MICHELL Instruments

# XZR400 Series Oxygen Analyzers User's Manual




97472 Issue 4
June 2019

Please fill out the form(s) below for each instrument that has been purchased.

Use this information when contacting Michell Instruments for service purposes.

| | |
|---|---|
| Instrument | |
| Code | |
| Serial Number | |
| Invoice Date | |
| Location of Instrument | |
| Tag No | |

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| Instrument | |
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| Serial Number | |
| Invoice Date | |
| Location of Instrument | |
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| Instrument | |
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| Serial Number | |
| Invoice Date | |
| Location of Instrument | |
| Tag No | |


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## Safety

The manufacturer has designed this equipment to be safe when operated using the procedures detailed in this manual. The user must not use this equipment for any other purpose than that stated. Do not apply values greater than the maximum value stated.

This manual contains operating and safety instructions, which must be followed to ensure the safe operation and to maintain the equipment in a safe condition. The safety instructions are either warnings or cautions issued to protect the user and the equipment from injury or damage. Use qualified personnel and good engineering practice for all procedures in this manual.

### Electrical Safety

The instrument is designed to be completely safe when used with options and accessories supplied by the manufacturer for use with the instrument. The input power supply voltage is 90 to 264 V A C, 47/63 Hz. Refer to labels on instrument or calibration certificate.

### Pressure Safety

DO NOT permit pressures exceeding 2 barg (29 psig) to be applied to the instrument. This maximum pressure applies to all versions of the instrument.

### Temperature Safety

During operation some parts of the instrument can be at very high temperatures.

### Toxic Materials

The use of hazardous materials in the construction of this instrument has been minimized. During normal operation it is not possible for the user to come into contact with any hazardous substance which might be employed in the construction of the instrument. Care should, however, be exercised during maintenance and the disposal of certain parts. Long exposure or breathing of the calibration gases may be dangerous.

### Repair and Maintenance

The instrument must be maintained either by the manufacturer or an accredited service agent. Refer to www.michell.com for details of Michell Instruments' worldwide offices contact information.

### Calibration

The recommended calibration (or verification) interval for the analyzer is 1 to 3 months depending on the location and application in which the instrument is used.

### Safety Conformity

This product carries the CE mark and meets the requirements of relevant European safety directives.

## Abbreviations

The following abbreviations are used in this manual:

| | |
|---|---|
| AC | alternating current |
| A | Ampere |
| barg | pressure unit (=100 kP or 0.987 atm) gauge |
| °C | degrees Celsius |
| °F | degrees Fahrenheit |
| l/h | liters per hour |
| l/min | liters per minute |
| mA | milliampere |
| min | minute |
| ppm | parts per million |
| psig | pound(s) per square inch (gauge) |
| RS232 | Modbus RTU serial data transmission standard |
| RS485 | Modbus RTU serial data transmission standard |
| T | temperature |
| V | Volts |

## Warnings

The following general warnings listed below are applicable to this instrument. They are repeated in the text in the appropriate locations.

**Where this hazard warning symbol appears in the following sections, it is used to indicate areas where potentially hazardous operations need to be carried out.**


**Where this symbol appears in the following sections it is used to indicate areas of potential risk of electrical shock.**


**Where this hot surface warning appears in the following sections it is used to indicate areas where the surface may potentially be dangerously hot.**

# 1 INTRODUCTION

The XZR400 Series Trace Oxygen Analyzer is designed to measure oxygen as an inpurity in nitrogen, carbon dioxide, argon, helium or other inert gases. Analysis is both quick and stable, utilizing our metallic sealed reference sensor (MSRS), with no requirement for reference air.

There are 4 versions of the XZR400 analyzer. All are trace oxygen analyzers designed to measure oxygen content in gas, between 0.01 ppm and 25% $O_2$ (250,000 ppm).

Michell Instruments can supply the analyzer so that it is suitable for use with enriched oxygen samples, including pure oxygen which may accidentally be introduced to the sample. This cleaning service must be ordered at the time of purchase as special components are required.

Extended operating ranges of 0 to 30% or 0 to 50% $O_2$ can be supplied but will require the analyzer to be cleaned for oxygen service.

Typical applications include:

Gas purity

Inerting or blanketing specific atmospheres

Combustion pre-mixing analysis

Respiratory or medical gas mixtures

Heat treatment

Four models of the XZR400 Series Oxygen Analyzer are available:

- A rack-mount model XZR400A1 (XZR-400-RM)
- A wall-mount model XZR400A2 (XZR-400-WM)
- A bench-mount model XZR400A3 (XZR-400-BM)
- A transportable model XZR400A4 (XZR-400-TP)

NOTE: The rack-mount version can be supplied with a built-in Easidew sensor for measuring moisture in the range -100 to +20 °C

Sample gases at pressures up to a maximum of 2 barg (29 psig) can be accepted.

The XZR400 Series includes the following front panel mounted items:

- Liquid crystal touchscreen display
- Flow adjustment valve
- Bypass control valve

## 1.1 Operating Principle

The analyzer operates on the zirconium oxide (zirconia) principle.

A sample of the gas to be measured is connected to the inlet port of the analyzer. The sample gas flows through stainless steel pipework into the oven where the zirconia oxygen sensor is located.

The sample flow should be set to between 1 and 3 l/hr using the electronic flowmeter, and sample and bypass needle valves on the front of the unit.

The sample gas circulates in the oven, which is heated to temperatures above 600°C, necessary for the zirconia oxygen sensor to operate properly.

The Michell Metallic Sealed Reference Sensor (MSRS) generates a signal that is proportional to the logarithm of the ratio of the oxygen partial pressure in the sample to the oxygen partial pressure contained on the sealed reference side of the MSRS.

The analyzer provides the $O_2$ concentration on the screen and via the 4-20 mA output (optional on XZR400A3).

The optional Easidew Transmitter utilizes ceramic impeadance technology and further details can be found on our website.

## 1.2 The MSRS Technology

The zirconium oxide sensors are often referred to as the 'high temperature' electrochemical sensors. The principle is based on the Nernst principle [W. H. Nernst (1864-1941)]. Zirconium oxide sensors use a solid state electrolyte and are stabilized with yttrium oxide. The zirconium oxide probe is plated on opposing sides with platinum which serves as the sensor electrodes. For a zirconium oxide sensor to operate properly, it must be heated to approximately 600°C. At this temperature, on a molecular basis, the zirconia lattice becomes porous, allowing the movement of oxygen ions from a higher concentration of oxygen to a lower one, based on the partial pressure of oxygen. The movement of oxygen ions across the zirconium oxide produces a voltage between the two electrodes, the magnitude of which is based on the oxygen partial pressure differential created by the reference and sample gas.

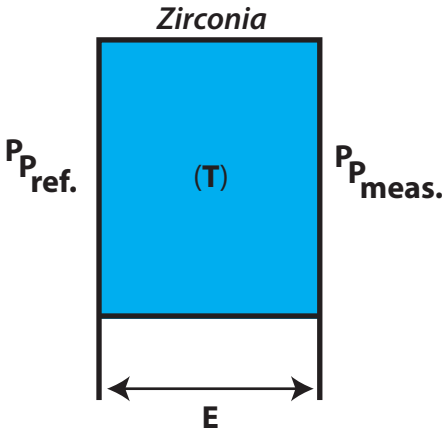



Figure 1 *Zirconia Sensor Operating Principle*

Within the oven the zirconium oxide MSRS is maintained at a temperature of 634°C. The MSRS generates a signal that is proportional to the natural logarithm of the partial pressure of oxygen p ($O_2$).

$$E = \frac{RT}{4F} \ln \frac{p\ (O_2 meas)}{p\ (O_2 ref)}$$

With a known reference electrode and a constant temperature it is possible to define the partial pressure of oxygen using the Nernst-equation (see above).

The conductivity of zirconium oxide increases exponentially with temperature. The oxide ion conductivity is optimized at temperatures above 600°C.

The MSRS technology allows the design of miniaturized zirconium oxide-based oxygen sensors. The low mass and volume of the MSRS sensors have a positive effect on the response time, which is one of the best available on the market.

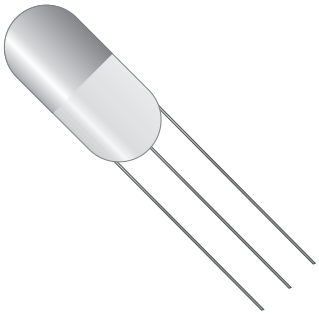


Figure 2 *MSRS Sensor*

Conventional zirconium oxide sensors require an air reference on one side of the sensor with the sample on the other. This provides a known constant on one side. The Michell MSRS does not require an air reference but instead utilizes a metal, and its oxide, sealed in the zirconium sheath. This allows the sensor operation to be irrespective of the ambient air quality and negates the requirement for a 'zero' calibration gas.

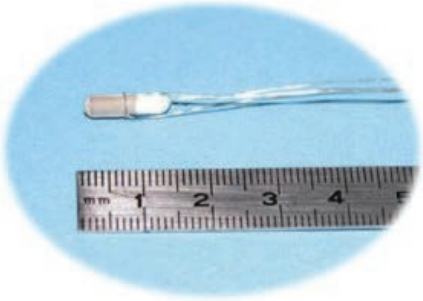


Figure 3 *MSRS Dimensions*

Temperature is a major component in the Nernst equation and can affect the accuracy of some sensors. Placing the thermocouple in contact with the small sensor body helps provide a very accurate temperature measurement. The complete design offers high accuracy and repeatability.

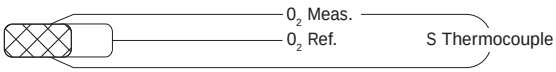



Figure 4 *MSRS Wiring*

*Figure 5* shows the MSRS and its S thermocouple installed in a 4-hole aluminum tube. This configuration has the part number XZR400-SMP. Any reference to the MSRS sensor refers to this complete assembly which is considered solid state and non user-serviceable.

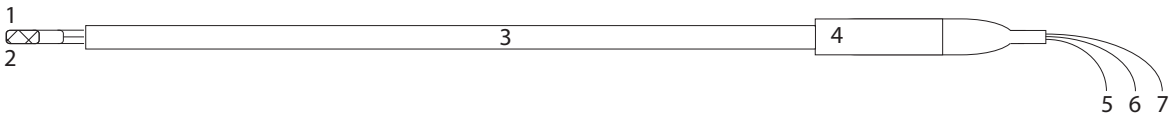



Figure 5 *XZR400 Series MSRS Assembly*

| Item | Description | Wiring |
|---|---|---|
| 1 | MSRS | |
| 2 | S-type thermocouple | |
| 3 | 4-hole alumina tube | |
| 4 | Stainless steel connector | |
| 5 | $O_2$ reference wire | blue wire |
| 6 | Common ($O_2$ meas. & - TC) | white wire |
| 7 | Positive thermocouple (+TC) | orange wire |

Table 1 XZR400 Series MSRS Assembly

# 2 INSTALLATION

**It is essential that the installation of the electrical and gas supplies to this analyzer be undertaken by qualified personnel.**

## 2.1 Unpacking the Analyzer

It is recommended that the packaging is retained until after successful commissioning and start up of the unit. If you choose to dispose of the packaging materials, please ensure that they are recycled in accordance with local legislation.

Standard contents in the box:

- XZR400 Series Oxygen Analyzer
- Power cable (except XZR400A2 model)
- Test result sheet

## 2.2 Preparation

Carefully read the following guidelines before installing the analyzer. If you are not sure about the installation conditions and other important factors please contact a Michell Instruments' Application Engineer or a Michell Instruments' representative prior to the installation.

The following list will help you to identify the recommended preparation steps:

- The analyzer should be installed at ambient temperatures between 0 and +55°C (32 to +131°F).
- The location of the installation should allow access to the display.
- The location of the installation should not expose the analyzer to any vibration.
- The cables should not be exposed to extreme temperatures and mechanical strain.

## 2.3 Dimensions - XZR400A1

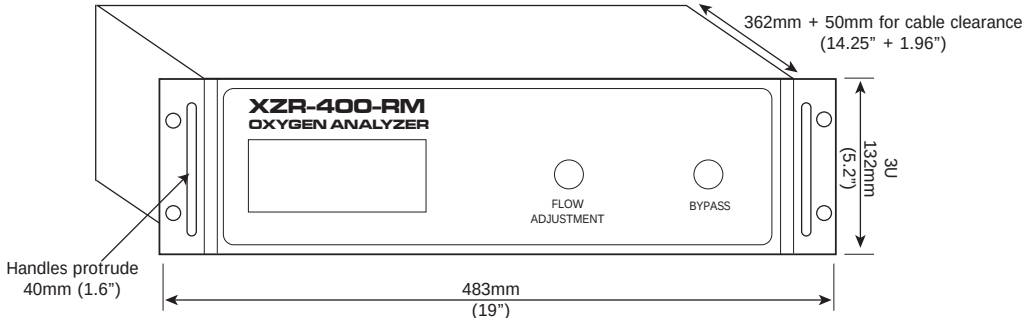



Figure 6 *Dimensions - XZR400A1*

### 2.3.1 Installing the XZR400A1

Choose your installation site carefully following the recommendations above. Once installed into the rack, there should be at least 2U clearance spaces from other equipment above and below the instrument.

To install, follow the steps below:

1. If necessary, remove any covers from the rack cabinet to gain access to the rear and side.
2. Slide the instrument into the rack and support its weight while the four fixing screws are inserted.
3. Ensure that the front panel of the instrument is flush and square with the front of the rack and tighten the fixing screws.

## 2.4 Dimensions - XZR400A2

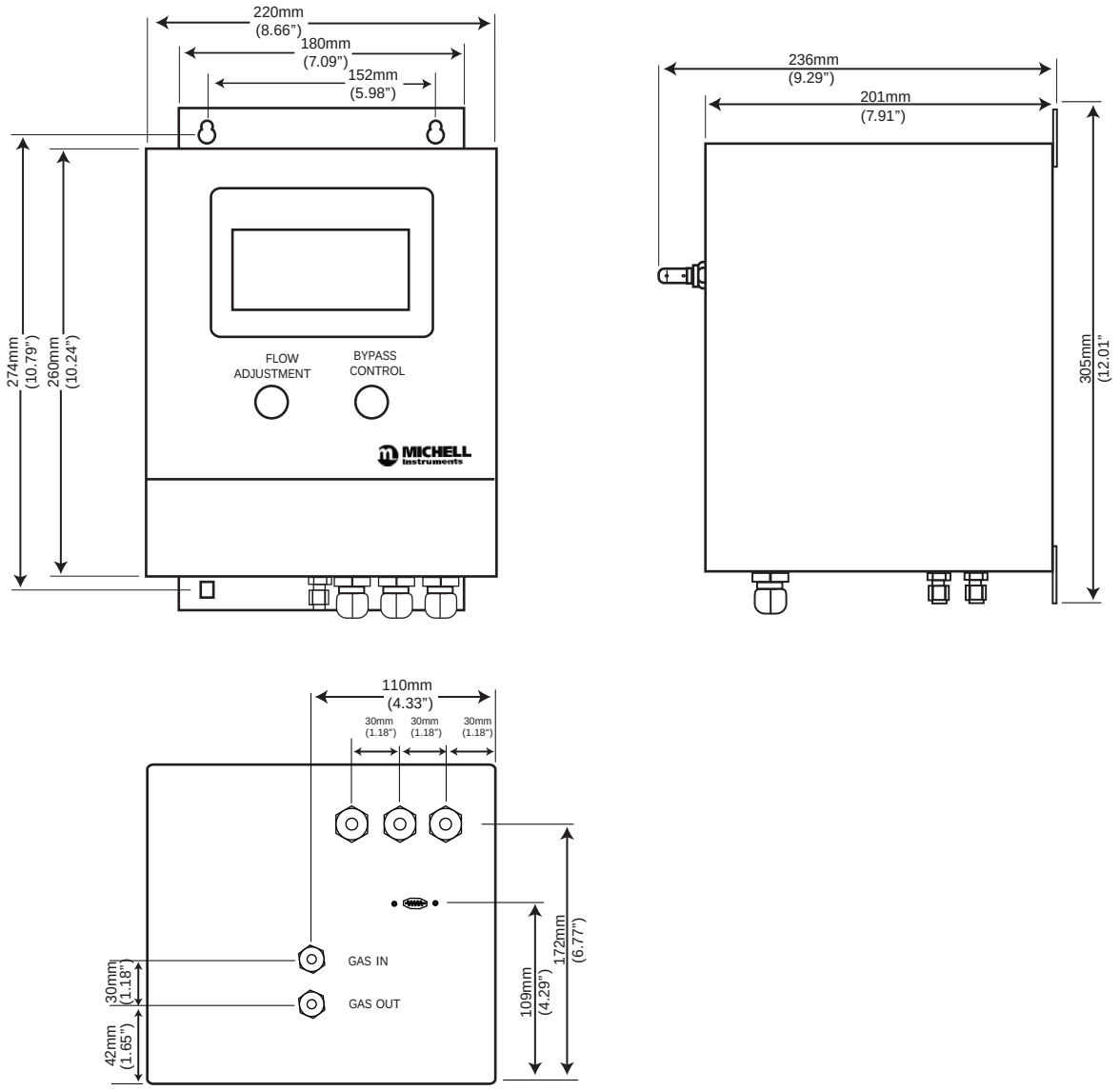



Figure 7 *Dimensions - XZR400A2*

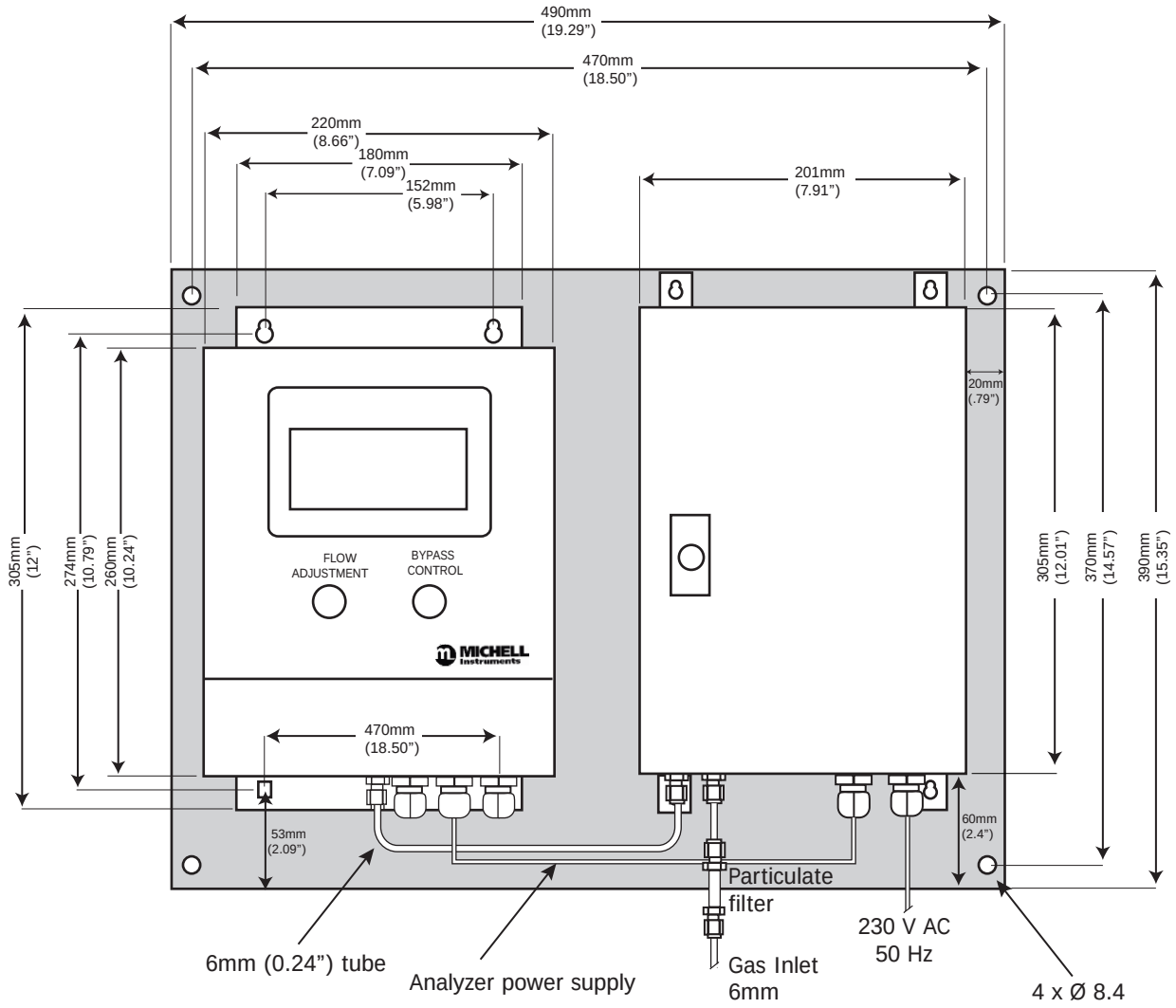



Figure 8 *Dimensions - XZR400A2 with External Pump Option*

### 2.4.1 Installing the XZR400A2

Choose your installation site carefully following the recommendations above.

