ANALOX SUB Mk II F

(SPECIAL VERSION FOR OCEANWORKS)

HYPERBARIC
OXYGEN AND CARBON DIOXIDE
MONITOR
WITH
AUTOMATIC PRESSURE COMPENSATION

Installation and Operation Manual

ANALOX SENSOR TECHNOLOGY LTD
15 ELLERBECK COURT
STOKESLEY BUSINESS PARK
STOKESLEY
NORTH YORKSHIRE
TS9 5PT
UK

Tel +44 (0) 1642 711400
Fax +44 (0) 1642 713900

Web: www.analox.net
Email: info@analox.net

LIST OF CONTENTS

1 PACKAGING CONTENTS CHECK

a) Analox Sub Mk II F main unit.

b) Analox Sub Mk II F REM1 Oxygen, Carbon Dioxide and Depth Remote Sensor Unit

c) Optional Analox Sub Mk II REM2 Temperature and Humidity Remote Sensor Unit – (not with Oceanworks system)

d) Gasket for flange mounting sensor unit.

e) Fixings for Display Unit 4x M5 bushes, 4x M5 bolts

f) Fixings for Remote Sensor 4x M5 bushes, 4 x M5 bolts, 4 x M5 nuts to use as required

g) Free Issued interconnecting cables as provided by customer

h) Data logging software

i) Calibration adaptors

j) User Manual

k) Test Certificate

2 INTRODUCTION

The Analox Sub Mk II F is a combined oxygen, carbon dioxide (CO_2) and pressure monitor that automatically compensates the CO_2 data for pressure effects. Optionally, temperature and humidity may also be measured if fitted at the time of manufacture

Parameter	Sensing technology	Sensor Location
Oxygen	Electrochemical cell	REM1
Carbon Dioxide	Infra-red absorption	REM1
Pressure	Strain gauge	REM1
Temperature	Platinum Resistor	REM2
Humidity	Capacitive	REM2

The complete system consists of:
X The SUB Mk II F main unit intended for installation in control rooms
X The REM1 and optional REM2 intended for installation in hyperbaric environments.

A large graphic display on the main unit shows the value of each measured parameter and the remote unit provides local displays of the monitored parameters.

The main panel can provide audio and visual alarms for the measured gas parameters. The alarm setpoints may be easily adjusted using the pushbuttons on the main panel.

The overall system is powered by a single supply as indicated on the rear of the main unit. The remote unit connects to the main panel, from which it obtains power.

The sensors are housed in splashproof enclosures that are vented to prevent collapse in hyperbaric environments. Gas levels are monitored by diffusion across waterproof membranes built into the REM1 unit.

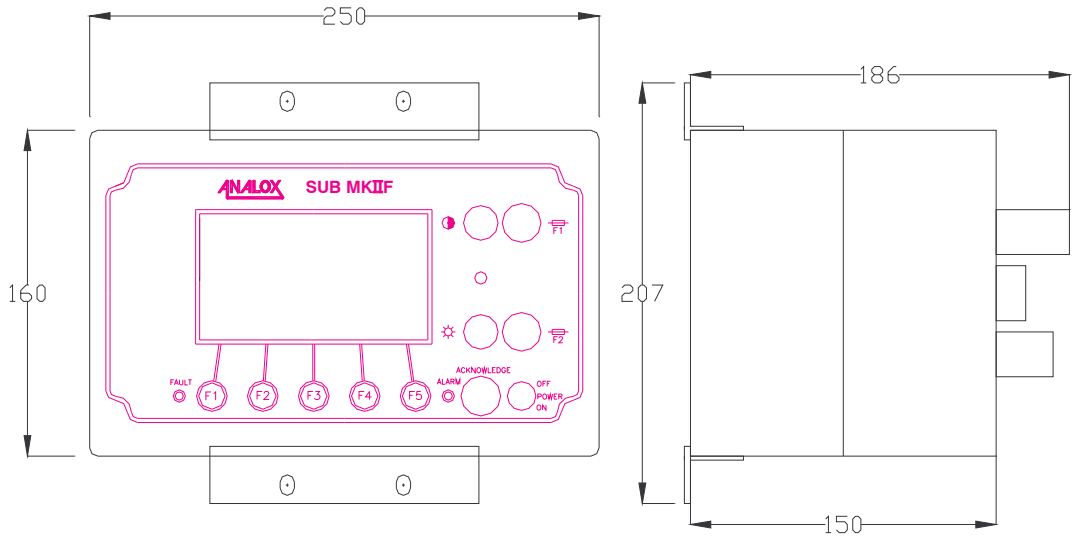
The user should ensure that the gas inlet ports remain as clean as possible to prevent the waterproof membranes becoming blocked. The sensor enclosure vents, situated beside the electrical connections must also be kept clean.

This special version built for Oceanworks has been modified as follows:

a) Oxygen measured and displayed in the range 0-1500mBar
b) Carbon Dioxide measured and displayed in the range 0-50mBar
c) Pressure measured and displayed in the range 0-10 Bar Absolute.
d) Remote sensors mounted in a different enclosure to suit direct flange mounting onto customers breathing loop pipework.
e) Main Panel Display Unit mounted in a different enclosure for use in the hyperbaric area.
f) Different connectors specified by the customer.

3 INSTALLATION

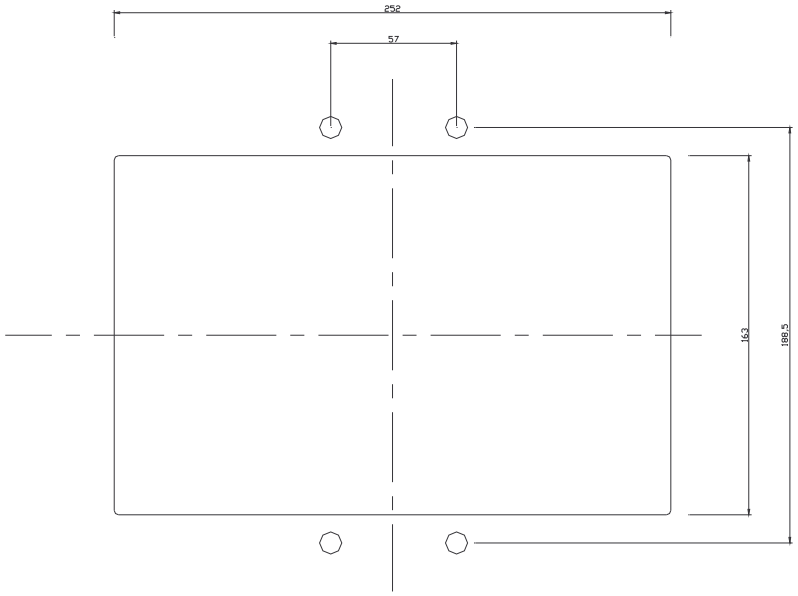
3.1 MAIN PANEL MECHANICAL INSTALLATION



The Main Panel unit is designed to be panel mounted. The panel must first be prepared to accept the instrument by making the cutout as shown below.

There must be sufficient room behind the panel to accommodate the electrical connectors.

The enclosures are fitted with a vent to prevent collapse in hyperbaric conditions. This is situated between the two electrical connectors. Ensure that the vent is not obstructed



MAIN PANEL CUTOUT

Four M5 captive nuts and four M5 screws are supplied with the instrument to mount it to the panel. If you use these, the captive nuts require a 10mm diameter hole.

If the unit is likely to be subjected to high levels of vibration, it is recommended to construct a supporting bar or shelf towards the rear of the unit.

Note that additional space will be required behind the panel for the mating connectors.

