XTP601
Process Oxygen Analyzer
User's Manual

97313 Issue 5.1
July 2018

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

Use this information when contacting Michell Instruments for service purposes.

Analyzer	
Code	
Serial Number	
Invoice Date	
Location of Instrument	
Tag No	

Analyzer	
Code	
Serial Number	
Invoice Date	
Location of Instrument	
Tag No	

Analyzer	
Code	
Serial Number	
Invoice Date	
Location of Instrument	
Tag No	

XTP601

For Michell Instruments' contact information please go to www.michell.com

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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 24 V DC, 1.5 A (max). Refer to labels on the instrument or calibration certificate.

Pressure Safety

DO NOT permit pressures greater than the safe working pressure to be applied to the instrument. The specified safe working pressure for this instrument is 3 barg (43 psig) max.

Temperature Safety

During operation some parts of the instrument may be at high temperature.

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 to, 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. For Michell Instruments' worldwide offices contact information go to www.michell.com.

Calibration

The recommended calibration interval for the analyzer is 3 months. Depending on the application in which the instrument is used, the calibration interval may be reduced. Please consult the factory for the specific calibration interval.

Safety Conformity

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

Equipment Ratings

This equipment must be supplied with a voltage of 24 V DC, 1.5 A (36 W).
The power is connected via PL9 on the mother board (see Section 4.5).
All input and output connectors are 2-part pcb mounted type.
The detachable, screw terminal half of each connector is designed to accept 24 -12 AWG stranded or solid conductors.

Abbreviations

The following abbreviations are used in this manual:

A	Ampere
AC	alternating current
bara	pressure in bar (absolute)
barg	pressure in bar (gauge)
°C	degrees Celsius
°F	degrees Fahrenheit
DC	direct current
kg	kilogram
kPa	Kilopascal
lb	pound
max	maximum
mA	milliampere
ml/min	milliliters per minute
mm	millimeters
ppm	parts per million
psig	pounds per square inch
scfh	standard cubic feet per hour
V	Volt
"	inches
Ω	ohm

Warnings

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

Where this symbol appears in the following sections it is used to indicate areas where potentially hazardous operations need to be carried out.
THESE TASKS SHOULD BE UNDERTAKEN BY QUALIFIED PERSONNEL ONLY.

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

NOTE: Warnings and important notifications are marked with bold text.

1 INTRODUCTION

This manual will show how to measure oxygen easily using the XTP601 Oxygen Analyzer.

The following sections contain information about:

- Analyzer components
- Operating instructions
- Calibration and maintenance of the Analyzer
- Installation

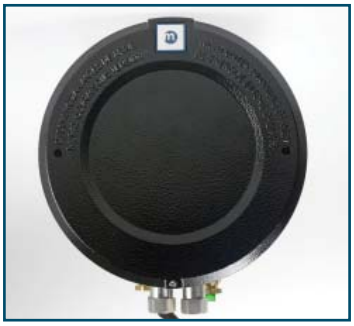
Please read this manual carefully and pay special attention to the safety warnings and notifications.

NOTE: Warnings and important notifications are marked with bold text.

The 3 versions of the XTP601 available are shown below:

The 5 versions of the XTP601 available as described below:

GP1, GP2 or EX1
Analyzer with touch screen
(capacitive buttons)



GP3 or EX3
Oxygen transmitter

Figure 1 *XPT601 Oxygen Analyzer Versions*

The XTP601 Oxygen Analyzer is based on Michell Instruments' advanced proprietary Thermo-Paramagnetic technology. It measures the percentage of oxygen in a wide range of gases, including nitrogen, hydrogen, carbon dioxide methane and biogas. The sensor is housed in a weather-proof (GP version) or explosion-proof (EX version) casing - both IP66 & NEMA 4X rated. It is suitable for a range of applications in safe or hazardous areas.

EX1, EX3 and GP2 models are supplied with flame arrestors for use with flammable gases or in hazardous areas.

NOTE: this manual relates to products with firmware version V1.07.

1.1 Features

- There are 2 versions of the XTP601 available:

  Analyzer with touch screen (capacitive buttons)

  Transmitter (base model)

- The XTP601 is calibrated in a specific background gas to match customer's requirements. This is displayed on the front screen of the analyzer or via the Application Software.
- The XTP601 provides 2 off 4-20 mA analog output signals that are proportional to the oxygen concentration. The primary 4-20 mA output is locked on the calibrated range of the instrument. The secondary output is user-selectable within the calibrated range.
- Modbus RTU over RS485 protocol serial communications are provided as standard.
- Accuracy of 1% FS or 0.02% O_2, whichever is greater. (Zero suppressed ranges ±0.2% O_2).
- Zero and span stability of 0.25% of span per month.
- The Thermo-Paramagnetic sensor used in the XTP601 Oxygen Analyzer has no moving parts. This makes it less sensitive to vibration and movement and highly resistant to drift over a long period of time, compared to other sensing technologies.
- Innovative sensor design which minimizes zero drift and offers increased protection against contamination.
- The robust and weather-proof enclosure (IP66 rated) allows the XTP601 to be installed on-site, at the point of measurement. It is also available with an explosion-proof casing and certified to II 2 GD Ex d IIB+H2 T6 Gb, Ex tb IIIC T85°C Db IP66 T amb -40°C to +55°C. (Dependant on O-Ring selection, see Section 1.3.)
- All of the analyzer functions can be accessed via the touch screen (capacitive) buttons (on display model), or via the Application Software.
- Low cost of ownership due to minimal maintenance. When required, the casing unscrews to allow for easy access to the sensor, enabling maintenance to be carried out quickly and easily.
- The XTP601 is certified to ATEX, IECEX, cCSAus, INMETRO & TC TR Ex for use in hazardous areas.
- 2 x single pole change-over relay alarms for oxygen concentration, supplied as standard. Can be configured as OFF, LOW or HIGH on the analyzer (GP1 or EX1) version or LOW or HIGH on the transmitter (GP3 or EX3) version.

1.2 Applications

The XTP601 has a robust sensor with high sensitivity and stability. It can be factory-calibrated in varying backgrounds to match the customer's process gas. The analyzer has a built-in local user interface with a display. The capacitive buttons work through the glass face, without needing to remove the lid.

Together with the purpose designed sampling system, the XTP601 is able to work under various process and environmental conditions. Examples of applications include:

- Monitoring inert blanketing gases
- Oxygen measurement at inlet of compressors in steel or gas industries for safety
- Biogas, waste, landfill and digester plants
- Inert gas for pharmaceutical industry and painting gas
- Catalyst regeneration

1.3 O-Ring Selection

The XTP601 is available with 3 types of O-rings to offer greater flexibility with material compatibility. The Viton O-ring is fitted as standard. The EKRAZ O-ring is available for solvent resistance. For extremely low temperatures there is a closed cell Silicone O-ring.

To comply with Hazardous Area certification, the material used in the EX1 & EX3 versions is dependent on the lowest ambient temperature of the area the units are to be installed in:

Ambient operating range:

-40°C to +55°C (-40°F to +131°F) (for Silicone version)

-15°C to +55°C (5°F to +131°F) (for Viton version) - Standard

-10°C to +55°C (14°F to +131°F) (for Ekraz version)

NOTE: Silicone O-ring is not suitable for oxygen enriched samples, i.e. 0_2 > 21%.

2 OPERATION

The XTC601 is not certified for use with ambient oxygen levels that are enriched (i.e. over 21% O2)

This analyzer has been manufactured within our quality procedures and is configured according to the purchase order. When it is installed and used as per the manufacturer's guidelines, it will operate within the stated specification.

Before starting operation it is recommended that the user becomes familiar with this manual in which all the equipment controls, indicators, the elements of the display and the overall menu structure are described.

2.1 Preparation

Before applying power and beginning the flow of gas, please ensure that the system has been properly installed following the instructions in Section 4.

Check that the wiring has been completed correctly.

Zero and Span gas cylinders with correct regulation and flow control should be in place before installing and powering up the analyzer. Commissioning should include a check with both gases and, if necessary, a field calibration performed.

All analyzers will be calibrated with an inlet pressure of 1 barg (14 psig) with an atmospheric vent and flow rate of 300 ml/min (0.63 scfh). The calibration gas applied to the analyzer should be at the same pressure and flow rate as the process gas being sampled.

Sample Inlet Pressure:

- 0 to 4 barg (0 to 58 psig)

Sample Flow Rate:

GP1 & GP3 models: 100 to 500 ml/min (0.2 to 1.06 scfh)

EX1, EX3 & GP2 Models: 270 - 330ml/min (0.54 to 0.66 scfh)

2.2 Powering up the Analyzer

After all the preparation work is done and the installation and wiring have been checked, turn on the analyzer and wait for at least 30 minutes (or until Cell T Not Stable message disappears). This will allow the analyzer to reach its operating temperature of +50°C (or +60°C if higher temperature cell is chosen) and protect it from any condensation forming in the sensor.

There is no power switch on the XTP601 Oxygen Analyzer. It is turned on automatically once a 24 V DC power source is applied. After the analyzer is powered up, the display will be illuminated. The analyzer takes up to 5 seconds to initialize, and during this period will display the product type and firmware version number.

Figure 2 *Initializing Screen*

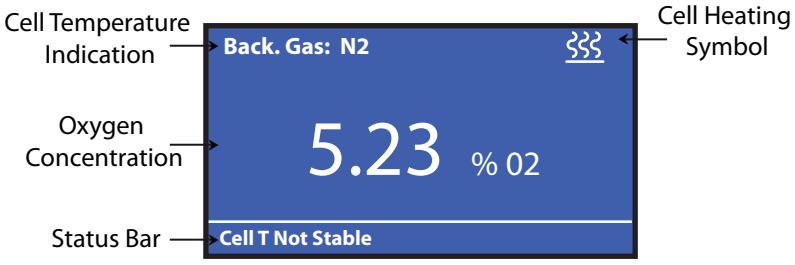


Figure 3 *Main Page*

Once initialized, the analyzer will show the Main Page which displays the O_2 concentration.

During warm-up (less than 25 minutes) a heating symbol will flash in the top right hand corner of the page. This symbol will remain until the temperature has stabilized for a minimum of 5 minutes. The analyzer will be ready for use within 30 minutes from power-up.

2.3 User Interface

2.3.1 Interface Controls

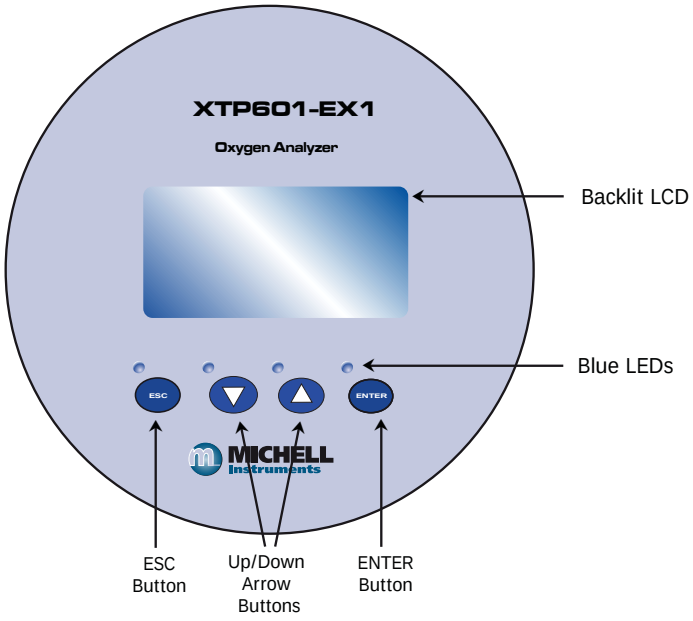


Figure 4 *User Interface*

The diagram above illustrates the user interface, which consists of a backlit Liquid Crystal Display and 4 touch-sensitive pads that facilitate user interaction through the glass of the enclosure.