Follow the steps below:

1. Identify a clean and flat surface on a wall or other vertical location e.g. an instrument panel that is suitable to hold the analyzer.
2. Prepare the mounting site by drilling 4 holes in appropriate locations corresponding to the dimension and location of the fastening holes at the back of the analyzer enclosure.
3. Fix the analyzer vertically to the installation surface using suitable screws. The gas connections and the electrical connections should be on the bottom.

## 2.5 Dimensions - XZR400A3

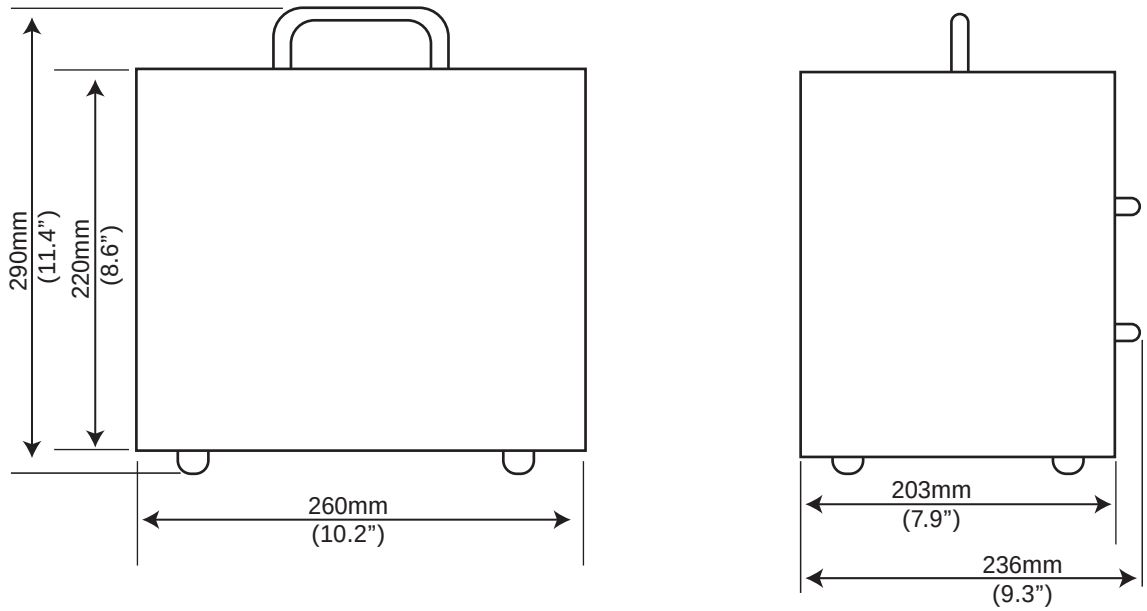



Figure 9 *Dimensions - XZR400A3*

## 2.6 Dimensions - XZR400A4

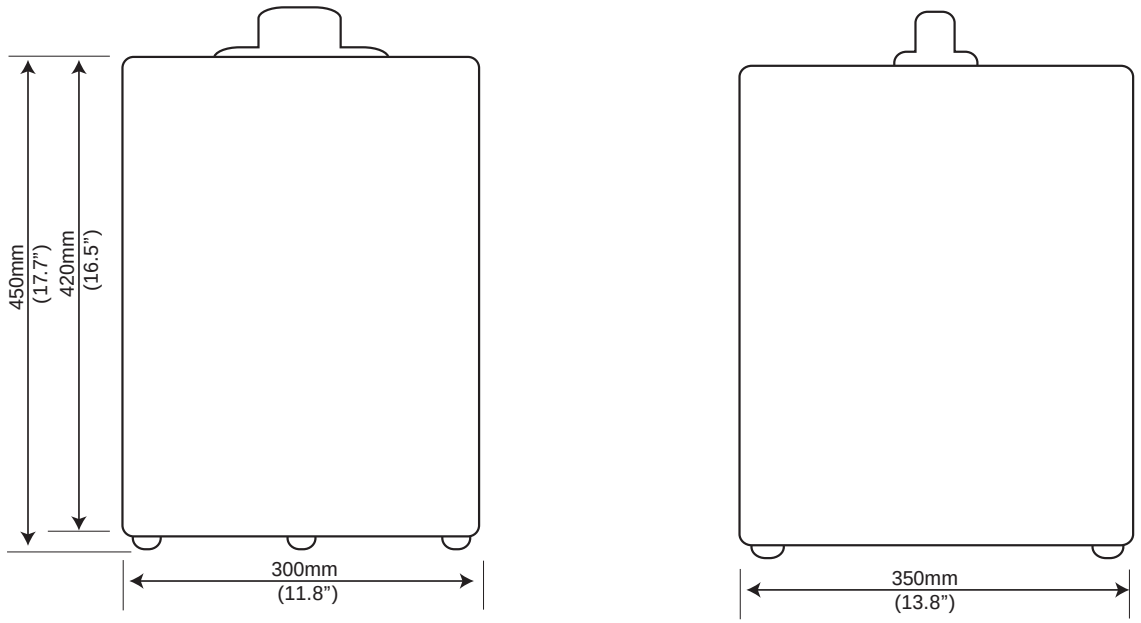



Figure 10 *Dimensions - XZR400A4*

## 2.7 Operating Requirements

### 2.7.1 Environmental Requirements

The XZR400 Series should be installed in a clean, dust free environment. The recommended ambient temperature is +20 to +25°C (+68 to +77°F) although the instrument will operate, within specification, inside the temperature band of 0 to +55°C (32 to +131°F). It must be installed indoors in a non-condensing atmosphere.

### 2.7.2 Electrical Requirements

The analyzer requires the following electrical supply:

90 to 264 V AC, 47/63 Hz

There are 2 concentration alarm relays. The output contacts are normally open and potential free. The relay switching capability is 10 W max (up to 100 V or up to 0.5 A).

### 2.7.3 Gas Requirements

**To ensure that the sample gas is properly conditioned a sampling system might be required.**

**Contact Michell Instruments if you wish to order a suitable sampling system.**

The gas must be clean, dry and oil mist free with the pressure up to a maximum of 2 barg (29 psig) and with particle size < 3 µm.

**The analyzer is not suitable for samples with hydrocarbons present. These will combust on the cell and consume oxygen molecules.**

### 2.7.4 Sampling System

Depending upon the application a sampling system may be used to cope with high pressure samples, samples with contamination or outdoor installations. The sampling system may include components such as filters, pressure gauges, by-pass loops, calibration inlet, pressure regulators and sample pumps - all installed on a panel, or in an enclosure.

It is recommended that a stainless steel construction is used for all parts that will be in contact with the gas.

Please consult Michell Instruments if a sampling system is required. Install the sampling system as close as possible to the XZR400 Series analyzer to ensure the best possible measurement results.

**NOTE: Michell Instruments can provide a suitable sampling system when delivering the analyzer. Contact a Michell Instruments' Application Engineer for more information.**

## 2.8 Connections to the XZR400A1

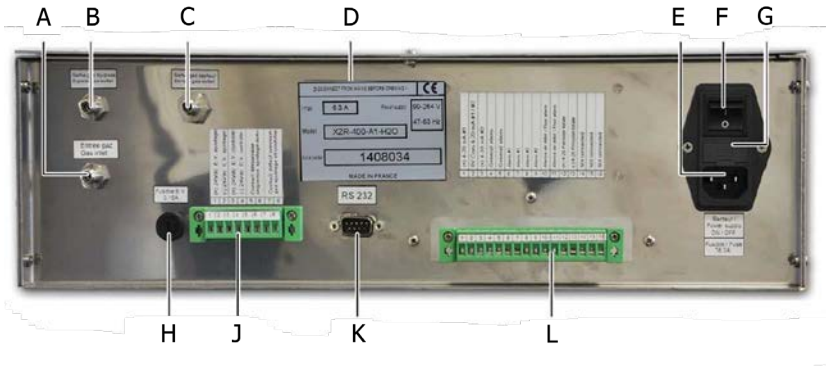
### 2.8.1 Front Panel


| Item | Description |
|---|---|
| A | Touchscreen LCD |
| B | Flow adjustment needle valve |
| C | Bypass control needle valve |

Figure 11 *Front Panel XZR400A1*

### 2.8.2 Back Panel

An electrical connection terminal is provided for signal and alarm connections.




| Item | Description |
|---|---|
| A | Inlet fitting for gas sample to be analyzed. |
| B | Outlet fitting for gas sample output bypass. |
| C | Outlet fitting for gas sample to be analyzed. |
| D | Manufacturer's plate. |
| E | Mains socket (90-132 / 187-264 V AC, 47/63 Hz). |
| F | On/Off button. |
| G | Housing for analyzer's 2 x electrical protection fuses (250 V AC, 6.3 A) |
| H | Housing for solenoid valve's electrical protection fuses (250 V AC, 3.15 A). Only fitted on the rack with automatic setting option. |
| J | Optional connector for the automatic setting option. |
| K | Optional D-sub DE9 male plug (RS232 port). |
| L | Electrical connector. |

Figure 12 *Back Panel XZR400A1*

### 2.8.3 Gas Inlet, Outlet and Bypass Gas Connections

The fluidic system comprises 2 flow control valves (sensor flow and by-pass flow), an electronic flow meter and a sensor. The gas connections are stainless steel Swagelok 1/8" couplings that provide a good seal and easy removal.

**The sample must be vented at atmospheric pressure, otherwise the total pressure adjustment option is required.**

**The measurement of hazardous gas samples require the analyzer's outlet to be outside the analysis area and must be in accordance with local regulations.**

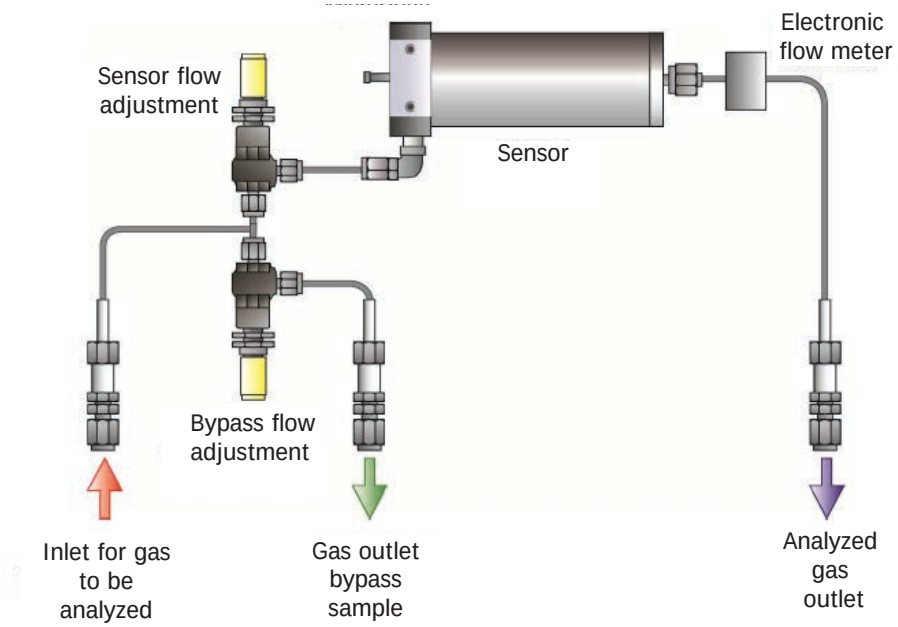



Figure 13 *Gas Circuit Diagram for Rack Version*

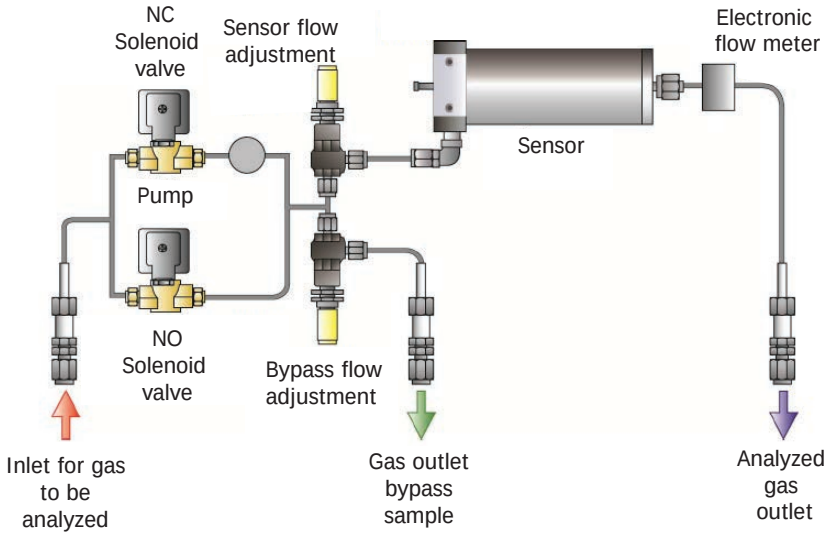
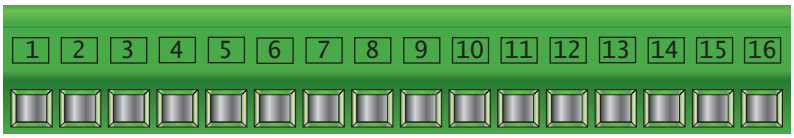



Figure 14 *Gas Circuit Diagram for Rack & Pump Version*

### 2.8.4 Electrical Terminal Block




| Item | Function |
|---|---|
| 1 | (+) 4-20 mA Output No 1. Measurement proportional to the chosen $O_2$ scale. |
| 2 | 0 V from the 4-20 mA Output No 1 & 2. |
| 3 | (+) 4-20 mA Output No. 2. Measurement proportional to the chosen $0_2$ scale. |
| 4-5 | General fault alarm dry contact (250 V AC, 2 A or 30 V DC, 2 A on resistive load. |
| 6-7 | Alarm No. 1 dry contact terminal (250 V AC, 2 A or 30 V DC, 2 A resistive load). Function mode (positive, normal) and hysteresis can be configured by setting the parameters. |
| 8-9 | Alarm No. 2 dry contact terminal (250 V AC, 2A or 30 V DC, 2A resistive load). Function mode (positive, normal) and hysteresis can be configured by setting the parameters. |
| 10-11 | Dry contact terminal for flow alarm option (250 V AC, 2 A or 30 V DC, 2 A on resistive load). |
| 12 | (+) 4-20 mA input. Option process pressure correction input. |
| 13 | (0V) 4-20 mA input. Option process pressure correction input. |
| 14 | RS485 Data +/A. |
| 15 | RS485 Data -/B. |
| 16 | RS485 0 V. |

Figure 15 *Electrical Terminal Block XZR400A1*

### 2.8.5 D-Sub DE9 plug

This optional D-Sub DE9 type male plug (9 pin) is used to connect an RS232 port.

### 2.8.6 Pluggable 8 pins electrical connector

This optional connector allows the connection of terminals for automatic analyzer calibration.

### 2.8.7 Sample Path

The MSRS sensor is placed inside an oven in which the gases to be analyzed are circulated. The oven consists of a gas inlet head and a outlet plate. 3 Viton O-rings ensure the sealing of this device (2 for the inlet and 1 for the outlet).

The internal sample path consists of:

- 2 flow control valves: sensor flow and by-pass flow
- 1 sealing head
- 1 outlet plate
- 1 oven tube
- 1 electronic flow meter
- 1 MSRS sensor
- 3 Swagelok 6mm stainless steel bulkhead unions (1 gas inlet and 2 gas outlets) - on the rear panel

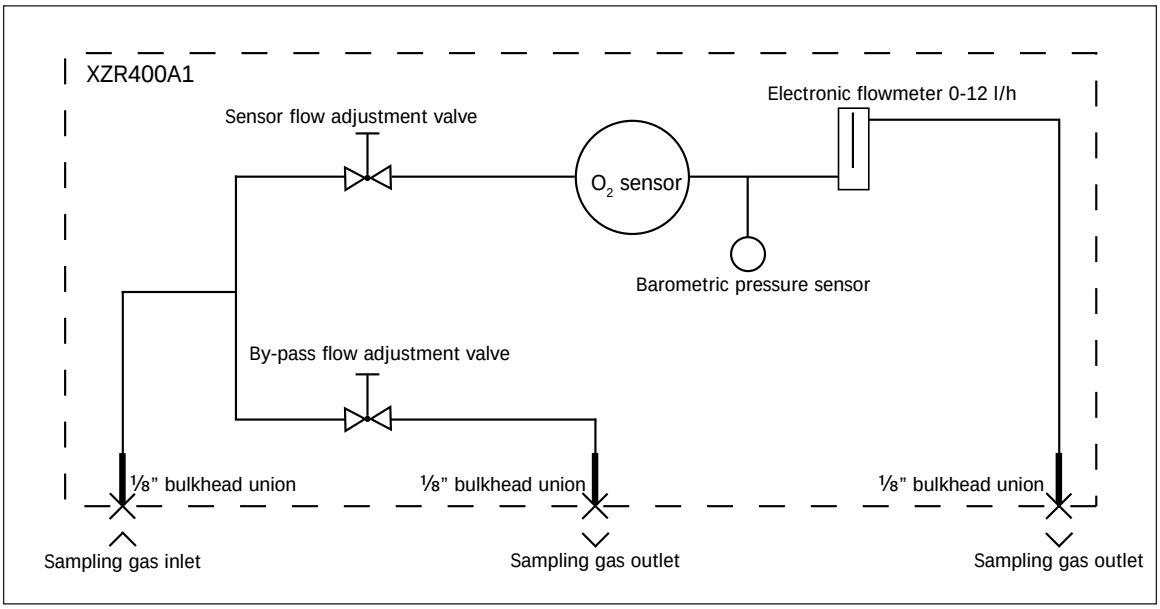



Figure 16 *Sample Path XZR400A1*

**Note**: The bypass valve must not be fully closed during measurement. Sample gas containing higher oxygen concentrations could be trapped in a dead leg formed by the closed valve and be slowly be flushed through the sensor. This is of particular concern post calibration (or exposure to air) when sampling pure gases with very low (<10ppm) oxygen.