3.2 REMOTE SENSOR MECHANICAL INSTALLATION

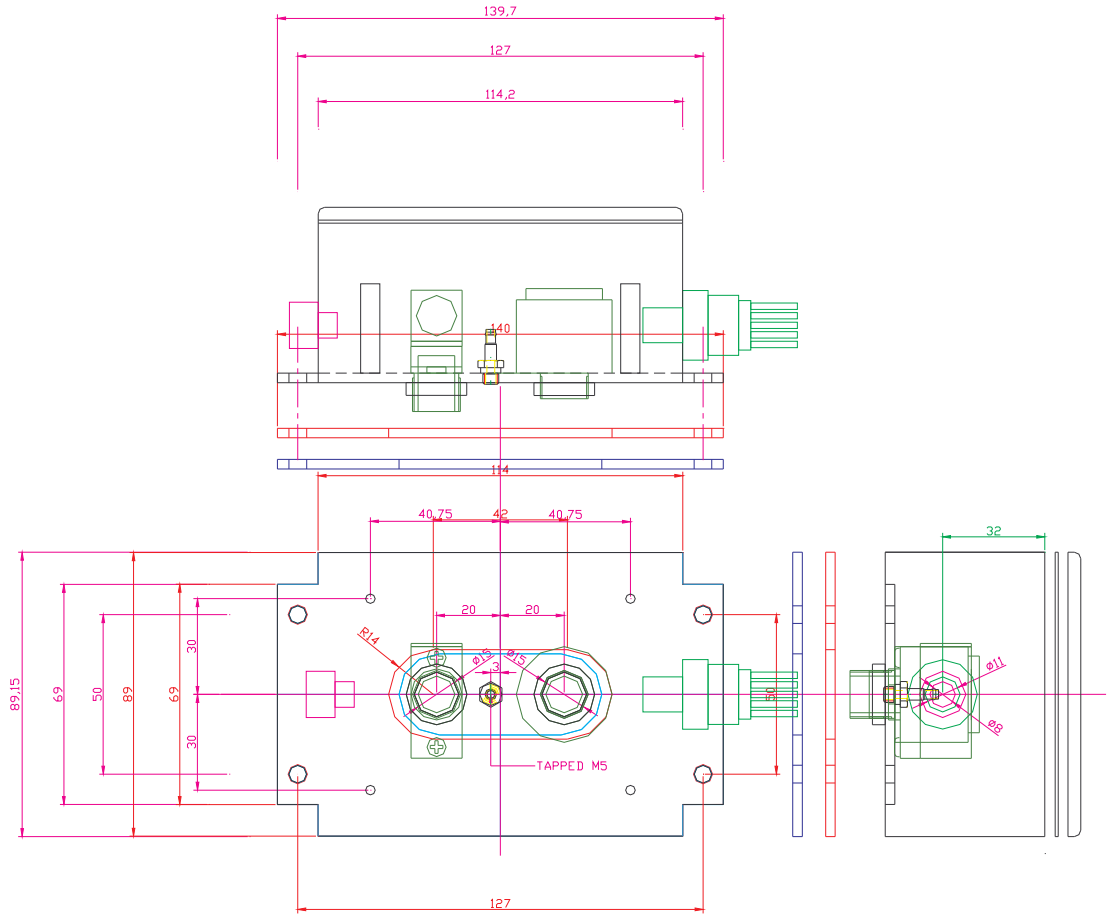
The special version of the REM1 is designed to be flange mounted onto the customer's own pipework. The unit is supplied with a gasket to interface between the sensor enclosure and the customer's flange.

The fixing points for the sensor were not agreed during specification other than to say that the holes would be 7/32". The sensor enclosure has come from the supplier with a slightly smaller hole (5mm).

Ideally to save losing fasteners and make fitting simpler, the mounting flange, or the enclosure would be tapped.

A few suggestions of how to make everything fit together:

a) use 4x M5 bolts and nuts (supplied)
b) tap the holes to a suitable size
c) fit an insert – 4 x M5 bushes supplied – (these may be a bit close to the edge of the flange).



The enclosures are fitted with a vent to prevent collapse in hyperbaric conditions. This is situated on the side of the enclosure. Ensure that the vent is not obstructed.

Allow for the space taken up by the mating electrical connector and wiring.

3.3 SYSTEM ELECTRICAL INSTALLATION

With the order for this unit, two systems were ordered, and one set of cables were free-issued by customer. These cables are supplied with the system, suitably labelled, such that the customer can very easily test the system on a desktop to become familiarised with the system. It will also serve as a guide to ensure correct installation wiring.

There are two connectors on the rear of the Main Panel display unit and one connector on the side of the Remote Sensor.

Connection details for these are as follows:

Display Unit : Power and Serial Interface Connector : Impulse MCBH-8-MP		
Pin No	Signal	Cable Core Colour (of customer supplied cable)
1	+24VDC supply	Black
2	0VDC supply	White
3	RS-232 TX (out of display unit)	Red
4	RS-232 RX (into display unit)	Green
5	RS-232 Ground	Blue
6	Spare	Brown
7	Spare	Yellow
8	Shield	Orange

NOTE : This wiring is almost the same as for the Sub MkIIP system supplied with this order. Note that the similar RS232 connections are not on the same pins as in the SubMkII version. Take care not to confuse the two systems.

Display Unit : Connection to Remote Sensor Connector : Impulse MCBH-5-FS		
Pin No	Signal	Cable Core Colour (of customer supplied cable)
1	Power+	Black
2	Power -	White
3	Data +	Red
4	Data -	Green
5	Ground	Blue

Remote Sensor : Connection to Display Unit Connector : Impulse MCBH-5-MP		
Pin No	Signal	Cable Core Colour (of customer supplied cable)
1	Power +	Black
2	Power -	White
3	Data +	Red
4	Data -	Green
5	Data Ground	Blue

The Diagram below shows the necessary wiring.
Note the cable colours refer to those of the cables supplied by the customer to Analox.

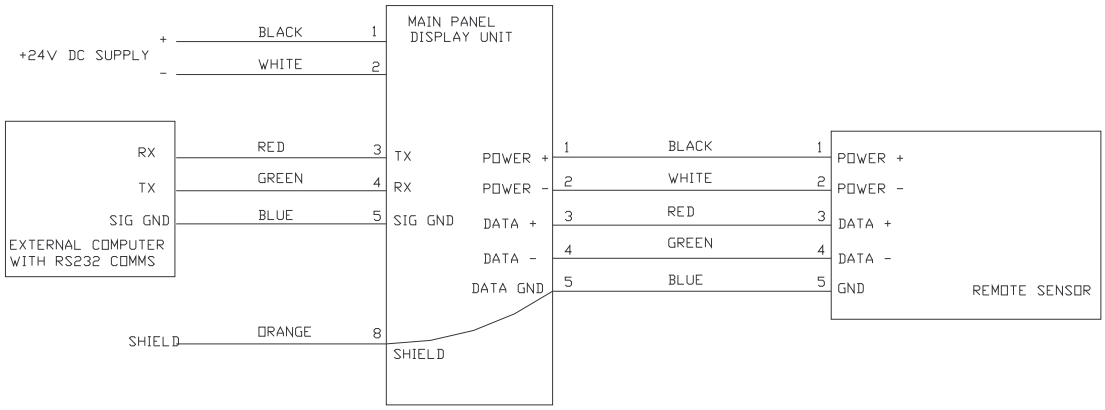
The external 24V DC supply powers the whole system. The Display Unit provides power to the Remote Sensor.

The two units communicate via an RS485 data pair (Data + and Data -).
An RS232 port on the Display Unit allows data transfer to an external computer fitted with an RS232 port and running suitable software.

For basic operation, the system does not require the Shield connection. The Shield serves only to suppress electrical interference. The shield connects internally within the Display Unit to a DC line filter, and from there to the connection to the Remote Sensor.

At the Remote Sensor, the shield is connected to the metal case.

