THE

MOGAS$_{93}$

Medical CO, CO2, O2 Gas Analyser

Installation and Operation Manual

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The Mogas93 Analyser Manual

The Mogas93 Analyser Panel

Mogas93 Controller Installation and Operation Manual

This manual covers all of the hardware and Software aspects of the Mogas93 Analyser. Each of the component parts of the system is discussed and hardware configuration is explained. Dimensional drawings are included.

This manual is divided into Three sections.

1. General overview of Mogas93 Analyser and basic connection information.
2. Main Control Board Software and Programming.
3. Individual Sensor/Transmitter operational Manuals.

End of Life Disposal

The Mogas93 Analyser is designed to give many years of reliable service, but if and when decommissioned and scrapped, it must be disposed of in accordance with the European Waste Electrical and Electronic Equipment Directive (WEEE) 2002/96/EC.

This means that it should be disposed of responsibly in accordance with an approved collection and disposal scheme or alternatively returned to the supplier for recycling or safe disposal.

Table of Contents

Revisions.

1.2: Calibration procedure added.	04/12/2014.	MW
1.3: Microx CO & CO2 Added	21/01/2016.	MW
1.4: Component Layout & Analyser Changes	22/06/2017	MW

1. INTRODUCTION

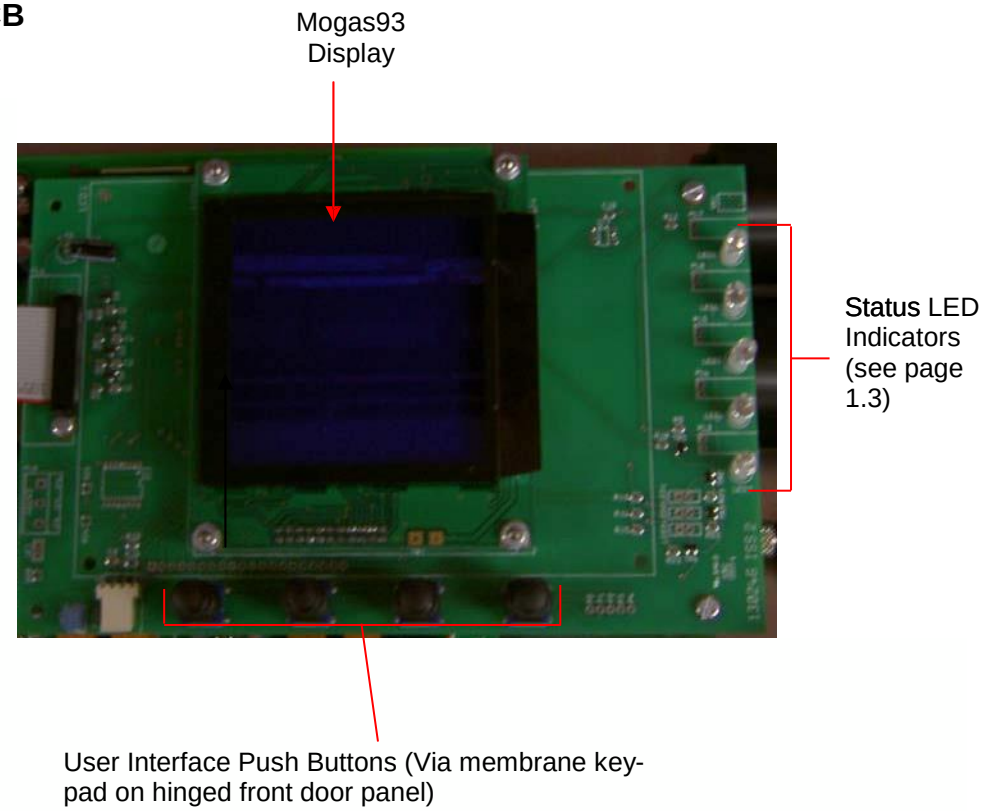
The Mogas93 Analyser Units provide a self contained solution for Medical Oxygen Purity Measurement. It is housed in a painted mild steel enclosure.

The Mogas93 Analyser Contains internal sample gas flow control and pipework, along with internal Sensors/Transmitters for Oxygen, Carbon Dioxide and Carbon Monoxide measurement of the sample gas stream. Also incorporated is a Dewpoint moisture Transmitter.
The Mogas93 displays concentrations of Oxygen (O2) 0-96%, Carbon Dioxide (CO2) 0-500ppm, Carbon Monoxide(CO) 0-50ppm and moisture content in the relevant % and ppm units.

Care has been taken with the design of the Mogas93 housings and internal chassis to facilitate ease of connection and wire termination. All on-site wiring to the system is via screw terminal connectors. The terminal cover has an internal label giving details of the external connections.

The Mogas93 Control Unit houses all of the components required to implement a sophisticated and reliable monitoring system (alarm relays etc).

Mogas93 Display PCB



The microcontroller module and display are mounted directly onto the hinged front door panel via connects to the main PCB via a single flat ribbon cable.

Microcontroller Module

Situated within the Mogas93 Control Unit Circuit Board is the Microcontroller Module. This module communicates with all Input channels connected to the system PCB.

The Microcontroller Module provides a user interface in the form of a back-lit graphics display and a four button multifunction keypad.

Five LED indications are provided directly by the Microcontroller Module and these are visible on the hinged front door panel of the Mogas93 Analyser Enclosure

- An Audible signal is also provided by a sounder mounted within Microcontroller module. This provides a local audible tone during alarm conditions.

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

Calibration of the system.

- This allows each channel to be calibrated independently. The sensor zero point and span can be set via this function.
- Calibration of the retransmitted output for each channel.
- Calibration of the channel power supply.

Input Module Relay Configuration.

- Each Input Module contains two relays for alarm levels 1 and 2. The alarm levels can be individually set to be either rising or falling.
- Fault relay.
- All relays can be configured normally energised or de-energised as required. Latching and non-latching functions can also be selected.

Mogas93 contrast adjustment

128x128 Graphics Module

LCD Contrast Adjust

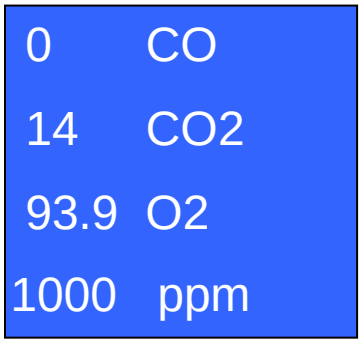
¾ Green LED for power.

¾ Red LED indication of Alarm level 3.

¾ Red LED indication of Alarm level 2

¾ Red LED indication of alarm level 1.

¾ Yellow LED indication of fault condition



Typical Operation Display for the Mogas93

I/O Circuitry and Customer Interface

The input circuit is identical for all channels. One channel monitors the Input of the O2 Sensor, another the CO Sensor and last channel the CO2 sensor, and interfaces the signals that it receives to the microcontroller module. These are all pre-wired within the control panel.

The input module on the control board is designed to accommodate Sensors that supplies signals in any of the following formats:

(a) 2- wire Current source 4 – 20mA.
(b) 3-wire power plus Current source 4 – 20mA.

The channel outputs are as follows.

The transmitted signal can be configured using jumpers to provide one of three output options:

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

The 4-20mA Outputs are as follows: (situated on control panel backplate)

Terminals 16 and 17, + and – output for CO2 Sensor -Channel 1
Terminals 18 and 19, + and – output for CO Sensor.- Channel 2
Terminals 20 and 21, + and – output for O2 Sensor- Channel 3

Situated on each of the three Input Modules are 2 single-pole change-over relays, (one pair related to the O2 Sensor, one pair to the CO Sensor and one pair to the CO2 Sensor. All relays have contacts rated at 5A (240V AC). These relays operate at the alarm levels when enabled. Ntron are able to implement modifications to the software to meet a customer's specific requirement.
The Relays are programmed to be Energised when the control panel is powered and in healthy condition. They de-energise when an alarm event occurs. It is recommended that a 'fail safe' protocol is followed when implementing these relay outputs into a control system, so that in Alarm condition (or power failure to the control panel) the contacts of the associated relay to the connected external circuit, are open (no circuit). This is known as 'Fail Open'.

Terminals 4	Common	
5	Fail Closed	Channel 1 CO2
6	Fail open	
Terminals 7	Common	
8	Fail Closed	Channel 2 CO
9	Fail open	
Terminals 10	Common	
11	Fail Closed	Channel 3 O2
12	Fail open	
Terminals 13	Common	
14	Fail Closed	System Fault
15	Fail open	

Screen terminals are provided for the connecting cable screens on all of the above terminal connection points.

1.1 INSTALLATION

Dimensions

390mm x 400mm x 200mm (Height x Width x Depth)

Siting the Mogas93

THE Mogas93 ANALYSER MUST BE SITED IN A NON-HAZARDOUS LOCATION WHERE THERE IS NO RISK OF THE PRESENCE OF POTENTIALLY EXPLOSIVE GAS.

A 100-240VAC 50 Hz supply is to be used to power the Mogas93.

The site of installation should be chosen with regard to the following:

- This equipment should not be located near to known sources of heat.
- Operating personnel should be within convenient reach of the equipment and within audible distance of alarms.
- Avoid mounting this equipment near potential sources of electrical interference e.g. motors, switch gear, radio transmitters etc.

System Wiring

All connections should be made according to the connection details in this document and any associated wiring diagrams specific to the system of which this control panel is a part of. It is advised that 'Bootlace Ferrules' or 'flat blade crimps' be used for tidy and reliable connections of wires into the Control Unit and Detector Head connectors.

Power Supply Input/Customer A.C. mains connection

100-240V AC Mains Supply, connectors 1, 2 and 3 on the main panel backplate.
Pin 1 =Live input
Pin 2 = Neutral input
Pin 3 =Earth input
A pre-wired connection lead is provided for the customer so no connection to these terminals is required by the customer.

There are two fuses situated on the main Control Board. These are:

FS1 (T1.0A)	AC supply Fuse (Not used)
FS2 (T500mA)	DC Supply Fuse

The main control board is powered via the 24VDC option and the mains input option to this board is not used.

An isolating switch should be provided between the power source and the Mogas93 Analyser to allow the supply to be easily disconnected. This should incorporate over current protection or a circuit breaker. Alternatively a fused supply would suffice.

Locations of the mains and interface terminals are shown below.

1.2 Sample Measurement

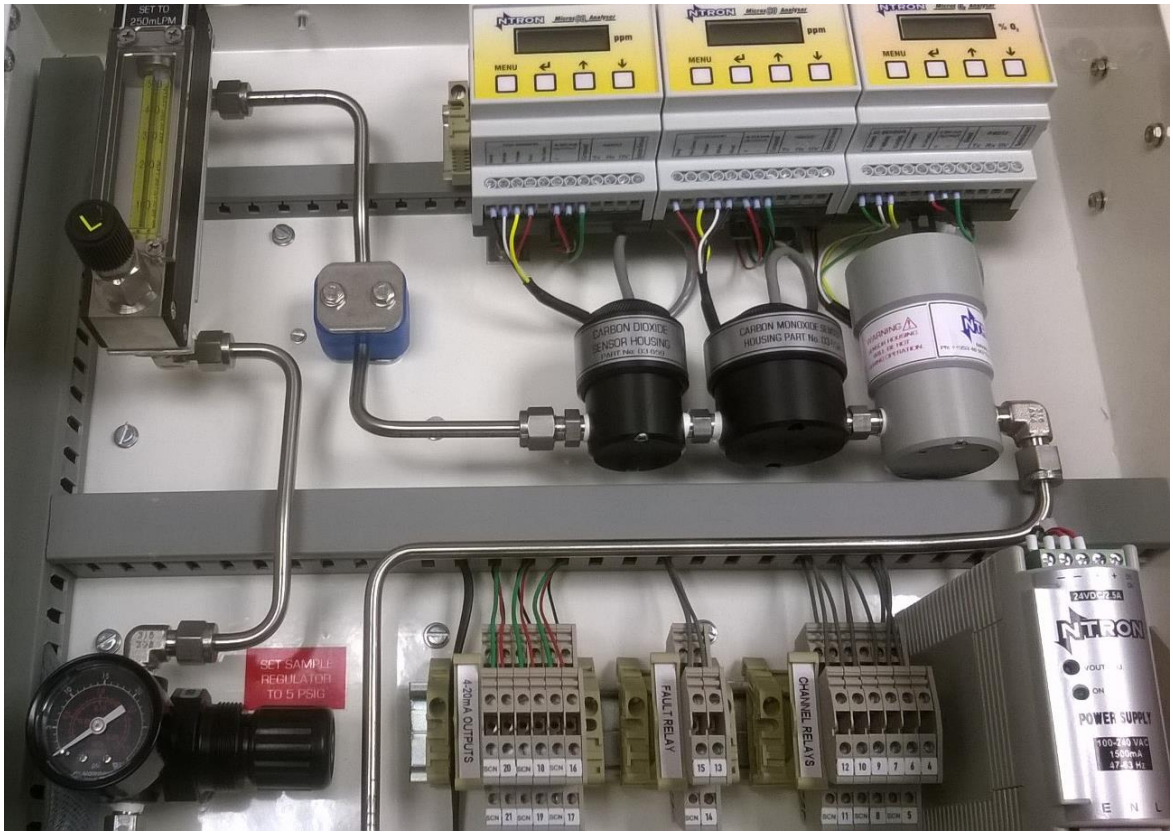
The sampling Circuit consists of a Regulator, Flowmeter, CO2, CO and O2 Sensors/Transmitters and Flowmeters. Please see photograph and diagrams that follow.

A positive Pressure sample Gas enters the Mogas93 ‘Sample In’ port, and is regulated to no more than 5 PSIG by the adjustable regulator, visible on a gauge.

The Sample Gas then passes through the system Flowmeter.
The Sample Gas Flow Rate is visible for setting and adjustment via the Flowmeter.
The Sample Gas now passes through the CO2 Sensor and then the CO Sensor and then through the O2 Sensor. These Sensors are each housed in a ‘Flow Through’ Housing, which allows the same Sample to be analysed by all sensors in turn.
Sample Flowmeter set to 250 mL/Min
The Sensor/Transmitter units all give a 4-20mA output into the control board proportional to the gas concentration and moisture level measured.

The Sample Gas is exhausted from the Mogas93 via the ‘sample Out’ port.

Both Sample gas In and Sample Gas Out ports are Stainless Steel ¼ ” o r 6mm Bulkhead Compression fittings. Suitable Piping and Filtration if required, is to be provided and fitted by the end user.

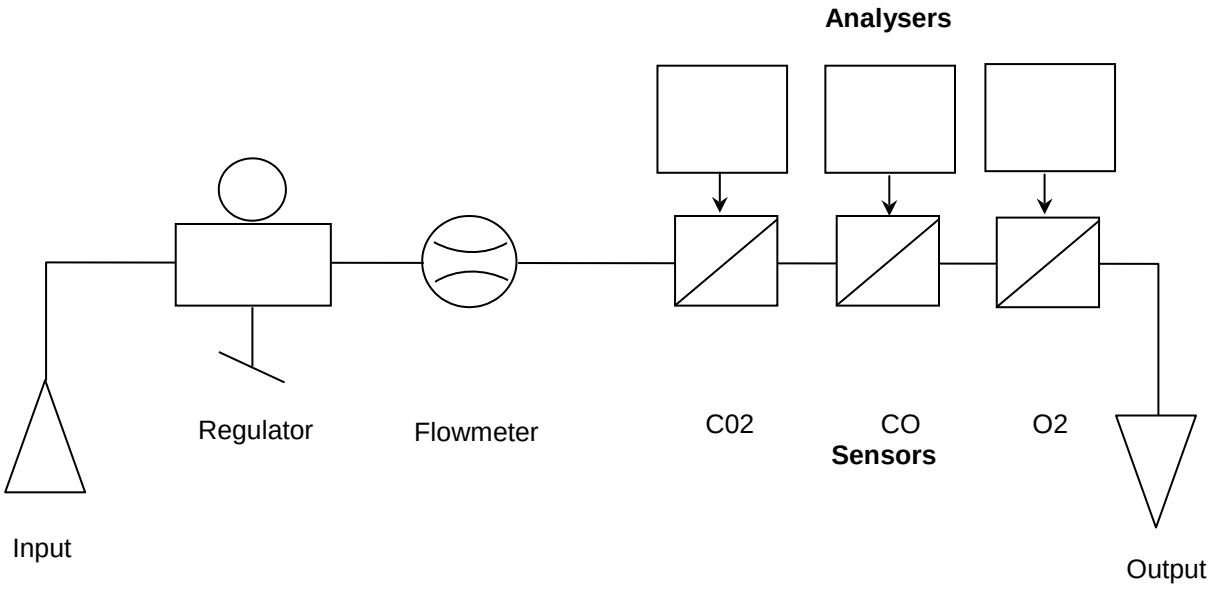


All connecting pipework is to be provided by the customer/end user.

The standard pipework connections into the panel are ¼” or 6mm compression fittings depending on customer specification at time of order.

Stainless Steel pipework is recommended though other materials are not precluded depending on process media being measured and security/mechanical protection of the installation..

The sample exhaust should be vented to a suitable location. Back pressure not to exceed 1psig. (or in some circumstances to process if a suitable pressure differential is available)



Internal sample Piping Diagram

1.3 Routine Servicing

The Mogas93 Control Units 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 Ntron as part of a maintenance contract.

Routine Inspection

It is advisable to periodically inspect the Mogas93 Analyser Installation:

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

Note: Do not use solvents to clean the Mogas93 display window on the control units.

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

1.4 Notes on Calibration

See page 33 onwards for specific calibration details

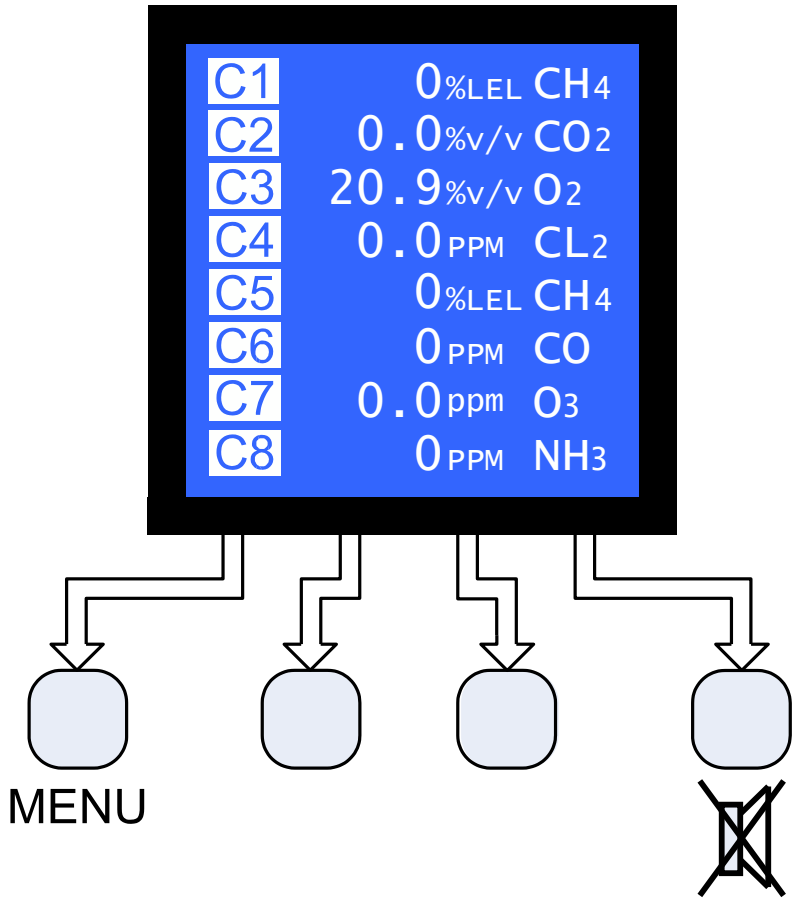
Customer calibration of this instrument will involve the individual Analysers (O2, CO & CO2) within the Mogas93 control panel. Calibration between the Analyser outputs and the Mogas93 main control board is factory set and will not need adjusting unless a complete Analyser unit is replaced. Detail of the main control board calibration is given for reference purposes.