**XZR400A1 WITH INTERNAL PUMP:**

- 3 Swagelok 6mm stainless steel bulkhead unions (1 gas inlet and 2 gas outlets) - on the rear panel
- 1 sampling pump (3 l/min)
- 2 electrovalves

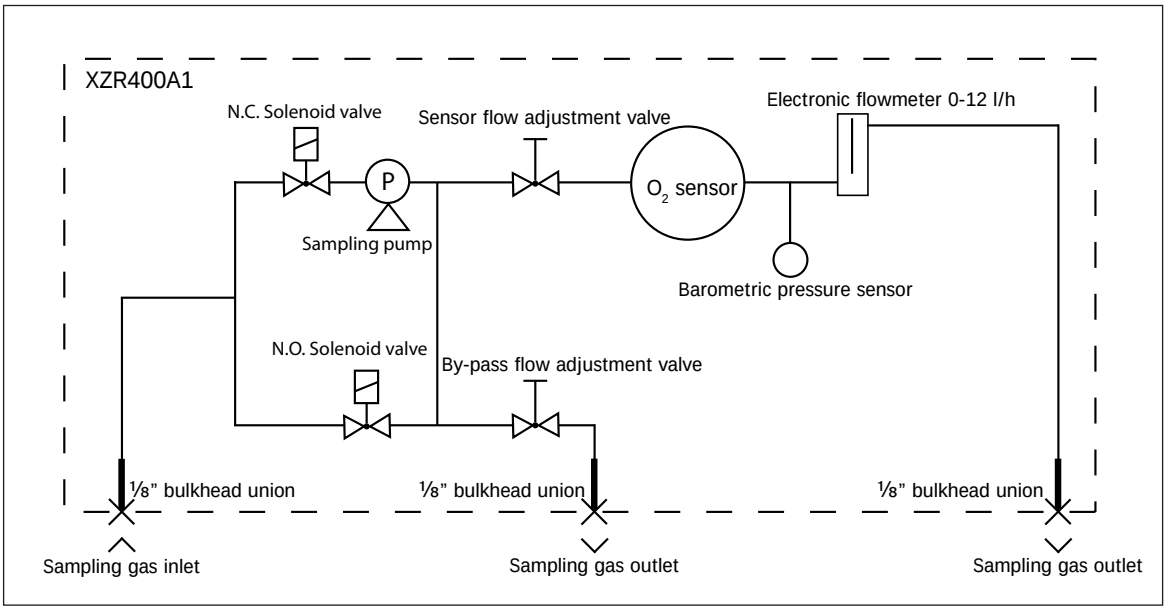



Figure 17 *Sample Path with Pump Fitted XZR400A1*

### 2.8.7.1 Signal Processing Path

The values of oxygen concentration and flow passing through the sensor are displayed continuously.

On specific screen pages the following control parameters are displayed:

- Oven temperature
- Ambient temperature (corresponding to the thermocouple junction temperature)
- $O_2$ concentration
- MSRS sensor voltage
- Barometric pressure (standard) or process pressure (optional)
- Flow passing through the sensor

**Analog Outputs:**

- 2 x 4-20 mA analog outputs proportional to user-defined scales. The wiring connector is on the rear side

**Standard Alarms:**

- General fault alarm
- 2 concentration alarms with user-configurable high/low thresholds and hysteresis

**Optional Alarm:**

- An optional flow alarm is available

## 2.9 Connections to the XZR400A2

The connections are shown below.


| Item | Description |
|---|---|
| A | Graphic touch screen - displays measurement and menus. |
| B | Multi-turn knurled knob for fine adjustment of the gas flow. |
| C | Multi-turn knurled knob for basic adjustment of the gas flow (bypass). |
| D | Removable plate for access to electrical terminal block and mains fuse. |
| E | Three cable glands are provided for the electrical connections. |
| F | Optional D-Sub DE9 male plug (RS485 or RS232 port). |
| G | Inlet fitting for the gas sample to be analyzed (for 6mm tube). |
| H | Outlet fitting for the analyzed gas sample (for 6mm tube). |

Figure 18 *Connections XZR400A2*

### 2.9.1 Gas Sample Inlet and Outlet Fittings

The gas path consists of 2 flow control valves (sensor flow and by-pass flow), a sensor and an electronic flowmeter. For the gas inlet and the outlet connections, Swagelok stainless steel 6mm bulkhead unions are used, which guarantees perfect sealing and easy removal.

**The evacuation of the analyzed sample must be carried out at atmospheric pressure, otherwise the total pressure adjustment option is required.**

**The measurement of hazardous gas samples require the analyzer's outlet to be outside the analysis area and must be in accordance with local regulations.**

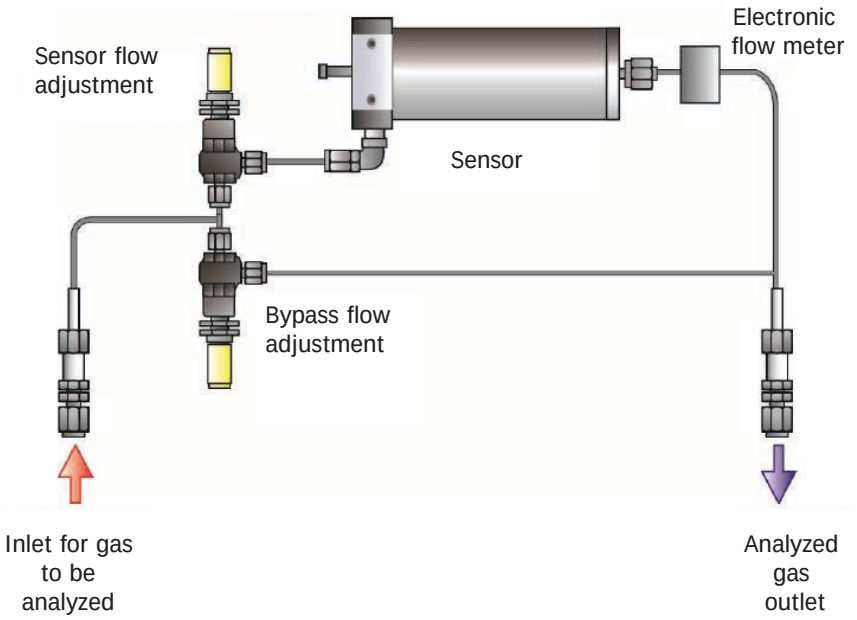



Figure 19 *Gas Circuit Diagram for XZR400A2, A3 & A4 models*

### 2.9.2 Sample Path

The MSRS sensor is placed inside an oven in which the gases to be analyzed are circulated. The oven consists of a gas inlet head and a outlet plate. 3 Viton O-rings ensure the sealing of this device (2 for the inlet and 1 for the outlet).

The internal sample path consists of:

- 2 flow control valves: sensor flow and by-pass flow
- 1 sealing head
- 1 outlet plate
- 1 oven tube
- 1 electronic flow meter
- 1 MSRS sensor

2 Swagelok 6mm stainless steel bulkhead unions (gases inlet and outlet) - under the analyzer

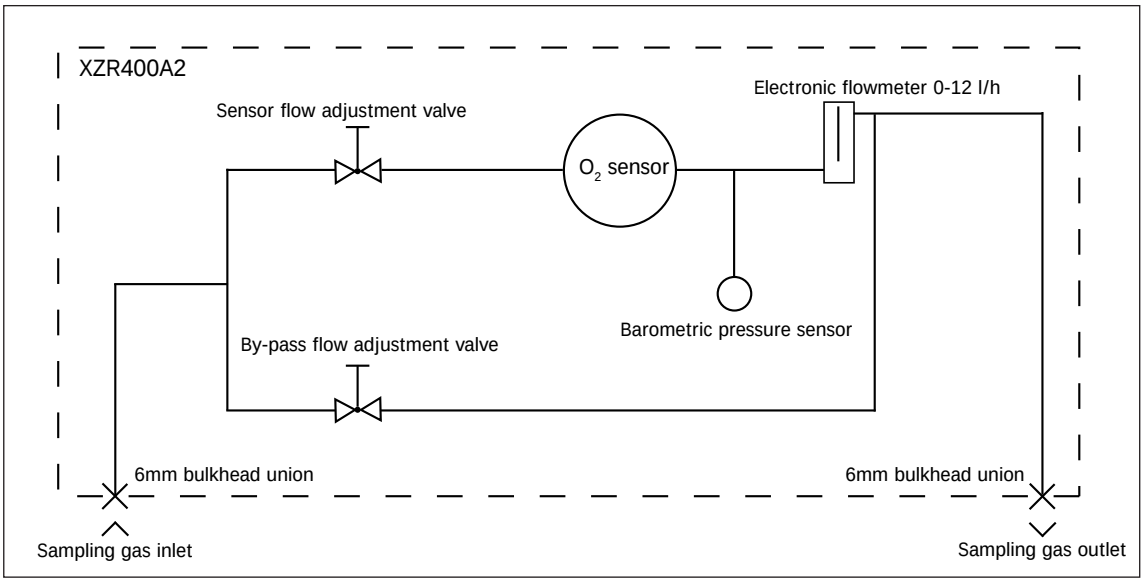



Figure 20 *XZR400A2 Sample Path*

Note: The bypass valve must not be fully closed during measurement. Sample gas containing higher oxygen concentrations could be trapped in a dead leg formed by the closed valve and be slowly be flushed through the sensor. This is of particular concern post calibration (or exposure to air) when sampling pure gases with very low (<10ppm) oxygen.

### 2.9.3 Electrical Terminal Block

The terminal block is located by removing the front panel cover.

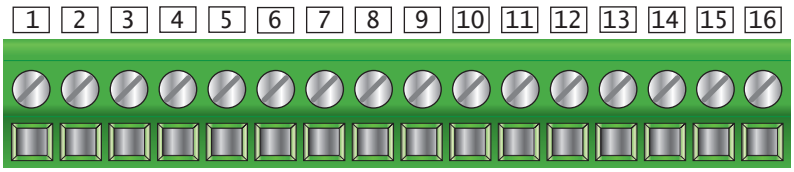



Figure 21 *Electrical Terminal Block XZR400A2*

| Item | Function |
|---|---|
| 1 | Connection to the MSRS cell; system reserved (TC+ – orange). |
| 2 | Connection to the MSRS cell; system reserved (common – white). |
| 3 | Connection to the MSRS cell; system reserved (reference – blue). |
| 4 | Oven connection, system reserved. |
| 5 | Oven connection, system reserved (see paragraph 15.2). |
| 6 | (+) 4-20 mA output measurement proportional to the chosen $O_2$ scale. A second 4-20 mA output is available as an option. |
| 7 | 4-20 mA (0 V). |
| 8-9 | Optional. Dry contact alarm for flow rate setting (250 V AC, 30 V DC or 2 A, 2 A resistive load). Direction of action. |
| 10-11 | Threshold alarm No. 1 dry contact terminal (250 V AC , 2 A or 30 V DC, 2 A on resistive load). Function mode (positive, normal) and hysteresis can be configured by setting the parameters. |
| 12 | Threshold alarm No. 1 dry contact terminal (250 V AC , 2 A or 30 V DC, 2 A on resistive load). Function mode (positive, normal) and hysteresis can be configured by setting the parameters. |
| 13 | Shared contact for alarms No.1 and No. 2. |
| 14 | Threshold alarm No. 2 dry contact terminal (250 VAC , 5A or 30 VDC, 5A on resistive load). Function mode (positive, normal) and hysteresis can be configured by setting the parameters. |
| 15 | Mains supply phase. |
| 16 | Mains supply neutral. |

The equipment is protected by a T2 A - 250 V AC timed fuse (5 x 20 mm) located near the terminal block

### 2.9.4 D-Sub DE9 plug

This optional D-Sub DE9 type male plug (9 pin) is used to connect an RS485 or RS232 port.

### 2.9.5 D-Sub DA15 plug

This optional D-Sub DA15 male plug (15 pin) is used to connect a second 4-20 mA output, a total pressure adjustment inlet, and the analyzer's auto adjustment terminals, as well as automatic scale switching operations.

### 2.9.6 Signal Processing Path

The values of oxygen concentration and flow passing through the sensor are displayed continuously.

On specific screen pages the following control parameters are displayed:

- Oven temperature
- Ambient temperature (corresponding to the thermocouple junction temperature)
- $O_2$ concentration
- MSRS sensor voltage
- Barometric pressure (standard) or process pressure (optional)
- Flow passing through the sensor

**Analog Outputs:**

The analog output can be configured to represent the measured oxygen parameters and is provided as a 2-wire signal. It can be set-up as a current loop signal 4-20 mA. The configuration of the output can be set via the **Main Menu**.

The analog output is proportional to user-defined scale. The connection is inside the enclosure, behind the removable panel on the front of the unit. An optional second 4-20 mA output is available.

### 2.9.7 Alarm Outputs

**Standard Alarms:**

- general fault alarm
- 2 concentration alarms with user-configurable high/low thresholds and hysteresis

Two alarm relays are provided. They are connected to the instrument via the terminal block inside the XZR400A2 Analyzer.

Under the **Main Menu**, the two concentration alarms can be set-up to operate when a pre-set parameter threshold level is exceeded (refer to Section 3.6.2). The direction of the activation, as well as the hysteresis can be configured.

The fault alarm is a non-configurable alarm which continuously monitors the status of the analyzer. During normal operating conditions the alarm is off. The alarm will be triggered and both relay contacts will open if:

- the oven temperature is low
- the thermocouple breaks
- a fault with the memory occurs

**Optional Alarm:**

- an optional flow alarm is available

## 2.10 Connections to the XZR400A3

### 2.10.1 Front Panel

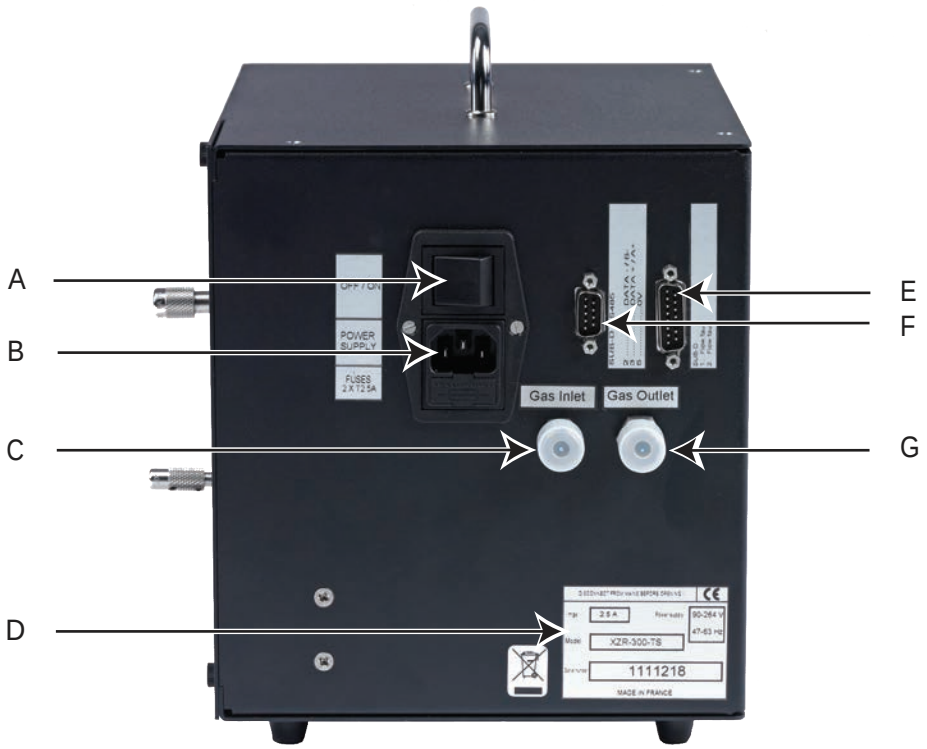
The front panel features are shown below:


| Item | Description |
|---|---|
| A | Carrying handle. |
| B | Multi-turn knurled knob for basic adjustment of the gas flow (bypass). |
| C | Graphic touch screen - displays measurement and menus. |
| D | Multi-turn knurled knob for fine adjustment of the gas flow. |
| E | Access plate to the MSRS sensor. |

Figure 22 *Connections Front Panel - XZR400A3*

### 2.10.2 Side Panel

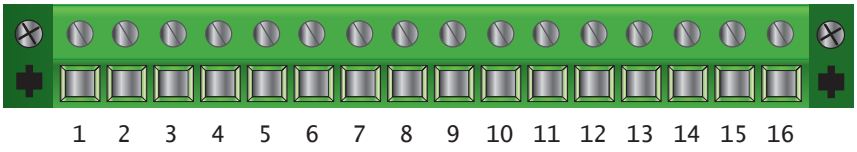
The side panel connections are shown below:




| Item | Description |
|---|---|
| A | ON/OFF button. |
| B | Mains socket (90-132/187-264 VA, automatic range switching, 47/63 Hz). |
| C | Inlet fitting for the gas sample to be analyzed (for 6mm tube). |
| D | Manufacturer's plate. |
| E | Optional Sub-D DE9 male connector; RS232 or RS485 output. |
| F | Optional Sub-D DA15 male connector |
| G | Outlet fitting for the gas sample to be analyzed (for 6mm tube). |

Figure 23 *Connections Side Panel - XZR400A3*

### 2.10.3 Electrical Terminal Block




| Item | Function |
|---|---|
| 1 | Connection to the MSRS cell; system reserved (TC+ – orange). |
| 2 | Connection to the MSRS cell; system reserved (common – white). |
| 3 | Connection to the MSRS cell; system reserved (reference – blue). |
| 4-5 | Oven connection, system reserved. |
| 6 | Optional (+) 4-20 mA output. Measurement proportional to the chosen $O_2$ scale. A second 4-20 mA output is available as an option. |
| 7 | Optional 4-20 mA (0 V). |
| 8-9 | Optional Dry contact alarm for flow rate setting (250 V AC, 30 V DC or 2 A, 2 A resistive load). Direction of action (positive, normal). |
| 10-11 | Optional General alarm dry contact terminal (250 V AC, 2 A or 30 V DC, 2 A on resistive load). Direction of action (positive, normal). |
| 12 | Optional Threshold alarm No. 1 dry contact terminal (250 V AC , 2 A or 30 V DC, 2 A on resistive load). Function mode (positive, normal) and hysteresis can be configured by setting the parameters. |
| 13 | Optional Shared contact for alarms No.1 and No. 2. |
| 14 | Optional Threshold alarm No. 2 dry contact terminal (250 V AC, 5 A or 30 V DC, 5 A on resistive load). Function mode (positive, normal) and hysteresis can be configured by setting the parameters. |
| 15-16 | Not connected. |

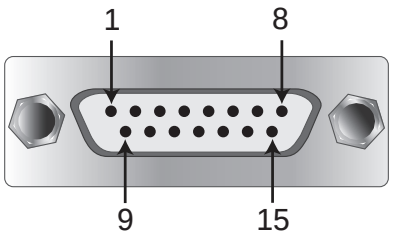
Figure 24 *Electrical Terminal Block XZR400A3*

## 2.11 Connections to the XZR400A4-Transportable


| Item | Description |
|---|---|
| A | Graphic touch screen - displays measurement and menus. |
| B | Multi-turn knurled knob for fine adjustment of the gas flow. |
| C | Multi-turn knurled knob for basic adjustment of the gas flow (bypass). |
| D | Mains socket (90 - 264 V AC, 47/63 Hz)<br>On/Off button.<br>Analyzer housing for 2 electrical protection fuses (250 V AC - T2A or 250 V AC - T6.3A). |
| E | D-Sub DE9 female connector. |
| F | Manufacturer's plate. |
| G | Inlet fitting for the gas sample to be analyzed (for 6mm tube) |
| H | Outlet fitting for the analyzed gas sample (for 6mm tube). |

Figure 25 *Connections Front Panel - XZR400A4*

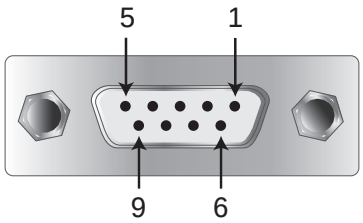
### 2.11.1 Electrical Terminal Block




| Item | Function |
|---|---|
| 1-2 | General alarm contact. |
| 2 | Alarm No.1 contact terminal. |
| 3 | Shared contact for Alarm No.1 and Alarm No.2. |
| 4 | Alarm No.2 contact terminal. |
| 5 | Not connected. |
| 7-8 | Optional Flow alarm. |
| 9 | Optional 4-20 mA output #1 positive (+). |
| 10 | Optional 4-20 mA output #1 ground (-). |
| 11 | Optional 4-20 mA output #2 positive (+). |
| 12 | Optional 4-20 mA output #2 ground (-). |
| 13-15 | Not connected. |

Figure 26 *Electrical Terminal Block XZR400A4*

### 2.11.2 D-Sub DE9 Type Plug




| Pin No. | Function |
|---|---|
| 1-2 | General alarm contact. |
| 3 | Shared contact for Alarm No 1 and Alarm No 2. |
| 4 | Alarm No. 1 contact terminal. |
| 5 | Alarm No. 2 contact terminal. |
| 6 | + 4-20 mA measurement. |
| 7 | 0 V of the 4-20 mA. |
| 8 | Optional. |
| 9 | Optional. |

Figure 27 *D-Sub DE9 Plug - XZR400A4*

## 2.12 Mains Power Supply - XZR400A1, XZR400A3 & XZR400A4

The AC power supply is a push fit into a power input socket as shown below. The method of connection is as follows:

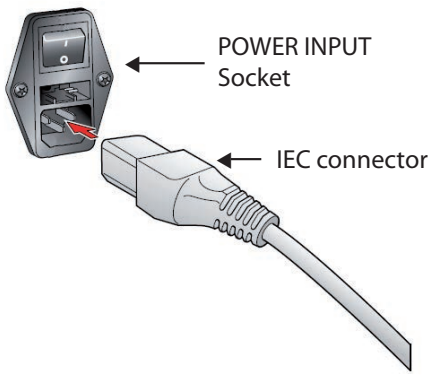



Figure 28 *Power Input Socket*

1. Ensure that both ends of the power cable are potential free i.e. not connected to an AC power supply.
2. Check that the **I/0** switch on the power supply connector is switched to **0**.
3. Push the IEC connector firmly into the power input socket.

