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The

MICROX

Oxygen Analyser

User Instruction Manual

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Issue Date:	**08/11/2010**

Microx User Manual

1 INTRODUCTION

1.1 Microx Module

The MICROX Module has been designed to allow OEM (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 can accept typically two different types of sensor as follows:

1) 0 - 25% Vol.
2) 0 - 1000 ppm.

It is not advisable to connect both sensors at the same time as this may result in some cross-talk between the ranges.

1.3.1 %Vol Sensor

The %Vol sensor input is connected to a variable gain amplifier allowing linearised oxygen measurements over the range 0-22% Vol. O2. with a resolution of 0.01% Vol. below 10% and 0.1% Vol. above.

The %Vol sensor can be calibrated between 0-25% to maintain the correlation between ranges.

1.3.2 PPM Sensor

The PPM sensor input is connected to a fixed and variable gain amplifier. This allows the module to have effectively three ranges which are transparent to the user.
The first range is effectively 0 – 200 ppm with a resolution of 0.1 ppm.
The second range is effectively 200 – 1000 ppm with a resolution of 1 ppm.
The third range is effectively 1000 – 10000 ppm with a resolution of 20 ppm.

The processor automatically sets the gain of the electronics to maximize the resolution of the measured oxygen level.

The PPM sensor range must be calibrated between 90 and 199 ppm oxygen to maintain the correlation between ranges.

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)
Sensor Input	
No of Channels:	2
Sensor 1 Sensor 2	%Vol oxygen PPM oxygen
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 Mounting Options

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)

Also available are:

Din Rail Mounting Version.

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

Wall Mounting Version

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

3.2 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.

3.3 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.

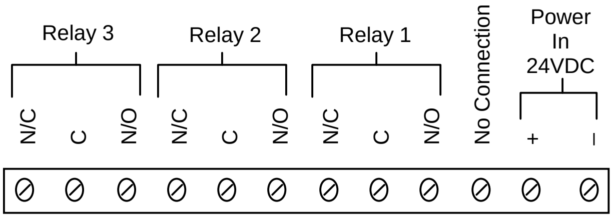
(Terminals located at the front of the Module, numbered as below)

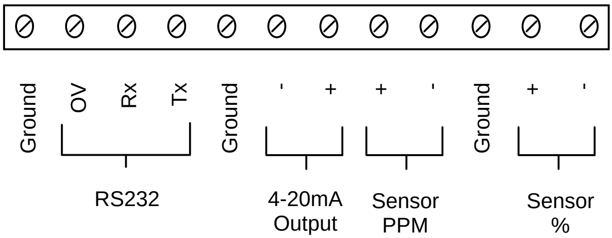
Pin	Function
1	% vol sensor -
2	% vol sensor +
3	Sensor Ground
4	% ppm sensor -
5	% ppm sensor +
6	4-20 mA output +
7	4-20 mA output -
8	Ground
9	TxD RS232
10	RxD RS232
11	0V RS232
12	System ground

Pin	Function
13	24V dc input -
14	24V dc input -
15	No connection
16	N/O contact relay 1
17	Com contact relay 1
18	N/C contact relay 1
19	N/O contact relay 2
20	Com contact relay 2
21	N/C contact relay 2
22	N/O contact relay 3
23	Com contact relay 3
24	N/C contact relay 3

Panel and Wall Mount Versions - DC Supply option.