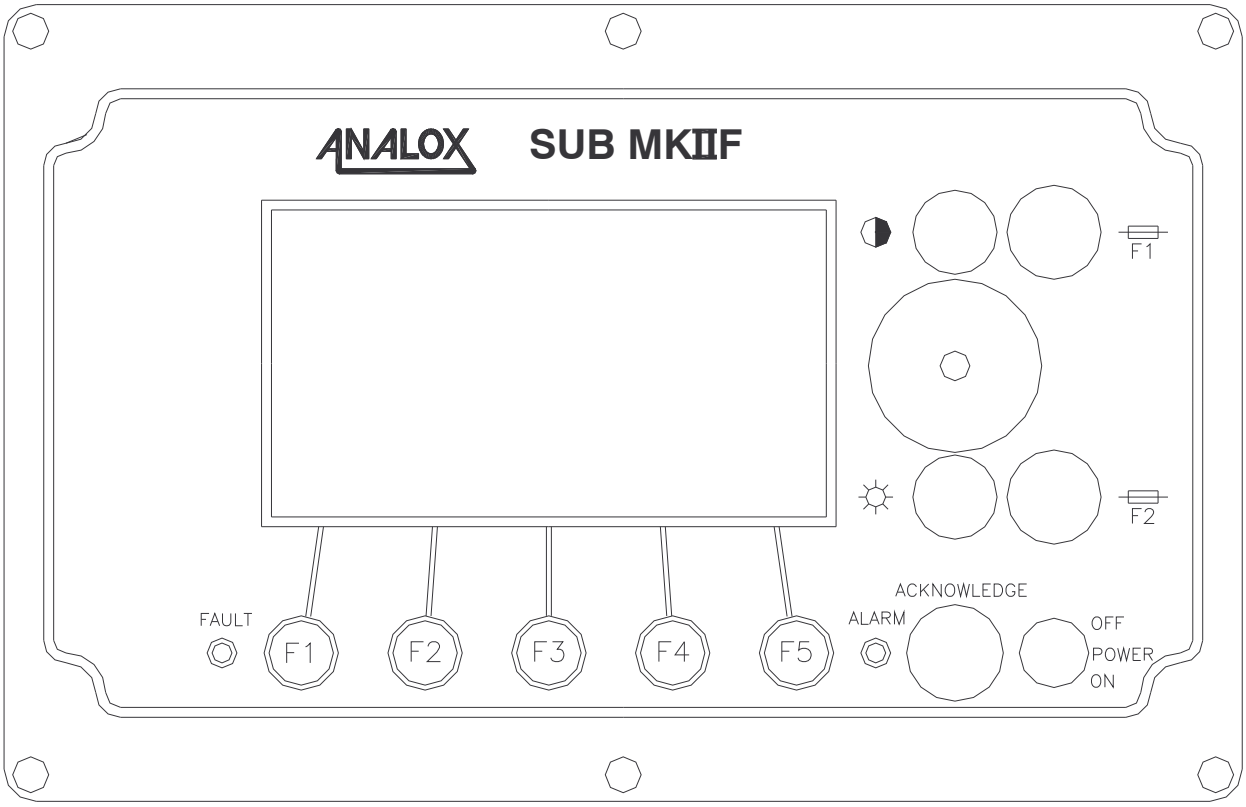
The customer may remove or modify these connections to suit the system into which the equipment is installed.



4 OPERATION

The Main Panel provides

a) a 240x128 pixel liquid crystal display
b) 5 function key pushbuttons F1-F5 which align with key legends on the display
c) a yellow alarm indicator lamp
d) a red fault indicator lamp
e) a contrast control for the display
f) a brightness control for the display back light
g) an Acknowledge pushbutton to acknowledge alarms and faults
h) an audible sounder to annunciate alarms and faults
i) a power switch controlling power to the instrument and to the remote sensor units
j) a fuse F1 for the Main Panel
k) a fuse F2 for the Remote Sensors



4.1 SWITCHING ON AND OFF

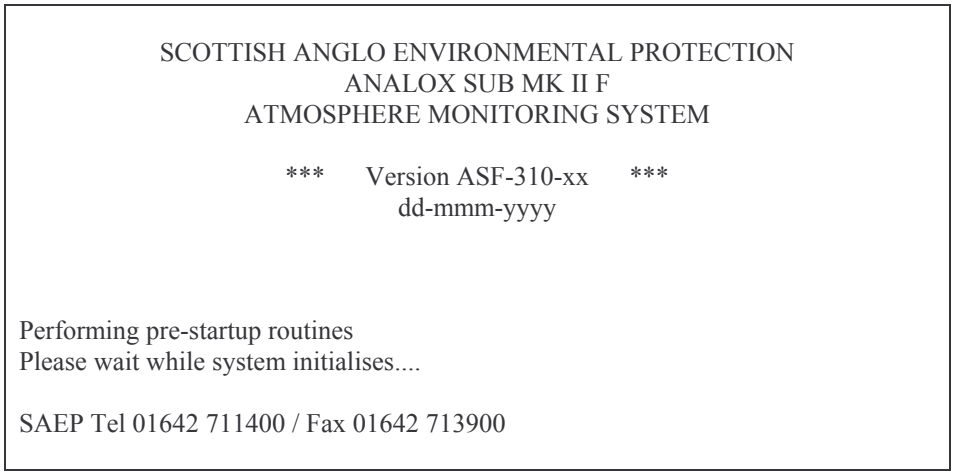
The Main Panel and the Remote Sensors are switched on by operating the Power switch on the Main panel. The switch has a locking device to prevent inadvertent operation. Gently pull the lever outwards and then down to turn the power on, and outwards and up to turn the power off. Releasing the lever re-applies the locking mechanism.

If the unit does not switch on, check the following:

a) check that the external power supply is healthy.
b) check that the supply fuse on the rear panel is not blown (mains powered instruments only).
c) check that the front panel fuses are not blown.

Several events take place at switch on. These are:

a) the audible alarm sounds for a few seconds (30-40) while the processor initialises. This ensures that in the event of a system crash via the on-board Watchdog controller, an operators attention will be attracted by the audible alarm. (It is possible to defeat the buzzer during this period – contact Analox for details).
b) both the Fault and Alarm indicators are illuminated to prove their operation
c) all pixels on the display are turned on and then off as a test of the display
d) a version number message is displayed on the screen as shown below. Note the version number on the screen may change as upgrades to the system are made.

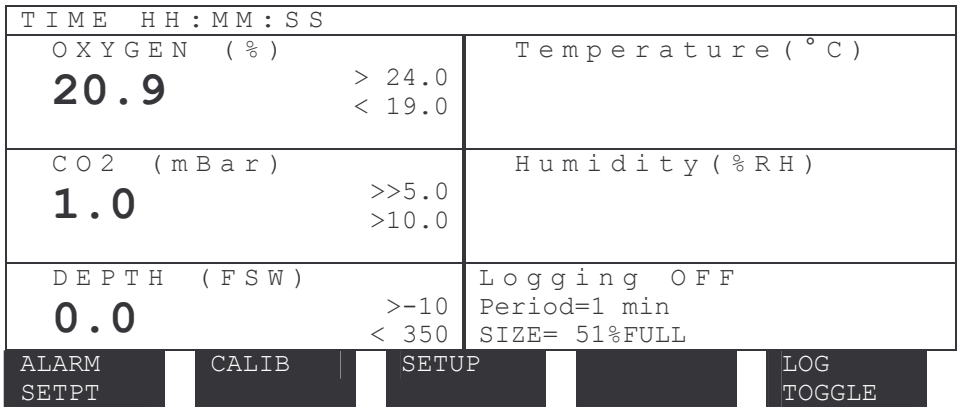


e) the screen is then cleared and the main application screen appears . It is quite normal, especially for carbon dioxide, for the sensors to take a short time to warm up and give stable readings. Alarms related to the sensor readings are inhibited for the first 40 seconds of operation to give the sensors time to settle.

f) If connected correctly, the remote units will briefly display '.8.8.8.8' on each of their displays at power on, followed by sensor readings after a brief delay. (Oceanworks special has no display – however there is an internal diagnostic LED which will flash continuously once per second).

4.2 MAIN DISPLAY SCREEN

The Main Display screen is shown below



The screen is divided into several parts as follows:

a) along the bottom of the screen, there are legends which align with the function keys.
b) the left hand side of the screen shows sensor readings for REM1 . Note that the range and units of measurement may change for specific instruments.

   Readings in alarm states are highlighted with a black background (reverse video). These readings correspond to those shown on the Remote Sensors.

c) Alongside the oxygen and carbon dioxide readouts, the present settings of the alarm setpoints are shown. < signifies a Low alarm, > a high alarm and >> a very high alarm.

d) The Time of day is displayed at the top of the display
e) Data Logging Status information is shown at the bottom of the display.
f) An activity indicator in the bottom right hand corner which shows that the processor is functioning.
g) The right hand side of the screen shows sensor readings for REM2 when fitted

4.3 ALARM SYSTEM

The primary alarm conditions monitored by the system are the oxygen, carbon dioxide, pressure (or depth), temperature and humidity alarms. These conditions are referred to as Alarms in the system.