### 2.12.1 Analog Outputs Connections

The analyzer is supplied with 1 or 2 off 4-20 mA outputs.


**The signal outputs will be connected to external systems that can potentially influence the operation of the process.**

**The alarm level signals could also be at mains potential so it is essential that, before connecting these signal lines, checks are made to ensure that these inputs are not live and that it is safe to handle them.**

The output connection can be wired directly to the terminal block on the back panel of the analyzer. Use screened cable.

The method of connection is as follows:


**Always use screened cable to connect the output to the external device.**

1. Strip back the wire for the positive output lead, exposing approximately 6mm (0.25") wire and clamp into the screw port labelled **4-20 mA +**.

   **Do not overtighten the screw.**

2. Strip back the wire for the negative output lead, exposing approximately 6mm (0.25") wire and clamp into the screw port labelled **4-20 mA –**.

   **Do not overtighten the screw.**

3. Connect the screen to the ground port.

### 2.12.2 Alarm Output Connections

Two alarm relays are provided and are connected to the instrument via the terminal block on the back panel of the analyzer.


**The signal outputs will be connected to external systems that can potentially influence the operation of the process.**

**The alarm level signals could also be at mains potential so it is essential that, before connecting these signal lines, checks are made to ensure that these inputs are not live and that it is safe to handle them.**

Alarms 1 and 2 are concentration alarms. The direction of the activation N/O or N/C, as well as the hysteresis, can be configured.

The output contacts are normally open and potential free. The relay switching capability is 10 W max (up to 100 V or up to 0.5 A).

The method of connection is as follows:


**Always use screened cable to connect the output to the external device.**

**Alarm 1**

1. Strip back the two wires for the alarm 1 output leads, exposing approximately 6mm (0.25") wire and clamp them into the two screw ports labelled as **Alarm 1**. **Do not overtighten the screw.**
2. Connect the screen to the ground port.

**Alarm 2**

1. Strip back the two wires for the alarm 2 output leads, exposing approximately 6mm (0.25") wire and clamp them into the two screw ports labelled as **Alarm 2**. **Do not overtighten the screw.**
2. Connect the screen to the ground port.

## 2.13 Gas Connection

**To ensure that the sample gas is properly conditioned a sampling system might be required.**

**Contact Michell Instruments if you wish to order a suitable sampling system.**

Sample gas connections are made via the gas input and gas output ports located on the back panel (XZR400A1), bottom panel (XZR400A2), side panel (XZR400A3) or front panel (XZR400A4) of the analyzer.

Both the input and output gas connections are 1/8"NPT for XZR400A1 and 6mm for all other models

**NOTE: To facilitate ease of connection to the port, at least 75mm (3") of the tubing coming out of the gas inlet port must be straight.**

The method of connecting to the gas inlet and gas outlet ports is as follows:

1. Connect the gas source from the sample system to the Swagelok® fitting at the inlet port on the instrument using 1/8" (or 6mm) stainless steel tubing. Tighten the fitting as much as possible by hand and tighten again with a 7/16" flat wrench (approximately 1¼ turns).
2. Connect the gas outlet port in a similar manner to that described in Step 1 using 1/8" (or 6mm) stainless steel tubing.

**If you undo the fitting again and reconnect it, first tighten up by hand and then tighten using a 7/16" flat wrench with no more than a 1/8 turn.**

**DO NOT OVER-TIGHTEN.**

**NOTE: Maximum sample pressure is 2 barg (29 psig).**

**NOTE: Sample is vented to atmosphere. Depending on the location of the analyzer it may require a vent line to a safe location that is freely ventilated.**

# 3 OPERATION

It is recommended that the user becomes familiar with Section 2 of this manual in which all the equipment controls, indicators, the elements of the display and the overall menu structure are described.

Prior to operation, the analyzer must have been connected to the correct electrical power supply and the relevant analog and alarm outputs connected to external systems as described in Section 2.

On delivery, the instrument will have been set-up with a standard set of default parameters defining the operation of the analyzer. These parameters can be changed as required by means of the **Main Menu**.

## 3.1 General Operational Information

The input gas must be at a pressure of less than 2 barg (29 psig). A pressure regulator is recommended when above 2 barg (29 psig) for better flow control. The outlet of the system must be at atmospheric pressure.

**NOTE: If the outlet is at higher pressure than atmospheric an optional process pressure correction is necessary. Please consult Michell Instruments in this case.**

The instrument is designed to operate with a gas flow of 2 l/h ±1 l/h.

**NOTE: For best results ensure that the sampling system is as close as possible to the XZR400 Series Analyzer.**

For all applications the sample gas is taken into the instrument via the gas inlet port located on the bottom panel of the analyzer, from where it passes into an oven chamber. The gas flow rate is then measured on the outlet side of the sample chamber, prior to being exhausted from the instrument via the gas outlet port.

The flow, necessary for the sample gas circulation, is generated by the sensor oven which utilizes the heat convection principle. The hot sample gas from the sensor oven is pushed by the hot oven gases, which are still in the oven. On the way out of the oven the sample gas cools, passing through the gas outlet port, and is carried away by the main gas flow.

The XZR400 Series Analyzers are suitable for the measurement of oxygen in a wide variety of clean and dry gases. It will not contaminate high purity gases and is safe for use in critical semiconductor and fibre optic manufacturing applications.

It is possible to continuously visualize the oxygen concentration in the range between 0.01 ppm and 25% oxygen. If required, the analyzer can display the MSRS voltage, the oven temperature and the temperature of the cold junction in the thermocouple.

## 3.2 Powering-up the System

Carefully check the electrical connection before applying the power.

| | |
|---|---|
| **Wall Mount Version** | Switch the external disconnecting device supplying power to the analyzer. This device does not have a built-in on/off switch. |
| **Portable and Rack Versions** | Switch the built-in on/off switch to the **ON** position |

Power-up the system. Observe all normal safety precautions during the powering-up procedure.

**Never allow sample gas to enter the analyzer when it is switched off.**

**In the case of power breakdown for more than 1 hour it is necessary to purge the analyzer with Nitrogen or instrument air dew point < -40.**

**This will prevent any condensation due to the oven being off.**

**Maintain the flow rate at 2 l/h ±1 l/h.**

## 3.3 Warm-Up Period

Upon power up, the screen appears as shown below. The analyzer performs a series of internal checks for about 5 seconds.

**NOTE: Touch the French or English area to display the menu in the required language.**


Figure 29 *Start-up Screen*

Wait about 15 minutes until the oven temperature reaches 634°C, indicated by the oven temperature line.

The low temperature alarm is displayed digitally throughout the rise in oven temperature; the general alarm contact is activated.

**NOTE: A flow greater than 3.5 l / h prevents the correct rise in oven temperature.**

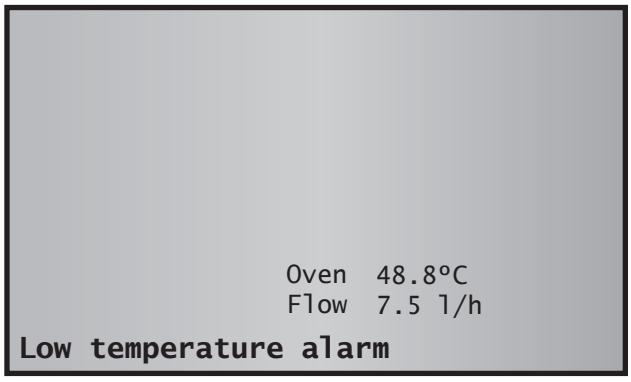



Figure 30 *Oven Temperature Screen*

If required, adjust the gas sample flow by operating the by-pass valve (B) and then the end flow valve (A) to obtain a 2 ±1 l/h flow rate (C).

**NOTE: For optional measurement do not fully close the by-pass valve.**

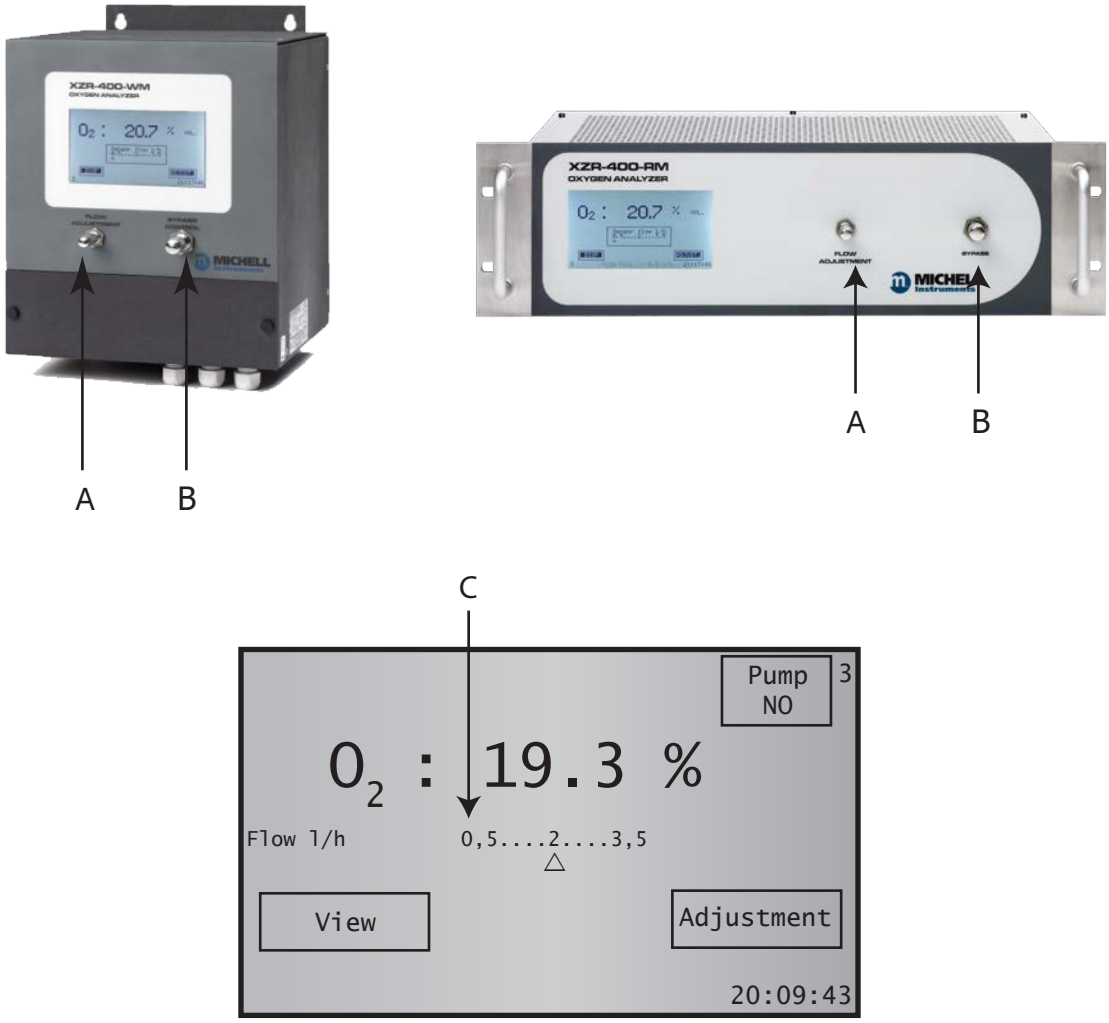



Figure 31 *Sample Flow Adjustment*

## 3.4 Main Screen

Once the temperature has been reached, the screen displays:

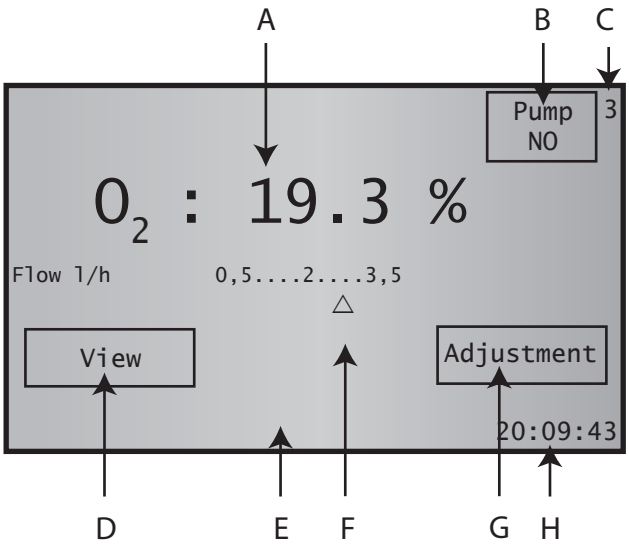



Figure 32 *Main Screen*

| | |
|---|---|
| **A** | Measured oxygen concentration between 0.01 ppm and 25%. The maximum measurement precision can only be obtained following an adjustment performed after a minimum of 3 hours of operation. However, upon receipt of the analyzer, this adjustment will have been performed in the factory as shown in the manufacturing check and adjustment sheet. |
| **B** | Pump **ON/OFF** button available on A1 or A4 models.<br>The **PUMP** signal flashes when the pump is operating |
| **C** | Screen number |
| **D** | Touch-sensitive **View** area |
| **E** | Message display area |
| **F** | Sample gas flow between 0.5 and 3.5 l/h, shown by the cursor position |
| **G** | Touch sensitive **Adjustment** area<br>Used to adjust the MSRS cell after changing the cell or the oven |
| **H** | Current time |

## 3.5 Control Parameters Display

On the Measurement Display Screen (3) touch the **VIEW** area

The Control Parameters Screen (3.1) will appear.

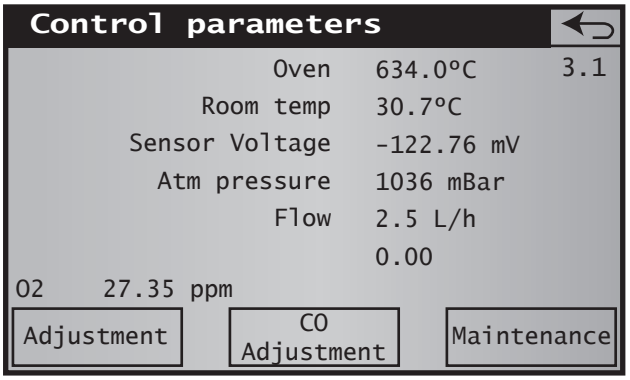



Figure 33 *Control Parameters Screen*

This displays the following information about the analyzer.

| | |
|---|---|
| **Oven** | Current temperature of the hot joint of the thermocouple corresponding to oven temperature. This must be 634°C. Temperatures 30°C below the reference and 50°C above the reference trigger a general alarm. |
| **Room Temperature** | Measure taken on the motherboard. This measurement is only used to compensate for the cold solder joint of the thermocouple. |
| **Sensor Voltage** | Measurement in mV of the voltage supplied by the measuring cell, which must be between -300 and +250 mV. A value greater than the upper limit generates a MSRS fault alarm. |
| **Atm pressure** | The pressure at the analyzer outlet must be near atmospheric pressure (between 800 and 1750 mbar). A value above 1200 mbar and under 800 mbar generates an oxygen measurement error. **NOTE: If the pressure is greater than 1750 mbar, the atmospheric pressure sensor can be damaged irreversibly.** |
| **Flow** | The sample's flow in l/hour must be 2 ±1 l/h. A flow value below 0.5 or greater than 3.5 l/h generates a general fault alarm displaying a Flow fault. |
| **O2** | Measured oxygen percentage |
| ⮌ | Return to Main Screen 3. The display returns to the Main Screen automatically if the touch screen is not used for 2 minutes. |
| **Adjust** | Displays the adjustment screen to calibrate the analyzer. |
| **Maintenance** | Displays the analyzer's parameter setting screen (access code, outputs, alarm limits, time-stamp, RS485, flow corrections). |

### 3.5.1 Configuration

To reach the Main Menu Screen enter the access code as follows.

- Touch the **VIEW** area of Screen 3. The Control Parameters Screen is displayed.
- Touch the **Maintenance** area.

**NOTE: To leave this screen touch Cancel area.**

- Touch the box labelled 0____
- Enter the access code on the keyboard. The default access code is 0.
- To correct an entry error press ⇦
- Touch the OK area.

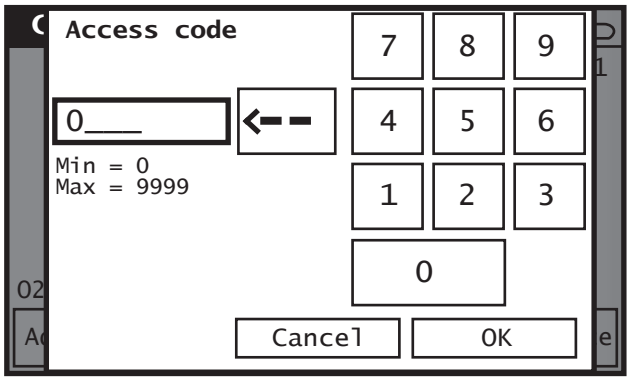



Figure 34 *Main Menu Access Screen*

If the access code is incorrect the screen goes back to Screen 3.1.

If the access code is correct the Main Menu Screen is displayed (5).