All versions have Application Software to monitor or adjust parameters. Application software will require a PC or laptop with comm port connection. If using RS232 serial port ensure that an isolated RS232 to RS485 converter is used.

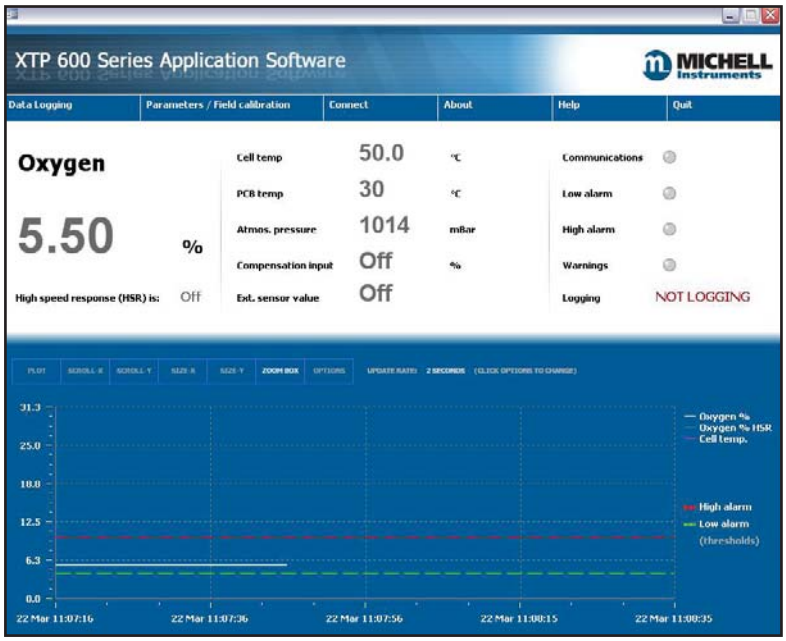


Figure 5 *XTP600 Series Application Software*

2.3.2 'ESC' Button

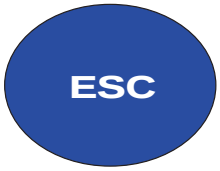


Figure 6 *ESC Button*

The **ESC** button is used to exit the current menu and to return to the previous menu. From the Main Page, pressing **ESC** will access the Info Page.

2.3.3 'Up/Down Arrow' Buttons

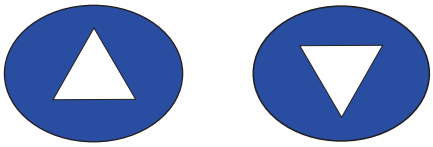


Figure 7 *Up/Down Arrow Buttons*

The **Up** (▲) and **Down** (▼) buttons are used to change pages, scroll through lists and adjust values. In the Reset and Field Calibration Menus, pressing the **Up** (▲) button 3 times will confirm a selection.

2.3.4 'ENTER' Button

Figure 8 *ENTER Button*

The **ENTER** button is used to select or de-select the highlighted item in a menu and to confirm a value. From the Main Page, pressing **ENTER** will access the Passcode Page.

2.4 Menu Structure

The EX1 and GP1 versions of the XTP601 have front pages that do not require a passcode but allow the user to scroll through and view oxygen concentration, recent trend, internal parameters, minimum & maximum oxygen concentration and alarm history.

In order to change any settings on the User Menu pages, the user must enter a passcode. There is also a separate passcode for service engineers to allow factory setting changes.

To access the User Menu press the **ENTER** button from the Main Page to call up a passcode prompt. Use the **Up** (▲) and **Down** (▼) buttons and press **ENTER** after each value.

The User Passcode is: 1919

From the Main Page the user can press the **ESC** button to view the Info Page. This page shows the firmware version, hours used, last calibration date, calibration pressure and the received Modbus code.

The user will be able to set up and access all functions of the transmitter versions via the Application Software supplied. The passcode is the same as the EX1 and GP1 versions (**1919**). The Application Software will be supplied on a CD with the unit.

The passcode is stored for one minute to allow access back into the User Menu, if necessary.

2.4.1 Menu Map

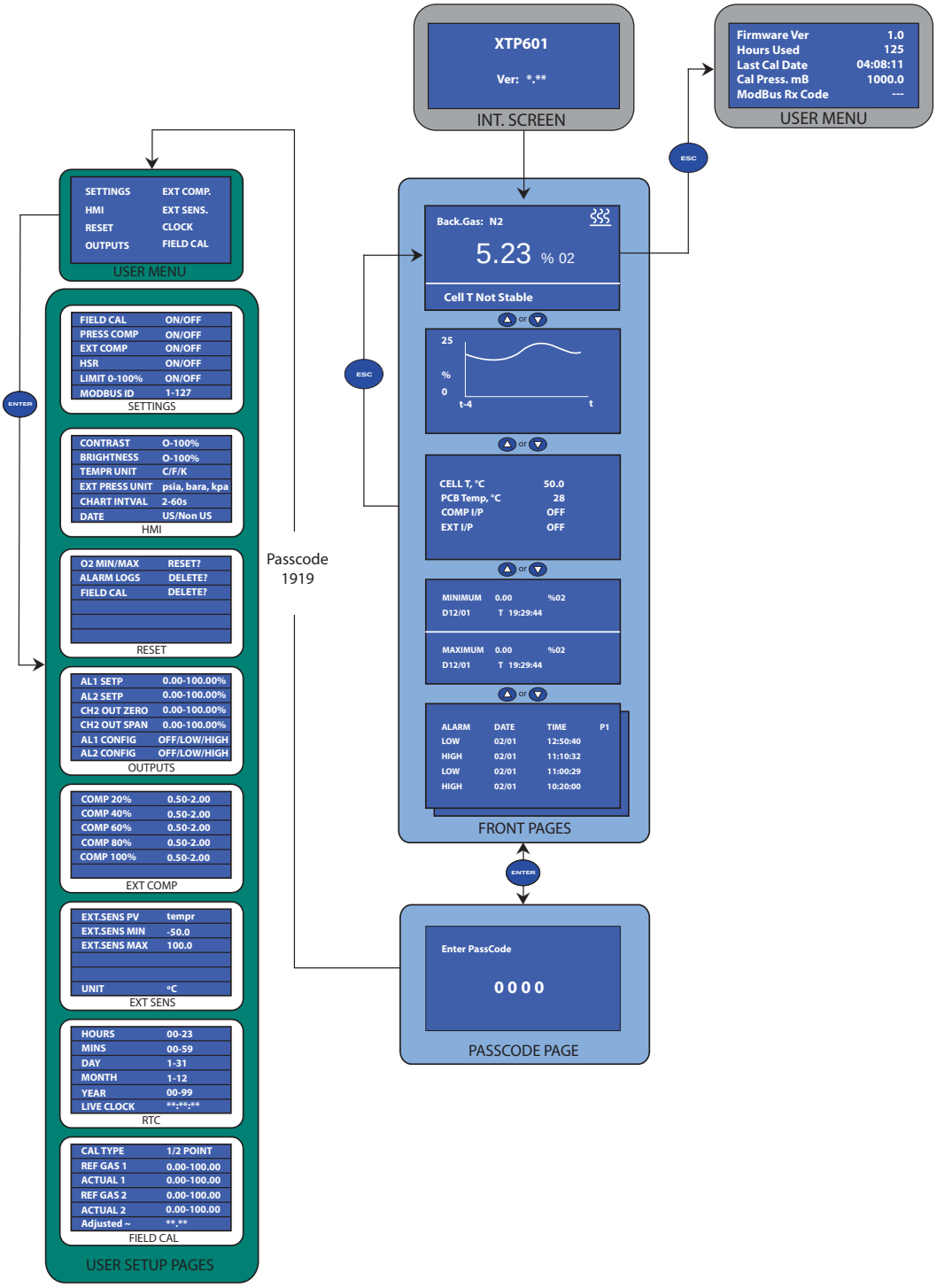


Figure 9 *Menu Map*

2.5 Front Pages (No passcode Required)

The EX1 and GP1 versions of the XTP601 have 5 front pages that the user can display without t he need for a passcode. **NOTE: These are for display of information only and there is no way of adjusting any settings on these pages.**

From the Main Page (O_2 concentration) the rest of the front pages can be accessed using the **Down** (▼) button. To return to the Main Page, either press the **Up** (▲) button the required amount of times or press the **ESC** button.

2.5.1 Main Page

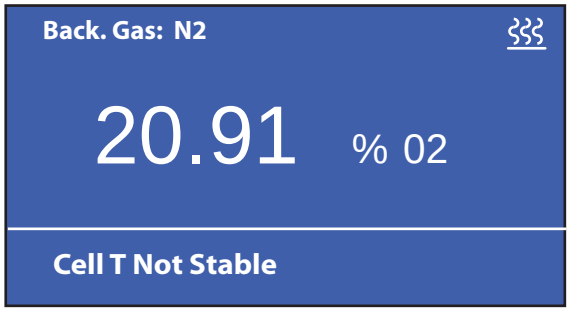


Figure 10 *Main Page*

Parameter	Description
Background Gas	Displays the background gas that the unit was calibrated in
% O2 (if HSR=OFF)	Real oxygen reading in % Display resolution = 0.01 (Display resolution 0.1% when min value is >=20%)
% O2p (if HSR = ON)	HSR oxygen reading (extrapolated quick response value of real oxygen reading) Real oxygen value is displayed in status bar
Flashing "Heating" Symbol	This flashes until cell temperature is stable at set point ±0.5°C for minimum of 5 minutes
Status Bar	Flashes any system warnings and error messages (see below)

Status Message Table	
Message **(Trigger Condition)**	**Light Guide** **(if fitted)**
% O2 out of range (beyond calibration range, e.g. 0-25%)	N/A
AL1 ON	ORANGE1 ON (app s/w only)
AL2 ON	ORANGE2 ON (app s/w only)
Comp i/p signal error (input < 3.6 mA or > 21 mA)	RED FLASH (priority2)
Ext sens signal error (input < 3.6 mA or > 21 mA)	RED FLASH (priority2)
Cell T not stable (not within ±0.5ºC of set point for continuous period of 5 minutes)	RED ON (priority1)
Cell T sensor error (cell temp measures <-50 or >+80ºC)	RED ON (priority1)
Press sensor error (pressure sensor < 850 or >1100 mbar)	RED ON (priority1)
O2 sensor error (Vcomp <1 or >8191)	RED ON (priority1)
PCB temp too high (PCB temp > cell temp set point)	RED ON (priority1)

2.5.2 Chart Page

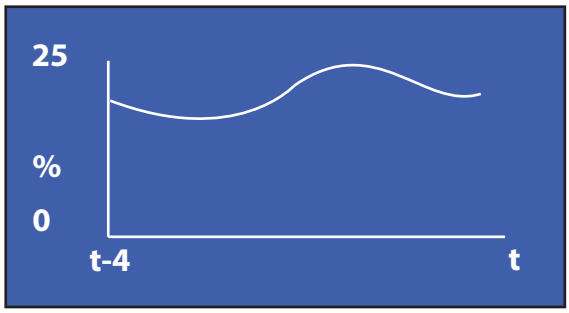


Figure 11 *Chart Page*

NOTE: This data is not available via the Modbus

- This indicative chart is continuously running at the set chart interval (2 to 60 seconds).
- Chart duration in seconds = (chart interval * 60).
- It is auto ranging with an auto range resolution of 1% O_2.
- It is reset if the chart interval is changed, the Display is changed between % **O_2** and % **O_2 HSR** or the instrument power is cycled.
- The chart will record either % O_2 (Non HSR) or % O_2 HSR if this is set to **ON** in the setup pages.
- Chart buffer size is 60 values and therefore the chart duration changes according to interval chosen.
- Chart data is only stored in volatile memory and therefore is not saved. Chart interval is saved and available in a Modbus register.
- Chart data is not available via serial comms as the Application Software is able to perform more sophisticated charting functions.