The design of the system is such that in trying to gather the correct information, various faults that may occur can be detected . These conditions are referred to as Faults in the system.

Both Alarms and Faults cause the Audible Sounder to pulse.

An Alarm condition occurring causes the 'ALARM' Indicator on the Main Panel to flash.

A Fault condition occurring causes the 'FAULT' Indicator on the Main Panel to flash.

The Acknowledge switch on the Main Panel may be pressed to silence the audible sounder. It will also cause the Fault and/or Alarm Indicators to stop flashing. If the alarm or fault condition still exists, the Alarm or Fault indicator will remain turned on.

When the Alarm or Fault condition ceases to exist, the alarm or fault indicators will be turned off and then remain turned off.

The system is arranged with non-latching alarms. This means that if an alarm or fault condition occurs, but then ceases to exist, then the Audible sounder will silence and the indicators will turn off without the Acknowledge switch having been pressed.

The Alarm conditions are reported back to the Remote sensor, causing the relevant display to flash as a local alarm indication. The Calibration Error Faults are also reported to the Remote Sensor so that a local indication is given that calibration is required.

LIST OF ALARM CONDITIONS

The Table below provides details of all of the alarm conditions annunciated by the system.

ALARM NAME	CONDITION CAUSING ALARM
Oxygen Low	Oxygen content is less than the low alarm setpoint
Oxygen High	Oxygen content is greater than the high alarm setpoint
Carbon Dioxide High	CO2 content is greater than the high alarm setpoint
Carbon Dioxide Very High	CO2 content is greater than the very high (HI2) alarm setpoint
Depth Low	Depth is less than the low alarm setpoint
Depth High	Depth is greater than the high alarm setpoint
Temperature Low	Temperature is less than the low alarm setpoint
Temperature High	Temperature is greater than the high alarm setpoint
Humidity Low	Humidity is less than the low alarm setpoint
Humidity High	Humidity is greater than the high alarm setpoint

Whenever any of these alarm conditions are recognised, the appropriate reading on the display is highlighted on a Black background (reverse video). The corresponding Remote Display will flash.

Hysteresis is applied to each of the alarm thresholds. The hysteresis band is pre-set to 2% of the alarm setpoint. Thus if a low oxygen alarm setpoint is set at 19.0%, the alarm will be raised when the oxygen level falls below 19.0% oxygen, and the alarm will be cleared when the oxygen level rises to 19.0% oxygen +2% (=19.38% oxygen).

Similarly if a high oxygen alarm setpoint is set at 24.0%, the alarm will be raised when the oxygen level rises above 24.0%, and the alarm will be cleared when the oxygen level falls to 24% oxygen -2% (=23.52% oxygen).

LIST OF FAULT CONDITIONS

The table below provides details of all of the fault conditions annunciated by the system.

FAULT NAME	CONDITION CAUSING FAULT	INDICATED BY	SUGGESTED REMEDIAL ACTION
Communication Timeout	Main Panel cannot communicate with the REM1 Sensor Unit	COMMS ERROR appears below REM1 heading, and sensor readings are blanked out on Main Panel	Ensure that REM1 sensor is connected and powered up. If it is, check the wiring is correctly made.
O2 Cal-H	The Main Panel has determined that the sensor reading is invalid when a High point calibration has been performed for a REM1 sensor	Cal-H appears in the O2 display	Recalibrate the appropriate sensor
Depth (Pressure) Cal-H		Cal-H appears in the Depth display	
Temperature Cal-H		Cal-H appears in the Temperature display	
Humidity Cal-H		Cal-H appears in the Humidity display	
O2 Cal-L	The Main Panel has determined that the sensor reading is invalid when a Low point calibration has been performed for a REM1 sensor	Cal-L appears in the O2 display	Recalibrate the appropriate sensor
Depth (Pressure) Cal-L		Cal-L appears in the Depth display	
Temperature Cal-L		Cal-L appears in the Temperature display	
Humidity Cal-L		Cal-L appears in the Humidity display	
CO2 Cal-S	The Main Panel has determined that the CO2 sensor reading is invalid when a Span calibration has been performed for a REM1 sensor	Cal-S appears in the CO2 display	Recalibrate the appropriate sensor
CO2 Cal-0	The Main Panel has determined that the CO2 sensor reading is invalid when a Zero calibration has been performed for a REM1 sensor	Cal-0 appears in the CO2 display	Recalibrate the appropriate sensor

4.4 FUNCTION KEYS

When first powered on, the Main Menu appears as shown below:

Press ‘ALARM SETPT’ to adjust alarm settings for any of the gas alarms
Press ‘CALIB’ to perform a calibration of any of the sensors
Press ‘SETUP’ to enter the SETUP menu.
Press ‘LOG TOGGLE’ to turn the Data Logging On or Off. Note it cannot be turned on if the storage memory is full.

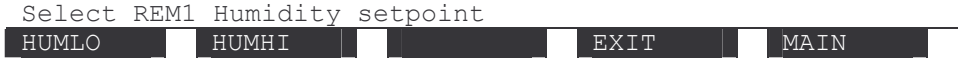
(Note that a datalogging cable is only supplied with instruments for which datalogging is specified at the time of ordering).

4.5 ALARM SETPOINT MENU

From the Main Menu, pressing 'ALARM SETPT' brings up a new menu requesting the user to select the zone in which the alarm setpoints are to be altered:

Pressing 'MORE' brings up a new menu for the REM2 sensor setpoints

On either of these screens, pressing O2, CO2, Depth, Temp or Humid will bring up the corresponding menu for that sensor as shown below.



On any of these screens, pressing EXIT will return to the previous menu, whilst pressing MAIN will return to the main menu.

Press 'O2-LO' to adjust the Oxygen low alarm setpoint. The present value of the alarm is displayed as shown below.

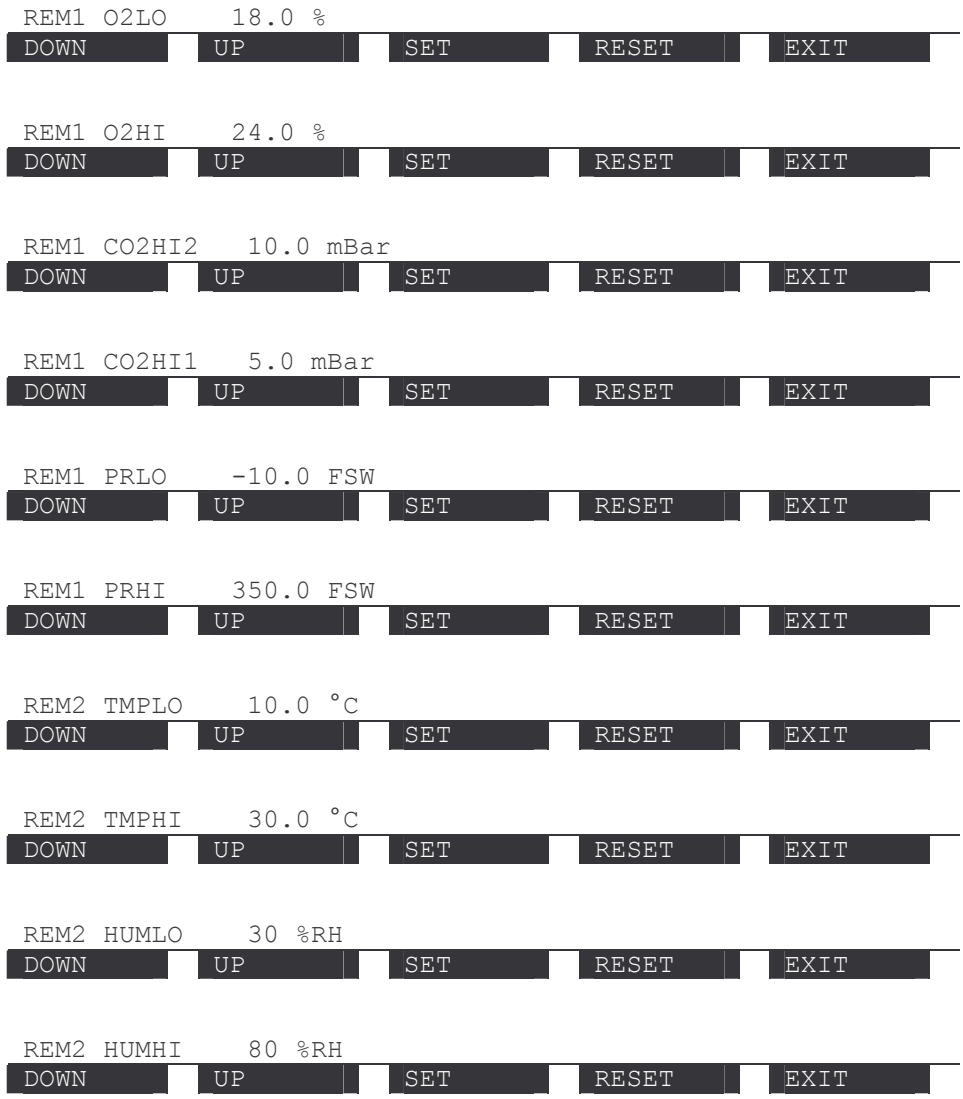
Press 'O2-HI' to adjust the Oxygen high alarm setpoint. The present value of the alarm is displayed as shown below.