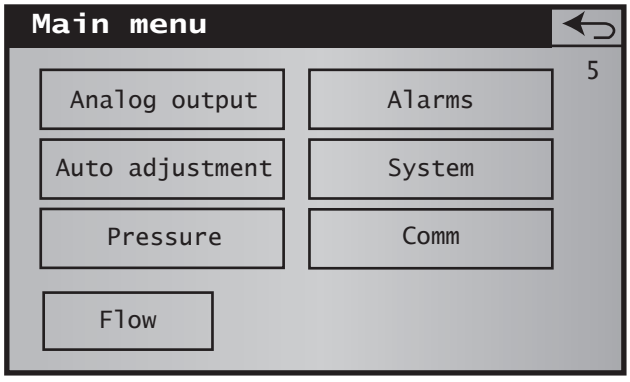


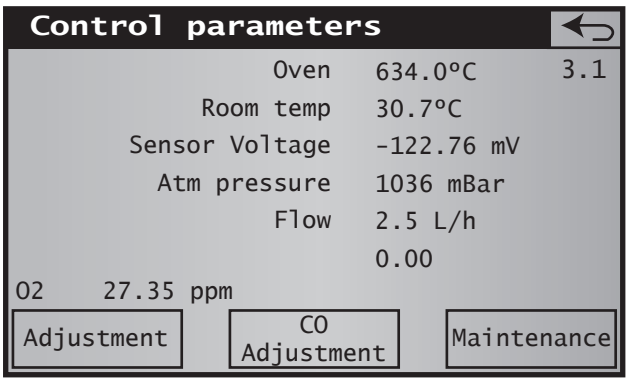

Figure 35 *Main Menu Screen*

### 3.5.2 Changing the Access Code

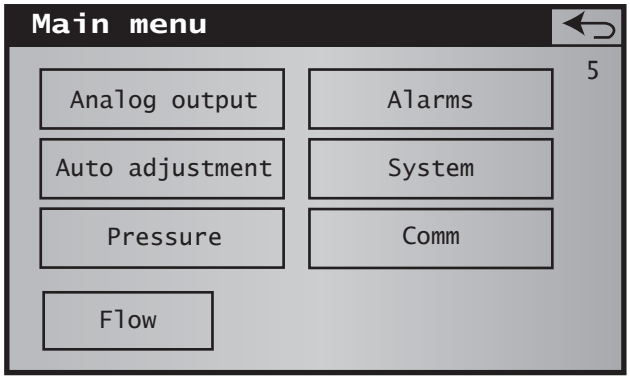
The default access code is **0000**. To change this code proceed as follows:

**NOTE: To leave a screen, touch ⮌ .**

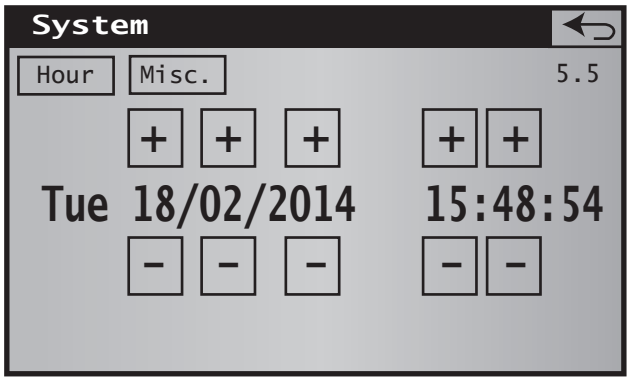
- Touch the **VIEW** area of Screen 3. The Control Parameters Screen is displayed.



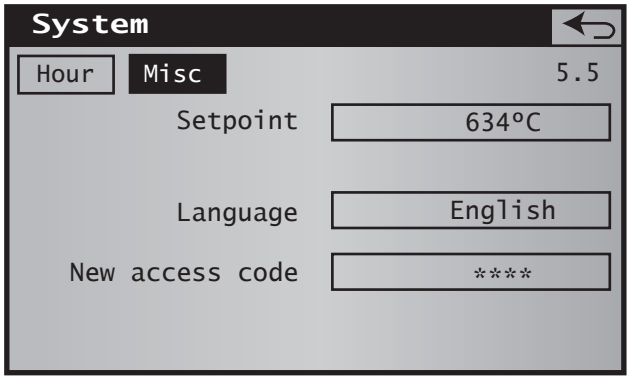

- Touch the **Maintenance** area.



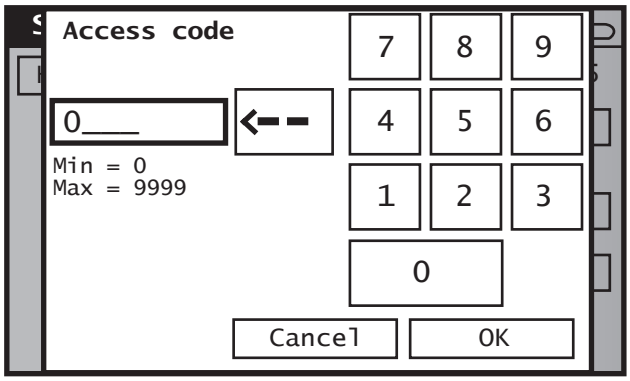

- Touch the **System** area.




- Touch the **Misc** tab




- Touch the **New Access code** area




- Enter the new access code
- To correct an entry error, press the ⇦ area
- Press the **OK** area

## 3.6 The Main (Expert) Menu

This menu accesses all of the configuration functions of the analyzer. Press the corresponding area to display the required screen.

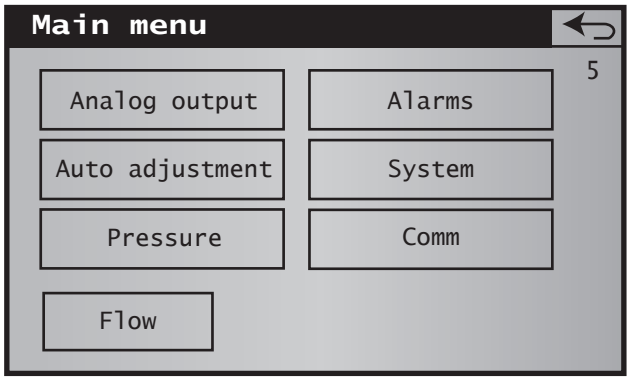



Figure 36 *Main Menu Screen*

| Area | Function | Section |
|---|---|---|
| **Analog output** | Configures the 4-20 mA analog output 1 | 3.6.1 |
| **Alarms** | Disables the 3 alarms (during adjustment and/or during normal operation) and sets the threshold and the function mode for alarm 1 and 2 | 3.6.2 |
| **Auto adjustment** | Configures the automatic cyclical adjustment (adjust) of the analyzer<br>Optional | 3.6.3 |
| **System** | Configures the analyzer timestamp function, oven temperature, menu display language, Expert access code and RS output configuration (ModBus address with RS485 or frame period with RS232). | 3.6.4 |
| **Pressure** | Configures the process pressure correction<br>Optional for all models | 3.6.5 |
| ⮌ | Returns to the Measurement Display Screen (3) | |
| **COM 232** | Sets the frequency of the frame transmission<br>Optional<br>Cannot coexist with the RS485 | 3.6.6 |
| **COM 485** | Sets the ModBus address of the analyzer and displays the message frames received by the analyzer via the RS485 interface<br>Cannot coexist with the RS232 | 3.6.6 |
| **Flow** | Configures the gas sample flow correction based on its density | 3.6.7 |

### 3.6.1 Analog 1

The Analog Output 1 screen (5.1) sets the parameters for the 0/4-20 mA output.

- Touch the area to select it and change it.
- Enter the new numeric value on the virtual keypad.
- Click **OK** to confirm or **Cancel** to discard the changes.

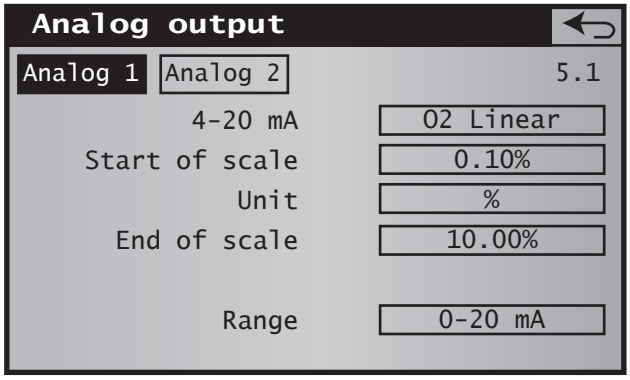



Figure 37 *Analog Output Screen*

| Area | Function |
|---|---|
| **4-20 mA** | Configuration of the 0/4-20 mA analog output No 1.<br>**LIN**: the output voltage must be linearly proportional to the oxygen measurement value.<br>**LOG**: the output voltage must be a logarithmic function with respect to the oxygen measurement value. Use this option when the signal span is greater than 3 decimal counts.<br>A current of 3.80 mA (4-20 mA output configured) or 21 mA is automatically generated when there is a general fault if:<br>• oven temperature is lower than 30°C or higher than 50°C from the setpoint<br>• thermocouple rupture<br>• flow less than 0.5 and greater than 3.5 l/h<br>• internal wiring fault |
| **Start of scale** | Configuring the concentration for the low scale and the measurement unit. Select a value and a unit corresponding to the concentration to be measured. |
| **Unit** | Configuration of the unit in which the value is expressed (% or ppm). |
| **End of scale** | Configuring the high scale concentration and the measurement unit. Select a value and a unit corresponding to the concentration to be measured.<br>**NOTE: the difference between the low scale and high scale value is limited to three decimal places to ensure correct resolution. This limitation only applies to a linear output type.** |
| **Range** | Configuration of the analog output (0-20 or 4-20 mA). |
| ⮌ | Returns to the Main Menu screen. |

#### Analog 2

The information is similar to that of the Analog 1 menu and can be reached by touching the Analog 2 area. When this option is not available, the display shows **Option not available.**

### 3.6.2 Alarms

**The Main Tab**

The Alarms Screen sets the general behaviour for alarms 1 and 2.

- Touch the area to select it and change it.
- Click **OK** to confirm or **Cancel** to discard the changes.

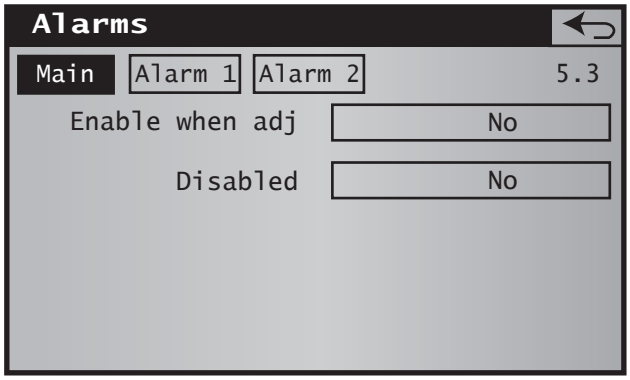



Figure 38 *Alarm Screen (Main)*

| Area | Function |
|---|---|
| **Enable when adj** | Sets the behaviour for alarms 1 and 2 exclusively during auto adjust operations or manual.<br>• **No**: exceeding the alarm threshold will not trigger the relay for alarms 1 and 2 during adjustment operations, or when alarm set off is configured by the user.<br>• **Yes**: exceeding the alarm threshold will trigger the relay for alarms 1 and 2 during adjustment operations, or when alarm set off is configured by the user. |
| **Disabled** | Sets the current behaviour for alarms 1 and 2 and that of the General fault exclusively in normal mode of operation (excluding adjustment).<br>• **No**: the alarms are operational; the corresponding alarm will be activated when an alarm is triggered and/or a fault occurs. This is the standard choice for the analyzer in normal operation.<br>• **Yes**: no alarms will be activated regardless of the alarm and/or fault present. Use this option during the commissioning of the analyzer, especially before the wiring the alarms. The blinking **Alarms Disabled** message will be displayed on the Measurement Display Screen (3).<br>**NOTE: Operating with alarms disabled must only be done temporarily, particularly during adjustments.** |
| **Alarm 1 tab** | Touch the area to display the alarm 1 threshold change screen. |
| **Alarm 2 tab** | Touch the area to display the alarm 2 threshold change screen. |
| ⮌ | Returns to the Main Menu Screen. |

### The Alarm 1 or Alarm 2 Tab

This screen is used to set the alarm function mode (high, low), the threshold and hysteresis for the selected alarm 1 or 2.

It is used mainly to enable or disable the alarms during the adjustment phases and during normal analyzer operation.

- Touch the area to select it and change it.
- Enter any new numeric value on the virtual keypad.
- Click **OK** to confirm or **Cancel** to discard the changes.

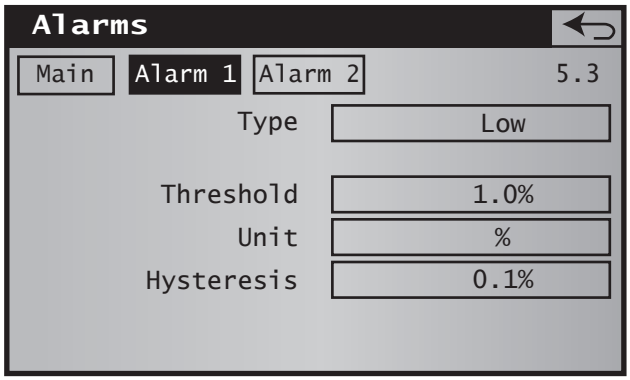



Figure 39 *Alarm Screen (Alarm 1)*

| Area | Function |
|---|---|
| **Type** | Sets the behaviour for alarm (1 or 2 according to the highlighted tab).<br>• **Low**: the alarm will be activated when the measurement value is equal or below the threshold set for the Alarm threshold line. The alarm must be disabled when the measurement value is above the threshold set for the Alarm threshold line.<br>• **High**: the alarm will be activated when the measurement value is equal to or above the threshold set for the Alarm threshold line. The alarm must be disabled when the measurement value is below the threshold set for the Alarm threshold line. |
| **Threshold** | Configures the alarm threshold value. Select the value and unit in relation to the future measurement. |
| **Hysteresis** | Sets the alarm 'delay' value to return to alarm-off condition. The greater this value is, the more the return to alarm-off condition value must be delayed. For example, with a hysteresis of 3ppm over a 15ppm alarm value, the alarm is triggered at 15ppm, but returns to the alarm-off position at a 12ppm value (15ppm - 3ppm). |
| ⮌ | Returns to the Main Menu Screen. |

### 3.6.3 Auto Adjustment (Optional)

#### Purpose

This function is used for the analyzer's auto adjust at a set time and at regular intervals set in hours or days. Solenoid valves connected to the D-Sub DA15 on the XZR400A2, and 8 pin connector on the XZR400A1 control any adjustment gas and control gas inputs. Additional contacts are used to launch the sequence.

#### Hardware configuration

Peripheral equipment must be installed as indicated.

#### Parameter setting for auto adjust

The Auto Adjust Screen sets the array of parameters used for the analyzer's auto adjust.

- Touch the area to select it and change it.
- Enter the new numeric value on the virtual keypad.
- Click **OK** to confirm or **Cancel** to discard the changes.

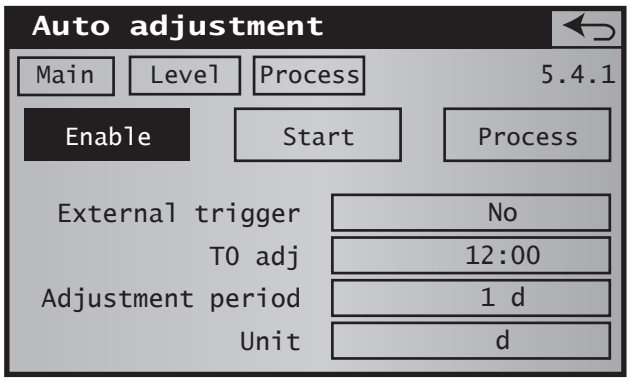
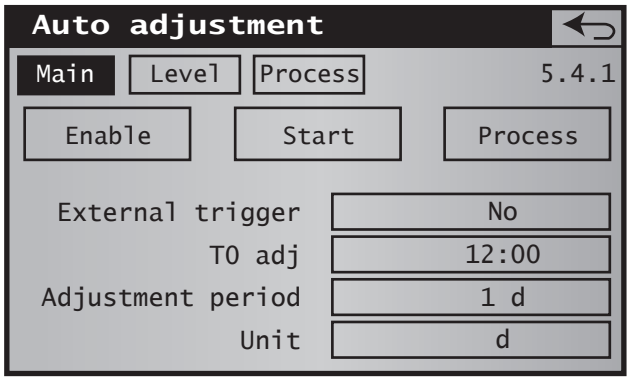


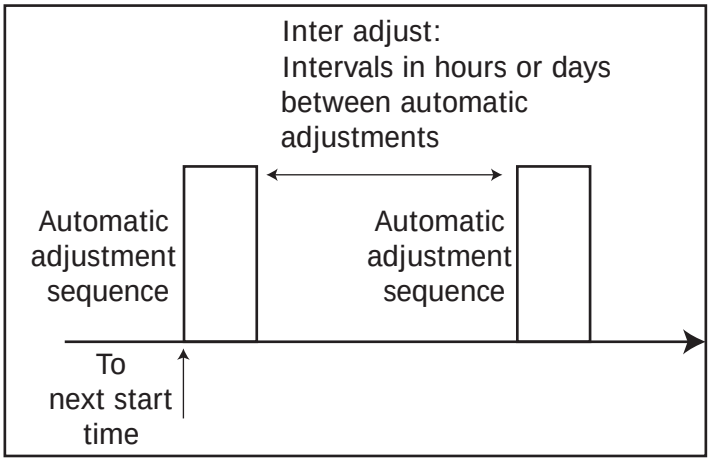

Figure 40 *Auto Adjustment Screen*

The three tabs, Main, Level and Process are described next.

**Main Tab**

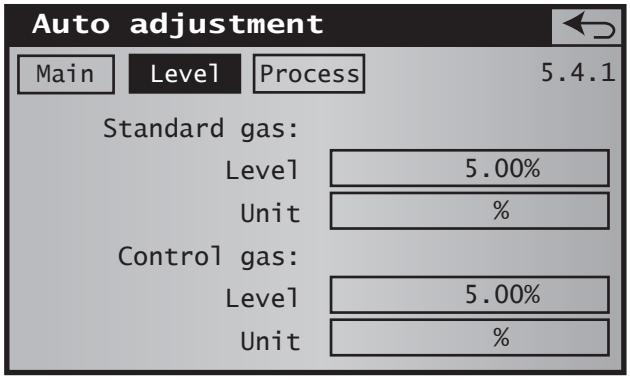



| Area | Function |
|---|---|
| **Enable / Disable** | Enables/disables the launch of the automatic adjustment. |
| **Start** | Management of the start of the auto-adjust procedure.<br>• **Start**: the auto adjust sequence is launched immediately, regardless of the other settings.<br>• **T0 start**: the auto-adjust sequence is launched at the time specified by the area **T0 Adjust.**<br>The interval is set by **Adjustment period** (see below). |
| **External trigger** | Management of an external launch control button (push-button or dry contact from an external PLC) controlling the launch of the auto adjust sequence (as opposed to the automatic launch of the Inter Start and Inter Adjust commands).<br>• **No**: pressing the external button connected to terminals 5-6 of the D-Sub DA15 connector or the 8 pluggable pin connector will not allow the launch of the auto adjust sequence.<br>• **Yes**: pressing the external button connected to terminals 5-6 of the D-Sub DA15 connector or the 8 pluggable pin connector will allow the launch of the auto adjust sequence. |
| **T0 adj** | Sets the start time of the next auto-adjust. |
| **Adjustment period** | Adjustment interval<br>Sets the time interval in hours or days between two auto-adjust sequences. See below. |
| **Unit** | d (day) or hr (hour)<br>Defines the time unit of the Adjustment interval. |



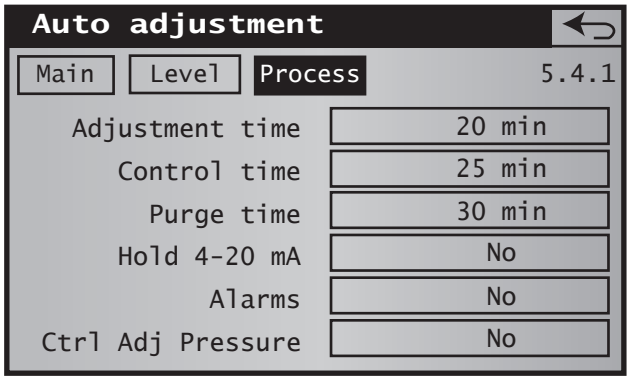
### Level Tab

The Level tab of the Auto adjust screen defines the unit and the value of adjustment and control gases.




| Area | Function |
|---|---|
| **Standard gas** | |
| **Level** | Defines the value of adjustment gas |
| **Unit** | Defines the unit of adjustment gas |
| **Control gas** | |
| **Level** | Defines the value of control gas |
| **Unit** | Defines the unit of control gas |

### Process Tab




| Area | Function |
|---|---|
| **Adjustment time** | Duration in minutes of the adjustment sequence. |
| **Control time** | Duration in minutes of the control sequence. |
| **Purge time** | Duration in minutes of purging. |
| **Hold 4-20 mA** | Concerns the 4-20 mA analyzer outputs<br>• **No**: 4-20 mA outputs will display the oxygen concentration during the adjusting sequence start until the purge end.<br>• **Yes**: 4-20 mA outputs are locked to the value measured before the adjustment sequence start until the end purge. |
| **Alarms** | Concerns the analyzer general fault alarm as well as Alarms 1 and 2<br>• **No**: alarms will remain operational during the adjust sequence start until the end of the purge.<br>• **Yes**: alarms will be disabled. |
| **Ctrl Adj Pressure** | Gas adjustment and control gas bottle pressure checking<br>• **No**: any pressure control on bottles of gas adjustment or gas control will be carried out. In case of fault in at least one of these bottles, the conformity of the adjustment or control cannot be guaranteed.<br>• **Yes**: the adjustment sequence or control will stop if any pressure fault is detected. The **No adjusting** message or **Control not possible** will be displayed. The previous adjustment will be retained. |
| ⮌ | Returns to the Main Menu Screen. |

**Automatic Adjustment Usage**

| Launch | Action |
|---|---|
| **Manual** | If external trigger has been selected, touch the dedicated push-button (or launch via the contact controlled by the external PLC) to launch the auto adjust sequence immediately. |
| **Immediately via the screen** | Regardless of the configuration for alternative launch modes, touch the immediate start area to launch the auto adjust sequence immediately. |
| **For defined date and interval** | If adjustment period (time interval between adjustments) and T0 adj (start time for the next auto adjust) have been defined, the auto adjust sequence is launched automatically at the scheduled time (T0 adj) and resumes cyclically after the adjustment period.<br>Example: interval adjustment 2h and T0 14h. If the operator pushes the Start area T0 at 17:00, self adjustment will be disabled until the next day to 14:00. It will then be started at 16:00, 18:00 and 20:00.<br>To stop the automatic sequence, touch the **Enable** area. |

### 3.6.4 System

This screen is used to update the analyzer's real-time time stamp clock, to set the oven's temperature or the interval between two RS232 messages, as well as the factory reset.