SECTION 2

2. OPERATION

During normal operation, the LC 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 Mogas93 Analyser operates on a Multigas controller platform which can accommodate up to 8 different gas monitoring circuits. These are shown as generic examples in the instructions that follow. The Mogas93 Analyser only monitors three types of gases which are pre-configured in the software following. These are O2, CO and CO2.

The following display and associated push buttons shows an LC8 unit that has all 8 channels configured.



Horizontally there are up to 4 regions, lines 1 to 4, each of which displays the channel information.

Vertically the display is split into 5 regions. Each region gives specific information for each channel.

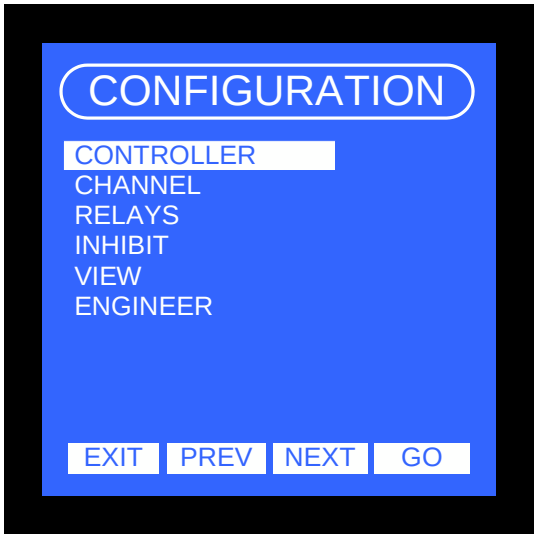
Note:
The Menu button and the alarm accept buttons are labelled; the other buttons are not identified. The buttons on the front of the LC Control Unit change depending upon the current display function.

2.1 Accessing 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 if the password is set.

3. Enter the correct password and press OK.
4. The default password for the system is 123 (If an incorrect password is entered the system will revert to the standard system default screen).
5. The following screen will be seen when the correct password is entered.



2.2 Alarm Conditions

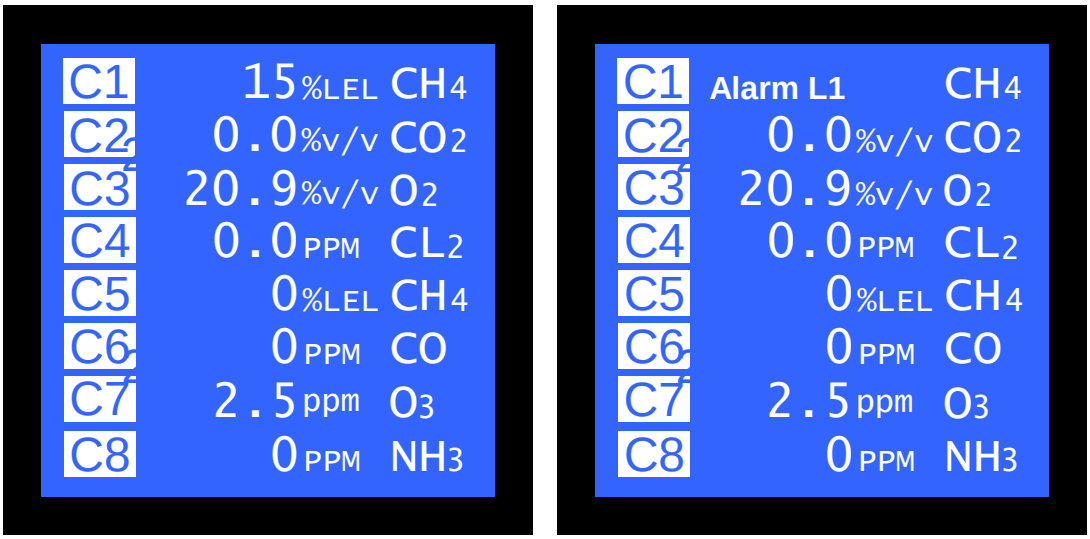
Gas Level Alarm

Gas level alarms can be of three types

1. Level 1 alarm
2. Level 2 alarm
3. Level 3 alarm

Level 1 Alarm

The LC 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).
Its alarm levels may be set as 15%, 30% and 50% LEL.



Each time a gas concentration is detected in excess of those set in the alarm levels configuration, in the above example 15% LEL, the LC 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.

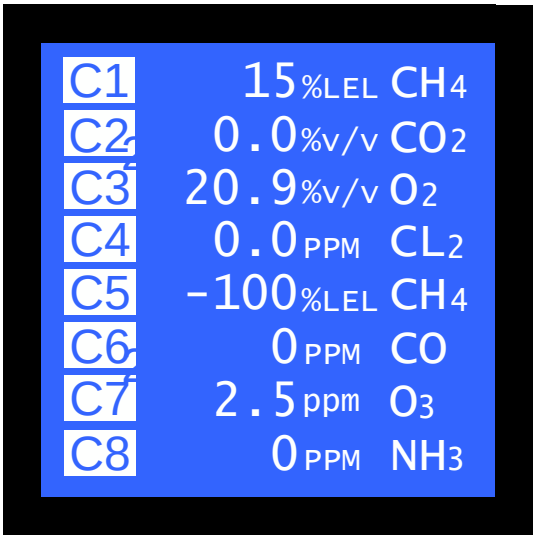
Note:
An alarm will be indicated on the display by the word Alarm appearing next to the channel in alarm, the Alarm status will alternate between the alarm levels and the gas reading.

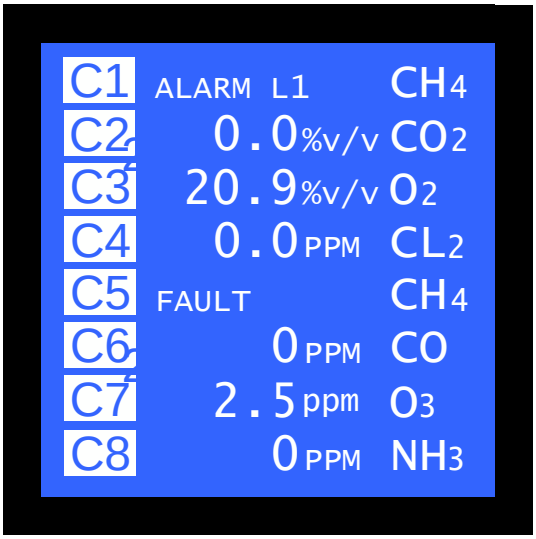
The local Alarm Red LEDs will light to indicate an Alarm condition, regardless of the display mode selected.

Fault Alarm

The control unit will indicate a fault if a detector head indicates less than 10% of its measuring range (i.e. below 2.4mA signal level).

Any channel that is in a fault condition is detected by the LC Control Unit which generates a fault message, drives the local Yellow LED and activates the fault relay.





Accepting the Alarm

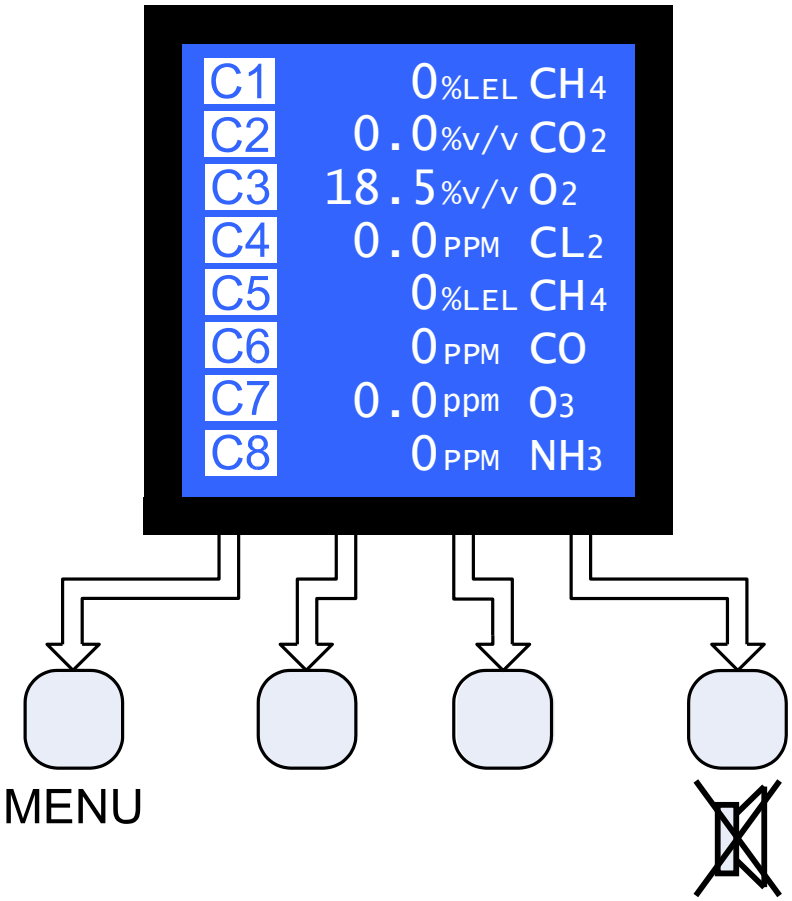
If an alarm condition is encountered and: -

The alarm relays are set as non-latching

Pressing alarm accept button will allow the sounder to be silenced.
When the alarm condition has passed, the relays will reset themselves to their healthy state.

The alarm relays are set as latching

Pressing alarm accept button will allow the sounder to be silenced.
The Alarm will only be cleared if the ACCEPT Button is pressed and the channel is no longer in an alarm condition.



2.3 Display Settings

The LCD display can be configured to display the gas levels using either the decimal point or the comma.
The display can also be set to give an additional message during alarm and fault conditions. This is useful when different languages are used and the text cannot be clearly displayed in the normal 5x8 character size.
The amount of time the backlight remains lit following a key press is also user configurable.

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 BACKLIGHT 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.
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.

Changing the Password

The *System Configuration* Menu can only be accessed following correct password entry. The default

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 8 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.
   Note: Entering no digits will disable the user password.

Note: forgotten password.
The user password can be overridden by the engineer password – contact Ntron.

2.4 Software Configuration

The software configuration has been made as flexible as possible in order to maintain capability with the many types of sensors available and the wide variety of possible applications. 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.

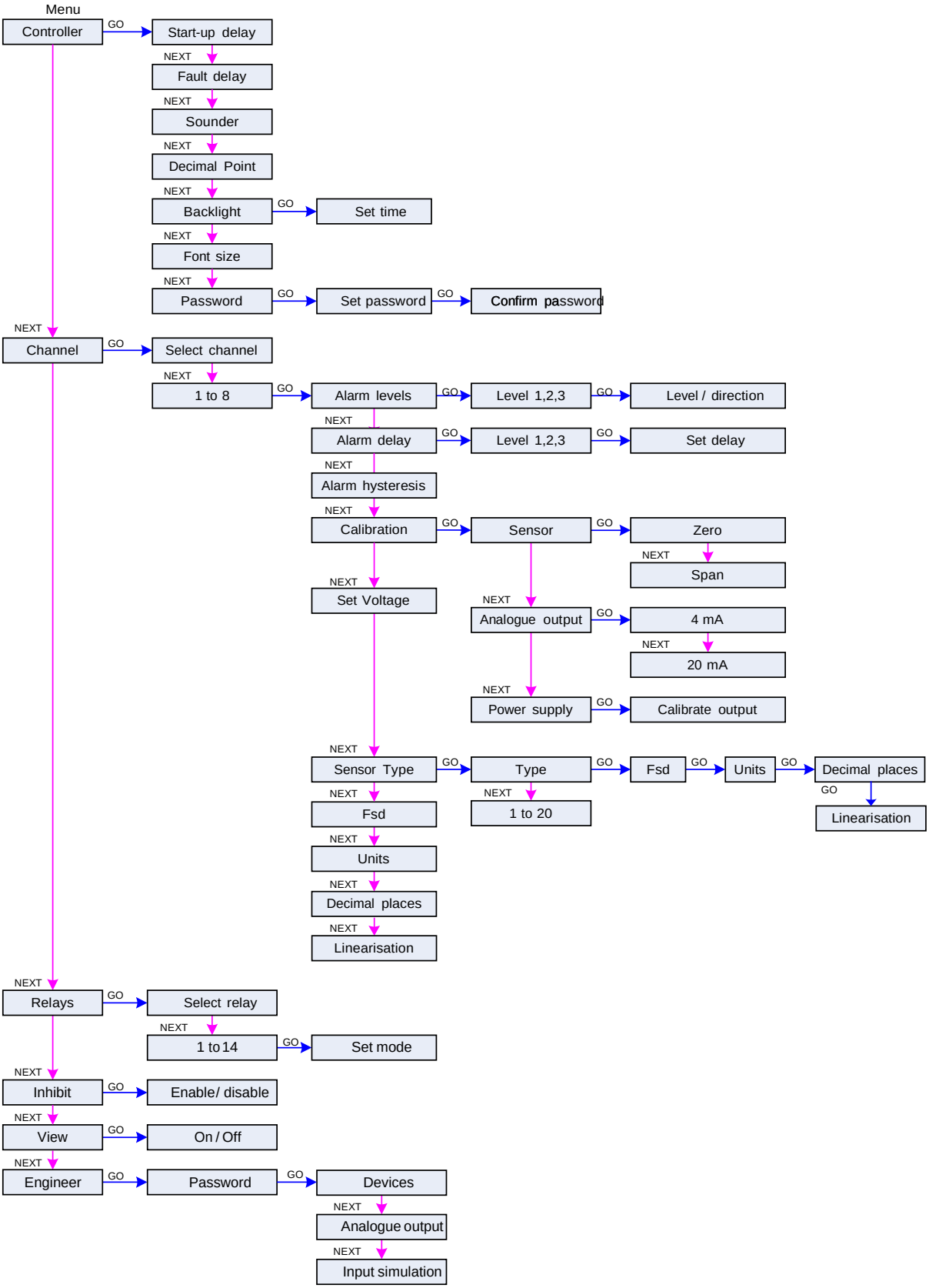
Refer to the '**LC System Installation and Hardware Configuration Manual**'

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 if enabled.

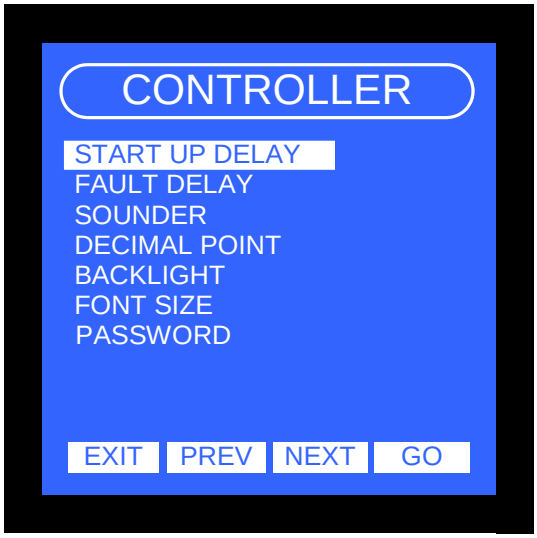
The configuration is consists of several parts:

1) Controller configuration
2) Channel configuration
3) Relays
4) Inhibit
5) View
6) Engineer

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


Menu
Controller
GO
Start-up delay
NEXT
Fault delay
NEXT
Sounder
NEXT
Decimal Point
NEXT
Backlight
GO
Set time
NEXT
Font size
NEXT
Password
GO
Set password
GO
Confirm password
NEXT
Channel
GO
Select channel
NEXT
1 to 8
GO
Alarm levels
GO
Level 1,2,3
GO
Level / direction
NEXT
Alarm delay
GO
Level 1,2,3
GO
Set delay
NEXT
Alarm hysteresis
NEXT
Calibration
GO
Sensor
GO
Zero
NEXT
Span
NEXT
Set Voltage
NEXT
Analogue output
GO
4 mA
NEXT
20 mA
NEXT
Power supply
GO
Calibrate output
NEXT
Sensor Type
GO
Type
GO
Fsd
GO
Units
GO
Decimal places
GO
Linearisation
NEXT
1 to 20
NEXT
Fsd
NEXT
Units
NEXT
Decimal places
NEXT
Linearisation
NEXT
Relays
GO
Select relay
NEXT
1 to 14
GO
Set mode
NEXT
Inhibit
GO
Enable/ disable
NEXT
View
GO
On / Off
NEXT
Engineer
GO
Password
GO
Devices
NEXT
Analogue output
NEXT
Input simulation

Controller

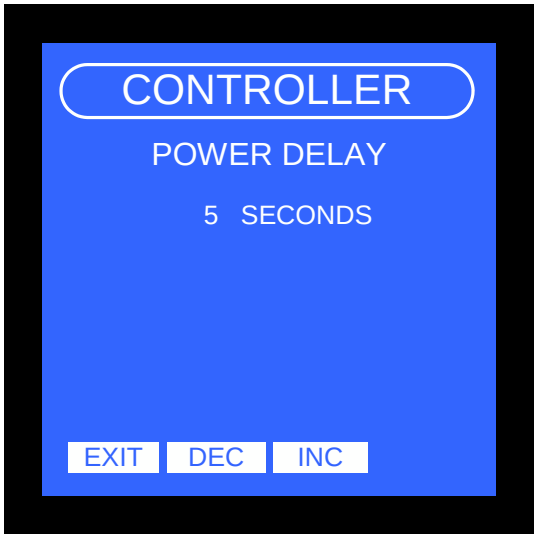


The following section details each menu option.

Start up Delay

This setting allows the LC system to ignore any readings taken following the transition following applying power. The setting can be between 0 and 180 seconds.

1. From the *System Configuration* menu, select CONTROLLER and press GO.
2. Next select the *Start up Delay* menu and press GO.
3. Select the desired time delay using the INCrease and DECrease buttons.

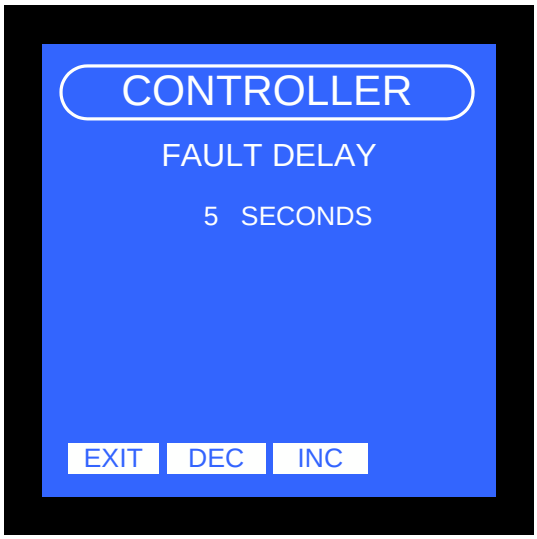


4. Press EXIT once adjustment has been made.
5. The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes.
6. Press EXIT, The display will return to the *Start up delay* screen.
7. Press EXIT, The display will now return to the normal screen.

Fault Delay

This setting allows the LC system to ignore any readings taken that result in a fault condition. The setting can be between 0 and 10 seconds.

1. From the *System Configuration* menu, select CONTROLLER and press GO.
2. Next select the *Start up Delay* menu and press GO.
3. Select the desired time delay using the INCrease and DECrease buttons.

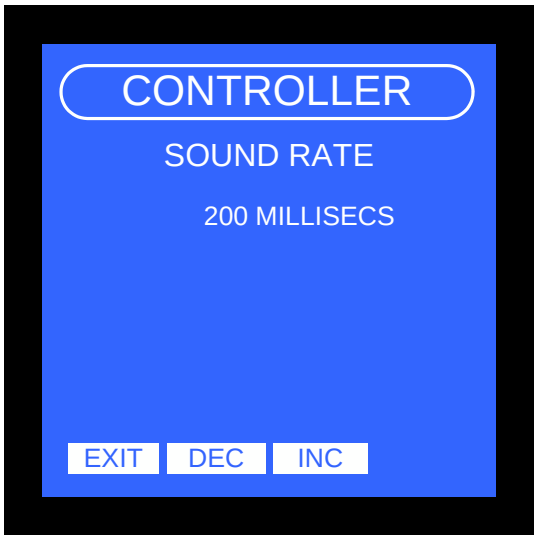


4. Press EXIT once adjustment has been made.
5. The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes. The display will return to the *Fault delay* screen.
6. Press EXIT twice, the display will now return to the normal screen.

