MULITIPLE  CALIBRATION  OPTIONS

CH1  CH2  CH3  CH4  CH5  CH6  CH7  CH8
 X


'X'  DENOTES  CHANNEL  SELECTED

LEFT  RIGHT  ZERO  CAL    TOG        EXIT    SET
```
   ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

5. Using the LEFT and RIGHT buttons select the first channel to be calibrated, press TOG. An 'X' will appear below that channel indicating selection. Select all other channels to be calibrated at this time.
6. Refer to the appropriate gas detector's operating instructions, and select the "4-20mA ZERO" mode on each gas detector head associated with the selected channels. Each head will now sink a current of 4mA simulating a zero gas environment.
7. Press the ZERO button at the control Unit.
8. Exit the "4-20mA ZERO" mode at each detector head.
9. Refer to the appropriate gas detector's operating instructions, and select the "4-20mASPAN " mode on each gas detector head associated with the selected channels This instructs the head to sink a current of 20mA simulating a full-scale gas environment.
10. Press the CAL button at the control unit.
11. Press SET at the control unit to save the calibration data.
12. The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.
13. Exit the "4-20mASPAN " mode at each detector head.
14. Calibration of all of the selected channels is now complete.

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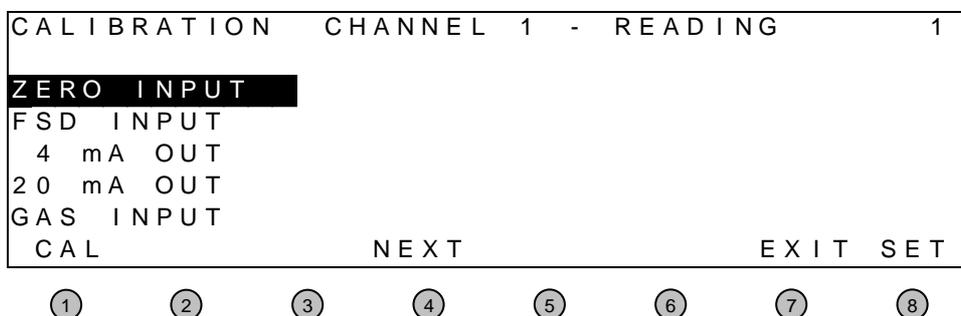7.1.3   Calibration of 'pellistor only' flammable heads.

It is possible to have a 'pellistor only' head calibrated to methane, while actually using it to detect a different flammable gas (e.g. butane).

Important:
Note the configuration of the channel to which the 'Pellistor Only' head is connected (refer to section 4.1.1).

- **If CROSS REF is set to OFF - calibrate the head to the same gas to which it is configured to detect.**
- **If CROSS REF is set to ON - calibrate the head to methane.**

1.   From the system configuration menu, select CHANNEL and press GO.
2.   Select the appropriate channel and press GO.
3.   From the channel options screen select CALIBRATION and press GO.
4.   The channel calibration screen will now be displayed:

```
CALIBRATION    CHANNEL  1  -  READING        1

ZERO  INPUT
FSD  INPUT
 4  mA  OUT
20  mA  OUT
GAS  INPUT
 CAL              NEXT              EXIT  SET
```
    ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

5.   Using the NEXT button at the Control Unit, select ZERO INPUT.
6.   Ensure the head is in a zero gas environment and press CAL. The display will now read 0.

Two options now exist:
Option 1 – FSD input.

- Select FSD INPUT using the NEXT button.
- Expose the sensor to its full-scale concentration of gas.
  Its full-scale concentration of gas must correspond to the full-scale set in the configuration for that channel (refer to section **4.1.1**).
- Allow the sensor adequate time to respond.
- When the reading has risen and stabilised (i.e. it no longer increases or decreases) press CAL. The display will now read the sensor FSD.
- Press SET at the control unit to save the calibration data.
- The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.

Option 2 – GAS input (Not possible using multiple channel calibration).

- Select GAS INPUT using the NEXT button. INCrease and DECrease will appear above buttons 5 & 6.
- Expose the sensor to a known concentration of gas (greater than 20% of the sensor FSD is recommended).
- Allow the sensor adequate time to respond.
- When the reading has risen and stabilised (i.e. it no longer increases or decreases) adjust the reading using the INCrease and DECrease buttons so that the displayed reading is correct for the gas concentration applied.

7. Press SET at the control unit to save the calibration data.
8. The system Warning screen will now appear. Press YES to save settings, or NO to abandon changes.

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7.1.4   Analogue output calibration.

Use the appropriate calibration method depending upon the analogue output configuration (refer to 'MCU System Installation and Hardware Configuration manual').
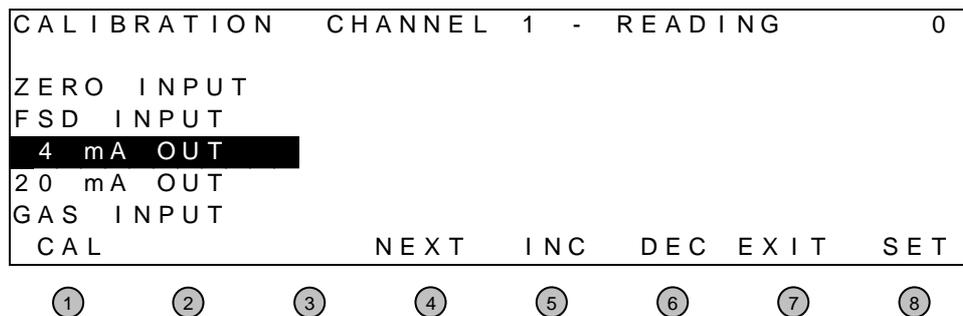
Method 1 (4-20mA output)

Connect an ammeter between pins 19 (-) and 20 (+) on the input/output module associated with the channel to be calibrated.

Method 2 (1-5V output)

Connect a voltmeter between pins 19 (-) and 20 (+) on the input/output module associated with the channel to be calibrated.

1.   From the system configuration Menu select CHANNEL and press GO.
2.   Select the channel to be calibrated and press GO.
3.   Select the CALIBRATION option and press GO. Highlight the '4 mA OUT' text on the screen using the NEXT button.
4.   The channel calibration screen will now be displayed:

```
C A L I B R A T I O N   C H A N N E L   1   -   R E A D I N G        0

Z E R O   I N P U T
F S D   I N P U T
 4   m A   O U T
2 0   m A   O U T
G A S   I N P U T
 C A L               N E X T   I N C   D E C   E X I T   S E T
```

①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

5.   Take a reading from the ammeter / voltmeter. Using the INCrease and DECrease buttons adjust the analogue output until 4mA can be measured ±0.1mA or until 1.0V can be measured ±0.03V.
6.   Highlight the '20 mA OUT' text on the screen using the NEXT button.
7.   Take a reading from the ammeter. Using the INCrease and DECrease buttons adjust the analogue output until 20mA can be measured ±0.1mA or until 5.0V can be measured ±0.03V.
8.   Press SET to store the calibration data.
9.   The system warning screen will now appear. Press YES to save settings, or NO to abandon changes.

8   Trouble shooting

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

8.1   Common faults

<u>Fault</u>
The detector head display is blank.

- Ensure the MCU has power connected.
- Ensure the current loop connections are correct at the detector head and at the MCU.
- Ensure all connectors within the detector head are attached.
- Ensure a voltage is present at the loop current connections at the detector head terminal block.
  Unless the detector head is mounted a significant distance from the MCU this voltage

  should be approaching 24V (7V minimum).

- Where an I.S. barrier is fitted, check that the barrier fuse is intact.

<u>Fault</u>
A flammable head is attached to channel 1 but the reading on the detector head display is a high negative number (e.g. –60).

- Check that the pellistor supply is connected to the head.
  The flammable heads require a separate supply to provide the pellistors with current in excess of the 4-20mA available loop current.

- Check that the 'pwr' supply measures 3.5V to 4.5V at the detector head.
  The voltage supply for the pellistors is regulated within the detector head at a factory pre-set level (2.0V for VQ2 type pellistors). In order to provide a regulated supply at the correct voltage the detector head 'pwr' connection must receive a minimum of 3.5V.

<u>Fault</u>
The detector head displays a valid reading, however the MCU does not appear to be displaying the same, or any valid reading.
- Ensure that the channel has been enabled within the software.
- Ensure the channel set up is correct i.e. gas type, range
- Check the appropriate jumper switch settings on the associated input module.
- Calibrate channel.

<u>Fault</u>
The MCU does not appear to communicate with channels five to eight.

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

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9   Service

9.1   Warranty

The quality of design and manufacture included in all Analox Ltd ensure a long and trouble free life.

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

9.2   Commissioning and service

The FGD control unit and FGD sensor heads are fully tested prior to delivery. However, after installation we strongly recommend that full system testing and commissioning be carried out. Analox Ltd service personnel are best equipped to perform the relevant tests and commissioning and will be able to offer advise regarding installation faults.

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

9.3   Sensor replacement

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

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

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

9.4   Routine servicing

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

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

9.4.1   Routine inspection

It is advisable to periodically inspect the MCU control unit Installation:

- Check cables to ensure no damage has occurred.
- Clean control unit casing using a clean cloth.
- Clean detector heads using a clean DAMP cloth.

Note:
Use of a dry cloth would constitute a static hazard.

- Inspect detector heads and ensure the sensor housings aperture is not obstructed.

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

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10   The MCU5

All of the features available within the MCU range of control units are available in both versions of the MCU5. However there are a small number of differences:

- The screen pictures shown throughout the manual will differ slightly to those that will be seen on the MCU5 display. However the MCU5 screens are intuitive and no difficulties should arise in their use.

- The number of buttons within the MCU5 has been reduced to six. The buttons that are used are identified by a legend attached to the display.

- The maximum number of channels that may be configured within the MCU5 is four.