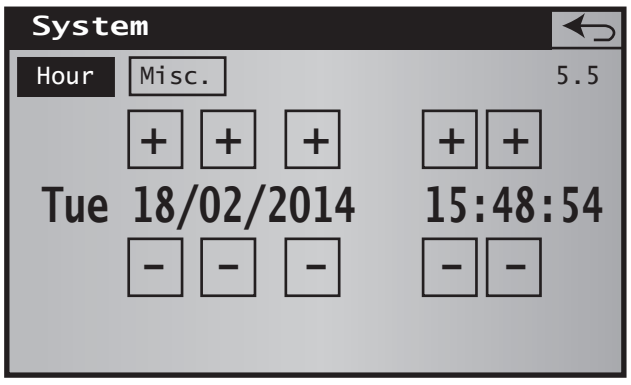
- Touch the area to select it and change it.
- Enter the new numeric value on the virtual keypad.
- Click **OK** to confirm or **Cancel** to discard the changes.

**Hour Tab**

The Hour tab concerns the system timestamp.

- Touch the + and – area to set the current time and date.

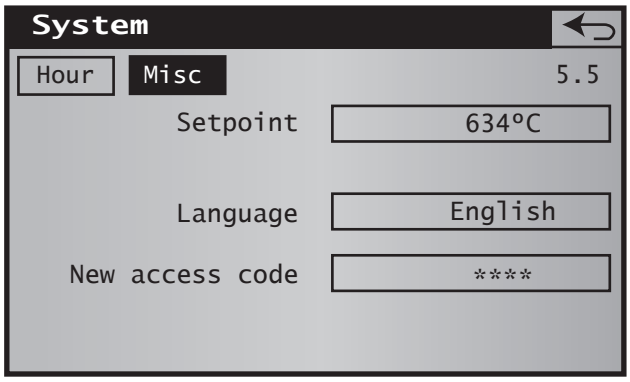
**NOTE: seconds will be resettled.**



### Misc Tab

The Misc tab of the System screen concerns the oven temperature setpoint, the menu display language and the access code modification.

- Touch the + and – area to set




| Area | Function |
|---|---|
| **Setpoint** | Enter the oven temperature value that the analyzer will use to operate. The default value is 634°C. An unsuitable temperature setting reduces the performance of the analyzer and can damage the MSRS oxygen measuring cell. |
| **Language** | Touch the **Language** area. In the opened window, change the displayed language. The new language will be applied at the next start.<br>**NOTE: the language selection is proposed if this choice was not selected at the analyzer start.** |
| **New access code** | Modifies the expert level code. By default, the expert code is **0**.<br>**Warning: If the access code is forgotten the equipment will need to be returned to the factory for Expert level code reset.** |
| **Factory settings** | The analyzer parameter values defaults are set at the factory, namely<br>• Oven temperature: 634°C<br>• Alarm No. 1 High mode, threshold: 3 ppm<br>• Alarm No. 2 High mode, threshold: 3.5 ppm<br>• Low scale and high scale, 4-20 mA output No. 1: 0.1 and 10 ppm<br>• Low scale and high scale, 4-20 mA output No. 2: 0.1 and 1000 ppm |

### 3.6.5 Total Pressure Correction (Optional)

This optional screen is used to adjust the low scale and the high scale of the external pressure sensor, which is connected to D-Sub DA15 for all versions, except for the XZR400A1 model, where the connection is carried out on the 8 pins connector. This sensor compensates the total pressure in the MSRS cell.

When the gas pressure at the analyzer output is greater than the atmospheric pressure sensor's upper limit (1,200 mbar), the total pressure adjustment is needed to guarantee optimum operation of the analyzer.

The input signal from the external pressure sensor is a 4-20 mA analog signal representing the output pressure of the analyzer. The signal enters the analyzer at terminals 11 and 12 of the D-Sub DA15 connector for all versions, except for the XZR400A1 model, where the connection is carried out on pins 12 and 13 of the screw terminal.

Defective wiring/electrical supply of the total pressure sensor, or no connection of the total pressure sensor's 4-20 mA signal to the analyzer, generates a general fault alarm and the display of a pressure fault message. This is not run if the sensor outputs a 0-5 V signal type.

In case of a pressure fault, the $O_2$ concentration will be displayed taking in account an atmospheric pressure of 1000mbar. If the pressure of the measured gas is not within a 1000mbar ±20mbar bracket, the $O_2$ concentration on the display will be off the relative 2% tolerance.

**Pressure Correction Screen**

- Touch the area to select it and change it.
- Enter any new numeric value on the virtual keypad.
- Click **OK** to confirm or **Cancel** to discard the changes.

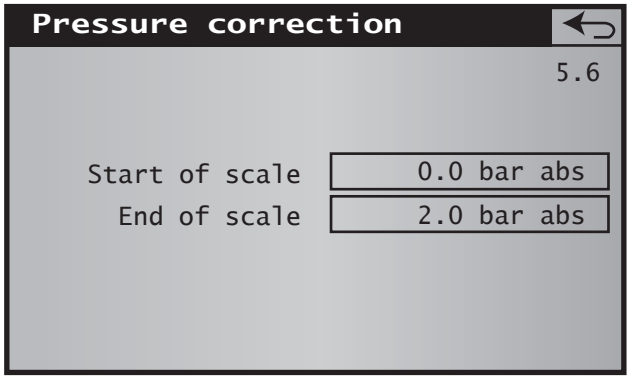



Figure 41 *Pressure Correction Screen*

| Area | Function |
|---|---|
| **Start of scale** | Touch the area to enter the low scale pressure value of the external sensor. |
| **End of scale** | Touch the area to enter the high scale pressure value of the external sensor. |
| ⮌ | Returns to the Main Menu Screen. |

### 3.6.6 COMM

#### 3.6.6.1 RS232

| Area | Function |
|---|---|
| **Frame period** | Sets the delay, in seconds, between two RS232 signal emissions, from 0 (no emission) to 999 seconds (one emission every about 16 minutes). |
| ← | Returns to the Main Menu Screen. |

#### 3.6.6.2 RS485

Only available for analyzers equipped with this output.

**Comm Screen**

The COM RS485 screen sets the RS485 output parameters.

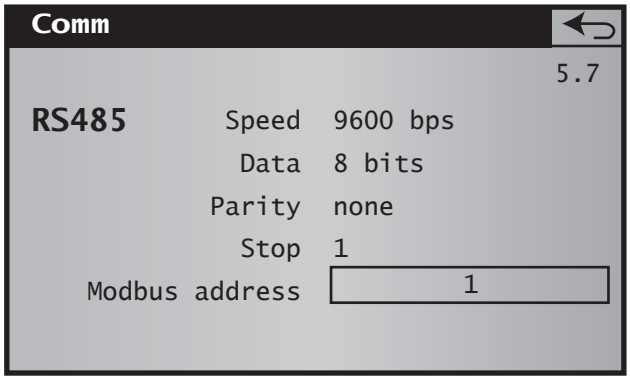



Figure 42 *Comm Screen*

| Area | Function |
|---|---|
| **RS485** | Indications of the RS485 interface connection parameters that cannot be modified.<br>• Speed: 9600 bauds<br>• Number of bits<br>• Parity: None<br>• Stop: 1 |
| **ModBus address** | The analyzer's ModBus slave address. Enter a value between 1 and 255, including terminals. |

### 3.6.7 Flow

This screen is used to define a flow correction factor depending on the density of the gas being analyzed. Use this function to optimize the flow measurement depending on the type of gas used.

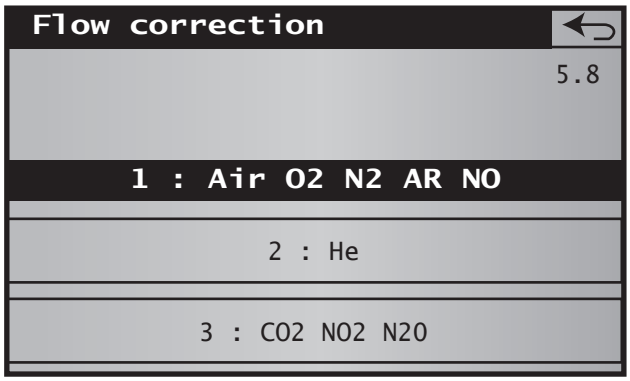



Figure 43 *Flow Correction Screen*

| Area | Function |
|---|---|
| **Flow correction** | Selects the adjustment factor number (1, 2 or 3) depending on the gas analyzed. For this choice, take the main gas into account. |
| ⮌ | Returns to the Main Menu Screen. |

# 4 CALIBRATION

The optimal measurement accuracy is reached when calibrating the analyzer after a minimum of three hours of operation.

Calibration is done on a single point ideally with an oxygen concentration of between 8% and 10% $O_2$. The gas concentration adjustment can be between 1 ppm and 25% oxygen.

**Avoid calibration gas concentrations between 1,000 ppm (0.1%) and 5,000 ppm (0.5%) as this is too close to the internal reference.**

It is possible to verify the linearity of the sensor with a second gas, rated at a different $O_2$ value. A single cylinder with $O_2$ at a known concentration is required for calibration. A second cylinder with a different concentration can be used to verify calibration (Control Gas).

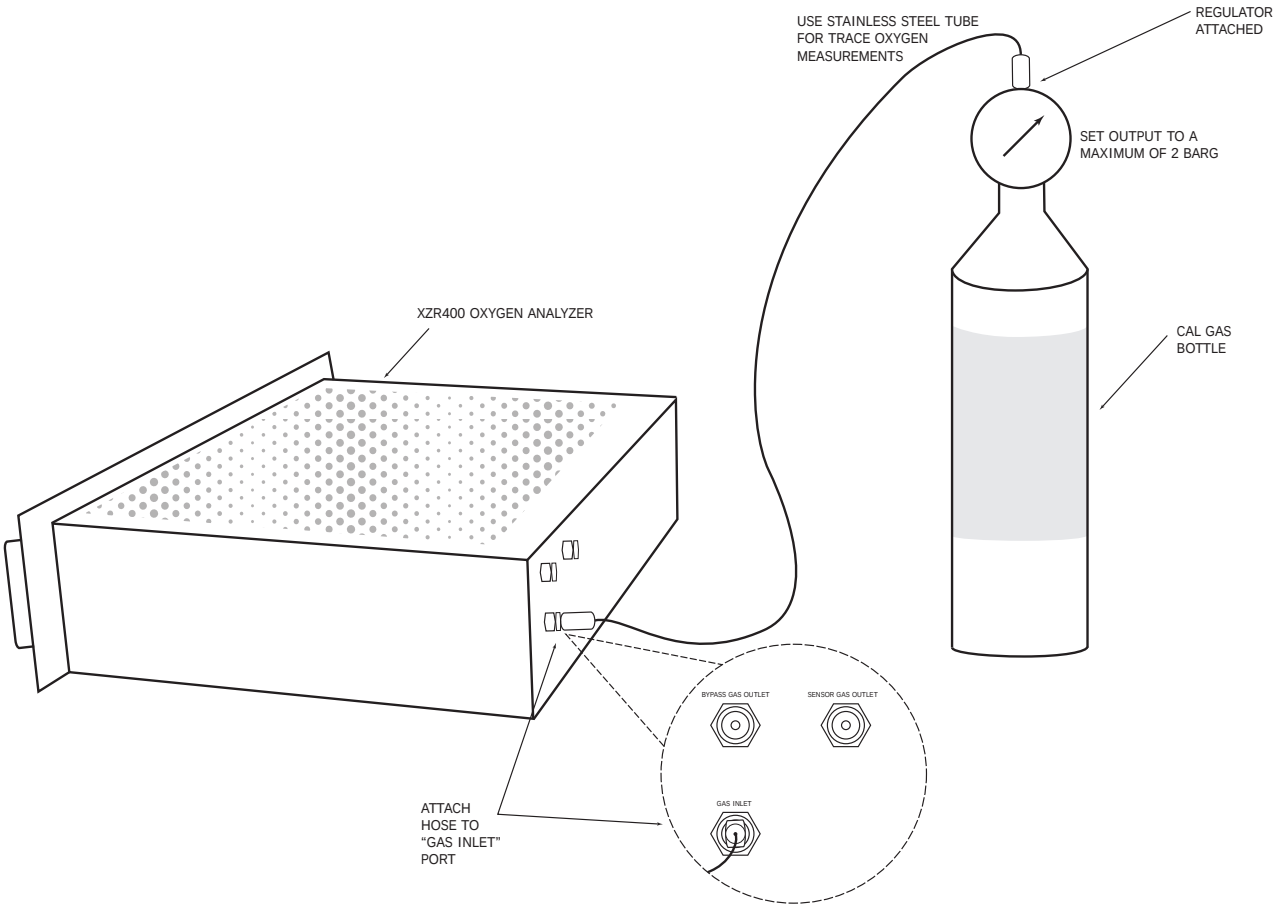



Figure 44 *Calibration Procedure with XZR400A1*

## 4.1 Definitions

- **Adjustment gas:** an adjustment gas used in order for the analyzer to correct a possible difference between the measured value and the actual $O_2$ content in the gas. The value which is written on the cylinder (or on the relevant analysis certificate) must be entered in the field **adjustment gas** section. The content can be in either % or ppm.
- **Control gas**: a gas with a different $O_2$ content than the adjustment gas. It helps in verifying the linearity of the sensor post calibration. The $O_2$ content can be either in % or ppm. This control is not compulsory.
- **Process gas**: the gas to be measured.
- **Calibration duration**: the period during which the adjustment gas eliminates the process gas out of the internal sample path. The quality of calibration will far be greater if the process gas is fully cleared away. A longer period is necessary when the adjustment gas value is low and/ or when the difference between the process gas and the adjustment gas is large. Calibration with % level oxygen gas requires approximately 5 minutes. Calibration with ppm level oxygen gas may require 30 minutes.
- **Purging time:** the period during which the process gas eliminates the adjustment gas (or verification gas) out of the internal sample path.

**If a low $O_2$ content (< 1000ppm) adjustment gas is used, a purge time is necessary to allow the stabilization of the measurement before starting the calibration sequence. This is even more important if the process gas is going to be at a very different concentration from that of the adjustment gas.**

### 4.1.1 ADJUSTMENT / Calibration Screen Pages 3.2, 3.2.1, 3.2.2 & 3.2.3

***NOTE: Prior to commencement of the adjustment/calibration the alarms can be disabled from screen page 5.3.***

From the Main Screen press **Adjustment** to get to screen page 3.2.

Pressing the ⮌ key from any of the Adjustment Screens will return to the previous screen.

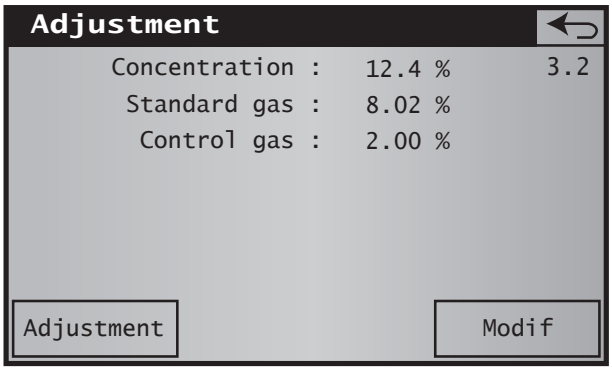



Figure 45 *Screen Page 3.2*

Ensure that the values on the Screen 3.2 are correct with respect to the calibration gas cylinder or certificate. If they are correct press the **Adjustment** button, this will take you to Screen 3.2.2.

If the values do not match press the **Modify** key, this will take you to Screen 3.2.1.

**'MODIF' . Incorrect Values**

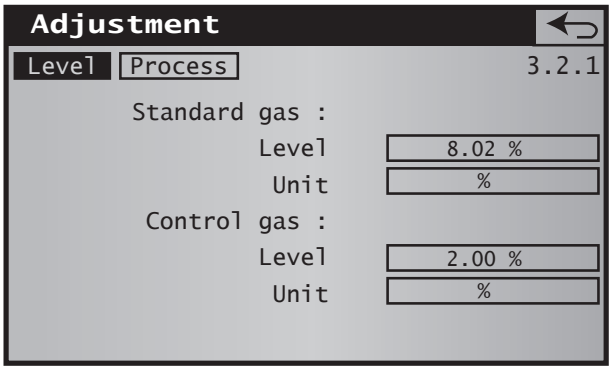


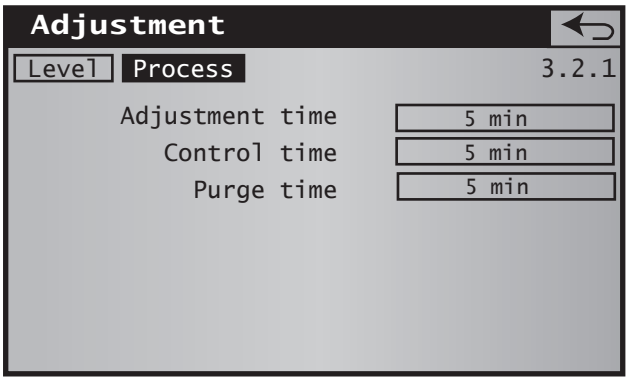

Figure 46 *Screen Page 3.2.1*

To change any of the values, press the relevant value key and use the numeric keypad to modify the value.