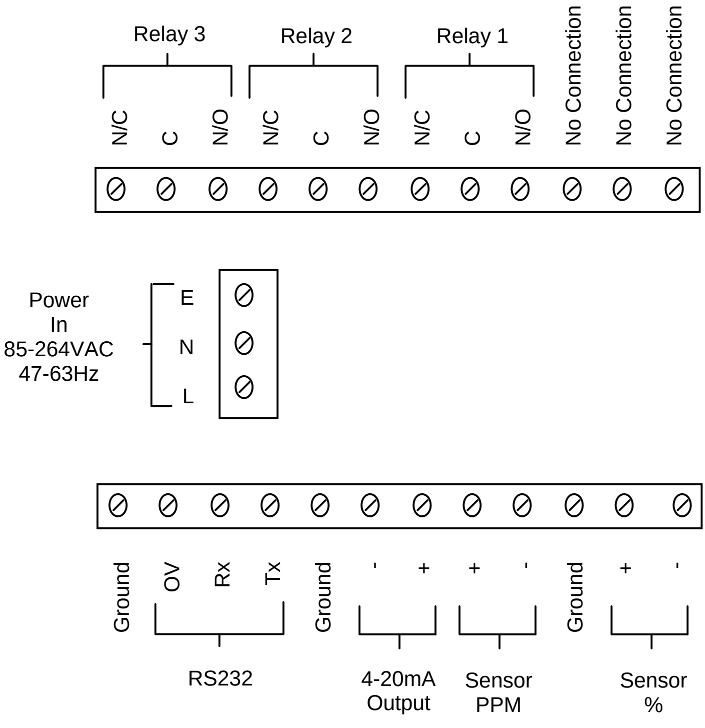
(Terminals located at the rear of the Module, identified as below as viewed)



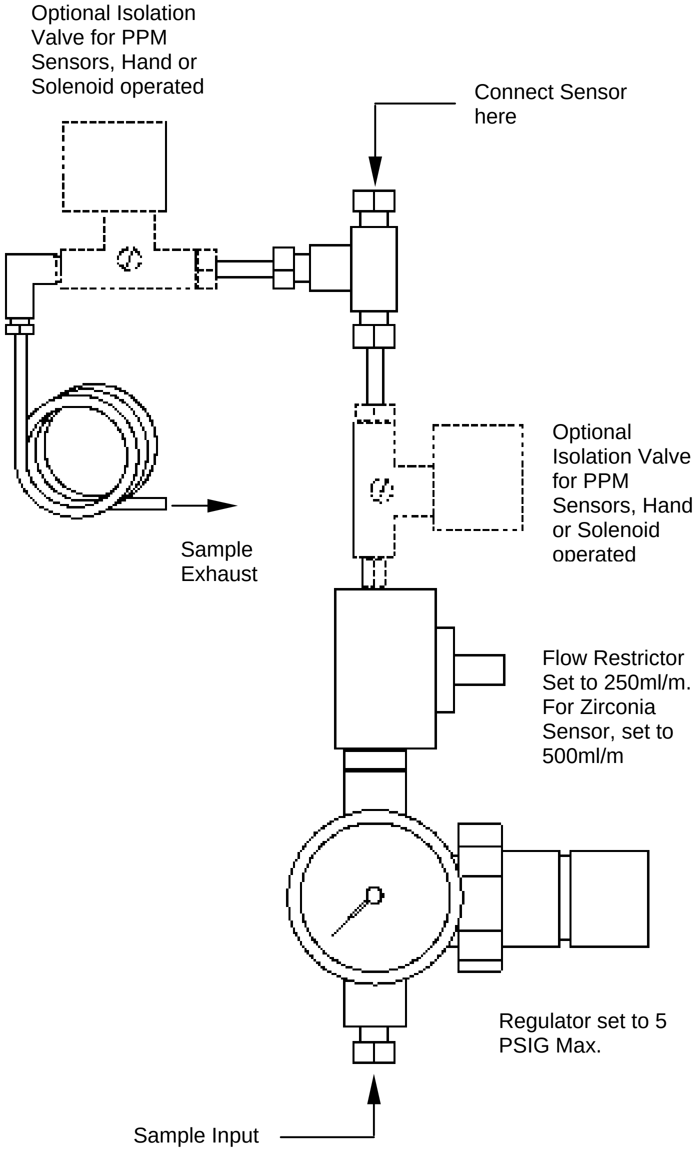


Panel and Wall Mount Versions - AC Supply option.