2.5.3 Secondary Parameters Page

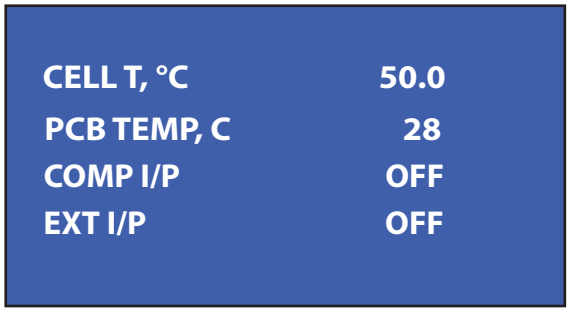


Figure 12 *Secondary Parameters Page*

Parameter	Description
CELL T	Sensor cell temperature display in set unit (°C, °F or Kelvin) Display Resolution = 0.1
PCB TEMP	Temperature display of Microcontroller in selected temperature unit This gives an indication of the internal GUB temperature Display Resolution = 1 unit Accuracy = ±2ºC
COMP I/P	The value of compensation input (mA i/p channel 1) as a % (4 mA=0% and 20 mA=100%) **OFF** displayed instead of value if external compensation is turned off
EXT I/P	Value of the external input in the selected parameter and unit (DEWP, TEMPR, PRESS or NONE) **OFF** displayed instead of value if external compensation parameter is set to **NONE**

2.5.4 O2 Min/Max Page

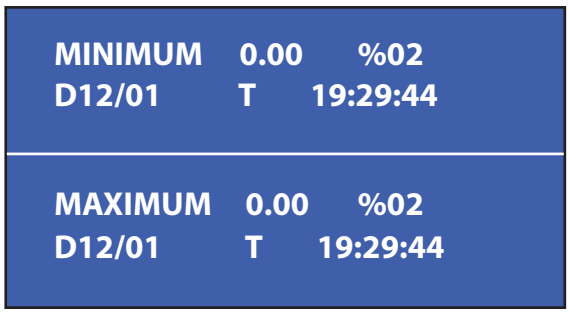


Figure 13 *O2 Min/Max Page*

This indicates the minimum and maximum O_2 values measured, along with date/time of occurrence. The value is reset manually via the Reset Page in the User Menu. **NOTE: This data is not saved in NV memory and is not available via serial communications or in the blind unit.**

2.5.5 Alarms Log Pages

Figure 14 *Alarms Log Page*

A maximum of 40 High/Low alarms, along with date and time of occurrence, are recorded in a ring buffer in NV memory. The most recent alarm will overwrite the oldest alarm when more than 40 alarms are recorded. The data is displayed over a maximum of 10 pages (with 4 alarms on each page). The latest alarm record is displayed in line 1 of page 1. This data is not available via serial communications or in the blind unit. The data is reset manually via the Reset Page in the User Menu. The data is saved and restored when the instrument is restarted. P1 = Page 1.

2.6 Info Page

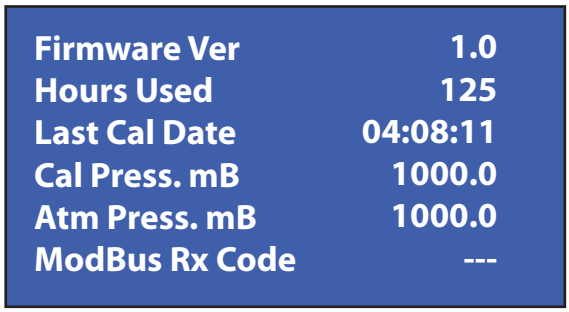


Figure 15 *Info Page*

From the Main Page it is possible to get to the Info Page by pressing the **ESC** button.

The information available is displayed below:

Parameter	Description
Firmware Ver	Indicates the firmware version installed in the instrument
Hours used	Indicates the number of hours that the instrument has been powered up
Last Cal Date	The date of the last field or Michell Calibration Character indicates **F** for Field and **M** for Michell
Cal Press, mB	The atmospheric pressure recorded during the last calibration (used as null reference point for pressure compensation)
Atm Press, mB	Current atmospheric pressure being read within the analyzer
ModBus Rx Code	The received Modbus function code is flashed here as soon as a function code is received – this is useful to check the Modbus communications to ensure that good data is coming through. If no code is received then '---' is displayed

2.7 User Set-Up Variables (Passcode Required)

In order to change any settings on the User Menu pages, the user must enter a passcode. There is also a separate passcode for service engineers to allow factory setting changes.

To access the User Menu press the **ENTER** button from the Main Page to call up a passcode prompt. Use the **Up** (▲) and **Down** (▼) buttons and press **ENTER** after each value.

The User Passcode is: 1919

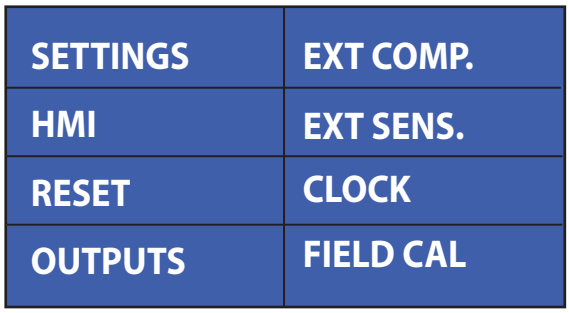


Figure 16 *User Set-Up Variables Page*

Use the **Up** (▲) and **Down** (▼) buttons to select the sub-menu required. Then press the **ENTER** button. This will give access to one of the following pages.

2.7.1 Settings Page

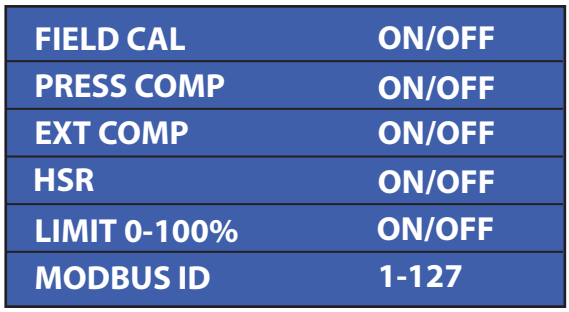


Figure 17 *Settings Page*

The analyzer is microprocessor-based and, as such, has settings and features accessible to the user.

Select the parameter required. The options will be highlighted and can be toggled between by pressing the **ENTER** button. These are all **ON/OFF** except for Modbus ID which, if only one analyzer is connected to your system, should be set to '**1**'.

Setting	Description/Operation	Options
FIELD CAL	Turns use of field calibration on or off It is automatically turned off when Michell or field calibration is being performed	**ON/OFF**
PRESS COMP	Turns pressure compensation on or off It is automatically turned off when Michell or field calibration is being performed	**ON/OFF**
EXT COMP	Turn externals sensor compensation on or off It is automatically turned off when Michell or field calibration is being performed	**ON/OFF**
HSR	Turns high speed response on or off It is automatically turned off when Michell or field calibration is being performed When HSR is ON then these values are derived from the % O_2 HSR value: • mA outputs (both channels) • alarm trigger points • chart values • min/max The Main Page displayed value is also HSR value (designated **% O_2p**) The NON HSR value will also appear in the status bar	**ON/OFF**
LIMIT 0-100%	Limits the % O_2 and % O_2p to 0.00 and 100.00% so that any drift below 0.00 and above 100.00 (for suppressed zero) is not visible mA outputs also limited accordingly	**ON/OFF**
Modbus ID	Unit's network address for Modbus communications	**1-127**

2.7.2 Human Machine Interface (HMI) Page

CONTRAST	O-100%
BRIGHTNESS	O-100%
TEMPR UNIT	C/F/K
EXT PRESS UNIT	psia, bara, kpa
CHART INTVAL	2-60s
DATE	DD/MM/YY

Figure 18 *HMI Page*

It is possible to change parameters within the HMI, as shown below:

Setting	Description/Operation	Options
CONTRAST	LCD contrast setting	**0-100%** in 10% steps
BRIGHTNESS	LCD backlit setting	**0-100%** in 10% steps
TEMPR UNIT	Global temperature unit selection	**°C, °F, K**
EXT PRESS UNIT	Pressure unit selection (for external sensor only)	**psia, bara, kPa**
CHART INTVAL	Chart interval	**2-60 s** in 2 sec steps
DATE	Date on the LCD can be either format	**DD/MM/YY or MM/DD/YY**

Scroll down past the DATE field to access the clock page.

2.7.3 Clock Page

HOURS	00-23
MINS	00-59
DAY	1-31
MONTH	1-12
YEAR	00-99
LIVE CLOCK	**:**:**

Figure 19 *Clock Page*

The real time clock and calendar is used to store date/time information for log data, min/max data and date of calibration. On entering this page all fields are initialized with the current values. These can be also be set through the application software.

Setting	Description/Operation	Options
HOURS	Hours	**00-23**
MINS	Minutes	**00-59**
DAY	Day	**1-31**
MONTH	Month	**1-12**
YEAR	Year	**00-99**
LIVE CLOCK	Current Time	**:**:**

2.7.4 Reset Page

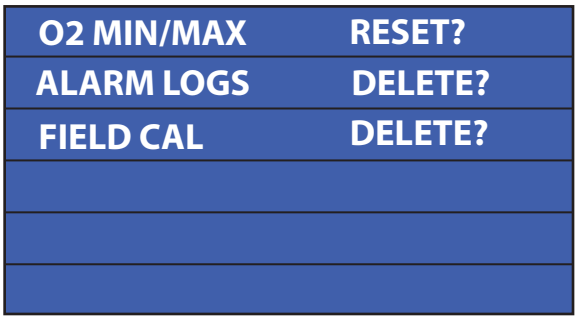


Figure 20 *Reset Page*

02 Min/Max and Alarm Logs can be cleared from this menu. See Sections 2.5.4 and 2.5.5 respectively for more information.

This menu can also be used to restore the original calibration settings. For more information see Section 3.3.