Press 'CO2HI' to adjust the carbon dioxide high alarm setpoint. The present value of the alarm is displayed as shown below.

Press 'CO2HI2' to adjust the carbon dioxide very high alarm setpoint. The present value of the alarm is displayed as shown below.

Press 'PR-LO' to adjust the Pressure/Depth low alarm setpoint. The present value of the alarm is displayed as shown below.

Press 'PR-HI' to adjust the Pressure/Depth high alarm setpoint. The present value of the alarm is displayed as shown below.



Press DOWN to decrease the appropriate setpoint. Maintain the switch pressed to make larger changes.
Press UP to increase the appropriate setpoint. Maintain the switch pressed to make larger changes.

Press SET when the new setting is correct. This instates the value just entered using the UP/DOWN keys as the new alarm setpoint. The menu reverts to the previous screen allowing another setpoint to be altered
Press RESET to revert to the original value prior to pressing UP or DOWN.
Press EXIT to escape back to the previous screen

4.6 CALIBRATION DATA

From the Main Menu, pressing ‘CALIB’ brings up a new menu requesting the user to either select REM1, REM2 or to enter calibration data for either REM1 or REM2 (Typically to tell the system the concentration of calibration gas in use).

Press ‘DATA1’ to enter details of calibration parameters relating to oxygen, carbon dioxide and depth.
Press ‘DATA2’ to enter details of calibration parameters relating to temperature and humidity for instruments with the optional REM2 fitted

Press ‘O2’ to select the options allowing calibration data to be entered for the oxygen calibration gas being used.

Press ‘CO2’ to select the options allowing calibration data to be entered for the carbon dioxide calibration gas being used.

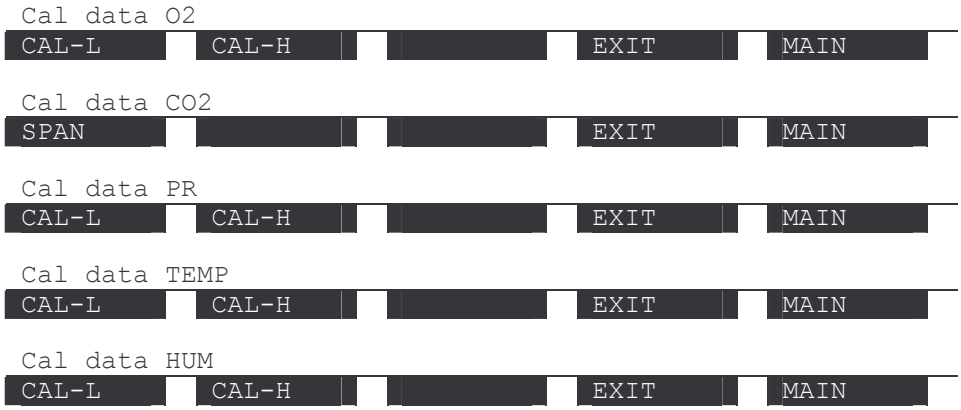
Press ‘PR’ to select the options allowing calibration data to be entered for the calibration pressures being used.

Press ‘TEMP’ to select the options allowing calibration data to be entered for the calibration temperatures being used.

Press ‘HUM’ to select the options allowing calibration data to be entered for the calibration humidities being used.

Press ‘EXIT’ to return to the previous menu.

Press ‘MAIN’ to return back to the main menu.



Press CAL-L or CAL-H to enter low or high value calibration data for oxygen, pressure, temperature or humidity, as

shown below.

Press SPAN to enter span data for carbon dioxide.

Press EXIT to return back to the previous menu allowing selection of another parameter for calibration data.

Press MAIN to return back to the main menu.

O2 CAL-L can be varied in the range 0.0% to 30.0%

O2 CAL-H can be varied in the range 50.0 to 100.0%

CO2 Span can be varied in the range 0.50 – 5.00% (may change with range of sensor)

PR CAL-L can be varied in the range 0.00 to 2.00 Bar Abs. Note the pressure must be defined in Bar Absolute, as this is the internal working range of the instrument. For alternative units, the conversion factors applied are 10MSW=1BarA, 32.808kjh = 1 BarA, 1.01325 BarAbs =1.0 ATA

PR CAL-H can be varied in the range 2.00 to 10.00 BarAbs (this will change with range of instrument). Note the pressure must be defined in Bar Absolute as above for CAL-L.

TMP CAL-L can be varied in the range 0.0 to 25.0 °C

TMP CAL-H can be varied in the range 30.0 to 100.0 °C

HUM CAL-L can be varied in the range 0.0% to 40.0%

HUM CAL-H can be varied in the range 50.0 to 100.0%

Press DOWN to decrease the appropriate setpoint. Maintain the switch pressed to make larger changes.
Press UP to increase the appropriate setpoint. Maintain the switch pressed to make larger changes.

Press SET when the new setting is correct. This instates the value just entered using the UP/DOWN keys as the new calibration data. The menu reverts to the previous screen allowing another data value to be altered
Press RESET to revert to the original value prior to pressing UP or DOWN.
Press EXIT to escape back to the previous screen

NOTE : When pressing SET, the calibration data value is transmitted to the Remote Sensor. The Remote Sensor must be switched on whilst performing these tasks.

4.7 CALIBRATION MENU

WARNING

DO NOT PRESS THESE BUTTONS UNLESS YOU ARE FAMILIAR WITH THE INSTRUMENT. ALTHOUGH THE SYSTEM PROTECTS AGAINST SOME FORMS OF ACCIDENTAL CALIBRATION, IT IS STILL POSSIBLE TO AFFECT THE ACCURACY OF GAS/PRESSURE MEASUREMENT.

From the Main Menu, pressing 'CALIB' brings up a new menu requesting the user to select the zone in which the calibration is to be altered:

Press 'REM1' to select options to perform calibration of REM1 sensors
Press 'REM2' to select options to perform calibration of REM2 sensors
Press 'DATA1' to enter details of calibration parameters relating to oxygen, carbon dioxide and depth. (refer to previous Section)
Press 'DATA2' to enter details of calibration parameters relating to temperature and humidity. (refer to previous Section)
Press 'MAIN' to return to the Main Menu.

Press 'O2' to select the options allowing calibration of the Oxygen sensor.
Press 'CO2' to select the options allowing calibration of the Carbon Dioxide sensor.
Press 'PR' to select the options allowing calibration of the Pressure (Depth) sensor.
Press 'EXIT' to return back to the previous menu
Press 'MAIN' to return back to the main menu.

Similarly for REM2

Calibrate REM2

Press ‘TMP’ to select the options allowing calibration of the Temperature sensor.
Press ‘HUM’ to select the options allowing calibration of the Humidity sensor.
Press ‘EXIT’ to return back to the previous menu
Press ‘MAIN’ to return back to the main menu.

Calibrate REM2 TMP

Calibrate REM2 HUM

Press CAL-L to calibrate the appropriate sensor at a low point in its output.