Sounder

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

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

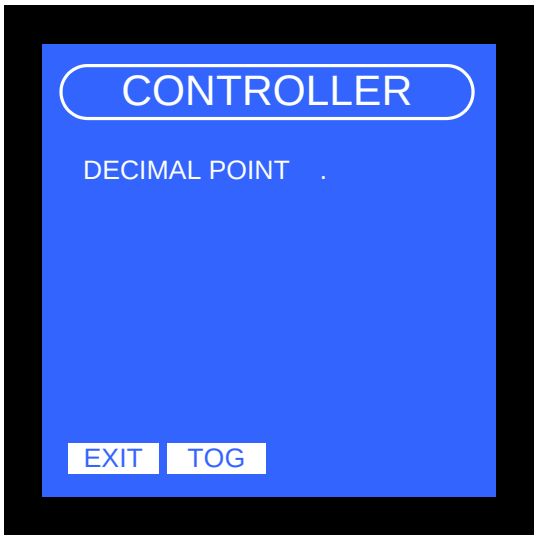


3) Use the INC, DEC buttons to select the frequency.
4) As the frequency is reduced the setting changes to always off then always on
5) Press EXIT leave the setting as it was.
6) The display will now return to the *Sounder* menu.
7) Press EXIT, The display will now return to the normal screen.

Decimal point

This option is used to allow the user to select the numerical display according to the location.

1) From the *ENGINEER* menu, select *Decimal point* and press GO.



2) Use the TOG buttons to select the decimal point or the comma.
3) Press EXIT leave the setting as it was.
4) The display will now return to the *Decimal point* menu.

Backlight

This option is used to allow the user to set the backlight operation. The backlight can be set to activate when a button is pressed for a pre-determined time. It can also be set to be continuously on or off allowing total flexibility in its use.

1) From the *CONTROLLER* menu, select *Backlight* and press GO.

2) Use the INC DEC buttons to select the required time.
3) Press TOG to change the mode between timed, always on and 50% dimmed.

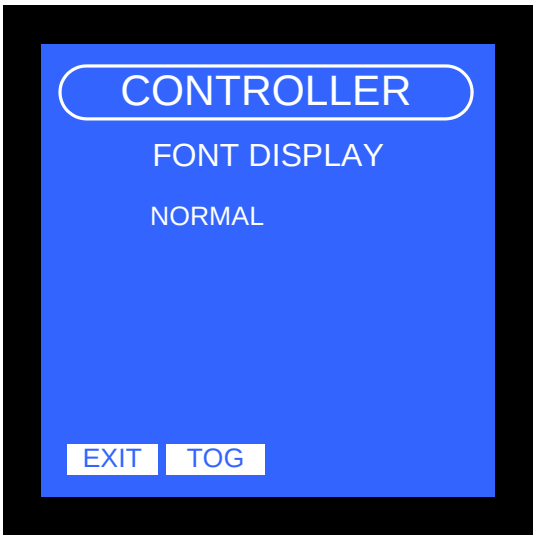
4) Press EXIT when the desired setting is selected.
5) The display will now return to the *Backlight* menu.

Note: some displays require that the backlight is on continuously.

Font Size

This option is used to allow the user to set the font size. If the large size is set then the readings will be maximised at the expense of some display information.

1) From the *CONTROLLER* menu, select *font size* and press GO.



2) Use the TOG button to select the required size.
3) Press GO when the desired setting has been entered.

Password

This option is used to allow the user to set the user password. The password can be from 0 to 8 digits long and must only contain the numbers 1, 2 and 3.

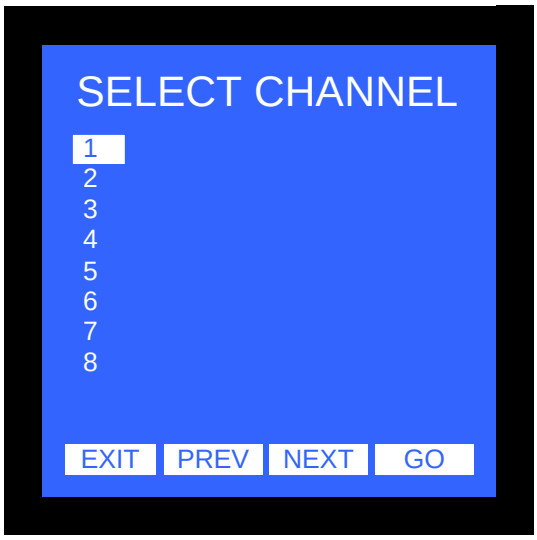
4) From the *CONTROLLER* menu, select *password* and press GO.

5) Use the 1, 2 or 3 buttons to select the required password.
6) Press GO when the desired number has been entered.
7) Confirm the password then press GO.
8) The display will now return to the *Password* menu.

Note: the password can be disabled by setting the password to 0, no numbers entered when setting, just press go for new and password confirmation.

Channel

There are 4 channels available for the LC4 and 8 for the LC8:



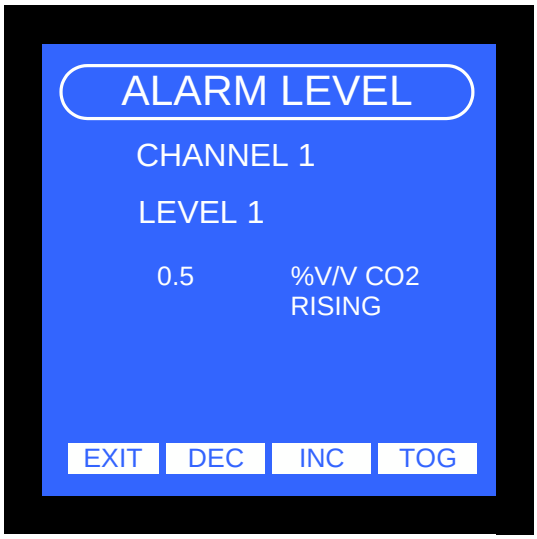
The channel menu has 7menu options as follows:

The following section details each menu option.

Alarm Levels

Each channel has three configurable alarm levels.

1. From the *Configuration* menu, select CHANNEL and press GO.
2. Select the appropriate channel number and press GO
3. Select ALARM LEVELS and press GO.
4. Select the alarm level 1, 2 or 3 and press GO.
5. The *Alarm Levels* configuration screen will now be displayed.



6. Press INCrease or DECrease until the desired alarm level is displayed. Press TOG as required to set the alarm as RISING or FALLING.

   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 rise 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 fall below 19.5%, in this instance we would set the alarm as FALLING.
7. Press EXIT 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 *Alarm Level* menu.
10. Repeat for the next alarm level.

Alarm Delay

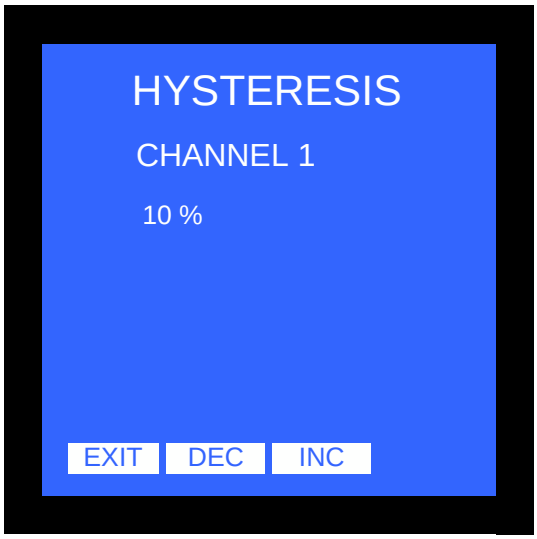
1. From the *System Configuration* menu, select CHANNEL and press GO.
2. Select the appropriate channel number and press GO
3. Select Alarm delay and press GO.
4. Select the alarm level 1, 2 or 3 and press GO.
5. The Alarm *Delay* screen will now be displayed.

6. Press INCrease or DECrease until the desired delay is displayed.
7. Press EXIT.
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 *Alarm delay level* menu.
10. Repeat for the next alarm level.

Alarm Hysteresis

Each channel has a hysteresis value associated alarm relays. This setting is used to eliminate relay chatter when the gas level hovers around alarm set point.

1. From the *System Configuration* menu, select CHANNEL and press GO.
2. Select the appropriate channel number and press GO
3. Select HYSTERESIS and press GO.
4. The Hysteresis screen will now be displayed.



5. Press INCrease or DECrease until the desired hysteresis is displayed.
6. Press EXIT.
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 *Alarm hysteresis* menu.

Calibration

Periodic Calibration of the Mogas93 instrument is required because the various sensors will deteriorate over the course of their lives and their outputs will need recalibration into the respective Analysers.
To perform these calibrations, gases of known concentration will need to be passed through the sensors for each respective Analyser. As all the sensors are in series with each other, this will involve applying three separate operations of presenting Oxygen, carbon Monoxide and Carbon Dioxide gases to the sample gas stream and calibrating each Analyser in turn.
Note that calibration is only required if the displayed concentration of gas does not match the calibration gas concentration.
Also, the calibration gas concentration should ideally match that of the original Ntron factory calibration gas. (See Ntron factory calibration certificates supplied).

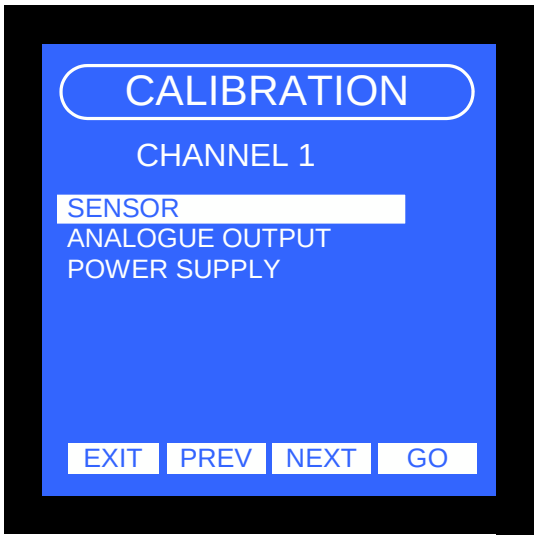
If calibration adjustment is required, then a SPAN procedure fro each Analyser will need to be undertaken when the calibration gas is being presented to the respective Analyser/Sensor combination. **Zero calibration is not required as this has been set at the Ntron factory. See the relevant Analyser manuals in the Appendix of this Manual.**

Calibration gases presented to the Mogas93 instrument should have means for suitable isolation and regulation. And gas pressure presented to the Mogas93 instrument **should not exceed 20 Barg.**

Procedure.

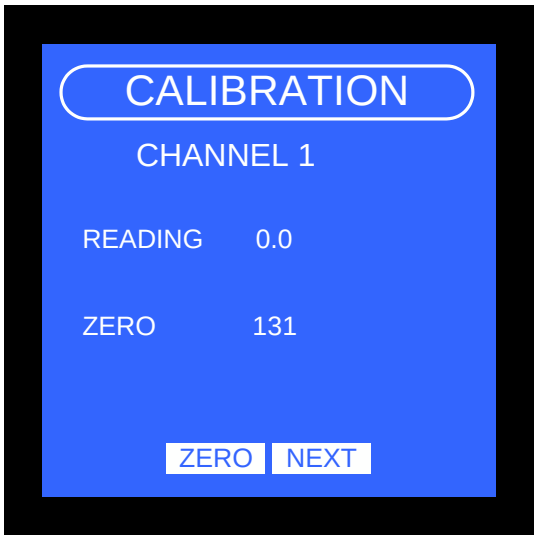
1. Apply O2 calibration gas to the Mogas93 sample input port for a few minutes. Allow display reading to stabilise. Flow rate of gas will be internally set to the correct amount of 250ml/m.
2. If display reading is the same as the calibration gas concentration, (within the gas tolerance range) then no further adjustment is necessary.
3. If display reading is outside the calibration gas tolerance range, then adjustment of the O2 Analyser is necessary.
4. For the O2 Analyser calibration adjustment, please see the Appendix to this manual- Microx O2 Analyser manual page 16.
5. Repeat the above procedure for both the CO and CO2 calibration gases and Analysers. For calibration instructions, see the appendix to this manual and the respective CO and CO2 Analyser user manual pages. (Page 15 in the CO user manual and page 15 in the CO2 user manual). Note that these manuals contain complete information for the individual operation of the respective Analysers and some information may not be relevant when the Analysers are used within the Mogas93 Instrument. The Mogas93 manual should be consulted and be viewed as the overriding instruction manual in all cases.

Main Control Board Calibration



Sensor

1. From the System Configuration menu, select CHANNEL and press GO.
2. Select the appropriate channel number and press GO
3. Select Calibration and press GO.
4. Select Sensor and press GO.
5. The following screen will now be displayed.



6. Press the ZERO button to zero the sensor. Make sure that the sensor is in zero gas before performing the zero function.
7. Press the NEXT button.

Note: The ZERO display shows the raw signal counts for the zero gas level. The ZERO value can be recorded which may be used to determine if the channel input is working correctly.

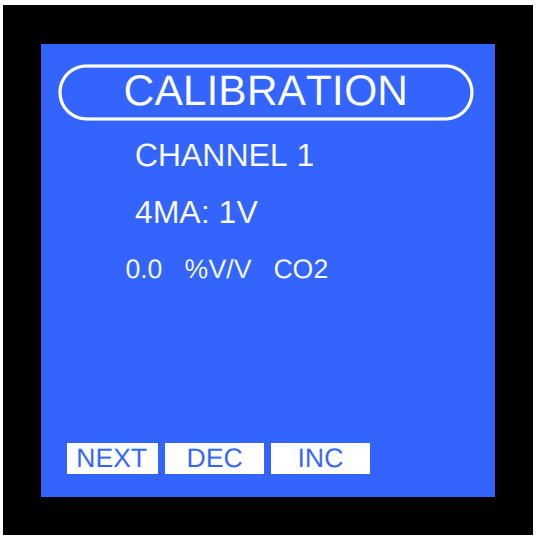
8. Apply the test gas. The reading should rise to approximately that of the gas level.
9. When the reading is stable press the SPAN button to calibrate the sensor. The Span button may be pressed repeatedly until the reading and span gas match.
10. Press EXIT. The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes.
11. The display will now return to the *Sensor* menu.
12. Press EXIT, The display will now return to the normal screen.

Note: The SPAN display shows the multiplication factor that is applied to the sensor signal to convert the signal to a gas level. The SPAN value can be recorded which may be used to determine if the channel input is working correctly.

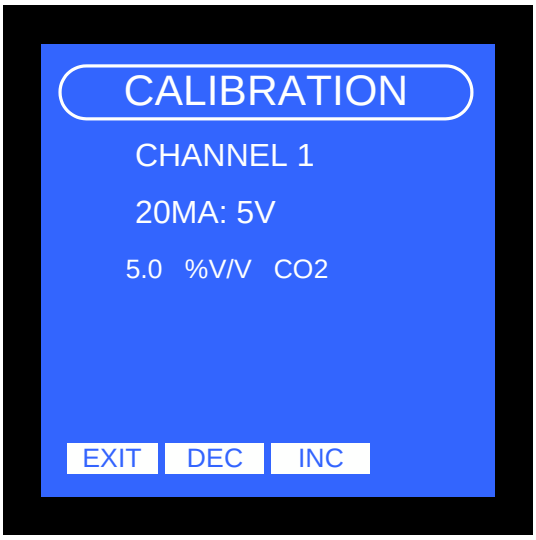
Analogue output

Connect a multimeter to the analogue output, select an appropriate range depending upon the channel configuration.

1. From the System Configuration menu, select CHANNEL and press GO.
2. Select the appropriate channel number and press GO
3. Select Calibration and press GO.
4. Select Analogue output and press GO.
5. The following screen will now be displayed.



6. Press the INCrease DECrease buttons to adjust the output to 4 mA or 1V.
7. Press the NEXT button.



8. Press the INCrease DECrease buttons to adjust the output to 20 mA or 5V.
9. Press the NEXT button.
10. The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes.
11. The display will now return to the *Analogue output* menu.
12. Press EXIT, The display will now return to the normal screen.

Power supply

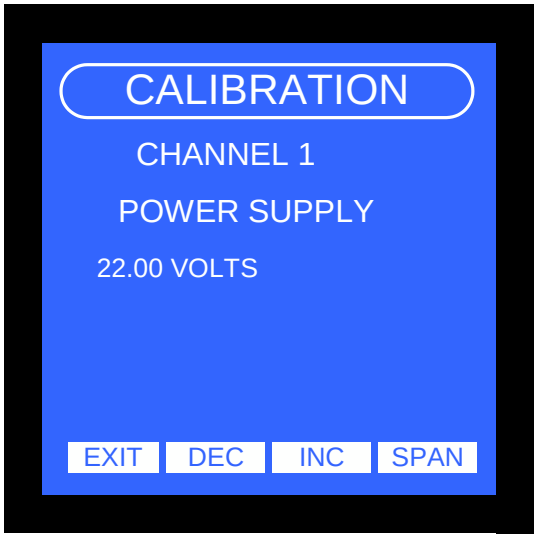
Each channel has a variable power supply that can be adjusted between 0 and 24 volts. This allows the user to set the supply to match the external device.

The power calibration voltage is displayed on the display during set up. This voltage is set to the actual measured voltage.

Note: it may be necessary to measure the voltage at the device if it a long way from the control unit.

Connect a multimeter to the variable PSU output, select a range that will display up to 30V dc.

1. From the System Configuration menu, select CHANNEL and press GO.
2. Select the appropriate channel number and press GO
3. Select Calibration and press GO.
4. Select Power supply and press GO.
5. The following screen will now be displayed.



6. Press the INCrease / DECrease buttons to adjust the displayed reading output to match the measured level.
7. Press the SPAN button when the display matches the measured level.
8. Press the EXIT button.
9. The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes.
10. The display will now return to the Calibration / *Power supply* menu.
11. Press EXIT until the display returns to the normal screen.

Set Voltage

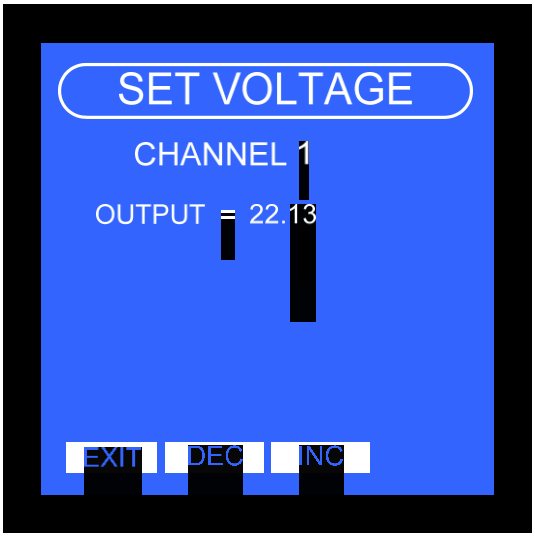
Each channel has a variable power supply that can be adjusted between 0 and 24 volts. This allows the user to set the supply to match the external device.

The power supply voltage is displayed on the display during set up, however the displayed voltage is dependent upon the load connected to the supply and may not read exact. The display voltage can be calibrated for any given load, see section 0.

Note: it may be necessary to measure the voltage at the device if it a long way from the control unit.

Connect a multimeter to the variable PSU output and select a range that will display up to 30V dc.

1 From the System Configuration menu, select CHANNEL and press GO.
2 Select the appropriate channel number and press GO
3 Select SET VOLTAGE and press GO.
4 The following screen will now be displayed.

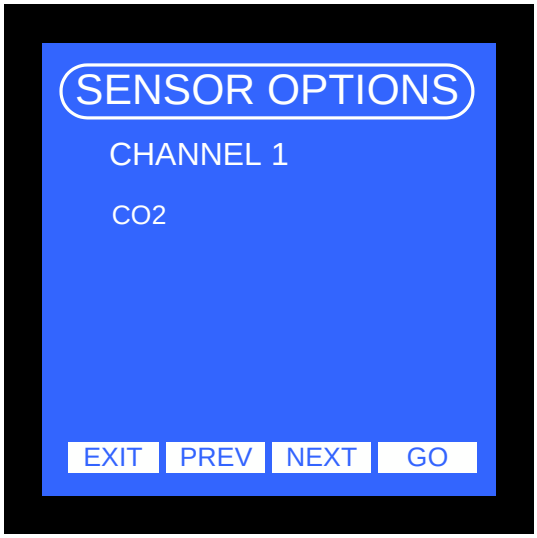


5 Press the INCrease or DECrease button to adjust the output to the desired level as shown on the multimeter.
6 Press the EXIT button.
7 The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes.
8 The display will now return to the SET VOLTAGE menu.
9 Press EXIT until the display returns to the normal screen.