To reset/delete highlight the item using the **Down** (▼) button. Press **ENTER** to select the item, then press the **Up** (▲) button 3 times to confirm the change. Press **ENTER** to deselect the item.

2.7.5 Outputs Page

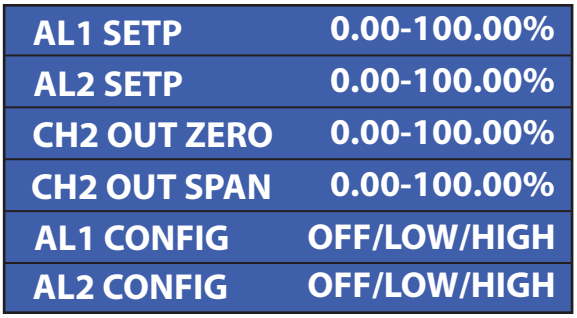


Figure 21 *Outputs Page*

The analyzer has two 4-20 mA outputs and 2 concentration alarm relays. The primary 4-20 mA is fixed to the calibrated range of the unit, the second is freely selectable within this range. The alarm relays are Single Pole Change-Over (SPCO) and are also freely assignable within the calibrated range. The alarm relays are rated to 250 V, 5 A maximum.

Setting	Description/Operation	Options
AL1 SETP	% O_2 set point for lo alarm relay	0 to 100% O_2
AL2 SETP	% O_2 set point for hi alarm relay	0 to 100% O_2
CH2 OUT ZERO	% O_2 point for 4 mA	0 to 100% O_2
CH2 OUT SPAN	% O_2 point for 20 mA	0 to 100% O_2
AL1 CONFIG	Turn on/off and set alarm 1	OFF, LOW OR HIGH
AL2 CONFIG	Turn on/off and set alarm 2	OFF, LOW OR HIGH

2.7.6 External Compensation Page

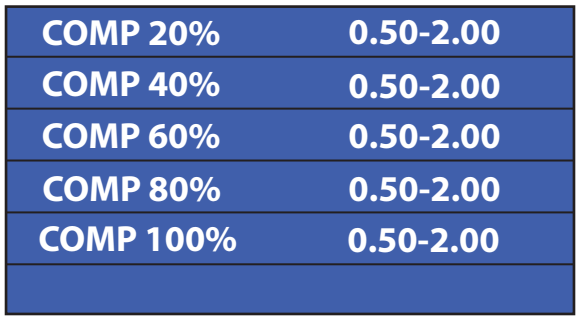


Figure 22 *External Compensation Page*

A 4-20 mA sensor may be used to compensate the % O_2 reading for the effects of process variables such as line pressure, flow, etc. The table of compensation factors may be edited for 5 points along the compensation sensor range. The values would be determined by applying the process variable at each point and noting the effect on the % O_2.

For example: a compensation is needed for line pressure. A 4-20 mA line pressure sensor would be ranged over the compensation range. While the instrument reads a fixed % O_2 value, a table is created (see example below) while varying the pressure at 20% of range intervals:

Pressure	% of Pressure span	O_2 reading	Effect = (affected value / non affected value)	Compensation factor = 1 / effect
0	0%	20.91	20.91/20.91=1.00	1.00
1	20%	21.65	21.65/20.91=1.04	0.96
2	40%	23.56	1.13	0.88
3	60%	25.99	1.24	0.81
4	80%	29.66	1.42	0.70
5	100%	38.85	1.86	0.54

The compensation factor values are then entered into the External Compensation table (excluding the 0% point as this will always be assumed to be 1 = no effect).

Below 0% (< 4 mA), the compensation factor is fixed to 1. Above 100% the compensation factor is extrapolated beyond the last factor.

2.7.7 External Sensor Page

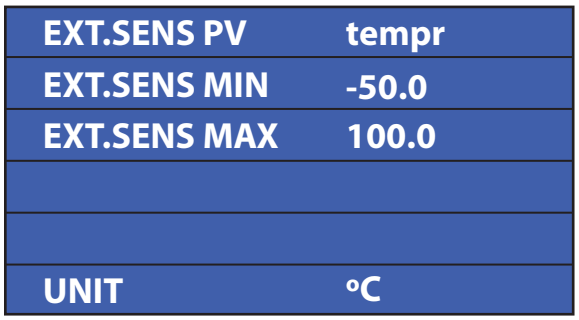


Figure 23 *External Sensor Page*

This page sets up the type and range of the 4-20 mA external sensor signal that may be connected to the XTP601 for viewing in the Main Page. The range is adjustable between the MIN and MAX values but is not adjustable for **Other** setting (fixed at 0% and 100%).

Setting	Description/Operation	Options
EXT.SENS PV	The process variable that is being measured by the external sensor Select **None** to turn the feature off **Other** represents a user-defined variable	**None, Dewpoint, tempr, Pressure, Other**
EXT.SENS MIN	Depends on parameter and unit settings: Dew point: -100°C, -148°F, 173.0 K Temperature: -50°C, -58°F, 223.0 K Pressure: 0.0 psia, 0.0 bara, 0.0 kpa Other: 0% (non adjustable)	minimum to EXT.SENS MAX
EX.SENS MAX	Depends on parameter and unit settings: Dew point: 20°C, 68°F, 293.0 K Temperature: 100°C, 212°F, 373.0 K Pressure: 44.1 psia, 3.0 bara, 304.0 kpa Other: 100% (non adjustable)	EXT.SENS MIN to maximum
UNIT	These are related to the type of sensor selected If **Other** is selected, then the unit will be a % of the overall range	**°C, °F, K, psia, kPa, bara, %**

2.7.8 Field Cal Page

CAL TYPE	1/2 POINT
REF GAS 1	0.00-100.00
ACTUAL 1	0.00-100.00
REF GAS 2	0.00-100.00
ACTUAL 2	0.00-100.00
Adjusted ~	**.**

Figure 24 *Field Cal Page*

Setting	Description/Operation
CAL TYPE	1 POINT or 2 POINT
REF GAS 1	Cal reference gas for 1 point cal, lower cal reference gas for 2 point cal
ACTUAL 1	Actual measured O_2 for REF GAS 1 See Section 3.1
REF GAS 2	Upper cal reference gas for 2 point cal Disabled if 1 point cal selected
ACTUAL 2	Actual measured O_2 for REF GAS 2 See Section 3.2 Disabled if 1 point cal selected
ADJUSTED ~	O_2 reading before and after change ~ symbol will be visible until reading is stable

See Section 3 for field calibration procedure.

2.7.9 Light Guide Option

The light guide is an optional accessory fitted, ideally, to the left hand cable entry and has a red and green LED to display the status.

- Green On - indicates instrument power is on.

- Red LED flashing - indicates when external compensation input or external sensor is out of range (if either is selected to **ON**). Out of range is <3.6 mA or >21 mA (see Status Message Table in Section 2.5.1).

- Red LED On – indicates an internal sensor error or instrument cell temperature not yet stabilized (see Status Message Table in Section 2.5.1) – for LED indication this takes priority over external errors.

These have been designed to follow the NAMUR NE44 standard.

3 CALIBRATION

Factory Calibration:

The unit is factory calibrated at 5 points to maximize the accuracy over the desired range. The calibration generally includes Zero & Span points as well as 3 intermediate points. In the case of suppressed zero ranges then the lowest concentration will replace the Zero Point.

NOTE: Analyzers are calibrated in background gas suitable for the specific application. Customer's calibration gases must match the process gas. Please refer to Test Result Sheet or a Michell Instruments' representative

Field Calibration:

Like all process analyzers, the XTP601 will require periodic calibration. The frequency entirely depends on the location, application and accuracy requirements of the user. The typical calibration period is expected to be between 1 and 3 months with a Zero gas and a Span calibration on a monthly basis. The user should establish a calibration frequency to ensure that the reading is within the specifications required for the process.

NOTE: It is possible to switch off the Field Calibration and revert to the Factory Calibration. This can be useful for diagnostic purposes if the reading is not what is expected. The unit is delivered with a factory calibration and, as such, would not have any field calibration data. As soon as the first field calibration is performed, the field calibration setting is automatically switched on.

Preparation:

Go to Settings Page (see Section 2.7.1) and make a note of ON/OFF options for all settings. Re-set these options after calibration.

Zero and Span gas cylinders with correct regulation and flow control should be in place before installing and powering up the analyzer. Commissioning should include a check with both gases and, if necessary, a field calibration performed.

All analyzers will be calibrated with an inlet pressure of 1 barg (14 psig) with an atmospheric vent and flow rate of 300 ml/min (0.63 scfh). The calibration gas applied to the analyzer should be at the same pressure and flow rate as the process gas being sampled.

Sample Inlet Pressure:

- 0 to 4 barg (0 to 58 psig)

Sample Flow Rate:

GP1 & GP3 models: 100 to 500 ml/min (0.2 to 1.06 scfh)

EX1, EX3 & GP2 Models: 270 to 330ml/min (0.54 to 0.66 scfh)

There are 2 types of field calibration available.

3.1 1 Point Calibration

This is a single point offset overlaid on top of the factory calibration. It is designed to correct minor drift and minor changes during transit. This calibration makes the unit very accurate at the calibration point and improves accuracy throughout the range.

The calibration gas should be of a value that is within the main area of interest, i.e. if main points of interest for a 0-25% range instrument are around the 6% area then apply a calibration gas as close as possible, in the example below we used 6.5% O2.

1. Apply the calibration gas and purge the unit for at least 5 minutes. View the chart until a flat line shows for 1-2 minutes.

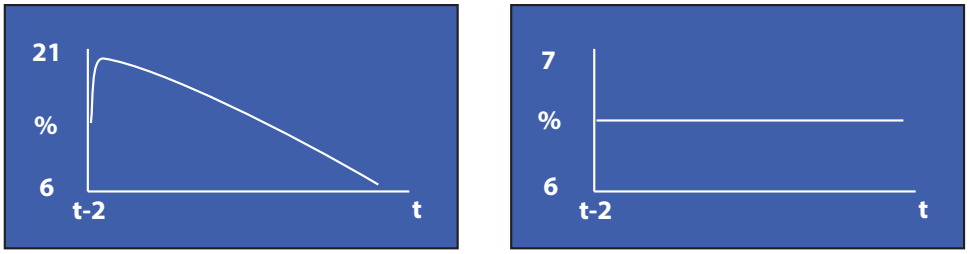


Figure 25 *1 Point Calibration Page*

2. Press **ENTER** to open the Passcode Page - 1919 Passcode. Navigate to the Field Cal page using the **Up** (▲) button. Press **ENTER** to highlight CAL TYPE and set to 1 POINT. Press **ENTER** to de-select.

3. Press **ENTER** to highlight REF GAS 1 and use the **Up** (▲) and **Down** (▼) buttons to match the value of the concentration of the calibration gas. **NOTE: This value only needs to be set when using a new gas cylinder.** Press **ENTER** to de-select.