For oxygen this could typically be 0% Oxygen or air (20.9% Oxygen). (Note the sensor must have been subjected to the correct calibration gas prior to this procedure, and the reading must have settled)

Press CAL-H to calibrate the appropriate sensor at a high point in its output.

For oxygen this could typically be 100% Oxygen. (Note the sensor must have been subjected to the correct calibration gas prior to this procedure, and the reading must have settled). Also note that the partial pressure of oxygen must not exceed the range of the instrument. Therefore when using 100% oxygen gas, the pressure reading must be less than 2 BarA.

Press ZERO to calibrate the appropriate carbon dioxide sensor in zero concentration CO2 (pure oxygen or pure nitrogen or a mixture of oxygen and nitrogen certified free from CO2)

Press SPAN to calibrate the carbon dioxide sensor with an appropriate span calibration gas. Note that the partial pressure of carbon dioxide must not exceed the range of the instrument. Therefore when using 0.5% gas, the pressure reading must be less than 10 Bar Absolute. It is recommended to perform calibration at atmospheric pressure.

Before performing any of these actions, a confirmation option will appear.

Calibrate REM1 O2 CAL-L

To continue the calibration, the user must press the YES option. Pressing NO or MAIN will not perform the calibration. The sensor must subjected to the calibration conditions at the time of pressing YES.

4.8 SETUP MENU

From the Main Menu, press ‘SETUP’ . The Setup Menu appears

Press ‘TIME’ to adjust the date and time
Press ‘LOG’ to alter the data logging time interval.
Press ‘MAIN’ to return to the Main Menu.

Initially the hours field will be highlighted. Press UP or DOWN to alter the hours.

Then press NEXT to highlight the minutes field. Press UP or DOWN to alter the minutes.

Then press NEXT to select the Seconds, Day, Month and Year fields as required.

When no further changes are required, press SET. If an invalid date has been selected, an ‘Invalid’ message will appear. Correct the date or press MAIN to abort entry of the date and time.

Press NEXT to select the Data Logging time interval as either 1 second, 5 seconds, 10 seconds, 30 seconds, 1 minute, 2 minutes or 5 minutes. This option can be altered at any time, irrespective of whether data logging is in progress.

5 DATALOGGING

The standard instrument uses a rear panel mounted 25 way Female D-type connector and a supplied cable to connect to PC for datalogging (and diagnostic) purposes./

This special version relies on the RS232 connections made through the rear panel Serial Interface connector.

5.1 RS232 DATA LOGGING CONNECTION

An RS232 connection must be made between a computer and the Diagnostic Port to use this facility.
A typical lead to connect a standard IBM PC compatible computer/laptop would consist of either a 9 or a 25 way D-type female connector connected to a 25 way male D-type connector. Refer to the diagram below for alternative connections.

SERIAL INTERFACE PORT MCBH-8-MP	PC SERIAL PORT	
	9 WAY FEMALE D-TYPE	25 WAY FEMALE D-TYPE
Pin 3	Pin 2	Pin 3
Pin 4	Pin 3	Pin 2
Pin 5	Pin 5	Pin 7

At power-up the data logging will always default to OFF.

To commence logging, press LOG TOGGLE on the Main Menu. Assuming the memory is not full, the Logging Status will change to ON.

During logging, the value of each measured parameter (Oxygen, CO_2 and Pressure and Temperature and Humidity if a REM2 is fitted) will be recorded every 60 seconds. This interval may be changed to an interval between 1 second and 5 minutes, as described in the Function Key section of this manual.

Data logging is stopped by pressing LOG TOGGLE again.

Every logged reading is stored with the date and time. Successive log runs can therefore be stored consecutively without having to delete the previous readings.

The state of the Data Log Buffer is indicated on the screen as %FULL. Since the unit can store several thousand readings, this will remain at a low number for a considerable time.

5.2 USE OF WINDOWS 95/98 HYPERTRM.EXE

A suitable communications programme must be run on the computer to access the serial port. HYPERTERM.EXE provided with Windows 95 will suffice, or several common terminal programmes such as Procomm or Kermit.

(Windows 3.1 was supplied with a utility called TERMINAL.EXE which may also be used. Contact Scottish Anglo for help if required.)

The Communication parameters required for successful communication are 9600 Baud, 8 Data Bits, No Parity, 1 Stop Bit, XON/XOFF handshaking. Pay attention to whether you connect to the COM1 or COM2 communication port on the PC.

1 Ensure that HyperTerminal has been installed. It is supplied by Microsoft with the Windows 95/98 CD-ROM. If it is not installed, go to Control Panel, Add/Remove Programs, Windows Setup, and select HyperTerminal from the Communications Utilities.

2 Start HyperTerminal. Usually this will be found under Start, Programs, Accessories, Communications, HyperTerminal, HyperTerm.exe

3 Click Cancel in the New Connection box

4 Select File, Open.

5 Ensure the Floppy Disk supplied by Analox is in your floppy disk drive (assumed to be A:)

6 Select the floppy disk drive A: in the 'Look In' box, and then select the ANALOXSUB.HT session file

7 To alter the COM port from COM1 to COM2 if necessary, select File, Properties. In the Connect Using box, select Direct to Com1 or Com2 as appropriate.

8 Switch the Analox Sub On

9 If the connection has been properly made, text will appear on the screen of the PC as shown below

dd-mmm-yyyy hh:mm:ss AMS Started

10 If no text appears, check the connections and the communication parameters. Also check that there is no conflict between the selected COM port and any other devices already in use on the PC.

11 Type HELP and note the commands GET and DEL, and then follow the instructions in the section below.

If the software is correctly configured and the correct connections made, switching the system on will result in a message ‘dd-mmm-yyyy hh:mm:ss System Started ’. The dd-mmm-yyyy and hh:mm:ss indicates the date and time on the microprocessor card.

Typing 'HELP' followed by pressing Enter will bring up a Help menu on the PC screen. The case of 'help' is not important – upper or lower case can be used.

```
ANALOX SUB Mk2F ASF-310-11 16-Mar-2004
HELP => Display this message
S,s  => Remote Message Dump On/Off
A,a  => Alarm Dump On/Off
D,d  => Sensor Dump On/Off
R    => Reset Comms Tries Diagnostic
T    => Display Comms Tries
GET  => Read Data Logged Information
DEL  => Delete Data Logged Information
KILL => Override Procesomms
NORM => Restore  Processor Comms
EXIT => Shutdown
```

All of the commands must be followed by pressing Enter.

5.3 RETRIEVE DATA: GET COMMAND

To download data from the instrument, first set the PC HYPERTRM.EXE program to capture data to file. This is done by selecting the option Transfers, Receive Text File.. Enter a suitable name for a file in which to store data, and note in which directory it is defined. Then press OK.

Note that data logging must be OFF for this to operate. If necessary press LOG TOGGLE to turn logging OFF

Now type GET followed by ENTER.

Data received will be in the form

```
DATE TIME,OXYGEN,CO2,DEPTH,
19-Mar-2004 07:20:39, 19.8,  3.6,  -0.3,
19-Mar-2004 07:20:44, 20.1,  3.6,  -0.4,
Data Output Completed
```

One line of data will appear for every sample of readings logged. The system can store several thousand readings. Retrieval of data may therefore take a while to complete.

When the 'Data Output Completed' message appears, press the STOP button on the PC screen to stop recording to file.

5.4 DELETE DATA: DEL COMMAND

The DEL command is used to delete the stored information from the system. Perform this command after successful retrieval of the data using GET. If DEL is not used, the same data will have to be retrieved again at the next GET command. For DEL to operate, data logging must be OFF. Press LOG TOGGLE if necessary.

5.5 USE OF RETRIEVED DATA

It is assumed that the user has already created a file in a known directory by performing the GET command. This file can be imported into any of the major spreadsheet (Excel, Lotus 123 etc) since it is stored in Comma Separated format.

Once the data has been imported into a spreadsheet, the data can be graphed and printed. Refer to the manual for your preferred spreadsheet.

Scottish Anglo can provide detail for an example data file using Microsoft Excel if required. The appearance of the graphs generated is then only dependant on the users ability to manipulate the spreadsheet.

5.6 'S' COMMAND

Typing 'S' and pressing Enter requests the system to transmit diagnostic data. This is the data stream between the Display Unit and the Remote Sensor. The significance of this data is similar to that documented for the MkIIP systems supplied.