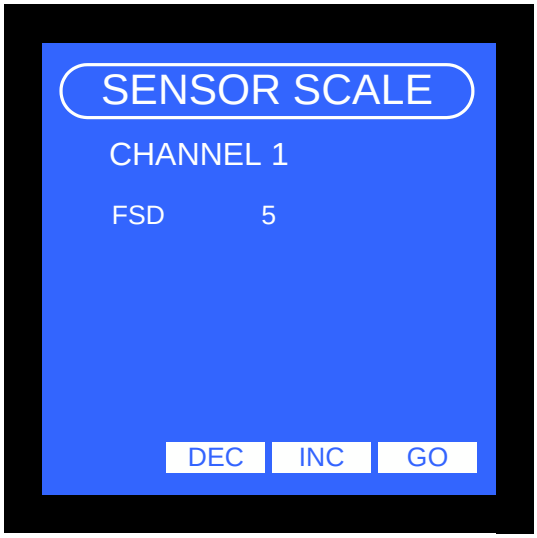
Sensor Type

This option allows the user to change the type of gas each channel is monitoring (as a result of sensor change).

From the *System Configuration* menu, select CHANNEL and press GO.
Select the appropriate channel number and press GO.
From the *Channel Options* screen select SENSOR TYPE and press GO.
A *Sensor Selection* screen will be displayed. Select the appropriate sensor type by using ten PREVious and NEXT buttons then press GO.



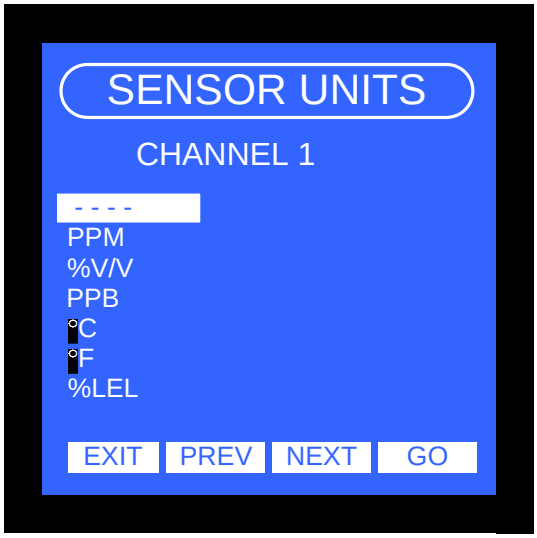
The *Sensor Scale* screen will now be displayed. This screen allows the user to choose the operating range of the sensor. The default values for the sensor will be displayed.



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

Press GO once the correct sensor range has been selected.

The *Sensor Units* screen will now be displayed. This screen allows the user to choose the units of the sensor.



Press GO once the correct sensor units have been selected. The following screen is displayed:

Select the appropriate display type by using the PREVious and NEXT buttons then press GO.
The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes.
The display will now return to the *Sensor Type* menu.
Press EXIT, The display will now return to the normal screen.

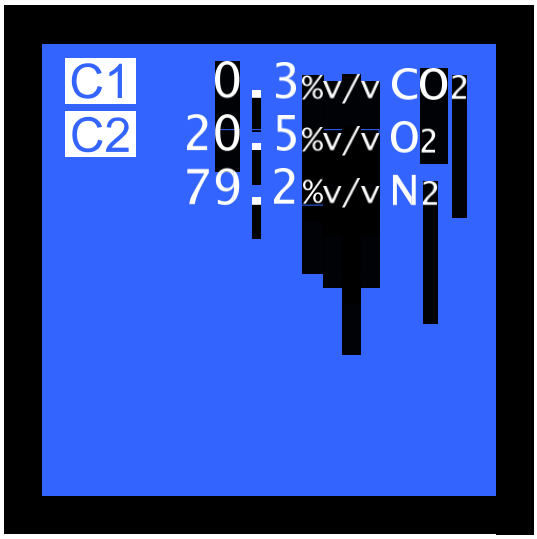
A linearization curve fit can be applied for oxygen sensors, the following screen will be shown:

A calibration must now be performed.

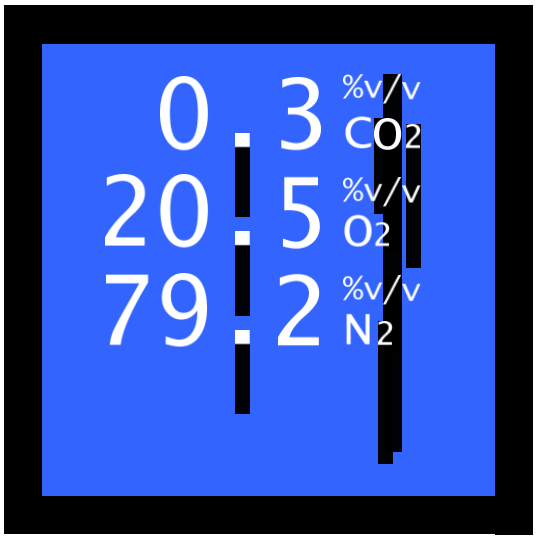
Nitrogen Sensor

The software can be configured for a virtual sensor for nitrogen gas. When the channel is set to nitrogen, $N_{2,}$ the nitrogen level is calculated by subtracting the previous channel readings from 100.

All channels must be set to %v/v with 1 decimal place. A typical display is shown below



Normal Font



Large Font

Note: any channel that reads negative, inhibited or the units are set to something other than %v/v will be treated as 0% reading.

Relay Options

Each relays has user configurable options available to them.

1. From the *System Configuration* menu, select Relays and press GO.

2. Select the appropriate relay using the PREVious and NEXT buttons and press GO

Notice that the arrow key points to the setting that will be changed when TOG is pressed. Pressing NEXT will move the arrow to the next option.

3. Press EXIT when the desired options are set.
4. The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes.
5. The display will now return to the *Relay* menu.
6. Press EXIT, The display will now return to the normal screen.

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 LC keypad.

Level 3 alarm relays

Relay 3 for Level 3 alarms don't individually exist but are combined to form 1 common level 3 relay. This results in only 1 option being made available – the latching function.

a. From the *System Configuration* menu, select Relays and press GO.

b. Select the appropriate relay using the PREVious and NEXT buttons and press GO

Notice only the LATCH option setting that will be changed when TOG is pressed.

c. Press EXIT when the desired options are set.

d. The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes.

e. The display will now return to the *Relay* menu.

f. Press EXIT, The display will now return to the normal screen.

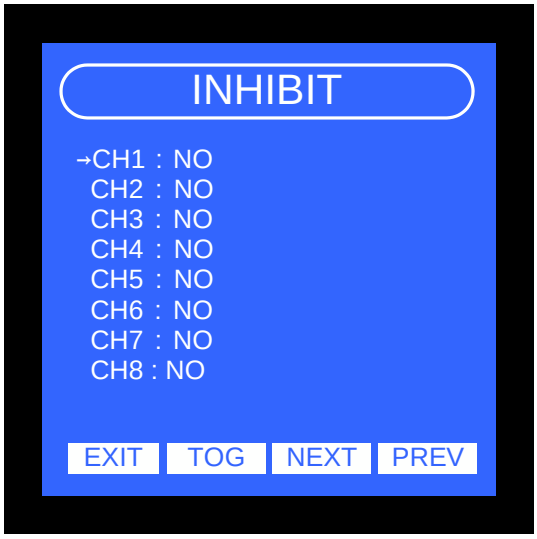
Inhibit

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.



3. Using the NEXT button select the first channel to be inhibited, press TOGGLE. A 'yes' or 'no' will appear next to the channel indicating selection.
4. Press EXIT 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 *Inhibit Channel* menu.
7. Press EXIT, The display will now return to the normal screen.

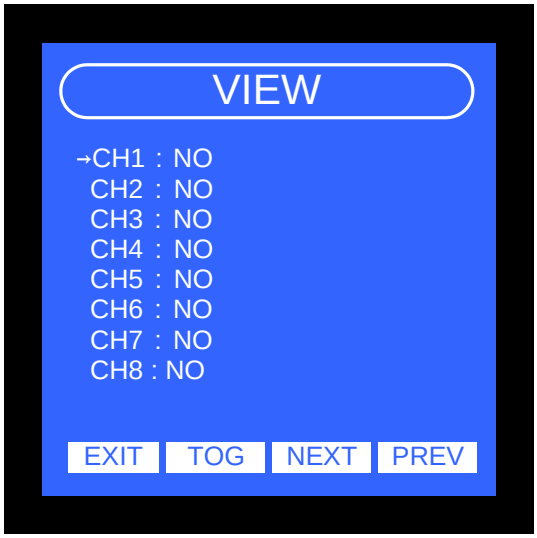
Important:
Do not forget to enable the channel once fault rectification or sensor replacement has been performed.

View

The View function allows channels to be hidden. Channels may require hiding for several reasons e.g.

A channel that is hidden will still function as an active channel unless it is inhibited.

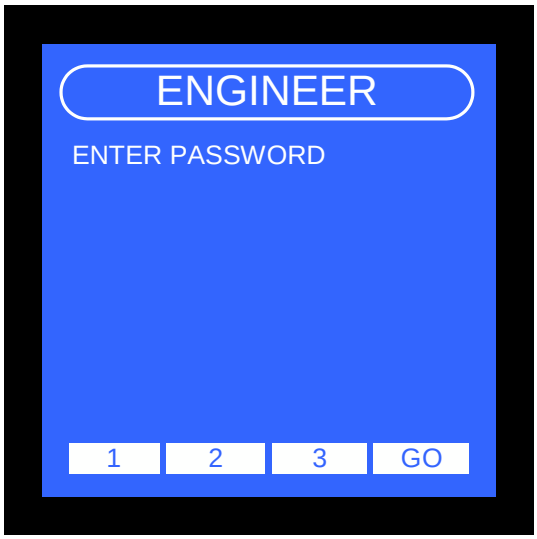
a. From the *System Configuration* menu, select INHIBIT and press GO.
b. The *Inhibit Options* screen will now be displayed.
   Note: Pressing Exit at any time will return the display to the System Configuration menu.



c. Using the NEXT button select the first channel to be inhibited, press TOGGLE. A ‘yes’ or ‘no’ will appear next to the channel indicating selection.
d. Press EXIT when all of the channels requiring inhibiting have been selected.
e. The system *Warning* screen will now appear. Press YES to save settings, or NO to abandon changes.
f. The display will now return to the *Inhibit Channel* menu.
g. Press EXIT, The display will now return to the normal screen.

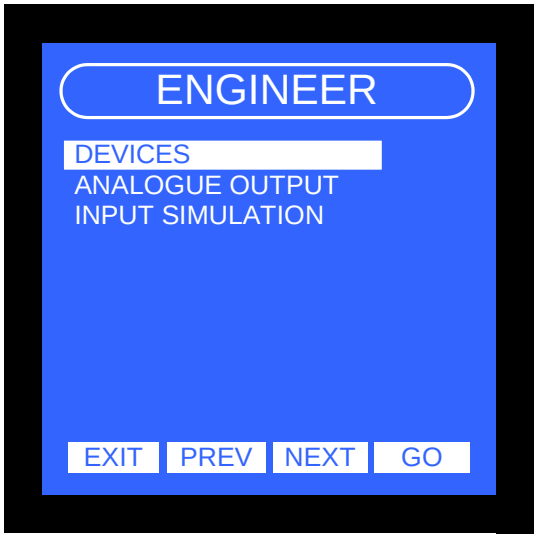
Engineer

This menu is provided to allow Ntron 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



The password can be obtained from Ntron.

There are three engineer options as seen on the following screen:



Devices

This option is used to allow the user to verify that the relays, sounder and indicators are operating correctly.

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

3) Use the PREV, NEXT buttons to set the desired option:
   Sound, L1 Led , L2 Led RLY FAULT etc
4) Use the TOG button to activate, deactivate the selected option.
5) Press EXIT when the tests have been completed. The display will now return to the *ENGINEER* menu.
6) Press EXIT twice, the display will now return to the normal screen.

Analogue output

This option is used to allow the user to verify that the analogue output is working correctly. Connect a multimeter to the analogue output.

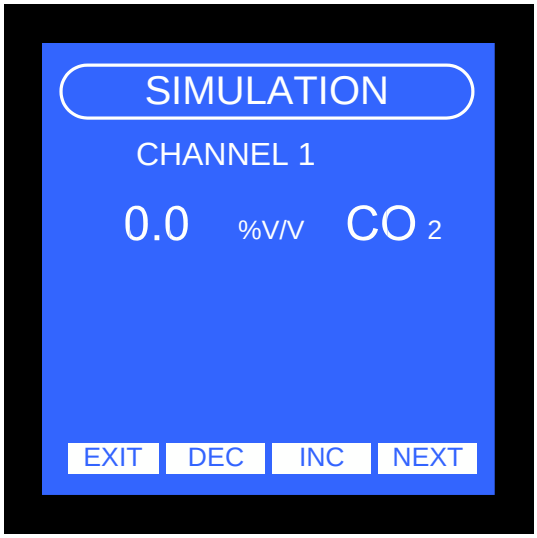
1) From the *ENGINEER* menu, select ANALOGUE OUTPUT and press GO.

2) Use the NEXT button to select the channel.
3) Use the INC, DEC buttons to increase, decrease the analogue output level.
4) Press EXIT when the tests have been completed.
5) The display will now return to the *ENGINEER* menu.

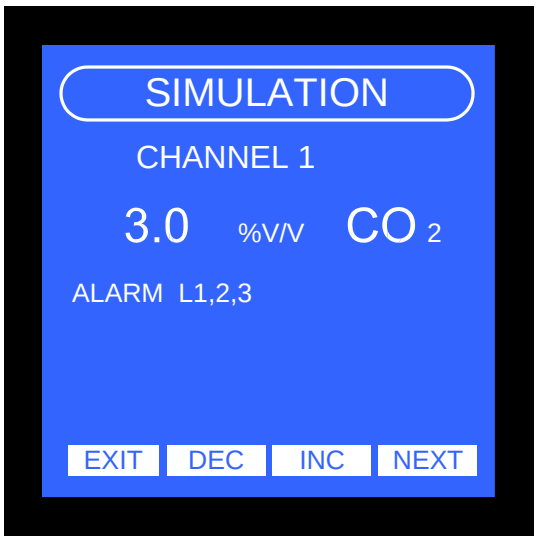
Input simulation

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) Use the NEXT button to select the channel.
3) Use the INC, DEC buttons to increase, decrease the sensor level.



4) Press EXIT when the tests have been completed.
5) The display will now return to the *Input simulation* menu.

2.5 SYSTEM RESET

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

Soft Reset.

The LC series control units can be reset without removing the power. This is achieved by pressing a combination of buttons on the front panel as follows:

1) Press and hold the two un-marked buttons.
2) Hold the buttons until the display shows the following screen.

Note: the bar graph shows the remaining time to reset the LC Controller, if the keys are released before the bar graph reaches the end then the controller will return to normal operation.

Appendix

The following pages contain the individual user operating manuals for the three types of Analyser fitted within this control panel;

Oxygen (%)- Microx
Carbon Monoxide (ppm) Microx CO
Carbon Dioxide (ppm) Microx CO2

Each manual details the operation and calibration procedures for each Analyser type and should be used in conjunction with the main Mogas93 manual.
Not all features covered in these individual Analyser manuals are relevant to the operation of the Mogas93 control panel.

The MICROX

Oxygen Analyser

User Instruction Manual

Issue Number:	**1.14**
Issue Date:	**16/05/2017**

NTRON
Gas Measurement

Microx User Manual

1 INTRODUCTION

1.1 Microx Module

The MICROX Module has been designed to allow OEM'S (Original Equipment Manufacturers) to use the module within their own equipment.

Key design features are:

- Compact enclosure
- Simple keypad calibration facility (utilising onboard LCD display).
- 4-20mA current source output for gas level indication (10-bit resolution).
- Input voltage range, 24VDC Nominal (12 – 30VDC) and 85-264VAC. (Panel and Wall mount versions)
- PCB mounted screw terminals for all connections.
- RS232 output for transmission of live data to a PC.

1.2 Operation

When power is first applied to the Microx module an initialisation procedure is performed as follows:

- All the display segments are displayed
- The software version number is displayed
- The company name is displayed
- The sensor type is displayed
- The display then shows the gas level.

The module is now operational

1.3 Sensor Inputs

The Microx Module is designed to interface with any one of the following 3 principal types of sensor technology.

Electro-Chemical
Solid State
Zirconia Dioxide

A number of different measurement ranges are possible as follows;

0-1000 ppm O2
0-10000 ppm O2
0-25% Vol. O2
0-96% vol. O2

The above list represents standard ranges. Other measurement ranges are possible.

2 SPECIFICATION

Supply	
Input Voltage Options:	24V DC nominal (12 – 30V DC) All versions. 85-264VAC Panel and Wall mount versions only.
Supply current:	140 mA at 24VDC nominal , all relays energised, 20 mA drawn on current loop.
Outputs	
Analogue Output:	4-20mA analogue output (10-bit resolution) Current Source.
Relays (Optional)	
3	Single pole change over. Rating 6 Amps 250 v AC
Fuses	
Fuse	500mA anti-surge on board fuse for circuit protection.
Additional Features	
Display:	4 Digit, 7 Segment Display.
Keypad:	4-Button Keypad
Software:	Software configuration, calibration and data logging provided by PC communications.
RS232 Output	Communications with PC @ 19200 baud.

3 MICROX MODULE

3.1 Fuses

A 500mA Anti-surge fuse is fitted to the OEM module, which is connected between the power supply and the OEM module. It is located next to the power input terminals.

3.2 Mounting Options

Din Rail Mounting Version.

Overall dimensions:
86mm(H) x 69mm(W) x
58mm(D).

Panel Mounting Version.

Overall dimensions:
96mm(H) x 96mm(W) x
83mm(D).
(including connection Terminals)

Panel cut-out dimensions
91mm(H) x 91mm(W)

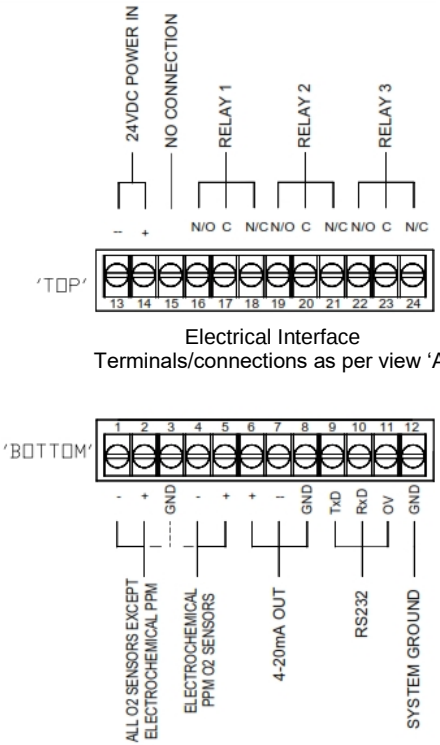
Wall Mounting Version

Overall dimensions:
145mm(H) x 110mm(W) x 93mm(D).
(including Cable Glands)

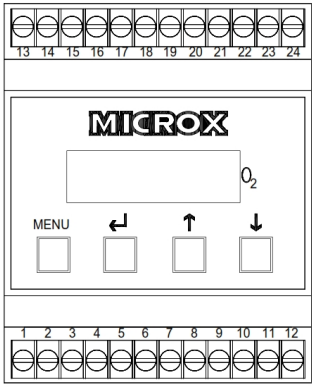
3.3 Field Connections

All connections to the module are provided in the form of screw terminals. The pin- outs for each Microx version are given below.

Din Rail Mounting version.