4. Ensure the Adjusted value at the bottom of the page has stabilized **NOTE: There will be a ~ symbol next to 'Adjusted' while the reading is stabilizing. When the ~ symbol disappears the reading will be stable and the next change can be made.**

5. Press **ENTER** to highlight ACTUAL 1 value and press the **Up** (▲) button 3 times. Ensure that the Adjusted value equals the REF Gas 1 value (±0.01%). Press **ENTER** to de-select. Press **ESC** to return to the Main Menu.

6. The Adjusted reading will now be the same as that displayed on the Main Page and be equal to the calibration gas.

7. The calibration process is complete. Return to sampling the process gas.

NOTE: On entering the field calibration page (whether or not a change has been made), the Pressure Compensation is switched off. After calibration go to the Settings Page (see Section 2.7.1) and re-set any feature that may have been turned off during the calibration process.

3.2 2 Point Calibration

This is a 2 point adjustment that is overlaid on top of the factory calibration. It is designed to correct minor drift and minor changes during transit. This calibration makes the unit more accurate throughout the range than the single point calibration.

1. Apply the lower calibration gas and purge the unit for at least 5 minutes. View the chart until a flat line shows for 1-2 minutes.

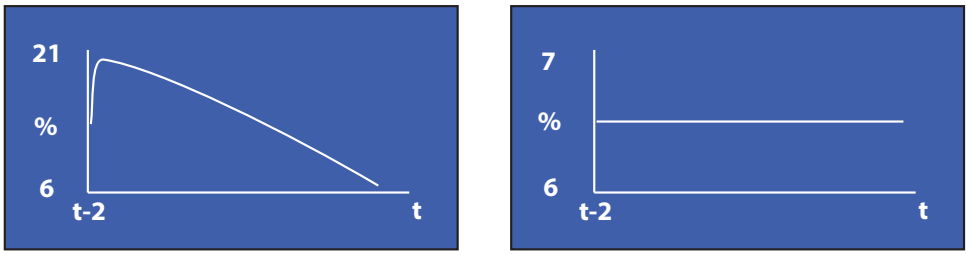


Figure 26 *2 Point Calibration Page*

2. Press **ENTER** to highlight CAL TYPE and set to 2 POINTS. Press **ENTER** to de-select.

3. Press **ENTER** to highlight REF GAS 1 and use the **Up** (▲) and **Down** (▼) buttons to match the value of the concentration of the lower calibration gas. **NOTE: This value only needs to be set when using a new gas cylinder.** Press **ENTER** to de-select.

4. Ensure the Adjusted value at the bottom of the page has stabilized **NOTE: There will be a ~ symbol next to 'Adjusted' while the reading is stabilizing. When the ~ symbol disappears the reading will be stable and the next change can be made.**

5. Press **ENTER** to highlight ACTUAL 1 value and press the **Up** (▲) button 3 times. Ensure that the Adjusted value equals the REF Gas 1 value (±0.01%). Press **ENTER** to de-select.

6. Apply the upper calibration gas and purge the unit for at least 5 minutes. View the chart until a flat line shows for 1-2 minutes (see above).

7. Press **ENTER** to highlight REF GAS 2 and use the **Up** (▲) and **Down** (▼) buttons to match the value of the concentration of the upper calibration gas. **NOTE: This value only needs to be set when using a new gas cylinder.** Press **ENTER** to de-select.

8. Ensure that the Adjusted value at the bottom of the page has stabilized.

9. Press **ENTER** to highlight ACTUAL 2 value and press the **Up** (▲) button 3 times. Ensure that the Adjusted value now equals REF Gas 2 value (±0.01%). Press **ENTER** to de-select. Press **ESC** to return to the Main Menu.

10. The Adjusted reading will now be the same as that displayed on the Main Page and be equal to the upper calibration gas.

11. The calibration process is complete. Return to sampling the process gas.

NOTE: The analyzers leave the factory with the field calibration function turned off. When first calibrating the analyzer go to the settings page and turn Field Calibration on. This can be done either just before or just after the field calibration procedure.

3.3 Field Calibration Reset

The Field Calibration can simply be turned ON or OFF in the settings page. But if the user would like to start again, the Field Cal (including saved data) can be deleted in this menu.

This feature is accessed by selecting the Reset Page (see below).

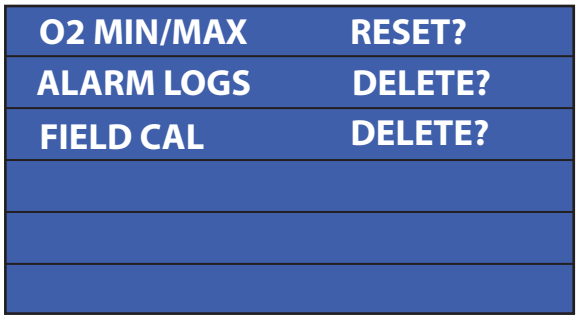


Figure 27 *Field Calibration Reset Page*

Select Field Calibration and highlight **DELETE?**, then press the **Up** (▲) button 3 times and then press **ENTER** to accept the change.

4 INSTALLATION

Before installing the analyzer, read through this manual carefully and take note of all warnings.

Do not open the casing while powered-up in a hazardous area without a 'hot works' permit.

Special care must be taken when the analyzer is energized.

The XTP601-EX versions must only be installed by suitably qualified personnel and in accordance with the instructions provided and the terms of the applicable product certificates.

Maintenance and servicing of the product must only be carried out by suitably trained personnel or returned to an approved Michell Instruments' Service Center.

Before the cover is refitted, the flamepath/threaded joint between the cover and body must be thoroughly wiped clean of dirt, grit or other foreign substances and then a thin coating of an approved form of non-setting grease applied to joint/threads. Ensure gasket is free from damage.

Threaded covers must be screwed on to a minimum of 7 full threads and then locked in position with the hex key provided.

The terms of the Hazardous Area Certification do not permit oxygen measurement in ambient areas with enriched oxygen.

4.1 Unpacking

If sold separately (not part of a sampling system), the XTP601 will be supplied in a custom box which should be retained for future use (such as service return). The box contains a small carton containing 2 lid keys and 1 hex key (for the grub screw). Any cable glands supplied will also be in the smaller carton. The manual will be loose in the main box.

Contents:

- XTP601 Process Oxygen Analyzer
- XTP601 97313 user's manual
- Test result sheet
- Carton (containing: 2 x lid keys, 1 x hex key and 1 x main pcb fuse.)
- Cable glands (if ordered)
- Application software CD
- 97327 - Product quick-start sheet (for GP versions only)
- 97297 - Hazardous Area requirement sheet (for EX versions only)

4.2 System Components

The XTP601 Oxygen Analyzer benefits from a modular construction, with the major parts of the analyzer shown below:

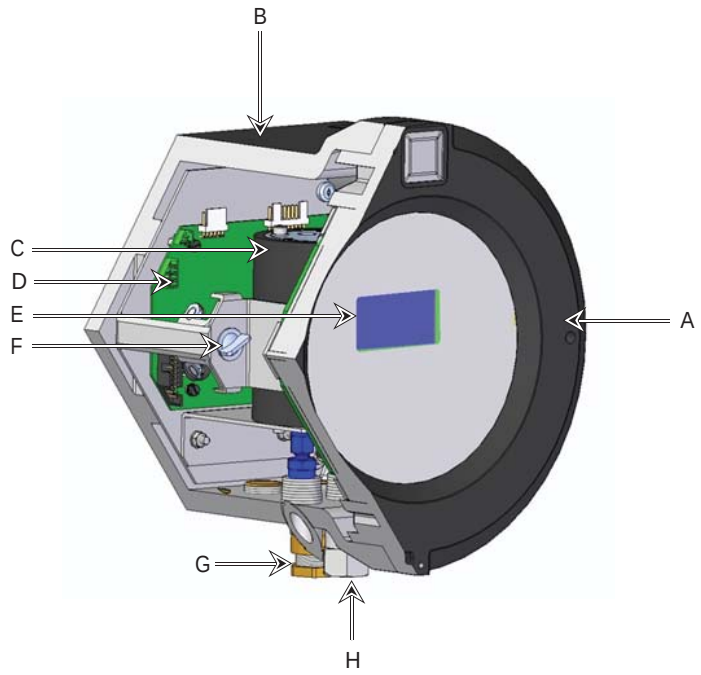


Figure 28 *XTP601 Cutaway Showing Major Components*

A	Lid with display and touch screen
B	Instrument case
C	Measuring cell
D	Motherboard
E	Display PCB
F	Quick release mechanism for display PCB
G	Cable/Conduit entries (3 available)
H	Gas Inlet (left hand side) / Outlet (right hand side)

4.3 Set-Up

- The XTP601 is designed to be panel or wall mounted. There are 2 bolt holes and 2 lugs (1 per corner) see Figure 11. Dimensional drawings can be found in Appendix B. Mount the analyzer before attempting to remove the lid.

WARNING: This unit is 24 V DC powered only! Do not attempt to loop-power this instrument via the 4-20 mA output as this will irreversibly damage the main pcb.

- The EXd thread is greased and therefore it may be advisable to wear latex gloves.
- Ensure that the grub screw is loose, using the hex key (supplied), to prevent scoring on the casing.
- Connect the earthing strap to the earth point on the right hand side ofthe case.
- Remove the lid, using the lid keys (supplied). The lid will require a firm grip to loosen.

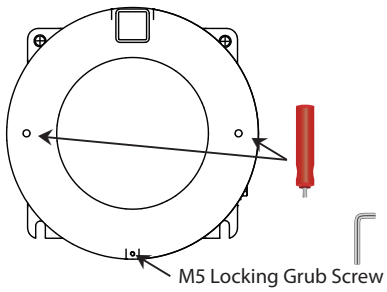


Figure 29 *XTP601 Lid Removal*

- If fitted, remove the display / status pcb via the two ¼ turn quick-connect fittings.
- Disconnect the ribbon / interconnecting cable from the loose pcb.

WARNING: Prior to connecting power, ensure the unit is correctly earthed via the earth point on the right hand side of the case.

- Connect to the power and outputs (see Section 4.5).
- After making all necessary connections, reconnect the pcb via the ribbon/ interconnecting cable & quick-connect fittings and replace the lid, ensuring at least 7 full turns on the thread to complete the gas path.
- Use the hex key (supplied) to tighten the grub screw. **NOTE: This is necessary in order to adhere to the hazardous area certification requirements.**
- For operating instructions refer to Section 2.

4.4 Mechanical Installation

There are 3 cable entries on the bottom surface, towards the rear, that can be utilized by the customer in a variety of manners. The following standard options are available: Cable Gland, Conduit Entry, Blanking Plug or Light Guide.