To change the gas unit (% to ppm or ppm to %), press the unit key.

Press the **Process** tab to check the Adjustment, Control and Purge times and correct and modify if necessary.

The length of time for each process should be long enough to ensure that the calibration gas sample is stable during Adjustment and Control and that the calibration gas is completely purged to a level close to normal operation (below any alarm threshold) before switching back to measuring the process.




Press the ⮌ key to return to Screen 3.2 and press the **Adjust** key to start the calibration procedure (Screen 3.2.2).

### ADJUST . Correct Values

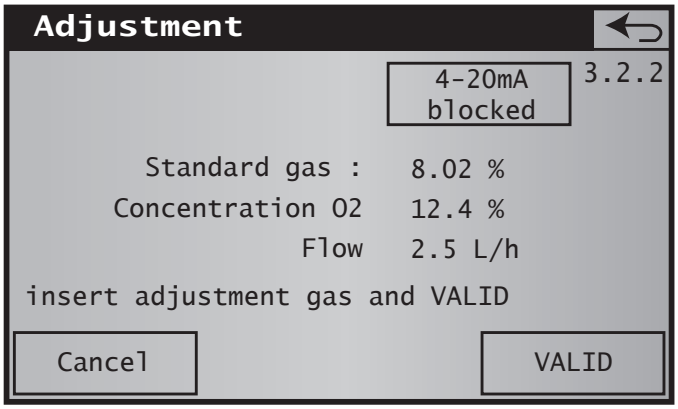



Figure 47 *Screen Page 3.2.2*

Press the 4-20 mA key to select whether the output is frozen (blocked) or will follow the gas concentration (active).

Open the gas cylinder to give a flow rate of 2 l/h ±1 l/h.

Wait for approximately 5 minutes for the concentration $O_2$ value to be close to the standard gas value and then press the **VALID** key. This will bring up Screen 3.2.3.

***An incorrect gas flow (0.5 < flow < 3.5 l/h) will prevent the calibration sequence from starting.***

**An incorrect gas flow DURING the calibration will cancel the sequence and screen page 3 will appear showing the message: Impossible to calibrate: flow fault.**

Screen page 3.2.3 shows the $O_2$ concentration in the adjustment gas and the time left before the purge sequence.

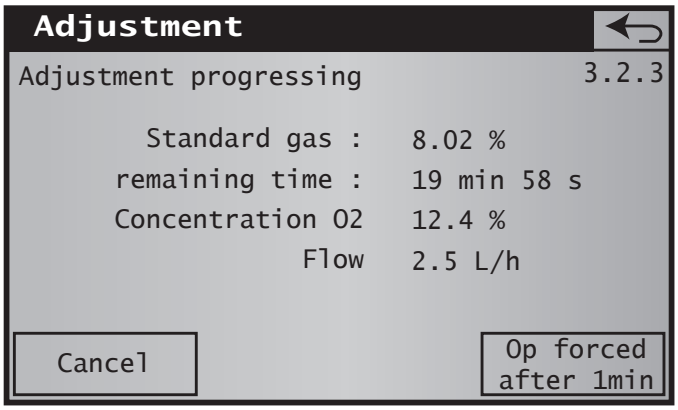



Figure 48 *Screen Page 3.2.3*

During the calibration sequence it is possible to:

- Force calibration after 1 minute if the reading is stable. Press the **Op forced after 1min** key and screen page 3.2.4 will show (after 1 minute).
- Cancel calibration at any time. Press the **Cancel** key and go to screen page 3.2.8.

### Cancel Calibration

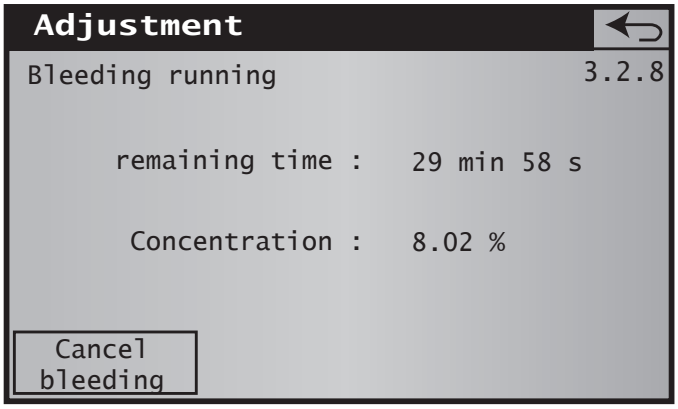



Figure 49 *Screen Page 3.2.8*

Pressing the **Cancel bleeding** key will return to the Main Screen.

### 4.1.2 Diagnosis of the MSRS Sensor Status - Screen pages 3.2.4 to 3.2.7

While the control gas passes through the analyzer after a calibration sequence, the MSRS sensor status is diagnosed to assess the working order of the analyzer.

The system compares the theoretical and measured concentration of the control gas.

To begin this diagnosis complete a calibration sequence (see Section 4.1.1). When the calibration is over, screen page 3.2.4 will appear.

Alternatively if the reading was stable and the calibration was forced from screen page 3.2.3 by pressing the **VALID** key, then screen page 3.2.4 will appear.

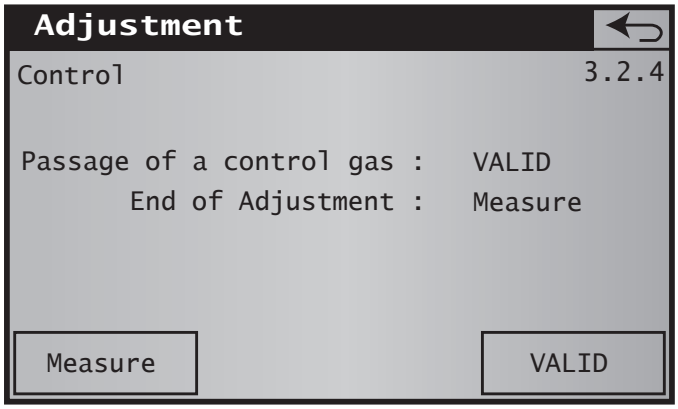



Figure 50 *Screen Page 3.2.4*

Pressing the **Measure** key will show screen page 3.2.7. To return to the measurement, close the adjustment gas cylinder. Pressing the **VALID** key will take you to screen page 3.2.8. A purge ends the calibration sequence.

Pressing the **VALID** key will start the Control gas process. The following screen page 3.2.5 will appear:

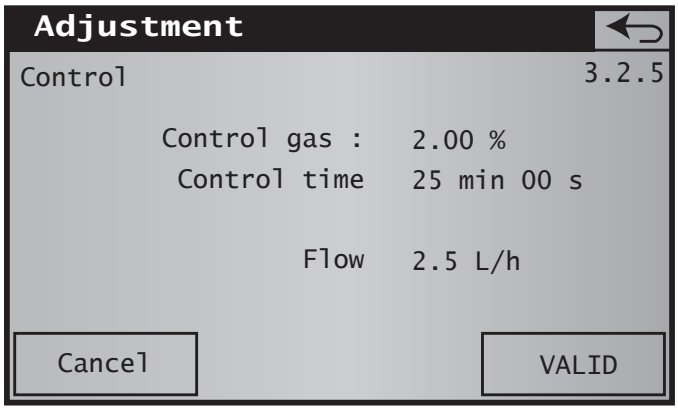



Figure 51 *Screen Page 3.2.5*

Pressing the **Cancel** key will take you to 3.2.8.

Press the **VALID** key **after** opening the control gas cylinder to give a flow rate of 2 l/h ±1 l/h and waiting until the control gas has cleared the process gas away from the internal sample path. Screen page 3.2.6 will appear:

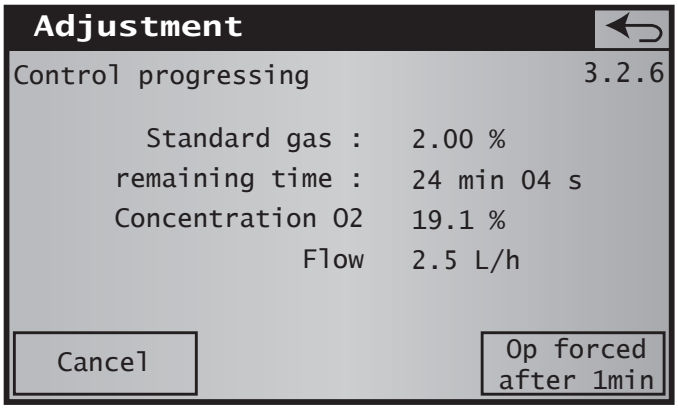



Figure 52 *Screen Page 3-2-6*

From this screen it is possible to:

- Force calibration after 1 minute if the reading is stable. Press the **Op forced after 1min** key and screen page 3.2.7 will show (after 1 minute).
- Cancel calibration at any time. Press the **Cancel** key and go to screen page 3.2.8.

At the end of the verification period, the diagnosis will appear on screen page 3.2.7:

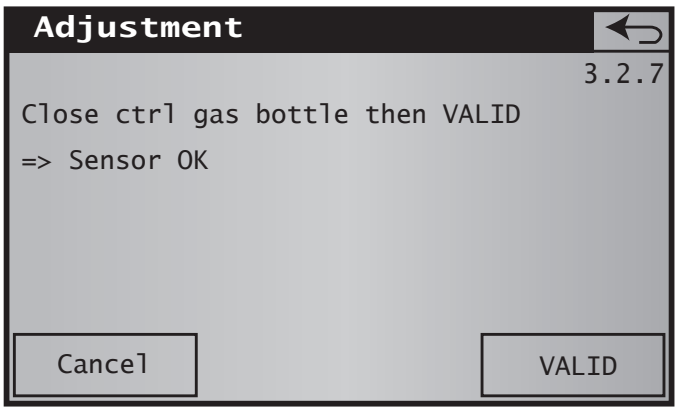



Figure 53 *Screen Page 3-2-7*

Three outcomes are possible and will be displayed as a message on the third row of the screen:

- The analyzer is operative.
- The analyzer's performance is not optimal. The MSRS sensor should be replaced at some time in the near future.
- The analyzer's performance is poor. Change the MSRS sensor immediately.

Pressing the **Cancel** key will return to the Main Screen.

Closing the control gas cylinder and pressing the **VALID** key will take you to screen page 3-2-8.

### Managing The Alarms During The Calibration Sequence

The alarms can be active or inactive during the calibration sequence.

When **NO** is on in the **Active during ADJ** section on screen page 5-3 the alarm contacts are not active during the calibration sequence.

When **YES** is on in the **Active during ADJ** section on screen page 5-3 the alarm contacts will be activated during the calibration sequence and will respond according to the configuration set by the user.

### De-Activation of Alarms

The alarms may be de-activated during installation and set-up. If the alarms are de-activated and the system detects a fault and/or an alarm threshold is passed, the alarm relays are not activated. In this case a message describing the fault will appear at the bottom of the default screen page 3.

When **NO** is on in the **Inhibit Alarms** section the alarms are operative.

When **YES** is on in the **Inhibit Alarms** section the alarms are de-activated.

# 5 MAINTENANCE

## 5.1 Troubleshooting Guide / Failure Analysis

| Observation | Cause | Corrective Action |
|---|---|---|
| Mains power plugged in and switched on but no display present | Fuse blown | • **Replace mains fuse:**<br>• Fuse Box: T2A/250V<br>• Mains socket: T6.3A/250 |
| | Analyzer not powered   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Measure the main inlet voltage<br>• If the measured voltage is 90 to 264 V AC verify the mains power to the analyzer |
| | Display disconnected   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Ensure the plugs of the 20-way ribbon cable are connected to both the display PCB and the mother board and that the wiring is intact<br>• Ensure the plugs of the 2-way cable are connected to both the display PCB and the mother board and that the wiring is intact<br>• Ensure the plugs of the 4-way cable are connected to both the display PCB and the mother board and that the wiring is intact |
| | Faulty analyzer | Return the analyzer to Michell Instruments for further investigation |

| Observation | Cause | Corrective Action |
|---|---|---|
| Display indicates **Low Temp** | Analyzer initializing | Wait for up to 20 minutes to allow the analyzer's oven to stabilize at the correct temperature |
| | Power supply under-voltage   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Measure the main inlet voltage<br>• If the measured voltage is 90 to 264 V AC verify the mains power to the analyzer |
| | Faulty heater element   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Measure the resistance of the heater across J11 pins 10-11<br>• If 8Ω < measured value < 11Ω replace the oven |
| | 15 V supply faulty   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Measure voltage across J11 pin 11 to J12 pin 10<br>• If 13 V < measured value < 15 V return the analyzer to Michell Instruments for further investigation |
| | Thermocouple short circuit   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Replace the MSRS Sensor Assembly<br>• Recalibrate instrument |
| | Gas flow exceeds limit | Reduce the gas sample flow to 2 l/hr ±1 l/hr |
| | Faulty analyzer | Return the analyzer to Michell Instruments for further investigation |

| Observation | Cause | Corrective Action |
|---|---|---|
| Display Indicates **T/C Fault** | Open circuit thermocouple   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Check for faulty wiring of sensor - repair as necessary<br>• Replace the MSRS / thermocouple sensor assembly<br>• Recalibrate instrument |
| | Broken thermocouple   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Replace the MSRS / thermocouple sensor assembly<br>• Recalibrate instrument |
| | Faulty analyzer | Return the analyzer to Michell Instruments for further investigation |
| Display Indicates **Low Flow** | Gas flow too low   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Measure voltage across J11 pin 11 to J12 pin 10<br>• If 13 V < measured value < 15 V return the analyzer to Michell Instruments for further investigation |
| | Leak in gas sample path   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Ensure all gas fittings are tight<br>• If the problem persists return the analyzer to Michell Instruments for further investigation |
| | Faulty electronic flow meter | Return the analyzer to Michell Instruments for further investigation |
| | Faulty analyzer | Return the analyzer to Michell Instruments for further investigation |
| Display Indicates **High Flow** | Gas flow too high | • Open the flow adjustment valve<br>• Close the bypass valve<br>• Adjust both valves to achieve a gas sample flow to 2 l/hr ± 1 l/hr |
| | Faulty electronic flow meter | Return the analyzer to Michell Instruments for sensor replacement |
| | Faulty analyzer | Return the analyzer to Michell Instruments for further investigation |

| Observation | Cause | Corrective Action |
|---|---|---|
| Display indicates **Sensor Fault** | Faulty wiring to sensor   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Check wiring from MSRS sensor assembly to J12 pin 1-3<br>• Replace the MSRS / thermocouple sensor assembly |
| | Faulty sensor   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Replace the MSRS / thermocouple sensor assembly |
| | Faulty analyzer | Return the analyzer to Michell Instruments for further investigation |
| Display indicates **Pressure Fault** | Internal pressure sensor fault | Return the analyzer to Michell Instruments for further investigation |
| | No signal from external pressure sensor   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Check wiring to ensure 4-20 mA input signal is present J12 pin 9-10<br>• Replace external sensor if problem persists |
| | No power to external pressure sensor | Check the power supply to external sensor |
| | Faulty analyzer | Return the analyzer to Michell Instruments for further investigation |
| Calibration gas measurement fault | Gas measures out of specification | Calibrate analyzer |
| | Calibration gas empty | Check calibration gas cylinder - replace if empty |
| | Faulty analyzer | Return the analyzer to Michell Instruments for further investigation |
| After calibration and during calibration gas verification $O_2$ outside tolerance | Unstable measurement | Wait for measurement to stabilize |
| | Sensor gas path leak   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Ensure all gas fittings are tight<br>• If the problem persists return the analyzer to Michell Instruments for further investigation |
| | Faulty MSRS Sensor   | **BEWARE OF ELECTRIC SHOCK / BURN HAZARD**<br>• Remove the analyzer cover<br>• Replace the MSRS / thermocouple sensor assembly |
| | Faulty analyzer | Return the analyzer to Michell Instruments for further investigation |

# Appendix A

# Technical Specifications

## Appendix A Technical Specifications

| | |
|---|---|
| **Sensor Type** | |
| Measurement Principle | Zirconium Oxide Sensor with Metallic Sealed Reference and S Type thermocoupe |
| **Performance** | |
| Gas | Clean, dry, oil free with particles less than 3 µm |
| Measurement Range | 0.1 ppm up to 25% $O_2$<br>Extended ranges available up to 0 to 100% $O_2$ |
| Lowest detectable limit (LDL) | 0.1ppm(v) $O_2$ |
| Accuracy (Intrinsic Error) | Less than 2% of reading |
| Response Time | < 11 seconds |
| Repeatability | ±0.1% of reading |
| Stability | 1% per month |
| Linearity | Better than ±1% |
| Drift | <1% of reading per week |
| Sample Flow Rate | 1 to 3 Nl/h with built-in fast loop |
| Maximum Sample Pressure | 2 barg (29 psig) |
| Maximum Sample Temperature | +100°C (+212°F) |
| Atmospheric Pressure Compensation | Built-in as standard |
| **Optional sensor** | |
| Moisture sensor | Easidew sensor can be fitted as an option. Please, see a separate datasheet for full specifications. |
| Measurement range | -100 °C to + 20 °C |
| Sample Flow rate | 60 to 300 Nl/hour |
| **Outputs** | |
| Analog Output | 0, 1 or 2 off 0/4-20 mA Linear with Galvanic Isolation output |
| Digital Communications Output | Modbus RTU over RS485 protocol (Standard on XZR400A1)<br>RS232 output (optional) |
| Output Load | Over 1,000 Ω |
| Self-Diagnostics | Via HMI |
| Output Ranges | 0.0 ppm to 1ppm up to 0 to 25% $O_2$<br>Extended ranges available up to 0 to 100% $O_2$ |
| Alarms | 2 threshold alarms, freely configurable<br>1 general fault alarm including flow alarm<br>1 flow alarm (optional) |
| Display Resolution | 0.01 ppm between 0.1 ppm and 10 ppm<br>0.1 ppm between 10 ppm and 10,000 ppm<br>0.01% between 1 to 10%<br>0.1% between 10 to 25% |
| Power Supply | 90 to 264 V AC, 47/63 Hz |
| Power Consumption | 50 VA |
| **Operating Conditions** | |
| Ambient Temperature Range | 0 to +55°C (+32 to +131°F) |

| | | | | |
|---|---|---|---|---|
| Sensor Temperature | Optimized at 634°C | | | |
| Operating Humidity | 5 to 90% RH without condensation | | | |
| **Mechanical Specification** | | | | |
| Model | Dimensions | Weight | Gas Connectors | Ingress Protection |
| **Rack mount:** | 19", 3U, 482.5 x 133 x 371.5mm | 10kg | 1/8" | IP20 |
| **Wall mount:** | 200 x 220 x 290mm | 5kg | 6 mm | IP40 |
| **Bench mount:** | 290 x 260 x 236mm | 5.2kg | 6 mm | IP20 |
| **Transportable:** | 450 x 300 x 330mm | 13.5kg | 6 mm | IP40 |
| Sample Gas Connections | All gas connections are Swagelok (MALE) Fittings (316 SS) | | | |