Electrical Interface
Terminals/connections as per view 'A'

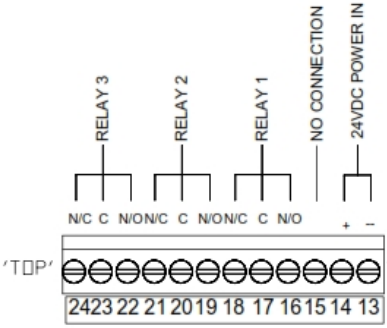


View 'A'

Note: Terminals 1,2 & 3 are for the connection of Electro-Chemical % and Zirconia % or ppm Sensors.
Terminals 4 & 5 are for the connection of Electro-Chemical ppm Sensors only. See Sensor for connection details. For Zirconia Sensors, connect the sensor power wires (+ & -) into terminals 14 and 13 of the Analyser along with the Analyser power wiring.

Panel and Wall Mount Versions - DC Supply option.

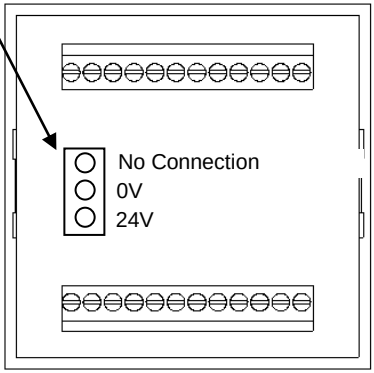
(Terminals located at the rear of the Module, identified as below as viewed)

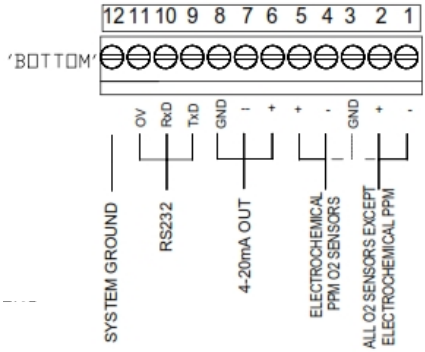


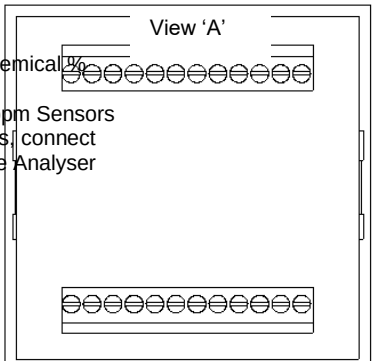
Supply by Customer

Electrical Interface
Terminals/connections as per view 'A'

Note: Additional Terminals fitted on Wall Mount DC version with **Zirconia** Sensor.



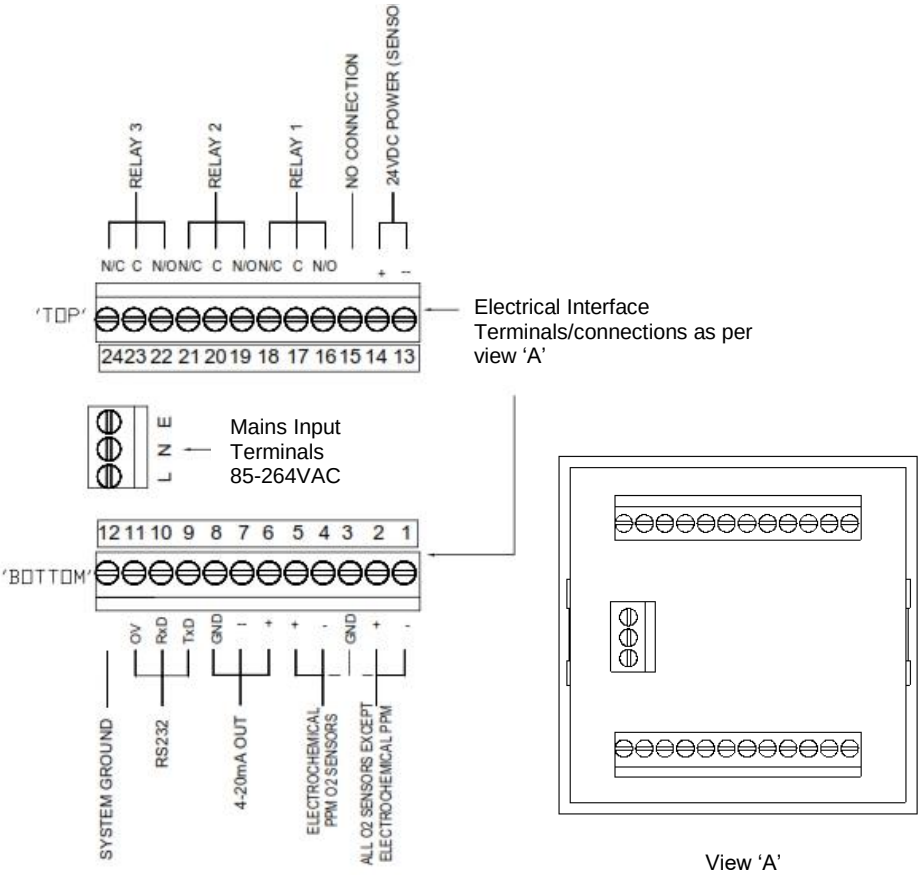




Note: Terminals 1,2 & 3 are for the connection of Electro-Chemical % and Zirconia % or ppm Sensors.
Terminals 4 & 5 are for the connection of Electro-Chemical ppm Sensors only. See Sensor for connection details. For Zirconia Sensors, connect the sensor power wires (+ & -) into terminals 14 and 13 of the Analyser along with the Analyser power wiring.

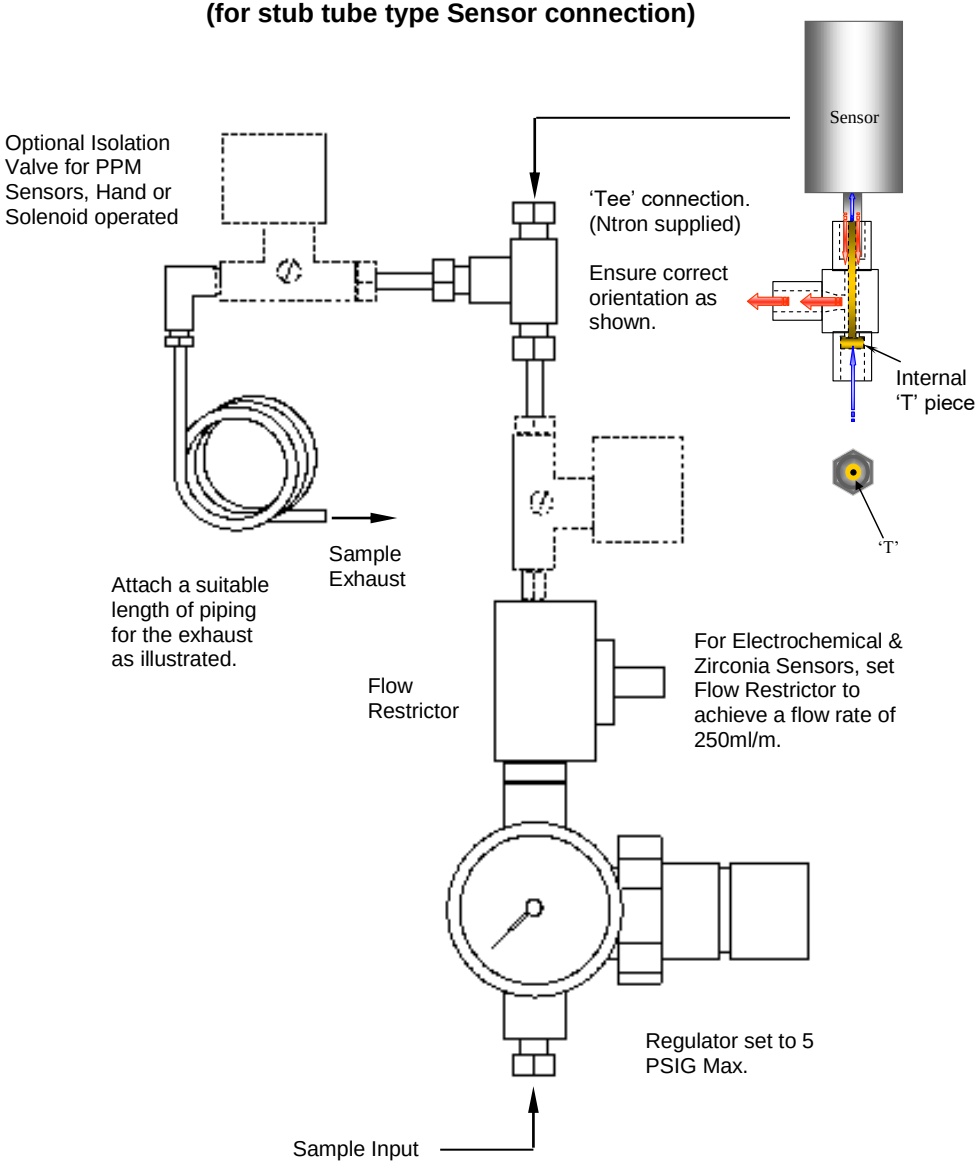
Panel and Wall Mount Versions - AC Supply option.

(Terminals located at the rear of the Module, identified as below as viewed)

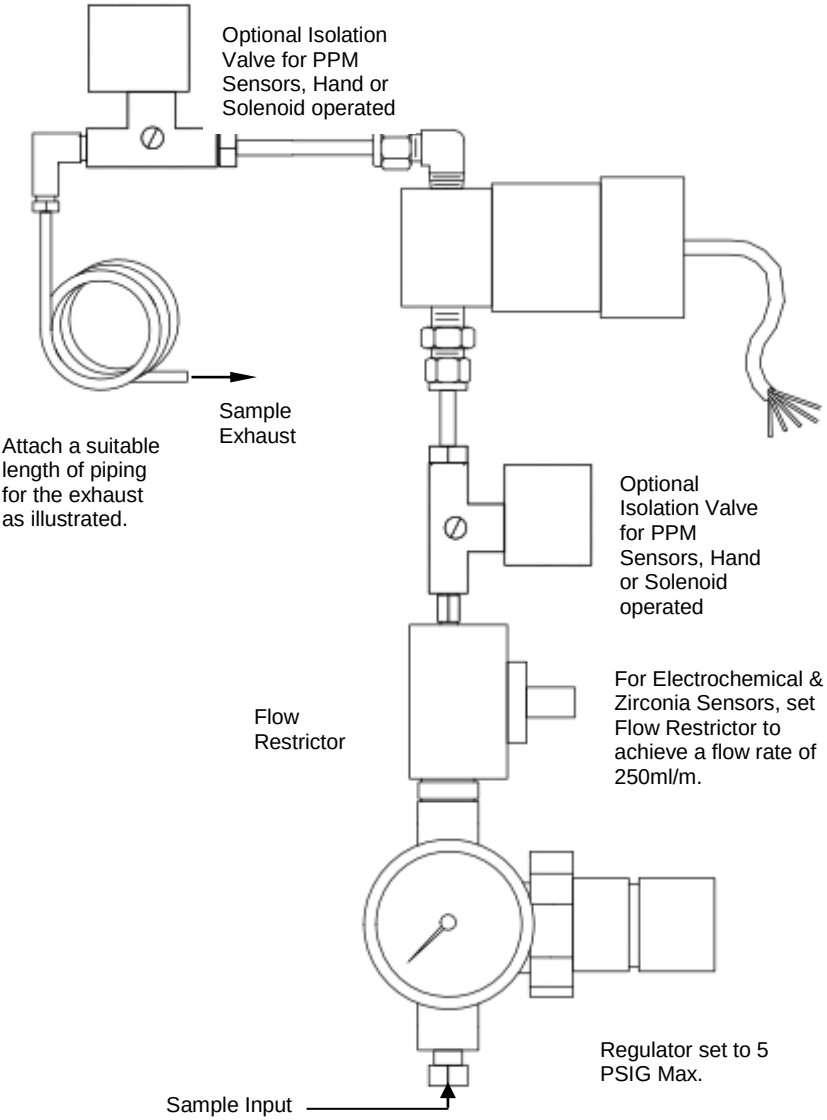


Note: Terminals 1,2 & 3 are for the connection of Electro-Chemical % and Zirconia % or ppm Sensors.
Terminals 4 & 5 are for the connection of Electro-Chemical ppm Sensors only. See Sensor for connection details. For Zirconia Sensors, connect the sensor power wires (+ & -) into terminals 14 and 13 of the Analyser.

3.4 Recommended Sampling System Piping #1 (for stub tube type Sensor connection)



3.5 Recommended Sampling System Piping #2 (for flow-through type Sensor connection)



3.6 RS232 connections

Contact Ntron for details if required.

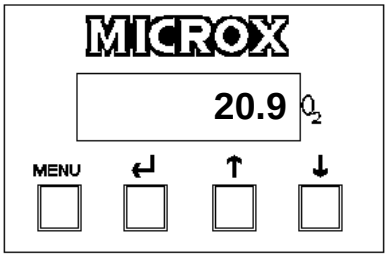
3.7 Analogue Output

The analogue output provides a means of indicating to external equipment (e.g. data loggers, remote displays) the gas levels currently being detected by the system. The output is that of a Current Source (4-20mA), where 4mA represents zero gas and 20mA represents gas at the sensor FSD.

4 SOFTWARE FEATURES

The menu system featured within the Microx module allows all calibration and configuration activities to be performed.

Note: It is important that that the Microx module is correctly configured for the sensor in use, prior to performing any feature available in the menu system.



A B C D

The keypad has the following functionality:

Button	Function	Alternate Function
A	Menu Open/Close	
B	Enter	
C	Next (Increment)	
D	Previous (Decrement)	

4.1 Password

The Microx module uses a password system to restrict the end user from carrying out certain changes that may compromise the use of the equipment.

The menu system is split into two areas, user and engineer. The user has access to menu options E:1 to E:10 (ppm configured module) and E:1 to E:9 (%Vol configured modules), while the engineer has access to menu options E:1 to E:19.

4.2 Menu options

Menu option	Function
E:1	Calibrate Sensor
E:2	Analogue output FSD
E:3	Set 4 mA
E:4	Set 20 mA
E:5	Sensor simulation
E:6	Set sensor type
E:7	Not used/Do Not Use
E:8	Diagnostics
E:9	Set Sensor type
E:10	Zero Offset (ppm Sensor only)
E:11	PPM Sensor Gain
E:12	% Vol Sensor Gain
E:13	Sensor Damping
E:14	New Sensor Data
E:15	Electronic Zero
E:16	Noise Rejection
E:17	Relay
E:18	Alarm Levels
E:19	Alarm Hysteresis

4.2.1 Menu 1 – Calibrate sensor

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:1**
- Press ENTER.
- Apply a known concentration of gas (applicable to sensor type) at a flow rate of between 100 to 500 ml/m. Allow time for the sensor to respond. (see diagram on page 8)
- Using the INC and DEC buttons set the reading to that of the calibration gas level.
- Press ENTER to span the sensor, '**– – – –**'will be displayed to confirm the sensor span has been performed.
  Note: Pressing the MENU button rather than the ENTER button exits the span feature without performing the calibration.
  Wait until the reading is stable, if not press the ENTER button to span the sensor.
- Press the MENU button to close the menu system.
  Note: The sensor span setting will be displayed (as a percentage value) on exit while the MENU key is pressed. Note that this value is a percentage of the initial calibration value set via "New Sensor Data" in menu E:14. See note below.
- Turn off and disconnect the calibration gas.

Note: On each occasion that a new sensor is connected and calibrated the "New Sensor Data" should be set via the procedure in menu 14. The setting should only be carried out after the calibration and not before. This will ensure that subsequent span setting figures displayed on exit of menu 1 will be valid.

Important!
Electro-Chemical Sensors.
For ppm configured modules that have been fitted with a replacement sensor the "Zero Offset" (Menu 10) must be entered prior to a calibration.

4.2.2 Menu 2 – Analogue output FSD

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:2**
- Press ENTER.
- Using the INCREASE and DECREASE buttons adjust the FSD to the required level.
- Press ENTER.
  Note: Pressing the MENU button rather than the ENTER button exits the sensor FSD feature without any change.
- Press the MENU button to close the menu system.
  Note: The Sensor FSD will be displayed on exit while the MENU key is pressed.

4.2.3 Menu 3 – Set 4 mA output

- Monitor the current sourced from the analogue output of the OEM module using a multimeter set to read milliamps.
- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:3**
- Press ENTER.
- Using the INCREASE and DECREASE buttons adjust the output to 4mA .
- Press ENTER.
  Note: Pressing the MENU button rather than the ENTER button exits the 4 mA feature without performing the calibration.
- Press the MENU button to close the menu system.
  Note: The 4 mA factor will be displayed on exit.

4.2.4 Menu 4 – Set 20 mA output

- Monitor the current sourced from the analogue output of the OEM module using a multimeter set to read milliamps.
- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:4**
- Press ENTER.
- Using the INCREASE and DECREASE buttons adjust the output to 20 mA.
- Press ENTER.
- Press the MENU button to close the menu system.
  Note: The 20 mA factor will be displayed on exit.

4.2.5 Menu 5 – Analogue Output Simulation

The Microx analogue output can be tested for functionality via menu 5. This option allows the user to simulate the analogue output.

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:5**.
- Use the UP and DOWN button to increase or decrease the analogue output. The value displayed on the Microx display will be equivalent to the analogue output.
- Press the MENU button to close the menu system.
  Note: The module will return to the conditions on entry.

4.2.6 Menu 6 – Sensor selection

Warning
The OEM Module is supplied configured for the Sensor type with which it is to be used.
Customer adjustment of this setting is not recommended. Please consult Ntron if a change of Sensor type is required.

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:6**
- Press ENTER.
- Using the INCREASE button select the required sensor type.
- Press ENTER.

  Note: The selected sensor must match the actual sensor fitted to the OEM module. If changing from one sensor type to the other ensure a sensor calibration is carried out prior to putting the analyser in to service.

  *****Note :If the module is configured for a ppm sensor the "zero offset (section 4.2.10) must be entered in addition and prior to a calibration.***

- Press the MENU button to close the menu system.
  Note: The Sensor Type will be displayed on exit while the MENU key is pressed.

Available sensors:

Display	Range
O2-1	0-25% Volume
O2-2	0-10,000 ppm
O2-3	0-25% Volume (Non Linearised)
O2-4	0-1000 ppm
O2-5	0-96% Volume
O2-6	0-100% Volume

4.2.7 Menu 7

Warning
Customer adjustment of this setting is not permitted. The module will be factory set prior to shipment at "0". Changing this value may limit the performance and, in extreme cases, the instrument may no longer detect gas.

4.2.8 Menu 8 - Diagnostics

This feature is a view-only feature. No configuration changes are possible from within this menu.

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:8**
- Press ENTER.
- The display will alternate between the current value and diagnostic code **E:8x**: where x is:
  - 0 Sensor signal, A to D counts low ppm range.
  - 1 Sensor signal, A to D counts high ppm range.
  - 2 Sensor signal, A to D counts %vol range.
  - 3 Firmware version.

- The diagnostic code can be selected by pressing the UP button.
- Press MENU to return the instrument to its standard mode of operation.

4.2.9 Menu 9 - Restore

This option allows the user to restore the configuration data to the factory default values. The user can restore either or both sensor data.

Warning
A restore will overwrite all previous calibration data for the selected sensor. To re-calibrate proceed in the following sequence,
Carry out an Electronic Zero, Section 4.2.15
If a ppm configured module enter the Zero Offset, Section 4.2.10
Carry out a Sensor Calibration, Section 4.2.1
Check the Analogue Output FSD is set correctly, Section 4.2.2
Carry out an Analogue Output Calibration, Section 4.2.3

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:9**
- Press ENTER.
- Press the UP key to select the sensor type.
- Press ENTER to restore the selected sensor data
  Note: Pressing the MENU button rather than the ENTER button exits the restore feature without performing any change.
- Press the MENU button to close the menu system.

4.2.10 Menu 10 – Zero offset
(Electro-Chemical Sensors only)

For ppm configured modules a “Sensor Zero Offset” value will need to be entered or re-entered each time the ppm sensor is replaced. The appropriate value will be marked on the ppm sensor and this figure will need to be programmed in to the module. A zero offset figure allows accurate calibration of ppm sensors that do not give a zero output for zero gas.