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



3.3 Recommended Sampling System Piping



3.3 RS232 connections

Microx	PC Connections		
Function	Function	9-way ‘D’	25-way ‘D’
TxD	RxD	2	3
RxD	TxD	3	2
0V	0V	5	9

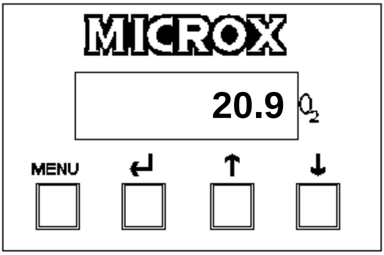
3.3 Analogue Output

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	Low ppm sensor calibration
E:8	Diagnostics
E:9	Restore
E:10	Zero Offset
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

4.1.1 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 500 and 1000cc/min. Allow time for the sensor to respond.
- 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.

Note: For ppm configured modules that have been fitted with a replacement sensor the "Zero Offset" (Menu 10) must be entered prior to a calibration.

4.1.2 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

- 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 4.1.10) 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	0-22% Volume
O2-2	0-1000 ppm
O2-3	0-25% Volume (Non Linearised)
O2-4	0-1000 ppm (Non Linearised)
O2-5	0-100% Volume (Non Linearised)

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.

4.1.7 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.

4.1.8 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

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 4.1.15
If a ppm configured module enter the Zero Offset, Section 4.1.10
Carry out a Sensor Calibration, Section 4.1.1
Check the Analogue Output FSD is set correctly, Section 4.1.2
Carry out an Analogue Output Calibration, Section 4.1.3

- 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.

4.1.10 Menu 10 – Zero offset

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 oxgen 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.

4.1.11 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:10. 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:10**
- 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.

4.1.12 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:11. 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.

4.1.13 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.

4.1.14 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

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.

4.1.16 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.

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 on the AtoD converter of each other before the display is updated. It takes a value of between 0 and 9, where 0 is no rejection and 9 is the maximum jejection.

Setting the noise rejection results in a two second delay for quick 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

4.1.17 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 Communications Protocol

The communications protocol used by the Microx module is used for communications between devices connected via an RS232 connection. This point-to-point, P2P, protocol is a frame-based protocol.

5.1 Control Byte Constants

The following control byte constants are used in the P2P protocol[1].

Read,	RD	=	0x13	(00010011)
Data Link Escape,	DLE	=	0x10	(00010000)
Write,	WR	=	0x15	(00010101)
Acknowledge,	ACK	=	0x16	(00010110)
Negative Acknowledge,	NAK	=	0x19	(00011001)
Single Data Frame,	DAT	=	0x1A	(00011010)
End of Frame,	EOF	=	0x1F	(00011111)
Write Password 1,	WP1	=	0xE5	(11100101)
Write Password 2,	WP2	=	0xA2	(10100010)

5.2 Frame Structure

The start of a frame is indicated by a DLE byte followed by the type of frame to follow (RD, WR, ACK, NAK, DAT). The end of frame is indicated by a DLE byte followed by an EOF byte.

Note: Each of the constants has bit 4 set and so is slip-resistant (i.e. if shifted this bit will be out of position). The values have a Hamming Distance of 2 (each code is at least 2 bits different from every other code).

Any DLE bytes that occur between a frame's start and end are prefixed with another DLE (*byte-stuffing*).

Following the EOF is a 16-bit checksum of the entire frame, each byte is added to produce the checksum.

5.3 Variables

Each piece of accessible data on a device is referred to as a *Variable*. Each variable is referenced by a *Variable ID*. A variable ID may be any number of bytes long.

The available Variables and their corresponding Variable IDs depend on the type of device, but here are a few examples for OEM module:

Purpose	Variable id	Comments
Live Data	1	Read only
Zero Sensor	2	Write only
Span Sensor	3	Write only
Version Information	4	Read only
Dac FSD	6	Read / write
Zero offset	7	Read / write

The structure of the data returned in each variable usually depends both on the type of device and the version of firmware running on the device.
Refer to device documentation for more information.

5.4 Reading a Variable

Send a read frame with the Variable ID to be read:

DLE	RD	var-id	DLE	EOF	Csum hi	Csum lo
		Byte stuffing				

Device response on success, where requested variable data < 255 bytes:

DLE	DAT	data-len	data	DLE	EOF	Csum hi	Csum lo
		Byte stuffing					

Device response on failure:

DLE	NAK	reason

Where ‘reason’ is a single byte failure code, the meaning of which depends on the device type, i.e.