Typing 's' and pressing Enter turns off the data output.

```
S
Remote Message Dump On
19-Mar-2004 13:34:29   :01A010300
19-Mar-2004 13:34:29 :01 C=1808 2996 00002 00002 P=0399 +0099 -0002 O=0490
+0199 +0201 T=+00236
19-Mar-2004 13:34:29   :01A010300
19-Mar-2004 13:34:30 :01 C=1808 2996 00002 00002 P=0397 +0098 -0003 O=0490
+0199 +0201 T=+00236
s
Remote Message Dump Off
```

5.7 'D' COMMAND

Typing 'D' and pressing Enter requests the system to transmit sensor display data. This is the data that actually appears on the system display

Typing 'd' and pressing Enter turns off the data output.

The system is specially configured to transmit this data automatically from power on time. This means that the external computer used by the customer only has to listen to the data, and does not have to request it.

```
D
Sensor Dump On
19-Mar-2004 13:34:33, O2, 20.2, CO2,  0.1, Pr,  -0.4,
19-Mar-2004 13:34:33, O2, 20.2, CO2,  0.1, Pr,  -0.4,
19-Mar-2004 13:34:34, O2, 20.1, CO2,  0.1, Pr,  -0.3,
19-Mar-2004 13:34:34, O2, 20.1, CO2,  0.1, Pr,  -0.3,
19-Mar-2004 13:34:34, O2, 20.1, CO2,  0.1, Pr,  -0.3,
d
Sensor Dump Off
```

The data consists of the date and time, followed by comma separated fields defining the oxygen concentration in percent, the CO2 concentration in mBar, and the pressure in feet sea water.

6 CALIBRATION

Calibration should only be performed by personnel with the necessary skills. Any abuse of the calibration controls may render the instrument inaccurate and unusable.

6.1 SEMI AUTOMATIC GAS CALIBRATION

The system features a semi-automatic calibration feature for zero and span of oxygen, carbon dioxide and pressure.

These adjustments are possible without internal access to the sensor unit, provided that the sensors are near to their ideal outputs.

The depth sensor is used in measuring the carbon dioxide content, therefore before altering the carbon dioxide calibration, ensure that the depth sensor is correctly calibrated.

To ensure the most accurate performance, ensure that settling time is allowed for all gas readings. Typically 2-5 minutes is required for adequate settling time.

6.2 PRESSURE SENSOR CALIBRATION

1 Subject the remote sensor to a known pressure in the range 0.00-2.00 Bar Absolute.
2 Ensure that the reading on the display is steady
3 Press CALIB, DATA1, PR, CAL-L and adjust the setting to the actual pressure in Bar Absolute.
4 Press SET to inform the remote sensor of the calibration pressure
5 Now press MAIN,CALIB, REM1, PR.
6 When you are sure the pressure is steady press CAL-L and then YES
7 Observe after a few seconds that the pressure reading on the display adjusts to the new calibration value.

8 Subject the remote sensor to a known pressure in the range 2.00-10.00 Bar Absolute. (Generally, the higher the pressure, the more accurate the calibration).
9 Ensure that the reading on the display is steady
10 Press MAIN, CALIB, DATA1, PR, CAL-H and adjust the setting to the actual pressure in Bar Absolute.
11 Press SET to inform the remote sensor of the calibration pressure
12 Now press MAIN,CALIB, REM1, PR.
13 When you are sure the pressure is steady press CAL-H and then YES
14 Observe after a few seconds that the pressure reading on the display adjusts to the new calibration value.
15 Reduce the pressure to a mid scale value and confirm that the reading on the instrument is correct.

6.3 OXYGEN SENSOR CALIBRATION

1 Fit the supplied calibration adaptors to the sensor inlets and pass calibration gas of a certified concentration (typically calibrated air 20.9% or nitrogen 0%) across the sensors at a flow rate of approximately 20-60 litres per hour (0.3-1.0 litres per minute)
2 From the MAIN menu press CALIB, DATA1, O2, CAL-L and adjust the gas concentration to the desired value (eg 0.0 for nitrogen, or 20.9% for air etc) The actual gas can be in the range 0-30.0%.
3 Press SET to inform the remote sensor of the calibration gas value.
4 Now press MAIN,CALIB, REM1, O2
5 When you are sure the oxygen and pressure readings are steady press CAL-L and then YES
6 Observe after a few seconds that the oxygen reading adjusts to the new calibration value (taking the absolute pressure into account)

7 Now pass a higher concentration certified calibration gas (typically 100% O2) across the sensors at a flow rate of approximately 20-60 litres per hour (0.3-1.0 litres per minute)
8 From the MAIN menu press CALIB, DATA1, O2, CAL-H and adjust the gas concentration to the desired value (eg 100.0 %) The actual gas can be in the range 50-100%
9 Press SET to inform the remote sensor of the calibration gas value.
10 Now press MAIN,CALIB, REM1, O2
11 When you are sure the oxygen and pressure readings are steady press CAL-H and then YES
12 Observe after a few seconds that the oxygen reading adjusts to the new calibration value (taking the absolute pressure into account)

6.4 CARBON DIOXIDE SENSOR CALIBRATION

1 Fit the supplied calibration adaptors to the sensor inlets and pass calibration gas containing no carbon dioxide (typically calibrated air 20.9% or nitrogen 0% or 100% oxygen) across the sensors at a flow rate of approximately 20-60 litres per hour (0.3-1.0 litres per minute)
2 From the Main menu press CALIB, REM1, CO2
3 When you are sure the carbon dioxide and pressure readings are steady press ZERO and then YES
4 Observe after a few seconds that the carbon dioxide reading adjusts to zero.

5 Now pass a certified calibration gas (typically 2.0% CO2) across the sensors at a flow rate of approximately 20-60 litres per hour (0.3-1.0 litres per minute)
6 From the MAIN menu press CALIB, DATA1, CO2, SPAN and adjust the gas concentration to the desired value (eg 2.05%) The actual gas can be in the range 0.50-5.00% (depending on range)
7 Press SET to inform the remote sensor of the calibration gas value.
8 Now press MAIN,CALIB, REM1, CO2
9 When you are sure the carbon dioxide and pressure readings are steady press SPAN and then YES.
10 Observe after a few seconds that the carbon dioxide reading adjusts to the new calibration value (taking the pressure into account).

6.5 TEMPERATURE SENSOR CALIBRATION

1 Subject the REM2 Sensor unit to a known temperature in the range 0-20°C.
2 From the Main menu press CALIB, DATA2, TEMP
3 Press CAL-L and enter the actual temperature to which the REM2 has been subjected. Press SET after obtaining the correct temperature value.
4 Press MAIN, CALIB,REM2,TEMP
5 When you are sure the temperature reading is steady, press CAL-L and then YES
6 Observe after a few seconds that the temperature reading adjusts to the correct value.
7 Now subject the REM2 sensor to a higher temperature (20-60°C)
8 From the Main menu press CALIB, DATA2,TEMP,CAL-H and enter the actual temperature to which the REM2 has been subjected. Press SET after obtaining the correct temperature value.
9 Press MAIN,CALIB,REM2,TEMP
10 When you are sure the temperature reading is steady, press CAL-H and then YES.
11 Observe after a few seconds that the temperature reading adjusts to the correct value.

6.6 HUMIDITY SENSOR CALIBRATION

1 Subject the REM2 Sensor unit to a known humidity in the range 0-40%RH.
2 From the Main menu press CALIB, DATA2, HUM
3 Press CAL-L and enter the actual humidity to which the REM2 has been subjected. Press SET after obtaining the correct humidity value.
4 Press MAIN, CALIB,REM2,HUM
5 When you are sure the humidity reading is steady, press CAL-L and then YES.
6 Observe after a few seconds that the humidity reading adjusts to the correct value.
7 Now subject the REM2 sensor to a higher humidity (50-100%RH)
8 From the Main menu press CALIB, DATA2,HUM,CAL-H and enter the actual humidity to which the REM2 has been subjected. Press SET after obtaining the correct humidity value.
9 Press MAIN,CALIB,REM2,HUM
10 When you are sure the humidity reading is steady, press CAL-H and then YES.
11 Observe after a few seconds that the humidity reading adjusts to the correct value.