The zero offset value is expressed in PPM oxygen and takes a value of between -10.0 and +10.0 ppm.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:10**
- Press ENTER. The display shows the zero offset.
- Use the UP / DOWN keys to set the level at that marked on the sensor.
- Press ENTER to store the new value in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.
- Press MENU to close the menu system.

Note: The zero offset must be programmed prior to a menu 1 calibration.

4.2.11 Menu 11 – PPM sensor Gain

This option is used to allow the user to adjust the sensor gain for optimal performance. Care should be taken when using this option, which is normally only used when a new sensor is fitted.

Warning
Customer adjustment of this setting is not recommended. The module will be factory set prior to shipment at a value appropriate to the sensor type fitted. Otherwise changing this value may limit the performance and, in extreme cases, the instrument may no longer detect gas.

The display alternates between the sensor signal level, indicated as a number between 0 and 4095, and the menu number, E:11. The value used should be about 2500.
The display indicates the gain setting when the Up / DOWN keys are pressed. The gain is between 0 and 31, a typical value would be 20.

Apply 1.8 mV to the sensor input.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:11**
- Press ENTER. The display shows the sensor peak output level.
- Use the INCREASE and DECREASE buttons to set the required signal level.
  Note: When the INCREASE and DECREASE buttons are being operated the display shows the amplifier gain setting as a number between 0 and 31. The larger the number the higher the gain, the lower the signal reading.

- Press ENTER to store the new value.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.
  Note: The signal gain setting will be displayed on exit while the MENU key is pressed.

4.2.12 Menu 12 – % vol sensor gain

This option is used to allow the user to adjust the sensor gain for optimal performance. Care should be taken when using this option, which is normally only used when a new sensor is fitted.

Warning
Customer adjustment of this setting is not recommended. The module will be factory set prior to shipment at a value appropriate to the sensor type fitted. Otherwise changing this value may limit the performance and, in extreme cases, the instrument may no longer detect gas.

The display alternates between the sensor signal level, indicated as a number between 0 and 4095, and the menu number, E:12. The value used should be about 3500.
The display indicates the gain setting when the Up / DOWN keys are pressed. The gain is between 0 and 31, a typical value would be 3.

Apply 13 mV to the sensor input.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:12**
- Press ENTER. The display shows the sensor peak output level.
- Use the INCREASE and DECREASE buttons to set the required signal level.
  Note: When the INCREASE and DECREASE buttons are being operated the display shows the amplifier gain setting as a number between 0 and 31. The larger the number the higher the gain, the lower the signal reading.

- Press ENTER to store the new value.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.
  Note: The signal gain setting will be displayed on exit while the MENU key is pressed.

4.2.13 Menu 13 – Sensor damping

Oxygen sensors output change when subjected to pressure changes.
The damping option is used to allow the user to reduce the effects of sudden changes by applying digital filtering. The larger the number the more the signal damping that is applied.

Note: The minimum setting is 5.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:13**
- Press ENTER. The display shows the damping factor that is applied to the sensor.
- Use the INCREASE and DECREASE buttons to set the required damping level.
- Press ENTER to store the new value.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.
  Note: The signal damping setting will be displayed on exit while the MENU key is pressed.

4.2.14 Menu 14 – New sensor data

This option allows the initial sensor calibration data to be set. It is used to predict the remaining sensor life.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:14**
- Press ENTER. The display displays E:14
- Press ENTER to store the new data in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.

4.2.15 Menu 15 – Electronics zero

Warning
Customer operation of this function is not recommended. The Electronic Zero operation has been completed prior to shipment and under normal circumstances, is not required to be actioned again. Performing this function may result in operational errors if not done correctly.

Disconnect the sensor and place a short at the sensor input to simulate 0% oxygen.

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:15**
- Press ENTER.
- Press ENTER to zero the sensor, '**– – – –**'will be displayed to confirm the sensor zero has been performed.
  Note: Pressing the MENU button rather than the ENTER button exits the zero feature without performing the calibration.
- Press the MENU button to close the menu system.

4.2.16 Menu 16 – Noise Rejection

Warning
Customer adjustment of this setting is not recommended. The module will be factory set prior to shipment at a value appropriate to the sensor type fitted. Otherwise changing this value may limit the performance and, in extreme cases, the instrument may no longer detect gas.

The unit has a noise rejection value associated with the reading and displaying of the measured gas level.

The noise rejection value is expressed in number of readings that must be within approximately 20 counts of each other on the A to D converter before the display is updated. It takes a value of between 0 and 9, where 0 is no rejection and 9 is the maximum rejection.

Setting the noise rejection results in a two second delay for fast changing gas levels.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:16**
- Press ENTER. The display shows the Noise rejection value.
- Use the UP / DOWN keys to set the desired level.
- Press ENTER to store the new value in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.
- Press MENU to close the menu system.

Note each range noise rejection differs in the equivalent gas level as follows:

Range %vol	Fixed A to D Counts	Typical span factor	Equivalent gas level %vol
0.00 - 0.0200	20	0.05	0.0001
0.02 - 0.1000	20	0.3	0.0006
0.10 – 1.0000	20	3.5	0.0070
0.0 – 5.0	20	0.004	0.08
5.0 – 25.0	20	0.013	0.26

4.2.17 Menu 17 – Relay

The unit is fitted with three relays that are operated in conjunction with one of three alarm levels.
Relay 1 is associated with alarm level 1.
Relay 2 is associated with alarm level 2.
Relay 3 is associated with alarm level 3.

The user can select if the relay is normally Energized, E' or normally de-energised, 'd' when the unit is **not** in an alarm condition. The relay can also be set to act on rising, 'r' or falling 'F' gas levels.

This option allows the user to configure the operation of the relays.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:17**
- Press ENTER. The display displays r:1
- Use the UP / DOWN keys to select the desired relay.
- The display will show the following:
  - E:r Normally energized, rising alarm
  - d:r Normally de-energized, rising alarm
  - E:F Normally energized, falling alarm
  - d:F Normally de-energized, falling alarm
- The mode of operation can be changed by pressing the UP button.
- Press ENTER to store the new data in the memory.

Note: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.

4.2.18 Menu 18 – Alarm levels

This option allows the user to set the operation of the alarm levels. There are three alarms levels associated with 3 relays.
Alarm level 1 is associated with relay 1.
Alarm level 2 is associated with relay 2.
Alarm level 3 is associated with relay 3.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:18**
- Press ENTER. The display displays A:1
- Use the UP / DOWN keys to select the desired alarm level.
- Press ENTER. The display shows the alarm level.
- Use the UP / DOWN keys to set the desired alarm level.
- Press ENTER to store the new value in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.
- Press MENU to close the menu system.

4.2.19 Menu 19 – Alarm hysteresis

The unit has a hysteresis value associated with the alarm levels to avoid relay chattering as the unit goes in and out of alarm conditions.

The hysteresis value is expressed as a percentage of the alarm set point and takes a value of between 0 and 10.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:19**
- Press ENTER. The display shows the hysteresis level.
- Use the UP / DOWN keys to set the desired level.
- Press ENTER to store the new value in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.
- Press MENU to close the menu system.

5 ROUTINE MAINTENANCE & SERVICING

The Microx module will provide reliable and fault free service when given regular maintenance and calibrations.

5.1 Routine Inspection and Maintenance

It is advisable to periodically inspect the Microx module installation:

Clean gas detector head using a clean DAMP cloth.

Inspect the sensor and ensure it is sound and the sensor-housing aperture is not obstructed (where applicable).

The maximum time interval between routine inspections and should be assessed by the calibrating personnel and will depend upon the environment in which the equipment is installed.

Calibration requirements and periods vary depending on sensor type and application. A reasonable schedule should be arrived at by the user.

Sensors utilising Zirconia Technology
These are very stable over their normal lifespan and usually do not require regular calibrations. A check on calibration can be made at intervals to suit the application by the user and if a calibration operation is deemed necessary, follow the instructions contained in this manual.

Avoid exposing the Sensor to moisture or wetting particularly if the gas being presented for measurement by the sensor contains condensable vapours or entraned liquids. Pre-filtering and drying of the gas to be sampled may be required by the user.
If the Sensor is not powered for any period, then condensable moisture must be prevented from entering the sample system and reaching the sensing element.
Other gases to avoid are halogens, organic vapours, H2S and SO4.

The

MICROX

Carbon Monoxide Analyser

User Instruction Manual

Issue Number:	**1.14**
Issue Date:	**08/07/2015**
S/W	**V.2.4.4**

NTRON
Gas Measurement

Microx User Manual

1 INTRODUCTION

1.1 Microx Module

The MICROX Module has been designed to allow OEM'S (Original Equipment Manufacturers) to use the module within their own equipment.
This Carbon Monoxide Analyser is based on the common Microx Module platform, hence the menu system is common throughout the Microx range. Some menu features are not relevant to the Carbon Monoxide Analyser and such ones are noted in this manual by the wording 'Not applicable-DO NOT USE' in the menu index and various warnings in RED text on the relevant menu pages.

In this manual, various abbreviations and terminology is used. 'CO' may be used to represent the wording 'Carbon Monoxide'. The Microx Module is otherwise referred to as the 'Microx CO Analyser' for the purposes of this Manual

Key design features are:

- Compact enclosure
- Simple keypad calibration facility (utilising onboard LCD display).
- 4-20mA current source output for gas level indication (10-bit resolution).
- Input voltage range, 24VDC Nominal (12 – 30VDC) and 85-264VAC. (Panel and Wall mount versions)
- PCB mounted screw terminals for all connections.
- RS232 output for transmission of live data to a PC.

1.2 Operation

Before power is applied to the Microx CO Analyser, ensure that all installation work is complete and verified safe and operable. Also ensure the Sensor is correctly connected to the Microx CO analyser.
When power is first applied to the Microx CO Analyser an initialisation procedure is performed as follows:

- All the display segments are displayed
- The software version number is displayed
- The company name is displayed
- The sensor type is displayed
- The display then shows the gas level.

The Microx CO Analyser is now operational

1.3 Sensor Inputs

The Microx CO Analyser uses a replaceable Carbon Monoxide Sensor in a sample gas stream. The Sensor assembly includes a flow through connection to which the sample gas is required to be presented via pipework and suitable connection fittings. A typical sample connection circuit is shown on page 11 of this manual. The sensor is provided with an integral connection cable for mounting remotely from the Microx CO Analyser. (Typical cable length is 0.5Mtr).
Connection to the Microx CO Analyser is described on pages 8-10 of this manual. Use appropriate tools and cable support/glanding depending on the model of Microx CO Analyser being used.

2 SPECIFICATION

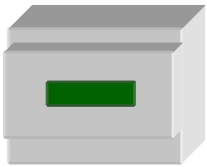
Supply	
Input Voltage Options:	24V DC nominal (12 – 30V DC) All versions. 85-264VAC Panel and Wall mount versions only.
Supply current:	140 mA at 24VDC nominal , all relays energised, 20 mA drawn on current loop.
Measurement range	
Standard	0-50ppm CO
Calibration gas	Typically in range 20-50ppm CO
Zero Gas	Typically Zero Air (20.9%O2 **with no CO content**)
Outputs	
Analogue Output:	4-20mA analogue output (10-bit resolution) Current Source.
Relays (Optional)	
3	Single pole change over. Rating 6 Amps 250 v AC
Fuses	
Fuse	500mA anti-surge on board fuse for circuit protection.
Additional Features	
Display:	4 Digit, 7 Segment Display.
Keypad:	4-Button Keypad
Software:	Software configuration, calibration and data logging provided by PC communications.
RS232 Output	Communications with PC @ 19200 baud.

3 MICROX MODULE

3.1 Fuses

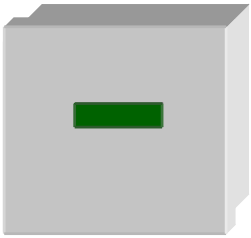
A 500mA Anti-surge fuse is fitted to the OEM module, which is connected between the power supply and the OEM module. It is located next to the power input terminals.

3.2 Mounting Options



Din Rail Mounting Version.

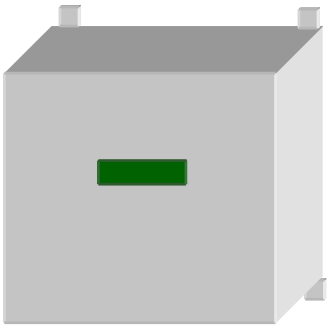
Overall dimensions:
86mm(H) x 69mm(W) x
58mm(D).



Panel Mounting Version.

Overall dimensions:
96mm(H) x 96mm(W) x
83mm(D).
(including connection Terminals)

Panel cut-out dimensions
91mm(H) x 91mm(W)



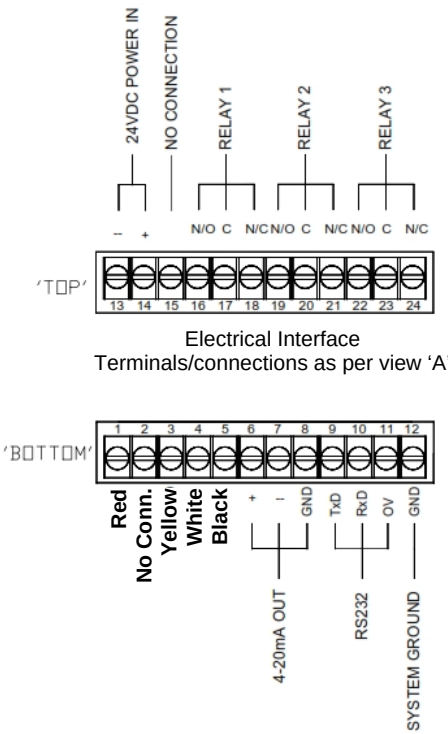
Wall Mounting Version

Overall dimensions:
145mm(H) x 110mm(W) x 93mm(D).
(including Cable Glands)

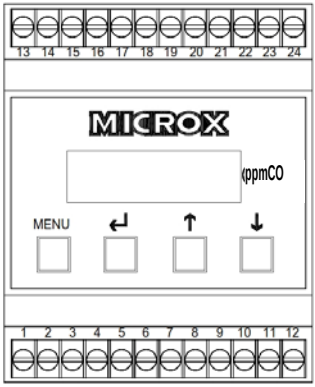
3.3 Field Connections

All connections to the module are provided in the form of screw terminals. The pin- outs for each Microx version are given below.

Din Rail Mounting version.



Electrical Interface
Terminals/connections as per view 'A'

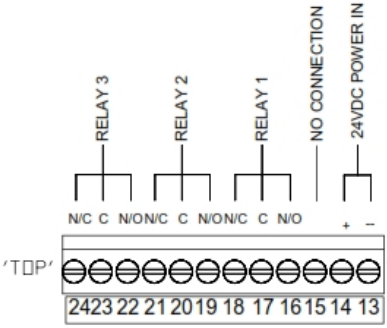


View 'A'

CO Sensor connections by Cable Colours
1=Red
2=No Connection
3=Yellow
4=White
5=Black

Panel and Wall Mount Versions - DC Supply option.

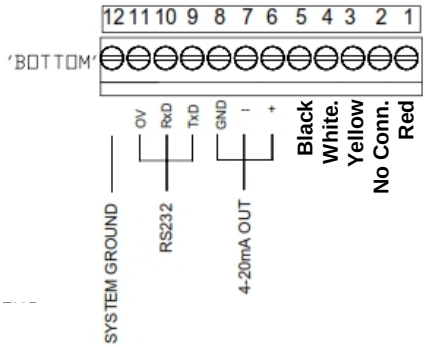
(Terminals located at the rear of the Module, identified as below as viewed)

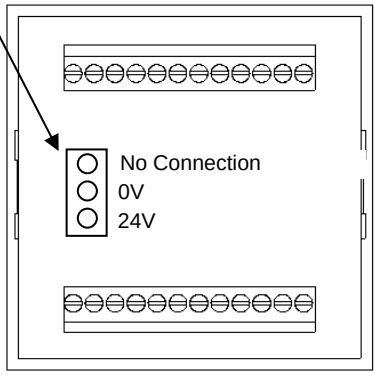


Supply by Customer

Electrical Interface
Terminals/connections as per view 'A'

minals fitted on Wall
ith **Zirconia** Sensor.



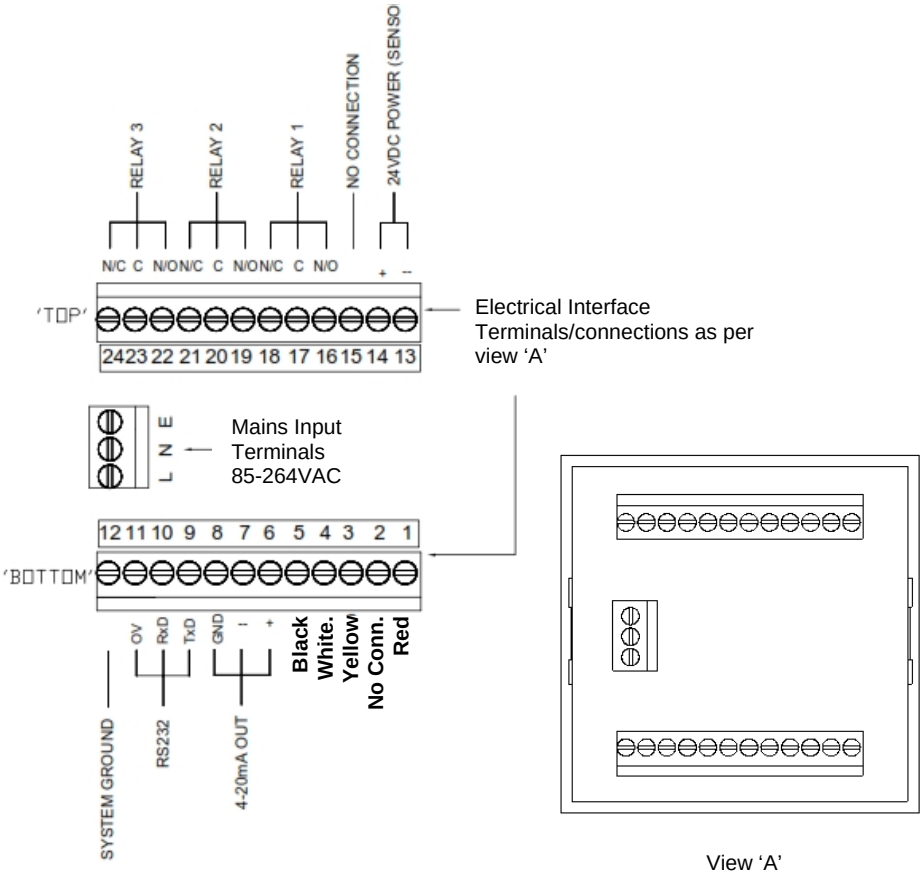


View 'A'

CO Sensor connections by Cable Colours
1=Red
2=No Connection
3=Yellow
4=White
5=Black

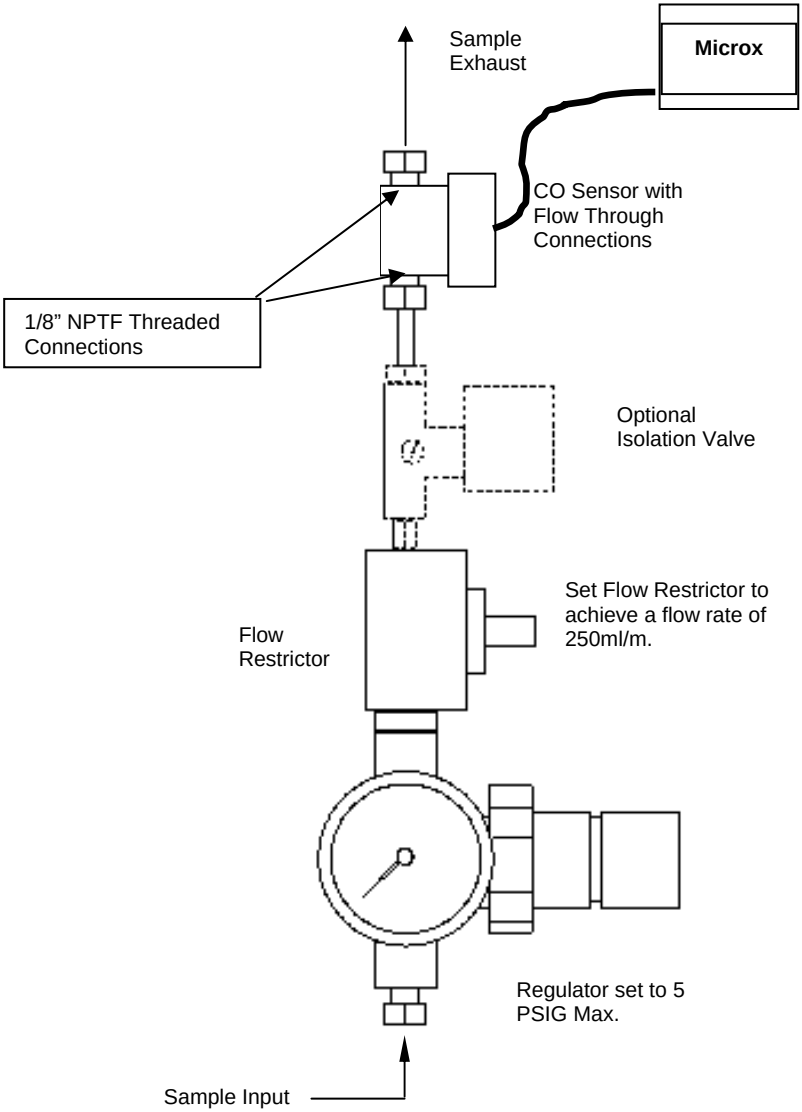
Panel and Wall Mount Versions - AC Supply option.