# Appendix B

# Modbus (RTU) over RS485

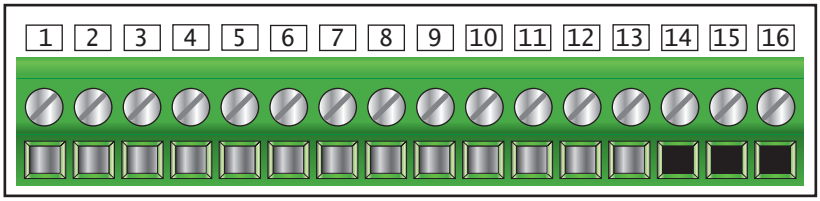
# Appendix B Modbus (RTU) over RS485

## B.1 Port Configuration

- Speed: 9600 bauds
- No parity
- 8 bits
- 1 stop
- No handshaking

## B.2 Hardware Configuration

16 way terminal block connections




- pin 14 RS485 B - Data (-)
- pin 15 RS485 A - Data (+)
- pin 16 RS485 0V

## B.3 RS485 Register Map

| Name | Address [Hex] | Address [Dec] | Modbus Command | Type [R/W] | Data Type | Notes | Standard Access | Expert Access |
|---|---|---|---|---|---|---|---|---|
| **DISPLAY PARAMETERS** | | | | | | | | |
| $O_2$ Measurement | 0x100 | 256 | 3 | R | 32 Bit Real | 0-250 000ppm (IEEE-754) | Yes | Yes |
| Oven Temperature | 0x104 | 260 | 3 | R | 32 Bit Real | (IEEE-754) | Yes | Yes |
| Ambient Temperature | 0x108 | 264 | 3 | R | 32 Bit Real | (IEEE-754) | Yes | Yes |
| MSRS Sensor Voltage | 0x10C | 268 | 3 | R | 32 Bit Real | (IEEE-754) | Yes | Yes |
| Atmospheric Pressure | 0x110 | 272 | 3 | R | 32 Bit Real | (IEEE-754) | Yes | Yes |
| Flow | 0x114 | 276 | 3 | R | 32 Bit Real | (IEEE-754) | Yes | Yes |
| **ADJUSTMENT PARAMETERS** | | | | | | | | |
| Adjustment Gas | 0x120 | 288 | 3/16 | R/W | 32 Bit Real | (IEEE-754) | Yes | Yes |
| Control Gas | 0x124 | 292 | 3/16 | R/W | 32 Bit Real | (IEEE-754) | Yes | Yes |
| Adjustment Duration | 0x128 | 296 | 3/6 | R/W | 16 Bit | ADJ.Gas Time [Mins] | Yes | Yes |
| Control Duration | 0x12A | 298 | 3/6 | R/W | 16 Bit | Control Gas Time [Mins] | Yes | Yes |
| Purge Duration | 0x12C | 300 | 3/6 | R/W | 16 Bit | Duration of Purge [Mins] | Yes | Yes |
| Start Adjustment | TBA | TBA | 3 | R | 16 Bit | | Yes | Yes |
| **CONFIGURATION** | | | | | | | | |
| Oven Set Temperature | 0x160 | 352 | 3/16 | R/W | 32 Bit Real | 634 Nom (IEEE-754) | No | Yes |
| **ANALOG OUTPUT 1** | | | | | | | | |
| Type: Lin / Log | 0x150 | 336 | 2/5 | R/W | Bit | Bit X 0=Lin 1=Log | No | Yes |
| Low Limit | 0x130 | 304 | 3/16 | R/W | 32 Bit Real | (IEEE-754) | No | Yes |
| High Limit | 0x134 | 308 | 3/16 | R/W | 32 Bit Real | (IEEE-754) | No | Yes |
| **ANALOG OUTPUT 2** | | | | | | | | |
| Type: Lin / Log | 0x150 | 336 | 2/5 | R/W | Bit | Bit X 0=Lin 1=Log | No | Yes |
| Low Limit | 0x138 | 312 | 3/16 | R/W | 32 Bit Real | (IEEE-754) | No | Yes |
| High Limit | 0x13C | 316 | 3/16 | R/W | 32 Bit Real | (IEEE-754) | No | Yes |
| **ALARM OUTPUT 1** | | | | | | | | |
| Type | 0x150 | 336 | 2/5 | R/W | Bit | Bit X 0=Lin 1=Log | No | Yes |
| Threshold | 0x140 | 320 | 3/16 | R/W | 32 Bit Real | (IEEE-754) | No | Yes |
| **ALARM OUTPUT 2** | | | | | | | | |
| Type | 0x150 | 336 | 2/5 | R/W | Bit | Bit X 0=Low 1=High | No | Yes |
| Threshold | 0x144 | 324 | 3/16 | R/W | 32 Bit Real | (IEEE-754) | No | Yes |
| STATUS Byte | 0x154 | 340 | 3 | R | Bit | See table below | No | Yes |
| Firmware Revision | 0x158 | 344 | 3 | R | Bit | 207=FW Rev 2.07 | Yes | Yes |

## STATUS BYTE

| Bit | Description (Configuration) | Bit | Description (Options) |
|---|---|---|---|
| **0** | Calibration Error | **16** | 2nd 4-20 mA |
| **1** | 0=FR (French) 1=GB (English) | **17** | Automatic calibration |
| **2** | 1=DE (German) 0=French/English | **18** | Unused Bit |
| **3** | Unused Bit | **19** | Unused Bit |
| **4** | 1=Alarms active during manual calibration | **20** | External pressure measurement |
| **5** | 1=Disable analog outputs during manual calibration | **21** | Flow alarm (Alarm 4) |
| **6** | 1=Alarms active during automatic calibration | **22** | Pump state |
| **7** | 1=Disable analog outputs during automatic calibration | **23** | RS232 |
| **8** | 1=Automatic calibration active | **24** | RS485 |
| **9** | External pressure control | **25** | Cleaning |
| **10** | External calibration password | **26** | Pressure sensor |
| **11** | Unused Bit | **27** | Unused Bit |
| **12** | Pump state | **28** | Unused Bit |
| **13** | Unused Bit | **29** | Unused Bit |
| **14** | Unused Bit | **30** | Unused Bit |
| **15** | Unused Bit | **31** | Unused Bit |

# Appendix C

# RS232 Serial Output

# Appendix C RS232 Serial Output

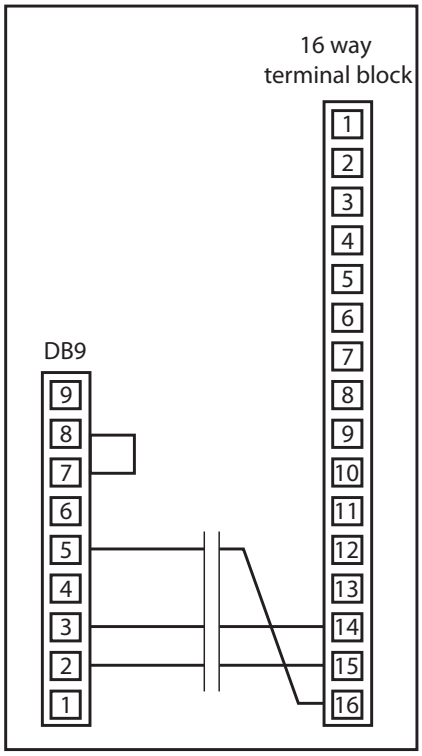
## C.1 Port Configuration

- 
- Speed: 9600 bauds
- No parity
- 8 bits
- 1 stop
- No handshaking

## C.2 Hardware Configuration

The wiring cable should be equipped with 1 DB9 female plug and bare wire connectors and connected as follows:

| DB9 | 16 way terminal block |
|---|---|
| pin 2 | pin 15 Tx |
| pin 3 | pin 14 Rx |
| pin 5 | pin 16 Ground |
| strap 7-8 (on same connector) | |



## C.3 RS232 Command List

| Mnemonic | ASCII Value | |
|---|---|---|
| _OXY↵ | $O_2$ concentration | XX.XX<br>or X.XXE±XX |
| _TEM↵ | Oven temperature | XXX.XX |
| _UMV↵ | MSRS voltage | XXX.XX |
| _AMB↵ | Ambient temperature | XX.XX |
| _ALR↵ | K1, K2, K3 Relay status<br>K1 +K2 +K3 = from 0 to 7<br>(1) (2) (4) | X |
| _CAL↵ | Sets self calibration after 10 minutes bleed | RECEIPT<br>PURGE? |
| _FIN↵ | Sets a 5 minute bleed in case of failure in calibration | RECEIPT<br>DEFAULT |
| _ACQ↵ | Acknowledges the alarms | RECEIPT |
| _ETA↵ | Display of calibration gas value | XX.XX |
| E_ETA_X.XX↵ | Set of calibration gas value | X.XX |
| _STP↵ | Display of oven temperature set point | XXX.XX |
| E_STP_XXX.XX↵ | Set of oven temperature | XXX.XX |
| _AL1↵ | Display of first alarm level | XXX.XX |
| E_AL1↵ | Set of first alarm level | XX.XX |
| _AL2↵ | Display of second alarm level | XXX.XX |
| E_AL2↵ | Set of second alarm level | XX.XX |
| _NET↵ | Starts self cleaning | RECEIPT |
| _YYY↵ | Unknown entry | ERROR |
| _TCA↵ | Measured oven temperature + coef. due to adjustment | XX.XX |
| _BRK↵ | Allows for: Ending the bleed during calibration<br>Ending self cleaning and start cooling down | XX.XX |
| _PAB↵ | Value of atmospheric pressure | XXXX.XX |

_ indication corresponds to the space bar
↵ indication corresponds to the return key

Table 2 RS232 Commands

# Appendix D

# Extended Operating Range (Optional)

## Appendix D Extended Operating Range - (Optional)

This option should be requested at the time of order stating the maximum oxygen percentage required - 0 to 30% or 0 to 50%.

The default range is 0 to 25%.

**NOTE: If an extended range is supplied then this will result in a reduction in resolution and accuracy below 1% $O_2$.**

**WARNING: If an extended range is purchased ensure that the analyzer has been cleaned for oxygen service before use.**

# Appendix E

# Process Pressure Correction (Optional)

# Appendix E Process Pressure Correction - (Optional)

When the process gas pressure is out of the atmospheric pressure range, the process pressure correction is required to guarantee the optimal efficiency of the analyzer.

The input signal is a 4-20 mA analog signal from an external pressure transmitter installed by the user at the outlet side of the process.

The following screen is used to configure the scale range:

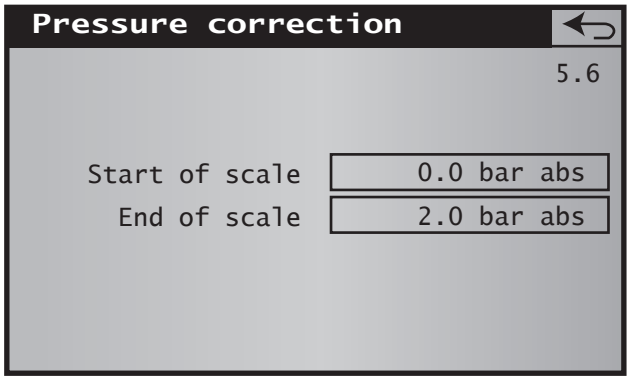


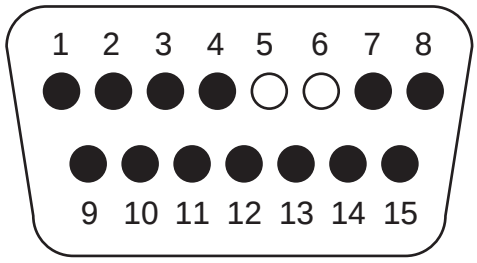

Figure 54 *Pressure Correction Screen*

An input signal of 4 mA corresponds to the low scale set value.

A input signal of 20 mA corresponds to the high scale set value.

## E.1 Process Pressure Correction Input Connections

The 4-20 mA pressure transmitter signals should be connected to the DB15 socket on the rear panel of the analyzer.




| Contact No | Function |
|---|---|
| 5 | (+) 4-20 mA / analog input of process pressure |
| 6 | (+) 4-20 mA / analog input of process pressure |

# Appendix F

# Flow Fault Contact (Optional)

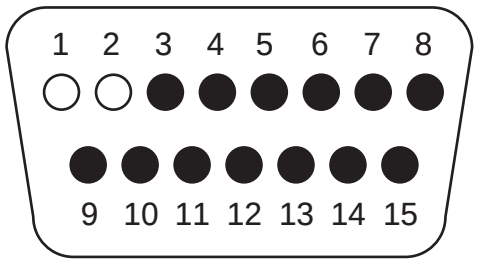
# Appendix F Flow Fault Contact - (Optional)

In normal conditions, the flow is between 0.5 l/h and 3.5 l/h, the contact is closed and potential free.

The relay switching capability is 150 W max (up to 5 A at 250 V AC or 5 A at 30 V DC).

## F.1 Flow Fault Output Connections

Access to the flow fault contact is via the DB15 socket on the rear panel of the analyzer.




| Contact No | Function |
|---|---|
| 1 | Flow fault contact |
| 2 | Flow fault contact |

# Appendix G

# Commutable Scale (Auto-Ranging)

## Appendix G Commutable Scale (Auto-Ranging)

This option allows following the $O_2$ concentration:

- Between 0 and 10 ppm on the first 4-20 mA output
- Between 0 and 100ppm, 0 and 1000ppm, 10 and 10000ppm, or 1 and 25% on the second 4-20 mA output

The alarm contacts 1 and 2 indicate the beginning and the end of the scale used on the second 4-20 mA output.

Settings are indicated below:

| 4-20 mA output | Low Scale | Up Scale | Alarm 1 Contact Position | Alarm 2 Contact Position |
|---|---|---|---|---|
| No 1 | 0 | 10ppm | | |
| No 2 | 0 | 100ppm | Open | Open |
| | 0 | 1000ppm | Closed | Open |
| | 10ppm | 10000ppm | Open | Closed |
| | 1% | 25% | Closed | Closed |

# Appendix H

# Optional moisture sensor

## Appendix H Optional moisture sensor

The XZR400 rack mount can be supplied with an Easidew moisture sensor fitted in the bypass leg to measure the moisture (dew point) of the sample. The sensor is capable of measuring dew point from -100°C to +20°C dew point. If supplied with a moisture sensor, dew point will be displayed underneath the oxygen concentration as shown below.

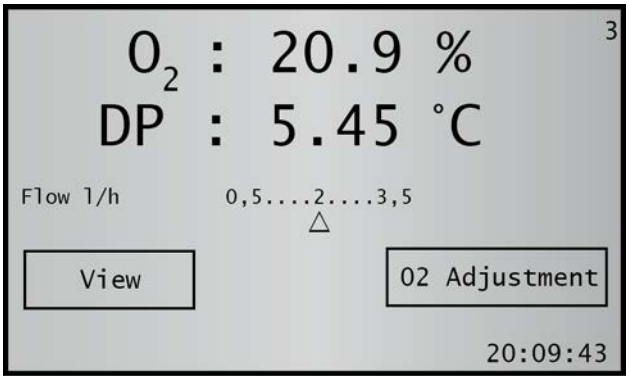



Figure 55 *Main Page*

In the control parameters page, the dew point is displayed to the right of the $O_2$ concentration as shown in figure 56.

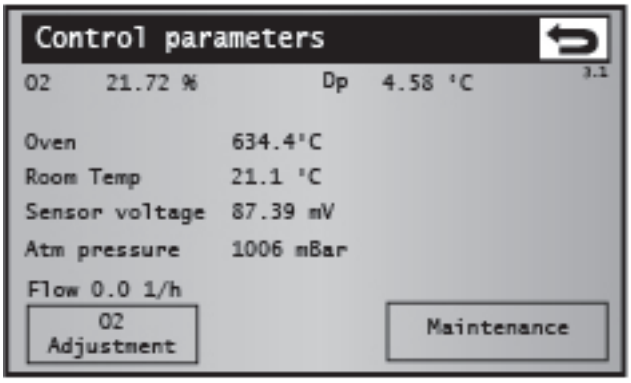



Figure 56 *Control Parameters Page*

In the main menu page, press the button labelled 'DP Sensor' to access the 4 to 20mA configuration.

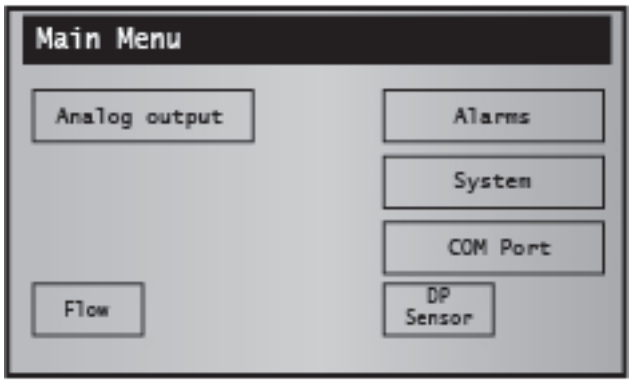



Figure 57 *Main Menu*

Even though the dew-point sensor located inside the analyzer, it is considered an external device by the firmware. In the DP Sensor page, you can configure the intput range from the dew-point sensor by pressing the Start and/or End of scale buttons and adjusting in the normal way. Only adjust these settings if you have already altered the range of the Easidew transmitter.

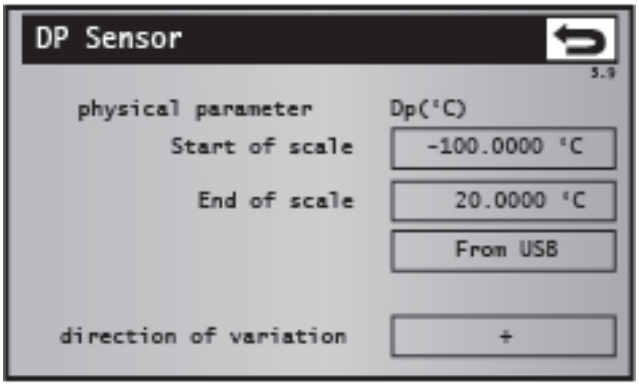



Figure 58 *DP Sensor Page*

NOTE: The analyzer will require a total flow of 60 to 300 Nl/hour (1 to 5 Nl/min) to ensure optimum response from the Easidew sensor.

# Appendix I

# Quality, Recycling & Warranty Information

## Appendix I Quality, Recycling & Warranty Information

Michell Instruments is dedicated to complying to all relevant legislation and directives. Full information can be found on our website at:

**www.michell.com/compliance**

This page contains information on the following directives:

- ATEX Directive
- Calibration Facilities
- Conflict Minerals
- FCC Statement
- Manufacturing Quality
- Modern Slavery Statement
- Pressure Equipment Directive
- REACH
- RoHS2
- WEEE2
- Recycling Policy
- Warranty and Returns

# Appendix J

# Analyzer Return Document & Decontamination Declaration

# Appendix J Analyzer Return Document & Decontamination Declaration

## Decontamination Certificate

**IMPORTANT NOTE: Please complete this form prior to this instrument, or any components, leaving your site and being returned to us, or, where applicable, prior to any work being carried out by a Michell engineer at your site.**

| | | | | |
|---|---|---|---|---|
| Instrument | | | Serial Number | |
| Warranty Repair? | YES | NO | Original PO # | |
| Company Name | | | Contact Name | |
| Address | | | | |
| Telephone # | | | E-mail address | |
| Reason for Return /Description of Fault: | | | | |

| | | |
|---|---|---|
| Has this equipment been exposed (internally or externally) to any of the following? Please circle (YES/NO) as applicable and provide details below | | |
| Biohazards | YES | NO |
| Biological agents | YES | NO |
| Hazardous chemicals | YES | NO |
| Radioactive substances | YES | NO |
| Other hazards | YES | NO |
| Please provide details of any hazardous materials used with this equipment as indicated above (use continuation sheet if necessary) | | |
| Your method of cleaning/decontamination | | |
| Has the equipment been cleaned and decontaminated? | YES | NOT NECESSARY |

Michell Instruments will not accept instruments that have been exposed to toxins, radio-activity or bio-hazardous materials. For most applications involving solvents, acidic, basic, flammable or toxic gases a simple purge with dry gas (dew point <-30°C) over 24 hours should be sufficient to decontaminate the unit prior to return.
**Work will not be carried out on any unit that does not have a completed decontamination declaration.**

### Decontamination Declaration

I declare that the information above is true and complete to the best of my knowledge, and it is safe for Michell personnel to service or repair the returned instrument.

| | | | |
|---|---|---|---|
| Name (Print) | | Position | |
| Signature | | Date | |

MICHELL Instruments

F0121, Issue 2, December 2011

**Notes:**


http://www.michell.com