6.7 INTERNAL CALIBRATION

Note: in normal operation, potentiometers should only be adjusted by suitably qualified personnel. ANY ABUSE OF THE CALIBRATION CONTROLS WILL ADVERSELY AFFECT THE ACCURACY OF THE INSTRUMENT AND MAY RENDER THE INSTRUMENT UNUSABLE. AFTER MAKING ANY CHANGES TO THE POTENTIOMETERS, THE SOFTWARE CALIBRATION PROCEDURES SHOULD ALWAYS BE PERFORMED.

a) Oxygen sensor calibration

The oxygen sensor input circuit is a fixed gain amplifier. The oxygen cell is expected to generate a DC voltage of between 7 and 13mV when exposed to atmospheric air (20.9% oxygen) at standard temperature and pressure. The signal varies linearly with the partial pressure of oxygen.

b) CO_2 sensor calibration

Calibration of the CO_2 sensor can only be performed by suitably qualified personnel with the correct diagnostic equipment and therefore should not be attempted. Please contact your service agent if a CO_2 sensor calibration is required.

c) Pressure sensor calibration

Re-calibration of the pressure sensor requires the adjustment of the pressure ZERO potentiometer (RV2) at atmospheric pressure, and adjustment of the pressure SPAN potentiometer (RV1) at an increased pressure - preferably around 90% of full scale. SPAN adjustment can be performed at a pressure lower than 90% of full scale, but this will result in a slightly less accurate calibration.

1. Whilst supporting the enclosure lid, undo the four screws at the corners of the REM1 enclosure.

2. With the sensor subjected to atmospheric pressure only, adjust pot. RV2 until the current atmospheric pressure is displayed on the REM1 pressure display.

3. Pressurize the sensor to approximately 90% of full scale and adjust pot. RV1 until the correct pressure is displayed on the REM1 display.

4. Repeat steps 2 and 3 until no further potentiometer adjustment is necessary. Replace the enclosure lid.

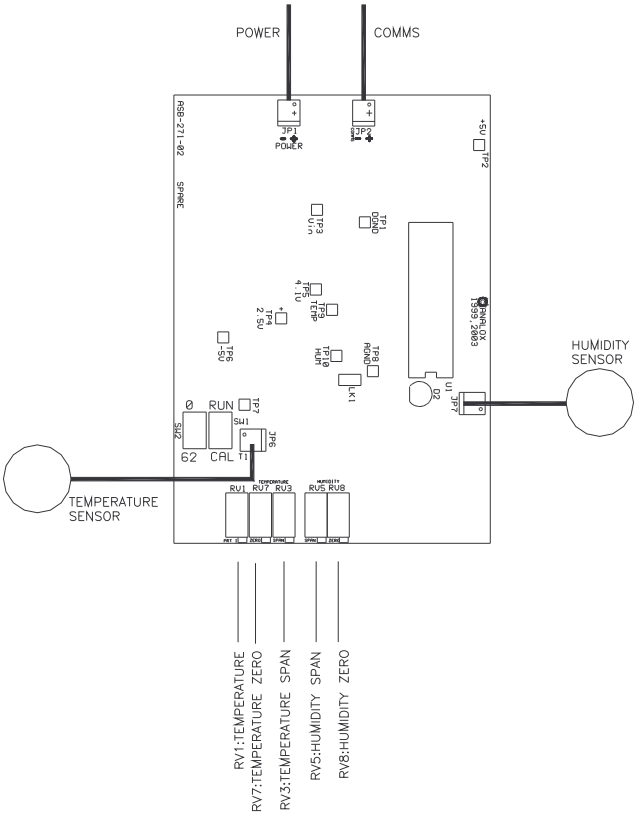
d) Temperature sensor calibration

1 Whilst supporting the enclosure lid, undo the four screws at the corners of the REM2 enclosure
2 Remove the connector from JP6 (Temperature Sensor).
3 Connect a milli-ammeter across the pins of JP6.
4 Adjust RV1 to achieve a current reading of 1.00mA.
5 Reconnect JP6
6 Now connect a voltmeter across TP9 (+) and TP8 (-).
7 Ensure SW2 is in the ‘0’ position.
8 Maintain the RUN/CAL switch to CAL.
9 Adjust RV7 to achieve a voltage reading of approximately 0.2v.
10 Ensure SW2 is in the ‘62’ position.
11 Maintain the RUN/CAL switch to CAL.
12 Adjust RV3 to achieve a voltage reading of approximately 2.5v
13 Repeat from Step 7 until no further adjustment is necessary
14 Perform the software calibration to complete the calibration.

e) Humidity sensor calibration

1 Whilst supporting the enclosure lid, undo the four screws at the corners of the REM2 enclosure
2
3 Now connect a voltmeter across TP10 (+) and TP8 (-). This signal typically varies between 0.2 and 3.0v for 0-100% humidity.
4 Subject the sensor to a 0% humidity and adjust RV8 to achieve a voltage reading of approximately 0.2v.
5 Subject the sensor to a 100% humidity and adjust RV5 to achieve a voltage reading of approximately 3.0v.
15 Repeat from Step 4 until no further adjustment is necessary
16 Perform the software calibration to complete the calibration.

REM2 Calibration pot positions:



7 TROUBLESHOOTING

SYMPTOM	REASON	SOLUTION
Main panel does not switch on	No power connected Front panel DC fuse F1 blown	Ensure power is connected correctly Switch it to ON Replace fuse if necessary. If replacement blows, seek assistance
Remote unit does not switch on	Main unit is switched OFF Fuse F2 on main unit blown Wiring incorrect Check for voltage at Remote Sensor	Switch main unit ON Replace fuse. If replacement blows, seek assistance Check wiring correct
Fault Indicator is ON and main unit sensor readings are replaced by 'COMMS ERROR' message.	Lack of communications with remote unit	Check remote has power and that wiring agrees with Installation drawings. While sensor is switched on, internal green LED will flash. If no communications , and wiring is correct, may need to replace line driver at either Display Unit or Remote Sensor.

8 SPECIFICATION

Power Source	External Stabilised 12-24V DC supply with regulation of better than +/- 300mV.
Operating Current	Average 400mA at 24V DC supply, peak current 550mA Power supply must be capable of providing instantaneous peak 2A at switch on
Fuses	F1 1A-M in supply to Main Panel F2 1A-M in supply to REM1 Both fuses are mounted on the front panel
Display Panel	LCD graphic display, 240 x 128 pixels Displays time in hours:minutes:seconds in 5mm high characters Displays current values of O_2, CO_2, Pressure, Temperature and Humidity using 10mm high large characters
Alarm Indicators	1 Alarm indicator for gas/environment alarms 1 Fault indicator for communications, calibration faults. 1 Audible Buzzer operating on alarm/fault conditions.
Operator controls	1 Power Switch to switch instrument on and off 5 Pushbuttons used via Menu System 1 Pushbutton to mute alarms
Oxygen Sensor	Analox 9100-9212-9HSUB oxygen sensor with up to 3 year life at 0.21 ATA ppO_2. Range 0-1500 mBar ppO2 Accuracy ±2.5 mBAR PPO2 for the range 190mBAR to 250mBAR PPO2 ±15mBAR PPO2 (±1% FS) for the remainder of the range Displayed as % (or as defined at time of order)
Pressure Sensor	Analox pressure transducer, with bridge output. Range 0-10.00 BarA Accuracy ± 0.25% of range Displayed as FSW (or as defined at time of order)
CO_2 Sensor	Analox BL5 low power, long life infra red sensor. CO2 reading is pressure compensated by microprocessor Range 0-50mBar ppCO2 Accuracy: ± 1.5mBAR from 0 to 25mBAR PPCO2, ± 3mBAR from 25 to 50mBAR PPCO2 Displayed as mBar, (or as defined at time of order)
Operating Temperature	0EC to 40EC
Storage Temperature	-30EC to 55EC
Dimensions	Main Panel 250mm (w) x 160mm (h) x 150mm (d) excluding electrical connectors and mounting cheeks REM1 140mm (w) x 90mm (h) x 55mm (d) excluding electrical connectors
Weight	Main Panel 2.2kg REM1 0.5kg