(Terminals located at the rear of the Module, identified as below as viewed)



CO Sensor connections by Cable Colours
1=Red
2=No Connection
3=Yellow
4=White
5=Black

3.4 Recommended Sampling System Piping



3.6 RS232 connections

Contact Ntron for details if required.

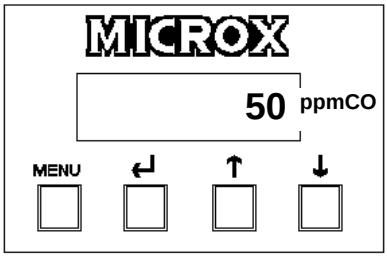
3.7 Analogue Output

The analogue output provides a means of indicating to external equipment (e.g. data loggers, remote displays) the gas levels currently being detected by the system. The output is that of a Current Source (4-20mA), where 4mA represents zero gas and 20mA represents gas at the sensor FSD.

4 SOFTWARE FEATURES

The menu system featured within the Microx module allows all calibration and configuration activities to be performed.

Note: It is important that that the Microx module is correctly configured for the sensor in use, prior to performing any feature available in the menu system.



A B C D

The keypad has the following functionality:

Button	Function	Alternate Function
A	Menu Open/Close	
B	Enter	
C	Next (Increment)	
D	Previous (Decrement)	

4.1 Password

The Microx module uses a password system to restrict the end user from carrying out certain changes that may compromise the use of the equipment.

The menu system is split into two areas, user and engineer. The user has access to menu options E:1 to E:9
For advance configuration, a pass code is required for entry into menus E:10 to E:19. This is normally reserved for factory configuration.

Menu options

Menu option	Function
E:1	Calibrate Sensor
E:2	Analogue output FSD
E:3	Set 4 mA
E:4	Set 20 mA
E:5	Sensor simulation
E:6	Not Applicable-DO NOT USE
E:7	Not Applicable -DO NOT USE
E:8	Diagnostics
E:9	Not Applicable -DO NOT USE
E:10	Not Applicable -DO NOT USE
E:11	Not Applicable -DO NOT USE
E:12	Not Applicable -DO NOT USE
E:13	Not Applicable -DO NOT USE
E:14	New Sensor Data
E:15	Electronic Zero
E:16	Not Applicable -DO NOT USE
E:17	Relay
E:18	Alarm Levels
E:19	Alarm Hysteresis

4.1.1 Menu 1 – Calibrate sensor

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:1**
- Press ENTER.
- Apply a known concentration of gas (applicable to sensor type) at a flow rate of between 100 to 500 ml/m. Allow time for the sensor to respond. (see diagram on page 8)
- Using the INC and DEC buttons set the reading to that of the calibration gas level.
- Press ENTER to span the sensor, '**– – – –**'will be displayed to confirm the sensor span has been performed.
  Note: Pressing the MENU button rather than the ENTER button exits the span feature without performing the calibration.
  Wait until the reading is stable, if not press the ENTER button to span the sensor.
- Press the MENU button to close the menu system.
  Note: The sensor span setting will be displayed (as a percentage value) on exit while the MENU key is pressed. Note that this value is a percentage of the initial calibration value set via "New Sensor Data" in menu E:14. See note below.
- Turn off and disconnect the calibration gas.

Note: On each occasion that a new sensor is connected and calibrated the "New Sensor Data" should be set via the procedure in menu 14. The setting should only be carried out after the calibration and not before. This will ensure that subsequent span setting figures displayed on exit of menu 1 will be valid.

4.1.2 Menu 2 – Analogue output FSD

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:2**
- Press ENTER.
- Using the INCREASE and DECREASE buttons adjust the FSD to the required level.
- Press ENTER.
  Note: Pressing the MENU button rather than the ENTER button exits the sensor FSD feature without any change.
- Press the MENU button to close the menu system.
  Note: The Sensor FSD will be displayed on exit while the MENU key is pressed.

4.1.3 Menu 3 – Set 4 mA output

- Monitor the current sourced from the analogue output of the OEM module using a multimeter set to read milliamps.
- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:3**
- Press ENTER.
- Using the INCREASE and DECREASE buttons adjust the output to 4mA .
- Press ENTER.
  Note: Pressing the MENU button rather than the ENTER button exits the 4 mA feature without performing the calibration.
- Press the MENU button to close the menu system.
  Note: The 4 mA factor will be displayed on exit.

4.1.4 Menu 4 – Set 20 mA output

- Monitor the current sourced from the analogue output of the OEM module using a multimeter set to read milliamps.
- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:4**
- Press ENTER.
- Using the INCREASE and DECREASE buttons adjust the output to 20 mA.
- Press ENTER.
- Press the MENU button to close the menu system.
  Note: The 20 mA factor will be displayed on exit.

4.1.5 Menu 5 – Analogue Output Simulation

The Microx analogue output can be tested for functionality via menu 5. This option allows the user to simulate the analogue output.

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:5**.
- Use the UP and DOWN button to increase or decrease the analogue output. The value displayed on the Microx display will be equivalent to the analogue output.
- Press the MENU button to close the menu system.
  Note: The module will return to the conditions on entry.

4.1.6 Menu 6 – Sensor selection

Warning
The OEM Module is supplied configured for the Sensor type with which it is to be used.
Customer adjustment of this setting is not recommended. Please consult Ntron if a change of Sensor type is required.

Type:02-8

4.1.7 Menu 7

Warning
Customer adjustment of this setting is not permitted.

4.1.8 Menu 8 - Diagnostics

This feature is a view-only feature. No configuration changes are possible from within this menu.

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:8**
- Press ENTER.
- The display will alternate between the current value and diagnostic code **E:8x**: where x is:
  - 0 Sensor signal, A to D counts low ppm range.
  - 1 Sensor signal, A to D counts high ppm range.
  - 2 Sensor signal, A to D counts %vol range.
  - 3 Firmware version.

- The diagnostic code can be selected by pressing the UP button.
- Press MENU to return the instrument to its standard mode of operation.

4.1.9 Menu 9 - Restore

Warning
Customer adjustment of this setting is not permitted.

4.1.10 Menu 10 – Zero offset

Warning
Customer adjustment of this setting is not permitted.

4.1.11 Menu 11 – PPM sensor Gain

Warning
Customer adjustment of this setting is not recommended. The module will be factory set prior to shipment at a value appropriate to the sensor type fitted. Otherwise changing this value may limit the performance and, in extreme cases, the instrument may no longer detect gas.

4.1.12 Menu 12 – % vol sensor gain

Warning
This setting is not relevant to this Analyser type and as such, customer adjustment of this setting is not permitted.

4.1.13 Menu 13 – Sensor damping

Warning
Customer adjustment of this setting is not permitted.

4.1.14 Menu 14 – New sensor data

This option allows the initial sensor calibration data to be set. It is used to predict the remaining sensor life.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:14**
- Press ENTER. The display displays E:14
- Press ENTER to store the new data in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.

4.1.15 Menu 15 – Electronics zero

This must be done with Zero gas applied to the sensor. (See specifications in section 2 of this manual)

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:15**
- Press ENTER.
- Press ENTER to zero the sensor, '**– – – –**'will be displayed to confirm the sensor zero has been performed.
  Note: Pressing the MENU button rather than the ENTER button exits the zero feature without performing the calibration.
- Press the MENU button to close the menu system.

4.1.16 Menu 16 – Noise Rejection

Warning
Customer adjustment of this setting is not recommended. The module will be factory set prior to shipment at a value appropriate to the sensor type fitted. Otherwise changing this value may limit the performance and, in extreme cases, the instrument may no longer detect gas.

4.1.17 Menu 17 – Relay

The unit is fitted with three relays that are operated in conjunction with one of three alarm levels.
Relay 1 is associated with alarm level 1.
Relay 2 is associated with alarm level 2.
Relay 3 is associated with alarm level 3.

The user can select if the relay is normally Energized, E' or normally de-energised, 'd' when the unit is **not** in an alarm condition. The relay can also be set to act on rising, 'r' or falling 'F' gas levels.

This option allows the user to configure the operation of the relays.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:17**
- Press ENTER. The display displays r:1
- Use the UP / DOWN keys to select the desired relay.
- The display will show the following:
  - E:r Normally energized, rising alarm
  - d:r Normally de-energized, rising alarm
  - E:F Normally energized, falling alarm
  - d:F Normally de-energized, falling alarm
- The mode of operation can be changed by pressing the UP button.
- Press ENTER to store the new data in the memory.

Note: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.

4.1.18 Menu 18 – Alarm levels

This option allows the user to set the operation of the alarm levels. There are three alarms levels associated with 3 relays.
Alarm level 1 is associated with relay 1.
Alarm level 2 is associated with relay 2.
Alarm level 3 is associated with relay 3.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:18**
- Press ENTER. The display displays A:1
- Use the UP / DOWN keys to select the desired alarm level.
- Press ENTER. The display shows the alarm level.
- Use the UP / DOWN keys to set the desired alarm level.
- Press ENTER to store the new value in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.
- Press MENU to close the menu system.

4.1.19 Menu 19 – Alarm hysteresis

The unit has a hysteresis value associated with the alarm levels to avoid relay chattering as the unit goes in and out of alarm conditions.

The hysteresis value is expressed as a percentage of the alarm set point and takes a value of between 0 and 10.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:19**
- Press ENTER. The display shows the hysteresis level.
- Use the UP / DOWN keys to set the desired level.
- Press ENTER to store the new value in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.
- Press MENU to close the menu system.

5 ROUTINE MAINTENANCE & SERVICING

The Microx Analyser will provide reliable and fault free service when given regular maintenance and calibrations.

5.1 Routine Inspection and Maintenance

It is advisable to periodically inspect the Microx Analyser

Clean gas detector head using a clean DAMP cloth.

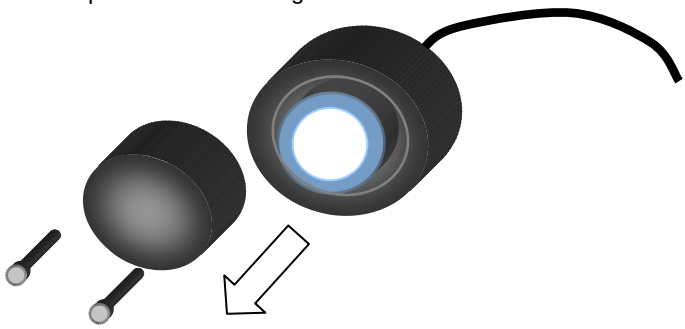
Inspect the sensor and ensure it is sound and the sensor-housing aperture is not obstructed (where applicable).

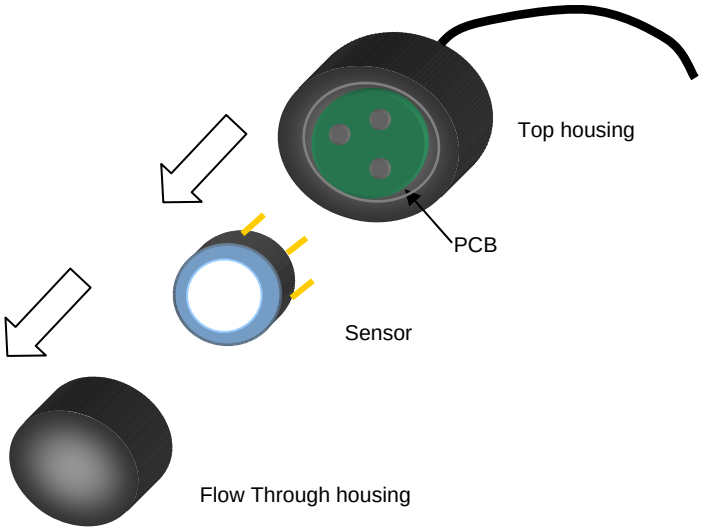
The maximum time interval between routine inspections should be assessed by the calibrating personnel and will depend upon the environment in which the equipment is installed.

5.1.1 Sensor Replacement

The Carbon Monoxide Electrochemical Sensor typically has a lifespan of 36 months in air. When replacement is required, the sensing element can be removed from the flow through housing and a replacement sensor fitted. The Sensor housing may have to be disconnected from the sampling gas circuit to perform this operation.

1. Remove the M3 Socket Head Screws securing the flow through section of the housing to the top half of the housing





The Sensor un-plugs from the PCB that sits within the top half of the sensor housing. **Note the position of the sensor and the contact pins during removal! Of the Sensor.**
Try and support the PCB when removing the sensor to prevent putting strain on the wiring connected to the PCB.
Replacement is a reversal of the above procedure.
Ensure that the positioning of the sensor is the same as when the original sensor was removed.

Ntron Ltd.
Mullaghboy Industrial Estate,
Navan, Co. Meath
Ireland.

The

MICROX

Carbon Dioxide Analyser

User Instruction Manual

Issue Number:	**1.14**
Issue Date:	**08/07/2015**
S/W	**V.2.20**

NTRON
Gas Measurement

Microx User Manual

1 INTRODUCTION

1.1 Microx Module

The MICROX Module has been designed to allow OEM'S (Original Equipment Manufacturers) to use the module within their own equipment.
This Carbon Dioxide Analyser is based on the common Microx Module platform, hence the menu system is common throughout the Microx range. Some menu features are not relevant to the Carbon Dioxide Analyser and such ones are noted in this manual by the wording 'Not applicable-DO NOT USE' in the menu index and various warnings in RED text on the relevant menu pages.

In this manual, various abbreviations and terminology is used. 'CO2' may be used to represent the wording 'Carbon Dioxide'. The Microx Module is otherwise referred to as the 'Microx CO2 Analyser' for the purposes of this Manual

Key design features are:

- Compact enclosure
- Simple keypad calibration facility (utilising onboard LCD display).
- 4-20mA current source output for gas level indication (10-bit resolution).
- Input voltage range, 24VDC Nominal (12 – 30VDC) and 85-264VAC. (Panel and Wall mount versions)
- PCB mounted screw terminals for all connections.
- RS232 output for transmission of live data to a PC.

1.2 Operation

Before power is applied to the Microx CO2 Analyser, ensure that all installation work is complete and verified safe and operable. Also ensure the Sensor is correctly connected to the Microx CO2 analyser.
When power is first applied to the Microx CO2 Analyser an initialisation procedure is performed as follows:

- All the display segments are displayed
- The software version number is displayed
- The company name is displayed
- The sensor type is displayed
- The display then shows the gas level.

The Microx CO Analyser is now operational

1.3 Sensor Inputs

2

The Microx CO2 Analyser uses a long life Infra Red Carbon Dioxide Sensor in a sample gas stream. The Sensor assembly includes a flow through connection to which the sample gas is required to be presented via pipework and suitable connection fittings. A typical sample connection circuit is shown on page 11 of this manual. The sensor is provided with an integral connection cable for mounting remotely from the Microx CO2 Analyser. (Typical cable length is 0.5Mtr).

Connection to the Microx CO2 Analyser is described on pages 8-10 of this manual. Use appropriate tools and cable support/glanding depending on the model of Microx CO2 Analyser being used.

2 SPECIFICATION

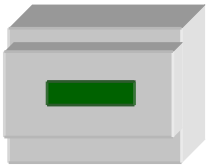
Supply	
Input Voltage Options:	24V DC nominal (12 – 30V DC) All versions. 85-264VAC Panel and Wall mount versions only.
Supply current:	140 mA at 24VDC nominal , all relays energised, 20 mA drawn on current loop.
Measurement range	
Standard	0-1000ppm CO2
Calibration gas	Typically 300ppm CO2
Zero Gas	Typically Zero Air (20.9%O2 **with no CO2 content**)
Outputs	
Analogue Output:	4-20mA analogue output (10-bit resolution) Current Source.
Relays (Optional)	
3	Single pole change over. Rating 6 Amps 250 v AC
Fuses	
Fuse	500mA anti-surge on board fuse for circuit protection.
Additional Features	
Display:	4 Digit, 7 Segment Display.
Keypad:	4-Button Keypad
Software:	Software configuration, calibration and data logging provided by PC communications.
RS232 Output	Communications with PC @ 19200 baud.

3 MICROX MODULE

3.1 Fuses

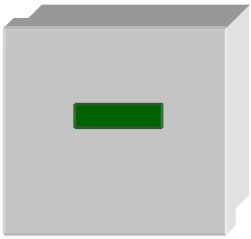
A 500mA Anti-surge fuse is fitted to the OEM module, which is connected between the power supply and the OEM module. It is located next to the power input terminals.

3.2 Mounting Options



Din Rail Mounting Version.

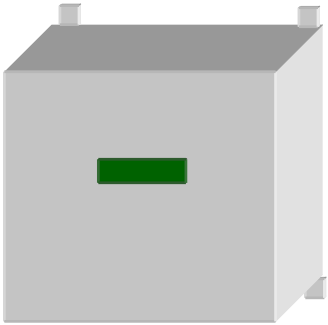
Overall dimensions:
86mm(H) x 69mm(W) x
58mm(D).



Panel Mounting Version.

Overall dimensions:
96mm(H) x 96mm(W) x
83mm(D).
(including connection Terminals)

Panel cut-out dimensions
91mm(H) x 91mm(W)



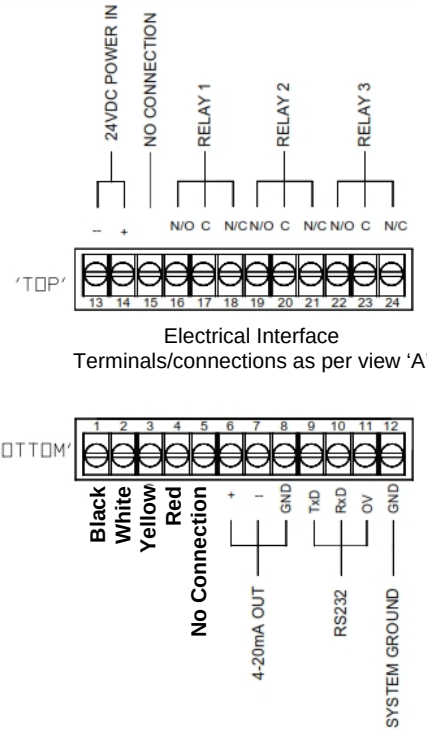
Wall Mounting Version

Overall dimensions:
145mm(H) x 110mm(W) x 93mm(D).
(including Cable Glands)

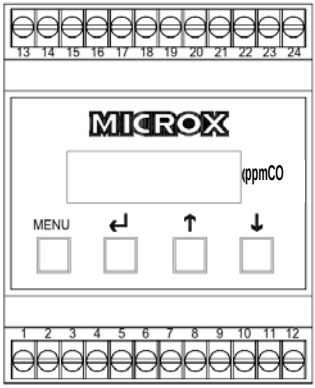
3.3 Field Connections

All connections to the module are provided in the form of screw terminals. The pin- outs for each Microx version are given below.

Din Rail Mounting version.