1 p2pNAKvarNotReadable,
2 p2pNAKvarNotWritable,
3 p2pNAKoutOfRange,
4 p2pNAKincorrectLength,
5 p2pNAKunexpectedBytes,
6 p2pNAKchecksumFailed,
7 p2pNAKincorrectVersion,
8 p2pNAKbusy,

5.4.1 Read example - read live data

0x10, 0x13, 0x01, 0x10, 0x1F, 0x1b, 0xd0

Device response on success:

DLE, DAT, Data length, Data, DLE, EOF, Crc High byte, Crc low byte, i.e.

0x10	DLE
0x1A	DAT
0x09	Data length
0x01	Version
0x00, 0x00, 0x00, 0x00	Gas reading, 32 bit floating point – IEEE format
0x98, 0x1C, 0xC6, 0x42	Life, 32 bit floating point – IEEE format
0x10	DLE
0x1F	EOF
0xE5	Crc high byte
0xB2	Crc low byte

Note: 0x42C61C98 = 99.05585

5.4.2 Read example - read Dac Fsd

0x10, 0x13, 0x06, 0x10, 0x1F, 0x9B, 0xBF

Device response on success:

DLE, DAT, Data length, Data, DLE, EOF, Crc High byte, Crc low byte, i.e.

0x10	DLE
0x1A	DAT
0x08	Data length
0x00, 0x00, 0x48, 0x43	Dac ppm FSD, 32 bit floating point – IEEE format
0x00, 0x00, 0xA0, 0x40	Dac Vol. FSD, 32 bit floating point – IEEE format
0x10	DLE
0x1F	EOF
0x75	Crc high byte
0x03	Crc low byte

Note: 0x43480000 = 200
0x40A00000 = 5

5.4.3 Read example - read Zero Offset

0x10, 0x13, 0x07, 0x10, 0x1F, 0x1B, 0xA8

Device response on success:

DLE, DAT, Data length, Data, DLE, EOF, Crc High byte, Crc low byte, i.e.

0x10	DLE
0x1A	DAT
0x04	Data length
0x63, 0x66, 0xA6, 0x3F	Zero Offset, 32 bit floating point – IEEE format
0x10	DLE
0x1F	EOF
0xC1	Crc high byte
0x12	Crc low byte

Note: 0x3FA66663 = 1.3

5.5 Writing a Variable

Send a write frame with the Variable ID to be written:

DLE	WR	WP1	WP2	var-id	DLE	EOF	csu mhi	csu mlo
				Byte stuffing				

Device response on success:

DLE	ACK

Where data to write is < 255 bytes, send a DAT frame:

DLE	DAT	data-len	data	DLE	EOF	Csum hi	Csum lo
		Byte stuffing					

Device response on write success:

DLE	ACK

Device response on write failure:

DLE	NAK	reason

Where 'reason' is a single byte failure code, the meaning of which depends on the device type, i.e.

Reason = 1, NotWritable
Reason = 2, WriteOutOfRange
Reason = 3, BadDataLength
Reason = 4, IncorrectVersion

5.5.1 Write example – zero sensor

Send the following bytes:
DLE, WR, WP1, WP2, Variable ID, DLE, EOF, Checksum High byte, Checksum low byte,
0x10, 0x15, 0xE5, 0XA2, 0x02, 0x10, 0x1F, 0xED, 0xD6

Device response on success:

0x10	DLE
0x16	ACK

Send the following bytes:
DLE, DAT, Data Len, Data, DLE, EOF, Checksum High byte, Checksum low byte
0x10, 0x1A, 0x00, 0x10, 0x1F, 0x2F, 0xC7

Device response on success:

0x10	DLE
0x16	ACK

5.5.2 Write example – span sensor

Send the following bytes:
DLE, WR, WP1, WP2, Variable ID, DLE, EOF, Checksum High byte, Checksum low byte,
0x10, 0x15, 0xE5, 0XA2, 0x03, 0x10, 0x1F, 0x6D, 0xC1,

Device response on success:

0x10	DLE
0x16	ACK

Send the following bytes:
DLE, DAT, Data Len, Data, DLE, EOF, Checksum High byte, Checksum low byte
i.e.
0x10, 0x1A, 0x04, 0x33, 0x33, 0xA7, 0x41, 0x10, 0x1F, 0x4B, 0x44

Device response on success:

0x10	DLE
0x16	ACK

Where 0x41A73333 = 20.9, IEEE float lsb first.