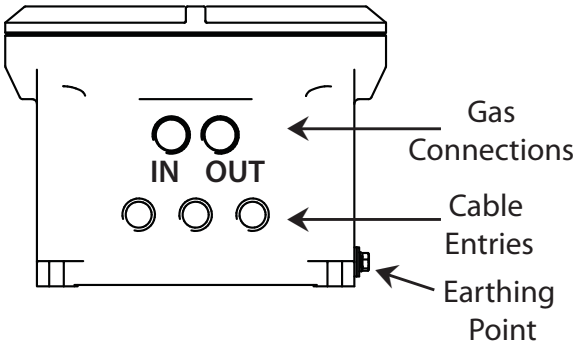


Figure 30 *XTP601 Cable Entries*

4.4.1 Gas Connection

The gas connections are on the bottom surface towards the front of the unit. The gas inlet is the left hand connection when viewing the unit from the front. GP1 and GP3 models have 1/4" NPT female and EX1, EX3 & GP2 models have 1/8" NPT female gas connections.

For applications where the oxygen concentration is 90% or above, any PTFE tape used must be unsintered. This is to prevent an explosion due to conventional PTFE tape acting as a potential fuel source.

Unsintered PFTE tape is available as an accessory from Michell Instruments (PTFE-TAPE-02).

4.4.2 Sample Gas Requirements

Samples must have a dew point at least 10°C less than the cell temperature (so as not to condense), be free from oil-mist and with particle size < 3µm. **NOTE: There is NO filtration inside the analyzer.**

Sample Inlet Pressure:

- 0 to 4 barg (0 to 58 psig)

Sample Flow Rate:

GP1 & GP3 models: 100 to 500 ml/min (0.2 to 1.06 scfh)

EX1, EX3 & GP2 Models: 270 to 330ml/min (0.54 to 0.66 scfh)

Ideally a flowmeter and needle valve would be placed in front of the analyzer and the vent would be open to the atmosphere.

4.4.3 Calibration Gases

Cylinders of the appropriate Zero and Span gases should be available for installation and commissioning. Dependent on the specific duty of the analyzer, these gases may have a lead time of several weeks. See Section 3 for more information.

If you are having difficulty in finding a local gas supplier, please contact your local Michell representative for assistance.

4.5 Electrical Installation

4.5.1 Power Supply and Input/Output Signal

The XTP601 requires 24 V DC power input at a maximum start-up current of 1.5 A.

All versions will use a braid screened multi-core cable. Ideally, one cable for signals (PL4, PL5) and another cable for power (PL9) / relay contacts (PL1). Braid of cables must be well terminated at the cable glands. Wire sizes should be between 28 to 16 AWG.

The terminal blocks for the power supply, input signal and output signal are located underneath the lower PCB. **NOTE: The terminal blocks are color co-ordinated to match the connectors - make sure this color coding is adhered to.**

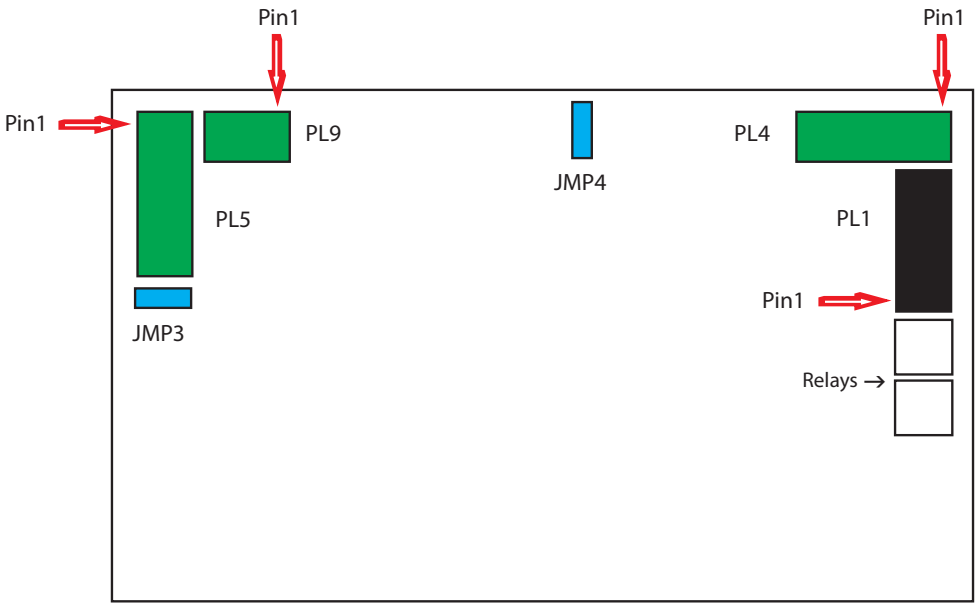


Figure 31 *Terminal Block Locations*

4.5.2 Power Supply (PL9 - Green)

PIN 3	PIN 2	PIN 1
0 V	N/C	24 V ±4 V

4.5.3 Signal Output

There are two 4-20mA linear signal output channels. Both are for oxygen concentration. One is fixed on the calibrated range of the unit and the second can be configured in the menu. **NOTE: When the instrument is warming up (cell temperature not stabilized) these outputs are factory set to 3.2 mA to indicate that the instrument is not ready.**

- The maximum mA output is approximately 20.5mA
- The minimum mA output is approximately 3.8mA
- The user can select the falut conditon to drive the mA output Low (3.2mA) or Hi (21.4mA).

4.5.4 Serial Output

The analyzer has Modbus RTU communications over RS485 protocol; please see Application Software CD for more details.

- Type: Modbus RTU over RS485
- RS485: 2 wire (plus ground), half duplex
- Baud Rate: 9600
- Parity: None
- Data bits: 8
- Stop bits: 1

4.5.5 Analog (4-20 mA) Outputs and Communications (PL5 - Green)

Warning: Do not attempt to loop-power this instrument via the 4-20 mA output as this will irreversibly damage the main pcb.

PIN 7	PIN 6	PIN 5	PIN 4	PIN 3	PIN 2	PIN 1
RS485 GND	RS485 B	RS485 A	Ch2 O/P -	Ch2 O/P +	Ch1 O/P -	Ch1 O/P +

NOTE 1: Channel 1 is fixed range output over instrument range and Channel 2 is adjustable between 0-100%.

NOTE 2: For long cable lengths, a termination resistor of 120Ω is provided to aid in impedance matching of the communications cable. This is selectable via JMP3. A terminating resistor is simply a resistor placed at the extreme end or ends of a cable on an RS485 network to reduce effects of impedance mismatch. Impedance mismatch can cause reflections of data as it passes down the cable and the reflections could be large enough to cause data errors.

NOTE 3: The maximum loop load resistance for mA outputs is 550Ω

NOTE 4: the mA outputs are powered with a 24V excitation voltage.

4.5.6 Alarm Relay Contacts (PL1- Black)

AL2			AL1		
PIN 6	**PIN 5**	**PIN 4**	**PIN 3**	**PIN 2**	**PIN 1**
Alarm 2 C	Alarm 2 NO	Alarm 2 NC	Alarm 1 C	Alarm 1 NO	Alarm 1 NC

- Type: SPCO (NO, NC and C)
- Contact Rating, Max: 2 A, 250 V AC
- Hysteresis is 0.03% O_2
- AL1 and AL2 can be configured as OFF, LOW or HIGH
- A low alarm switches on when % O_2 is below the set point and switches off when % O_2 is above the set point + Hysteresis
- A high alarm switches on when % O_2 is above the set point and switches off when % O_2 is below the set point - Hysteresis
- When the instrument is warming up (cell temperature not stabilized) both relays are OFF

4.5.7 Analog (4-20 mA) Inputs and Sensor Excitation Voltage (PL4 - Green)

PIN 6	PIN 5	PIN 4	PIN 3	PIN 2	PIN 1
Ch2 I/P -	Ch2 I/P +	Ch2 Exc.V	Ch1 I/P -	Ch1 I/P +	Ch1 Exc.V

The XTP601 features 2 input channels for 4-20 mA signal from external instruments such as pressure transmitters or other devices to compensate for pressure or background gas influence.

The input configured as **EXT SENS** (External Sensor) can be viewed on the Secondary Parameters Page under the heading **EXT I/P** (External Input).

NOTE 1: Channel 1 is External Compensation input and Channel 2 is External Sensor input.

NOTE 2: Excitation voltage = Same as power supply ±1 V if JMP4 connected across top 2 pins and 15 ±0.5 V (max 100 mA per channel) if JMP4 connected across bottom 2 pins.

4.5.8 Light Guide

The optional light guide can be fitted to the left hand cable entry. If this is required for the Hazardous Area version of the analyzer this must be specified at time of purchase order.

If fitted in a Hazardous Area (EX) version of the XTP601 the light guide not be dismantled by the user. Dismantling the Light Guide will invalidate the the certification.

NOTE: Only 1 light guide can be fitted to each analyzer.