Electrical Interface
Terminals/connections as per view 'A'

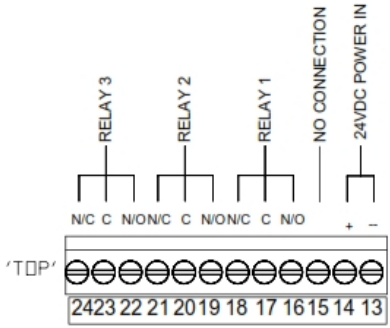


View 'A'

CO2 Sensor connections by Cable Colours
1=Black
2=White
3=Yellow
4=Red
5=No Connection

Panel and Wall Mount Versions - DC Supply option.

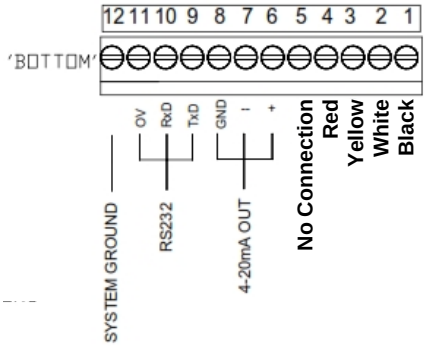
(Terminals located at the rear of the Module, identified as below as viewed)

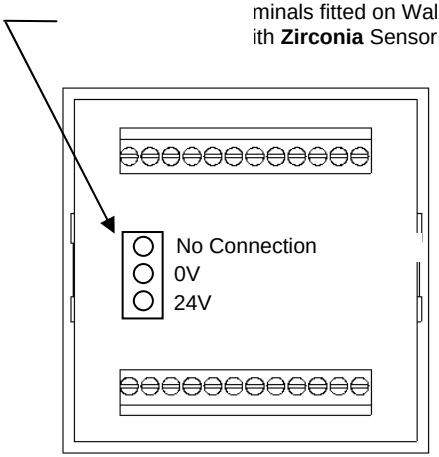


Supply by Customer

minals fitted on Wall
ith **Zirconia** Sensor.

Electrical Interface
Terminals/connections as per view 'A'



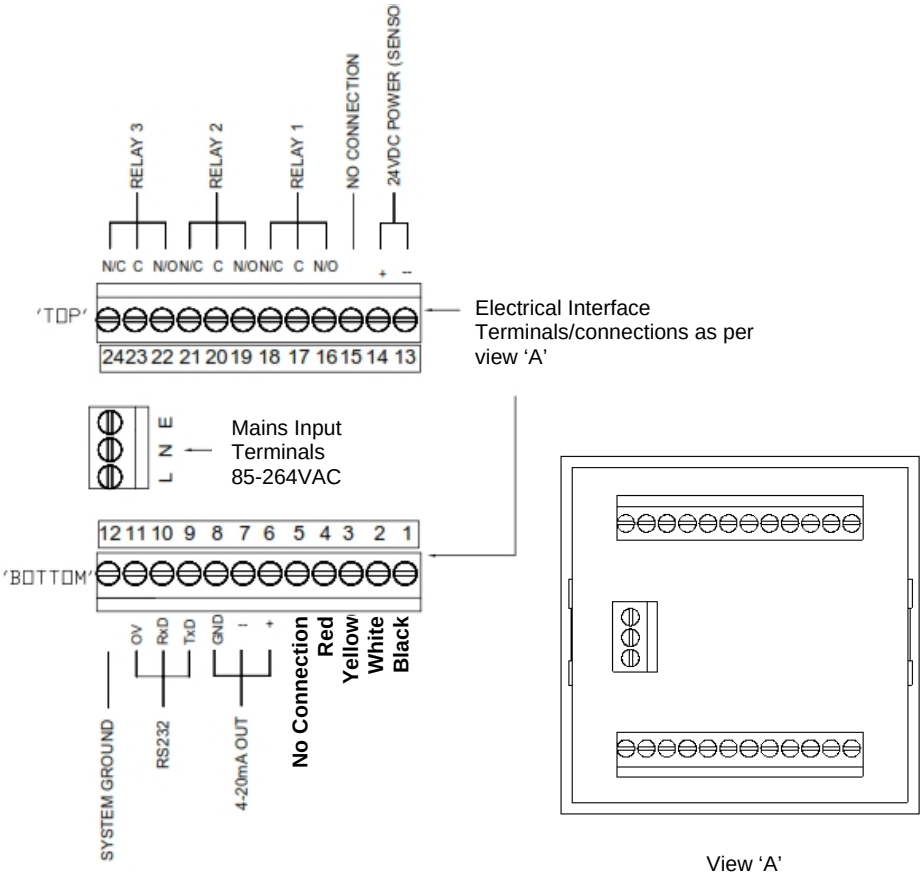


View 'A'

CO2 Sensor connections by Cable Colours
1=Black
2=White
3=Yellow
4=Red
5=No Connection

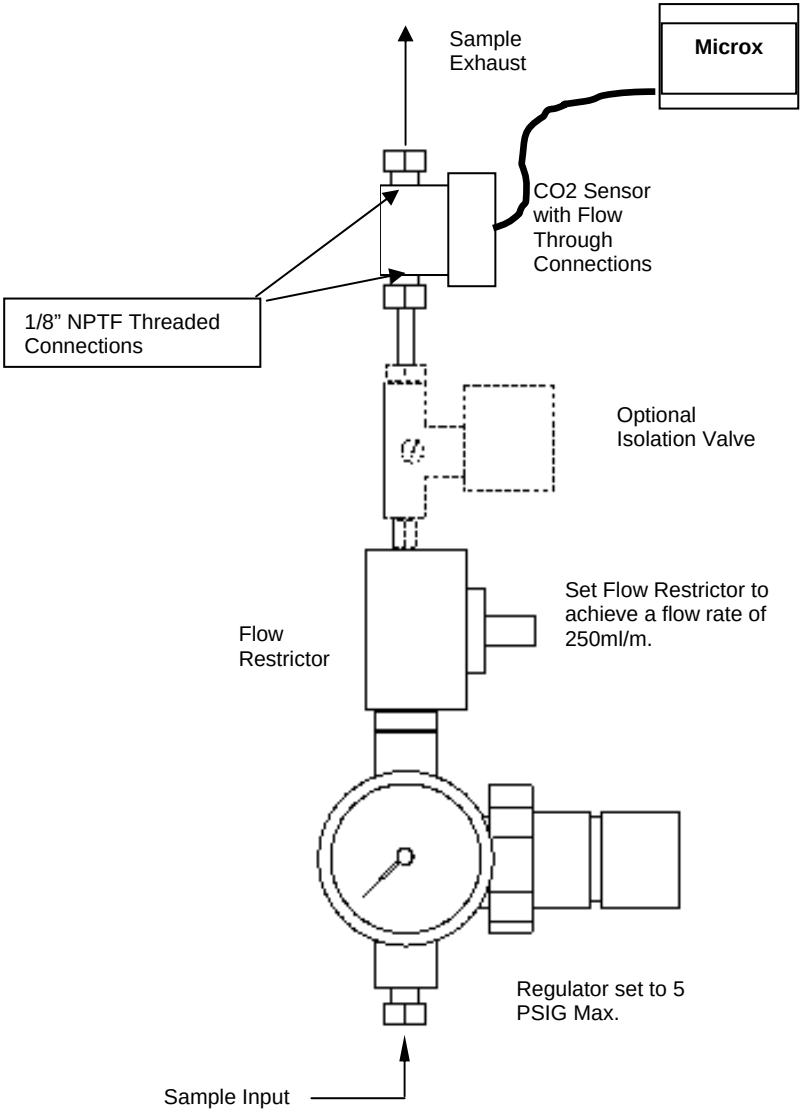
Panel and Wall Mount Versions - AC Supply option.

(Terminals located at the rear of the Module, identified as below as viewed)



CO2 Sensor connections by Cable Colours
1=Black
2=White
3=Yellow
4=Red
5=No Connection

3.4 Recommended Sampling System Piping



3.6 RS232 connections

Contact Ntron for details if required.

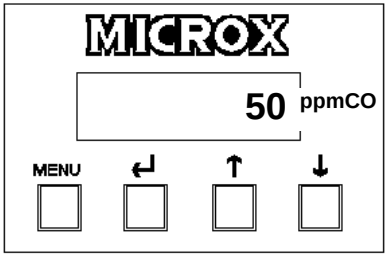
3.7 Analogue Output

The analogue output provides a means of indicating to external equipment (e.g. data loggers, remote displays) the gas levels currently being detected by the system. The output is that of a Current Source (4-20mA), where 4mA represents zero gas and 20mA represents gas at the sensor FSD.

4 SOFTWARE FEATURES

The menu system featured within the Microx module allows all calibration and configuration activities to be performed.

Note: It is important that that the Microx module is correctly configured for the sensor in use, prior to performing any feature available in the menu system.



A B C D

The keypad has the following functionality:

Button	Function	Alternate Function
A	Menu Open/Close	
B	Enter	
C	Next (Increment)	
D	Previous (Decrement)	

4.1 Password

The Microx module uses a password system to restrict the end user from carrying out certain changes that may compromise the use of the equipment.

The menu system is split into two areas, user and engineer. The user has access to menu options E:1 to E:9
For advance configuration, a pass code is required for entry into menus E:10 to E:19. This is normally reserved for factory configuration.

Menu options

Menu option	Function
E:1	Calibrate Sensor
E:2	Analogue output FSD
E:3	Set 4 mA
E:4	Set 20 mA
E:5	Sensor simulation
E:6	Not Applicable-DO NOT USE
E:7	Not Applicable -DO NOT USE
E:8	Diagnostics
E:9	Not Applicable -DO NOT USE
E:10	Not Applicable -DO NOT USE
E:11	Not Applicable -DO NOT USE
E:12	Not Applicable -DO NOT USE
E:13	Not Applicable -DO NOT USE
E:14	New Sensor Data
E:15	Electronic Zero
E:16	Not Applicable -DO NOT USE
E:17	Relay
E:18	Alarm Levels
E:19	Alarm Hysteresis

4.1.1 Menu 1 – Calibrate sensor

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:1**
- Press ENTER.
- Apply a known concentration of gas (applicable to sensor type) at a flow rate of between 100 to 500 ml/m. Allow time for the sensor to respond. (see diagram on page 8)
- Using the INC and DEC buttons set the reading to that of the calibration gas level.
- Press ENTER to span the sensor, '**– – – –**'will be displayed to confirm the sensor span has been performed.
  Note: Pressing the MENU button rather than the ENTER button exits the span feature without performing the calibration.
  Wait until the reading is stable, if not press the ENTER button to span the sensor.
- Press the MENU button to close the menu system.
  Note: The sensor span setting will be displayed (as a percentage value) on exit while the MENU key is pressed. Note that this value is a percentage of the initial calibration value set via "New Sensor Data" in menu E:14. See note below.
- Turn off and disconnect the calibration gas.

Note: On each occasion that a new sensor is connected and calibrated the "New Sensor Data" should be set via the procedure in menu 14. The setting should only be carried out after the calibration and not before. This will ensure that subsequent span setting figures displayed on exit of menu 1 will be valid.

4.1.2 Menu 2 – Analogue output FSD

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:2**
- Press ENTER.
- Using the INCREASE and DECREASE buttons adjust the FSD to the required level.
- Press ENTER.
  Note: Pressing the MENU button rather than the ENTER button exits the sensor FSD feature without any change.
- Press the MENU button to close the menu system.
  Note: The Sensor FSD will be displayed on exit while the MENU key is pressed.

4.1.3 Menu 3 – Set 4 mA output

- Monitor the current sourced from the analogue output of the OEM module using a multimeter set to read milliamps.
- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:3**
- Press ENTER.
- Using the INCREASE and DECREASE buttons adjust the output to 4mA .
- Press ENTER.
  Note: Pressing the MENU button rather than the ENTER button exits the 4 mA feature without performing the calibration.
- Press the MENU button to close the menu system.
  Note: The 4 mA factor will be displayed on exit.

4.1.4 Menu 4 – Set 20 mA output

- Monitor the current sourced from the analogue output of the OEM module using a multimeter set to read milliamps.
- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:4**
- Press ENTER.
- Using the INCREASE and DECREASE buttons adjust the output to 20 mA.
- Press ENTER.
- Press the MENU button to close the menu system.
  Note: The 20 mA factor will be displayed on exit.

4.1.5 Menu 5 – Analogue Output Simulation

The Microx analogue output can be tested for functionality via menu 5. This option allows the user to simulate the analogue output.

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:5**.
- Use the UP and DOWN button to increase or decrease the analogue output. The value displayed on the Microx display will be equivalent to the analogue output.
- Press the MENU button to close the menu system.
  Note: The module will return to the conditions on entry.

4.1.6 Menu 6 – Sensor selection

Warning
The OEM Module is supplied configured for the Sensor type with which it is to be used.
Customer adjustment of this setting is not recommended. Please consult Ntron if a change of Sensor type is required.

Sensor Type 02-4

4.1.7 Menu 7

Warning
Customer adjustment of this setting is not permitted.

4.1.8 Menu 8 - Diagnostics

This feature is a view-only feature. No configuration changes are possible from within this menu.

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:8**
- Press ENTER.
- The display will alternate between the current value and diagnostic code **E:8x**: where x is:
  - 0 Sensor signal, A to D counts low ppm range.
  - 1 Sensor signal, A to D counts high ppm range.
  - 2 Sensor signal, A to D counts %vol range.
  - 3 Firmware version.

- The diagnostic code can be selected by pressing the UP button.
- Press MENU to return the instrument to its standard mode of operation.

4.1.9 Menu 9 - Restore

Warning
Customer adjustment of this setting is not permitted.

4.1.10 Menu 10 – Zero offset

Warning
Customer adjustment of this setting is not permitted.

4.1.11 Menu 11 – PPM sensor Gain

Warning
Customer adjustment of this setting is not recommended. The module will be factory set prior to shipment at a value appropriate to the sensor type fitted. Otherwise changing this value may limit the performance and, in extreme cases, the instrument may no longer detect gas.

4.1.12 Menu 12 – % vol sensor gain

Warning
This setting is not relevant to this Analyser type and as such, customer adjustment of this setting is not permitted.

4.1.13 Menu 13 – Sensor damping

Warning
Customer adjustment of this setting is not permitted.

4.1.14 Menu 14 – New sensor data

This option allows the initial sensor calibration data to be set. It is used to predict the remaining sensor life.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:14**
- Press ENTER. The display displays E:14
- Press ENTER to store the new data in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.

4.1.15 Menu 15 – Electronics zero

This must be done with Zero gas applied to the sensor. (See specifications in section 2 of this manual)

- Press the MENU button to open the menu system.
- Using the NEXT and PREVIOUS buttons select menu option: **E:15**
- Press ENTER.
- Press ENTER to zero the sensor, '**– – – –**'will be displayed to confirm the sensor zero has been performed.
  Note: Pressing the MENU button rather than the ENTER button exits the zero feature without performing the calibration.
- Press the MENU button to close the menu system.

4.1.16 Menu 16 – Noise Rejection

Warning
Customer adjustment of this setting is not recommended. The module will be factory set prior to shipment at a value appropriate to the sensor type fitted. Otherwise changing this value may limit the performance and, in extreme cases, the instrument may no longer detect gas.

4.1.17 Menu 17 – Relay

The unit is fitted with three relays that are operated in conjunction with one of three alarm levels.
Relay 1 is associated with alarm level 1.
Relay 2 is associated with alarm level 2.
Relay 3 is associated with alarm level 3.

The user can select if the relay is normally Energized, E' or normally de-energised, 'd' when the unit is **not** in an alarm condition. The relay can also be set to act on rising, 'r' or falling 'F' gas levels.

This option allows the user to configure the operation of the relays.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:17**
- Press ENTER. The display displays r:1
- Use the UP / DOWN keys to select the desired relay.
- The display will show the following:
  - E:r Normally energized, rising alarm
  - d:r Normally de-energized, rising alarm
  - E:F Normally energized, falling alarm
  - d:F Normally de-energized, falling alarm
- The mode of operation can be changed by pressing the UP button.
- Press ENTER to store the new data in the memory.

Note: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.

4.1.18 Menu 18 – Alarm levels

This option allows the user to set the operation of the alarm levels. There are three alarms levels associated with 3 relays.
Alarm level 1 is associated with relay 1.
Alarm level 2 is associated with relay 2.
Alarm level 3 is associated with relay 3.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:18**
- Press ENTER. The display displays A:1
- Use the UP / DOWN keys to select the desired alarm level.
- Press ENTER. The display shows the alarm level.
- Use the UP / DOWN keys to set the desired alarm level.
- Press ENTER to store the new value in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.
- Press MENU to close the menu system.

4.1.19 Menu 19 – Alarm hysteresis

The unit has a hysteresis value associated with the alarm levels to avoid relay chattering as the unit goes in and out of alarm conditions.

The hysteresis value is expressed as a percentage of the alarm set point and takes a value of between 0 and 10.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:19**
- Press ENTER. The display shows the hysteresis level.
- Use the UP / DOWN keys to set the desired level.
- Press ENTER to store the new value in the memory.
  Note: Pressing the MENU button rather than the ENTER button exits without any change.
- Press MENU to close the menu system.

5 ROUTINE MAINTENANCE & SERVICING

The Microx Analyser will provide reliable and fault free service when given regular maintenance and calibrations.

5.1 Routine Inspection and Maintenance

It is advisable to periodically inspect the Microx Analyser
Clean gas detector head using a clean DAMP cloth.

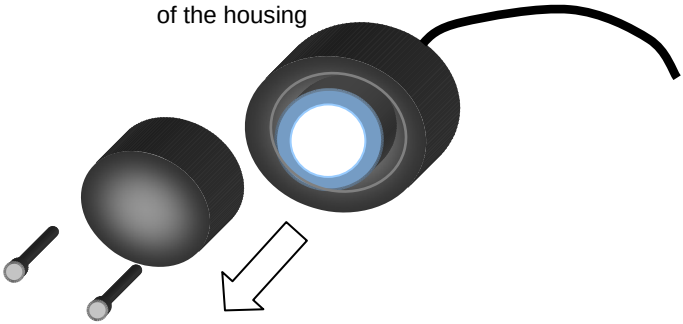
Inspect the sensor and ensure it is sound and the sensor-housing aperture is not obstructed (where applicable).

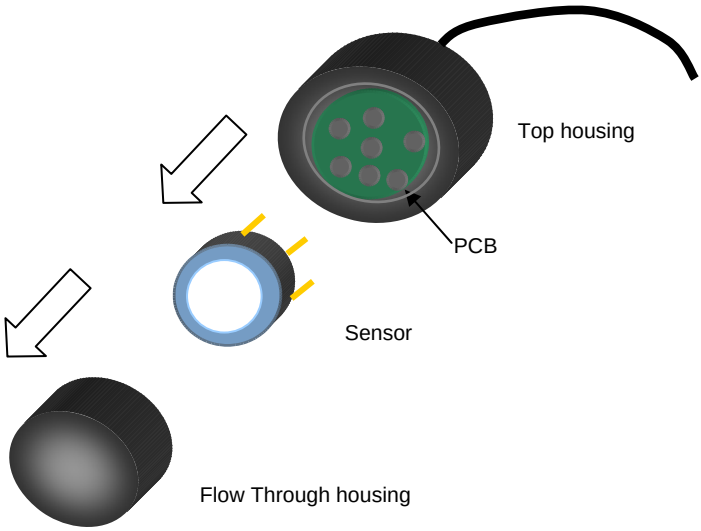
The maximum time interval between routine inspections should be assessed by the calibrating personnel and will depend upon the environment in which the equipment is installed.

5.1.1 Sensor Replacement

The Carbon Dioxide Infra Red Sensor typically has a lifespan of 5 years.
When replacement is required, the sensing element can be removed from the flow through housing and a replacement sensor fitted.
The Sensor housing may have to be disconnected from the sampling gas circuit to perform this operation.

1. Remove the M3 Socket Head Screws securing the flow through section of the housing to the top half of the housing





The Sensor un-plugs from the PCB that sits within the top half of the sensor housing. **Note the position of the sensor and the contact pins during removal! Of the Sensor.**
Try and support the PCB when removing the sensor to prevent putting strain on the wiring connected to the PCB.
Replacement is a reversal of the above procedure.
Ensure that the positioning of the sensor is the same as when the original sensor was removed.

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