5.5.3 Write example – Dac Fsd

Send the following bytes:
DLE, WR, WP1, WP2, Variable ID, DLE, EOF, Checksum High byte, Checksum low byte,
0x10, 0x15, 0xE5, 0XA2, 0x06, 0x10, 0x1F, 0x6D, 0x85

Device response on success:

0x10	DLE
0x16	ACK

Send the following bytes:
DLE, DAT, Data Len, Data, DLE, EOF, Checksum High byte, Checksum low byte
0x10, 0x1A, 0x08, 0x00, 0x00, 0x16, 0x43, 0x00, 0x00, 0x90, 0x40, 0x10, 0x1F, 0x54, 0xD3

Device response on success:

0x10	DLE
0x16	ACK

Note: in this case Dac ppm range = 150 (0x43160000)
Dac Vol. Range = 4.5 (0x40900000).

5.5.4 Write example – Zero Offset

Send the following bytes:
DLE, WR, WP1, WP2, Variable ID, DLE, EOF, Checksum High byte, Checksum low byte,
0x10, 0x15, 0xE5, 0XA2, 0x07, 0x10, 0x1F, 0xED, 0x92

Device response on success:

0x10	DLE
0x16	ACK

Send the following bytes:
DLE, DAT, Data Len, Data, DLE, EOF, Checksum High byte, Checksum low byte
0x10, 0x1A, 0x04, 0xCD, 0xCC, 0x2C, 0x40, 0x10, 0x1F, 0xAF, 0XB4

Device response on success:

0x10	DLE
0x16	ACK

Note: in this case Zero Offset = 2.7 (0x402CCCCD)

5.6 Data Structures

The data that is transferred via the P2P protocol take the form of structures.

The data types are as follows:

Char	1 byte	8-bits
Integer	2 bytes	16-bits
Double	4 bytes	32-bits

There are three structures used by the Microx module. These are as follows:

5.6.1 configuration data

```
struct {  // common
          unsigned char Version;
          unsigned char Display;
          unsigned char SensorType;
          unsigned int DacZero;
          double DacSpan;
          // 0-1000ppm
          unsigned int Range1Fsd[2];
          unsigned int Range1Zero[2];
          double Range1Span[2];
          double Range1CalGas[2];
          unsigned char Range1GainPot[2];
          // 0-5%
          unsigned int Range2Fsd;
          unsigned int Range2Zero;
          double Range2Span;
          double Range2CalGas;
          // 0-25%
          unsigned int Range3Fsd[2];
          unsigned int Range3Zero[2];
          double Range3Span[2];
          double Range3CalGas[2];
          unsigned char Range3GainPot[2];
          unsigned char RelayMode;
          double Alarm_O2_PPM[3];
          double Alarm_O2_VOL[3];
          double Hysteresis;
          unsigned char Damping;
          double DacFsd[2];
          // New sensor
          unsigned int Range1ZeroNew;
          double Range1SpanNew;
          unsigned int Range3ZeroNew;
          double Range3SpanNew;
          unsigned char SerialNumber[10];
          // Dual range calibration
          double PpmZeroOffset;
          double PpmLowCalGas;
          unsigned int PpmLowCalZero;
          unsigned char Filter;
}ConfigData;
```

5.6.2 live data

```
struct{
        unsigned char Version;
        double Reading;
        double Life;
}LiveData;
```

5.6.3 Calibration gas

```
struct {
        double GasValue;
}CalGas;
```

5.6.4 Dac FSD

```
struct {
        double DacFsdPPM;
        double DacFsdVOL;
}CalGas;
```

5.6.5 Zero Offset

```
struct {
        double ppmZeroOffset;
}ZeroOffset;
```

6 ROUTINE MAINTENANCE & SERVICING

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

6.1 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 should be assessed by the calibrating personnel and will depend upon the environment in which the equipment is installed.

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