Appendix A

Technical Specifications

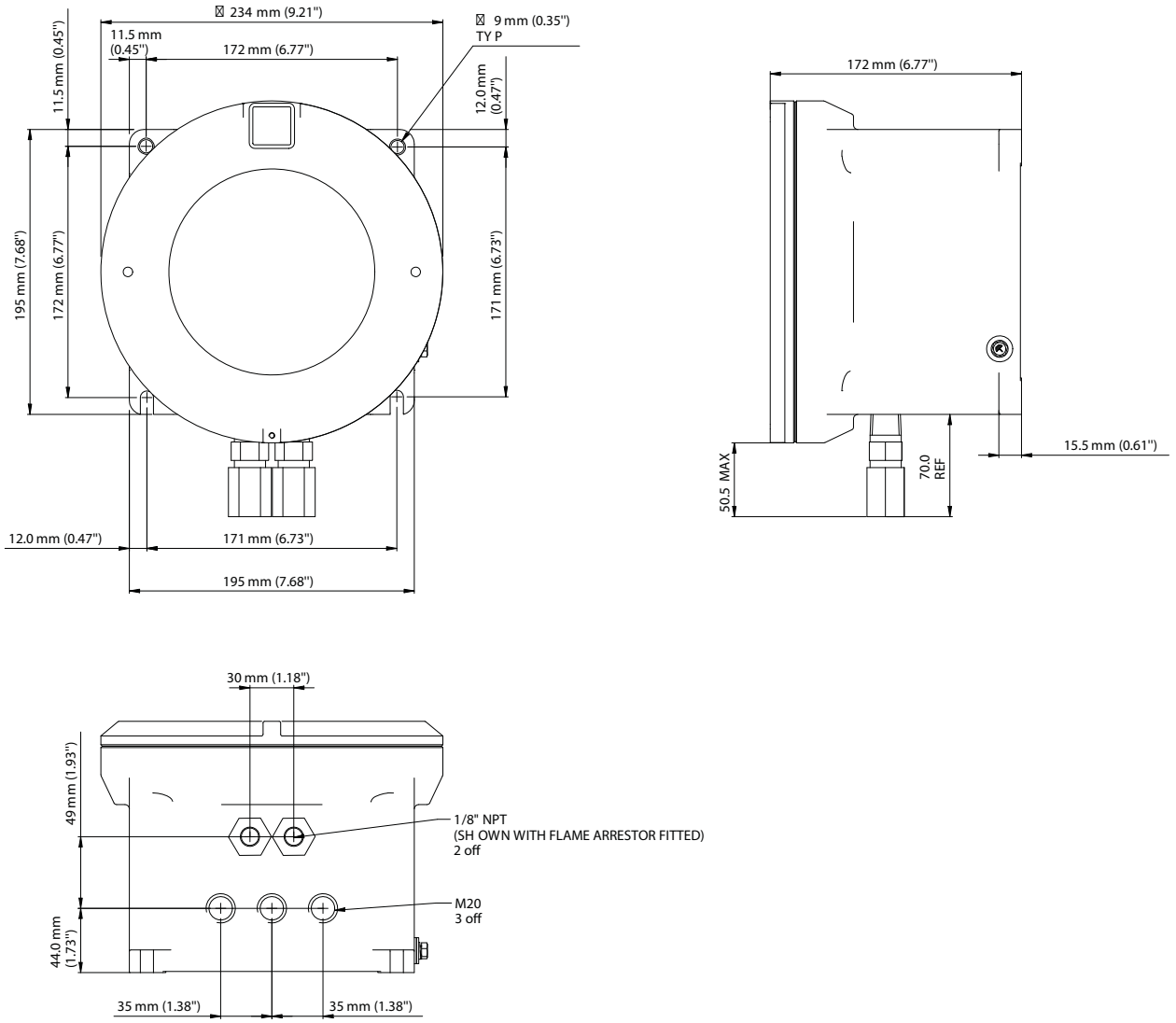
Appendix A Technical Specifications

Performance	
Measurement Technology	Thermo-paramagnetic oxygen sensor
Gas	Process and non-condensing sample with particles <3µm
Measurement Range	Select from 0-0.5% up to 0-50% and 20-100% up to 90-100%
Display Resolution	0.01% (0.1% for suppressed zero ranges)
Display Type	Backlit LCD
Accuracy (excluding suppressed zero ranges)	< ±1% of span or ±0.02% O_2 whichever is greater
Accuracy (for suppressed zero ranges 20/80/90-100%)	< +/-1% of Span or 0.2% O_2 whichever is greater
Response Time (T90) with HSR enabled	< 15 seconds
Repeatability	±0.2% of span or 0.01% O_2 whichever is greater
Linearity	±0.5% of span or 0.05% O_2 whichever is greater
Zero Stability	±0.25% of span per month
Span Stability	±0.25% of span per month
Sample Flow Rate	GP1 and GP3: 100 to 500 ml/min (0.2 to 1.06 scfh) EX1, EX3 and GP2: 270 to 330 ml/min (0.6 to 0.7 scfh)
Sample Pressure	0.75 to 5 BarA (11 to 72.5 psiA)
Sample Temperature	5 to 55°C (+41 to +122°F) max (+45°C (+113°F) for standard cell)
Sample Cell Temperature	Standard +50°C (+113°F) (Optional +55°C and +60°C (+131°F and +140°F) for ranges 0-0.5% up to 0-50% only.)
Background Gas	Analyzer is calibrated in the background gas of the process. Standard gases are: N2, CO2, CH4, H2 & Biogas. Others available on request.
Electrical Input/Output	
Analog Inputs	2 off 4-20 mA inputs One for an external sensor that can be displayed on the screen One to act as an active compensation for the process conditions
Analog Outputs	2 off 4-20 mA outputs (powered with 24V excitation voltage)
Output Ranges	Primary range is set to the calibrated range of the instrument The second is user selectable 0-100%
Alarms	2 off single pole changeover (SPCO) relays for O_2 concentration (250 V, 5 A max)
Datalogging	The user can use the digital communications to log the output from the analyzer The unit will store 40 alarm points and the min/max O_2 concentrations with date and time stamp
Digital Communications	Modbus RTU over RS485 Protocol
Power Supply	24 V DC; 1.5 A max
Cable Entries	Analyzer is supplied with 3 x M20 cable entries. Cable glands, conduit entries and blanking plugs are available as accessories.

Operating Conditions	
Ambient Temperature	5 to +55°C (+41 to +131°F)
Atmospheric Pressure	750mbar to 1250mbar
Mechanical Specification	
Warm Up Time	< 25 minutes
Stabilization Time	5 minutes
Dimensions	234 x 234 x 172mm (9.2 x 9.2 x 6.7") (w x d x h)
Weight	9.7kg (21.4lbs)
Wetted Materials	316 & 430F stainless steel, boroscillicate glass, platinum, 3M 2216 plus O-ring
O-Ring Materials	Viton, Silicone or Ekraz
Gas Connection	EX1, EX3 & GP2: 1/8" NPT (female) GP1 and GP3: 1/4" NPT (female)
Ingress Protection	IP66, NEMA 4X
Hazardous Area Certification	
Certification Codes	**ATEX** II 2GD Ex d IIB+H2 T6 Gb Ex tb IIIC T85°C Db IP66 **IECEx** Ex d IIB+H2 T6 Gb Ex tb IIIC T85°C Db IP66 **INMETRO** Ex d IIB+H2 T6 Gb Ex tb IIIC T85°C Db IP66 **TC TR Ex** 1Ex d IIB+H2 T6 Gb **cCSAus** Class I, Division 1, Groups B C D, T6
Temperature Ranges as per O-Ring type	Silicone: Ta = -40 to +55°C Viton: Ta = -15 to +55°C Ekraz: Ta = -10 to +55°C

The XTP601 process oxygen analyzer meets or exceeds all relevant clauses in BS EN 50104 : 2010 "Electrical apparatus for the detection and measurement of oxygen".

A.1 Dimensions Ex version



NOTE 1: GP1 and GP3 models have 1/4" NPT female gas connections. EX1, EX3 and GP2 models have 1/8" NPT female gas connections.

NOTE 2: Fixing mounts are NOT symmetrical. This is to ensure correct orientation.

Figure 32 *XTP601 Dimensional Drawings*

Appendix B

Modbus Register Map

Appendix B Modbus Register Map

Compatible with XTP601 Firmware Version: V1:03

Addr	Function	Access	Ranges/Resolution	Type
0	Modbus Instrument Address (ID)	R/W	1-127	A
1	Settings Register	R/W	0-65535	B
2	Display Contrast / Brightness	R/W	0-100% / 0-100%, 10% steps	C
3	Units Register (Tempr, Pressure, Ext Sens, Param, etc)	R/W	See reg details	D
4	Chart Interval	R/W	2-60 sec, in 2 sec intervals	A
5	Spare			
6	Alarm 1 (Lo alarm) Set point	R/W	Instrum range min Instrum range max, 0.01	G
7	Alarm 2 (Hi alarm) Set point	R/W	Instrum range min Instrum range max, 0.01	G
8	O2 Range Zero (Ch1 output zero)	R	0.00 to O2 Range Span	G
9	O2 Range Span (Ch1 output span)	R	O2 Range Zero to 100.00	G
10	CH1 comp coefficient 20%	R/W	0.50-2.00	G
11	CH1 comp coefficient 40%	R/W	0.50-2.00	G
12	CH1 comp coefficient 60%	R/W	0.50-2.00	G
13	CH1 comp coefficient 80%	R/W	0.50-2.00	G
14	CH1 comp coefficient 100%	R/W	0.50-2.00	G
15	N2 VCOMP ADC (for ratio comp)	R	0-8191	A
16	BACKG VCOMP ADC (for ratio comp)	R	0-8191	A
17	BACKG ZERO (for zero offset value)	R	-10.00-10.00 %	G
18	BACKG SPAN (for ratio gas value)	R	0.00-100.00 %	G
19	BACKG CAL VALUE (for ratio gas value)	R	0.00-100.00 %	G
20	CH2 Input (Ext Sensor) zero	R/W	See reg details	F
21	CH2 Input (Ext Sensor) span	R/W	See reg details	F
22	Alarm Configuration	R/W	See reg details	
23	Cell Tempr Set point	R	40-70 C	A
24	PID Proportional Term	R	1-20000	A
25	PID Integral Term	R	1-500	A
26	PID Derivative Term	R	1-100	A
27	HSR Var A (gain or multiplier)	R	2-200	A
28	HSR Var B (rate of gain reduction)	R	0-40	A
29	O2 Field Cal Reference 1	R/W	Instrum range min to Instrum range max + 20% of range, 0.01	G
30	O2 Field Cal Actual 1	R/W	-199.99-199.99	G
31	O2 Field Cal Reference 2	R/W	Instrum range min to Instrum range max + 20% of range, 0.01	G
32	Pressure at calibration	R	800.0-1200.0 mBar	F
33	Atmos Press Offset	R	-100/+100mBar	K
34	Spare			
35	Bridge Pot Wiper Code	R	0-1023	A
36	Gain Pot Wiper Code	R	0-1023	A
37	O2 Field Cal Actual 2	R/W	-199.99-199.99	G
38	Cal 02 Ref1	R	0.00-100.00	G
39	Cal 02 Ref2	R	0.00-100.00	G

Addr	Function	Access	Ranges/Resolution	Type
40	Cal 02 Ref3	R	0.00-100.00	G
41	Cal 02 Ref4	R	0.00-100.00	G
42	Cal 02 Ref5	R	0.00-100.00	G
43	Cal 02 ADC1	R	0-8191	A
44	Cal 02 ADC2	R	0-8191	A
45	Cal 02 ADC3	R	0-8191	A
46	Cal 02 ADC4	R	0-8191	A
47	Cal 02 ADC5	R	0-8191	A
48	mAINPUT1 4mA Cal point	R	0-8191	A
49	mAINPUT1 20mA Cal point	R	0-8191	A
50	mAINPUT2 4mA Cal point	R	0-8191	A
51	mAINPUT2 20mA Cal point	R	0-8191	A
52	mAOUTPUT1 4mA Cal point	R	0-8191	A
53	mAOUTPUT1 20mA Cal point	R	0-8191	A
54	mAOUTPUT2 4mA Cal point	R	0-8191	A
55	mAOUTPUT2 20mA Cal point	R	0-8191	A
56	CH2 output zero	R/W	O2 range min to 0-100%, 0.01	G
57	CH2 output span	R/W	CH2 output zero to instrum range max, 0.01	G
58	Last Cal Date DATE/MONTH	R	1-31/1-12	J
59	Last Cal Date: Field or Factory (bit 15) / YEAR (bits0-3)	R	0=Factory, 1=Field / 0-99	J
60	PCB Tempr Offset (for MSP430 Int Tempr only) – NOT USED in latest f/w	R	-100/+100 C	K
61	Spare			
62	Spare			
63	Hours Of Operation	R	0-65535	A
65	Set Clock HRS	W	00-23	J
66	Set Clock MIN	W	00-59	J
67	Set Clock DAY	W	01-31	J
68	Set Clock MONTH	W	01-12	J
69	Set Clock YEAR	W	00-99	J
70	%O2 without HSR	R	-199.00-199.99%	G
71	%O2 with HSR	R	-199.00-199.99%	G
72	Cell Temperature	R	-99.9-99.9 or equiv in F or K	F
73	PCB temperature (from MSP)	R	-99 to 99 C or equiv in F or K	K
74	Atmos pressure	R	0-1500mBar	A
75	mA1 Input in % (comp signal)	R	0.0-100.0%	F
76	mA2 Input (ext sensor signal)	R	See Reg Details	F
77	Status Flags register	R	0-65535	I
78	Clock HOURS/MIN	R	00-23 / 00-59	J
79	Clock SEC/DAY	R	00-59 / 01-31	J
80	Clock MONTH/YEAR	R	01-12 / 00-99	J
81	%O2 MINIMUM (stats)	R	-199.00-199.99%	G
82	%O2 MAXIMUM (stats)	R	-199.00-199.99%	G
83	VCOMP	R	0-8191	A

Addr	Function	Access	Ranges/Resolution	Type
84	Firmware Version	R	0.00-200.00	G
85	Live ADC 02	R	0-8191	A
86	Live ADC mA INPUT1	R	0-8191	A
87	Live ADC mA INPUT2	R	0-8191	A
88	Live ADC CellTempr	R	0-8191	A
89	Live ADC Pressure	R	0-8191	A
90	Live ADC PCB Tempr	R	0-8191	A
91	%O2 without field cal correction	R	-199.00-199.99%	G
92	Spare			
93	Spare			
94	Spare			
95	Spare			
96	Spare			
97	Spare			
98	Spare			
99	Spare			

Register Type A: Unsigned Integer

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w

Unsigned integer. Range = 0 to 65535

Register Type B: Settings

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w

Bit	HEX	Meaning
0	0001	Field Cal On
1	0002	Pressure Compensation On
2	0004	External Compensation On
4	0010	HSR On
5	0020	Display Limit 0-100% On

Register Type C: Display Parameters

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Display Brightness								Display Contrast							
r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w
0-100 in 10% steps								0-100 in 10% steps							

Register Type D: Units

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w

Bits	HEX	Meaning (binary)
0, 1	0003	00=degC, 01=degF, 10=K
2, 3	000C	Ext press unit, 00 = psia, 01=bara, 10=kPa
4	0010	Field cal type, 0=1 gas (offset), 1=2 gas
5	0020	Date format 0=Non US, 1=US
6	0040	SPARE
7,8,9,10	0780	SPARE
11,12,13	3800	Ext Sensor Parameter (000=none, 001=dewp, 010=tempr, 011=press, 100=other)
14,15	C000	SPARE

Register Type F: -2000.0 to +2000.0

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w

Range = 0 to 40000 represents -2000.0 to +2000.0
Conversion: (RegValue – 20000)/10.0

For external sensor values
Dew point: -100/+20 degC, -148.0/+68.0degC, 173.0/293.0 K
Tempr: -50.0/+100.0 degC, -58.0/+212.0 degF, 223.0/373.0 K
Pressure: 0.0/44.1 psia, 0.0/3.0 barA, 0.0/304.0 kpa

Register Type G: -200.00 to +200.00

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w

Range = 0 to 40000 represents -200.00 to +200.00
Conversion: (RegValue – 20000)/100.00

Register Type I - Status/Error

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

Bit	HEX	Meaning	Namur LED
0	0001	Displays O2HSR or O2 depending on setting (system)	N/A
1	0002	%O2 out of range (beyond calibration range, e.g. 0-25%)	N/A
2	0004	AL1 ON	YELLOW 1 ON
3	0008	AL2 ON	YELLOW 2 ON
4	0010	Ext Comp i/p signal error (input < 3.6mA or > 21mA)	RED FLASH (priority2)
5	0020	Ext sens. signal error (input < 3.6mA or > 21mA)	RED FLASH (priority2)
6	0040	Cell T not stable (not within ± 0.5 degC of setpoint for continuous period of 5 minutes)	RED ON (priority1)
7	0080	Cell T sensor error (cell tempr measures <-50 or >80°C)	RED ON (priority1)
8	0100	Press sensor error (Press sensor < 850 or >1100 mbar)	RED ON (priority1)
9	0200	O2 sensor error (Vcomp <=1 or >=8191)	RED ON (priority1)
10	0400	PCB tempr too high (PCB tempr > Cell tempr setpoint)	RED ON (priority1)
11	0800	N/A	N/A
12	1000	N/A	N/A
13	2000	N/A	N/A
14	4000	Instrument is transmitter version (system)	N/A
15	8000	N/A	N/A

Register Type J

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w

For reading each 8 bits represents a RTC value. For setting only the lower 8 bits are used for each RTC value.

Register Type K: -32767 to +32767

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w

Range = 0 to 65535 represents values
Conversion: (RegValue – 32767)

Register Type L: Alarm Configuration

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w

Bits	Meaning
1, 0	00 = Alarm1 is Inactive (off) 01 = Alarm1 is a Low Alarm 10 = Alarm1 is a High Alarm
3, 2	00 = Alarm2 is Inactive (off) 01 = Alarm2 is a Low Alarm 10 = Alarm2 is a High Alarm

Appendix C

Hazardous Area Certification

Appendix C Hazardous Area Certification

The XTP601-EX Oxygen Analyzer is certified compliant to the ATEX Directive (2014/34/EU) and IECEx for use within Zone 1 & 2 Hazardous Areas and has been assessed so by SIRA Certification (Notified Body 0518).

The XTP601-EX Oxygen Analyzer is certified compliant to the North American Standards (USA and Canada) for use within Class I, Division 1, Groups B, C and D Hazardous Locations and has been assessed so by cCSAus.

C.1 Product Standards

This product conforms to the Standards:

EN60079-0:2009
EN60079-1:2007
EN60079-31:2009
CSA C22.2 No 0-10
CSA C22.2 No 30-M1986 (R 2007)
CSA C22.2 No 142-M1987 (R 2009)
IEC60079-0:2007
IEC60079-1:2007
IEC 60079-31:2008
UL 916
UL 1203

C.2 Product Certification

This product is attributed with the product certification codes:

ATEX & IECEx
II 2 GD Ex d IIB+H2 T6 Gb
Ex tb IIIC T85°C Db IP66

North American
Class I, Division 1, Groups B, C, D

C.3 Global Certificates/Approvals

ATEX	Sira12ATEX1042X
IECEx	SIR12.0013X
cCSAus	2541173
TC TR Ex	RU C-GB. ГБ05.B.00152
INMETRO	NCC 14.03166 X

These certificates can be viewed or downloaded from our website at:
http://www.michell.com

C.4 Special Conditions

1. Cable entry holes shall be fitted with either an appropriately certified cable gland or appropriate certified blanking element. These shall provide and maintain a minimum enclosure ingress protection of IP66.
2. The maximum pressure associated with the process medium in the internal pipes shall be limited to 4 bar.
3. The maximum temperature associated with the process medium shall be limited to 55°C.
4. The flameproof joints of the flame arrestors & breather are not intended to be repaired.

C.5 Maintenance and Installation

The XTP601-EX must only be installed by suitably qualified personnel and in accordance with the instructions provided and the terms of the applicable product certificates.

Maintenance and servicing of the product must only be carried out by suitably trained personnel or returned to an approved Michell Instruments' Service Center.

Flame paths are not intended to be repaired.

Appendix D

Quality, Recycling, Compliance & Warranty Information

Appendix D Quality, Recycling, Compliance & 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

This information is also available in pdf format.

Appendix E

Analyzer Return Document & Decontamination Declaration

Appendix E 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

EU Declaration of Conformity

MICHELL Instruments

Manufacturer: **Michell Instruments Limited**
48 Lancaster Way Business Park
Ely, Cambridgeshire
CB6 3NW. UK.

CE

On behalf of the above named company, I declare that, on the date that the equipment accompanied by this declaration is placed on the market, the equipment conforms with all technical and regulatory requirements of the directives.

XTP601-GP Series Oxygen Analyser

and complies with all the essential requirements of the EU directives listed below.

2014/30/EU EMC Directive

(effective from 22nd July 2017)

2011/65/EU Restriction of Hazardous Substances Directive (RoHS2)

RoHS2 EU Directive 2011/65/EU (Article 3, [24]) states, *"industrial monitoring and control instruments means monitoring and control instruments designed exclusively for industrial or professional use".* (mandatory compliance effective date 22nd July 2017).

and has been designed to be in conformance with the relevant sections of the following standards or other normative documents.

EN61326-1:2006	Electrical equipment for measurement, control and laboratory use – EMC requirements –Class B (emissions) and Industrial Locations (immunity).
EN61010-1:2010	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

2014/68/EU PE Directive

This product and sample systems & accessories that may be supplied with them do not bear CE marking for the Pressure Equipment Directive, and are supplied in accordance with Article 4, paragraph 3 of 2014/68/EU by using SEP (sound engineering practice) in the design and manufacturer and are provided with adequate instructions for use.

Andrew M.V. Stokes, Technical Director

December 2016

EU Declaration of Conformity

Manufacturer:	Michell Instruments Limited
Address:	48 Lancaster Way Business Park Ely, Cambridgeshire CB6 3NW. UK.

Equipment Type: **XTP601-EX*-C* Series Oxygen Analyser:**

2014/34/EU ATEX Directive

Provisions of the Directive fulfilled by the Equipment:

Group II Category 2GD **Ex d IIB+H2 T6 Gb**
Ex tb IIIC 85°C Db IP66
Tamb -40°C to +55°C *The use of O ring Options will affect Tamb ratings.*

Notified Body for EC-Type Examination

SIRA Certification, Chester. UK. Notified Body No. 0518

Notified Body for Production (QAN & QAR):

Baseefa, Buxton. UK. Notified Body No. 1180

EC-Type Examination Certificate:

Sira 12ATEX1042X

Standards used:

EN 60079-1:2007
On 1st August 2017 this standard will cease to have harmonised status. **EN60079-1:2014** has now superseded.

EN 60079-0:2012
On 7th October 2016 this standard will cease to have harmonised status. **EN60079-0:2012/A11:2013** has now superseded.

EN60079-31:2009
On 1st January 2017 this standard will cease to have harmonised status. **EN60079-31:2014** has now superseded.

A technical review of these standards against the old standards showed that the equipment remains in conformance with all relevant clauses and that the State of the Art is maintained. The Essential Health & Safety Requirements of the Directive is still maintained with no changes necessary for the safe and reliable functioning and operation of the product with respect to the risks of explosion).

IECEx

Certificate of Conformity No.

IECEx SIR 12.0013X

Ex d IIB+H2 T6 Gb
Ex tb IIIC 85°C Db IP66
Tamb -40°C to +55°C *The use of O ring Options will affect Tamb ratings.*

Standards used:

IEC60079-0:2007
IEC60079-1:2007
IEC60079-31:2008

Other Directives

2014/30/EU EMC Directive
Is in conformity with the following Standard(s) or Normative Document(s):
EN61326-1:2006 *Electrical equipment for measurement, control and laboratory use - EMC requirements. Class B (emissions) and Industrial Locations (immunity).*

2011/65/EU Restriction of Hazardous Substances Directive (RoHS2)
RoHS2 EU Directive 2011/65/EU (Article 3, [24]) states, *"industrial monitoring and control instruments means monitoring and control instruments designed exclusively for industrial or professional use".* (mandatory compliance effective date 22nd July 2017).
EN61010-1:2010 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements.

On behalf of the above named company, I declare that, on the date the equipment accompanied by this declaration is placed on the market, the equipment conforms with all technical and regulatory requirements of the above listed directives.

Andrew M.V. Stokes, Technical Director.
August 2017

http://www.michell.com