SERVOMEX ANALYZERS
HIGH-PERFORMANCE GAS ANALYSIS

SERVOPRO MultiExact 4100 Analyzer

Installation and Operator Manual

SERVOMEX
a spectris company

IMPORTANT INFORMATION

Continued safe and reliable operation of this equipment is conditional on all installation, operation and maintenance procedures being carried out in accordance with the appropriate manuals, by personnel having appropriate qualifications, experience and training. Failure to observe the requirements of the manual may result in the user being held responsible for the consequences and may invalidate any warranty. Servomex accepts no liability for unauthorized modifications to Servomex supplied equipment.

Servomex has paid particular attention to Health and Safety throughout this manual. Where special precautions need to be taken due to the nature of the equipment or product, an appropriate safety icon and warning message is shown. Special attention should be made to section 3 – Safety, where all such messages are summarized.

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North America:

Servomex Group Inc.
4 Constitution Way
Woburn MA 01801-1087
United States

t: +1 781 935 4600
+1 800 433 2552 (US toll free)
f: + 1 781 938 0531
e: americas_sales@servomex.com
w: www.servomex.com

Europe:

Servomex Group Ltd
Jarvis Brook
Crowborough
East Sussex TN6 3FB
United Kingdom

t: + 44 (0) 1892 652 181
f: + 44 (0) 1892 662 253
e: europe_sales@servomex.com
w: www.servomex.com

Representative:

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1 Introduction

1.1 About this manual

1.1.1 Scope of the manual

This manual covers the installation, operation and routine maintenance of the MultiExact 4100 Analyzer. It is intended for those already familiar with the installation, use and maintenance of analytical or process instrumentation.

The information in this manual is general. Transducer-specific instructions are contained in the relevant appendices at the rear of the manual.

A separate manual covers the AquaXact 1688 transmitter in more detail, including theory and performance data.

1.1.2 Safety information

Read this manual and make sure you fully understand its contents before you attempt to install, use or maintain the analyzer.

The following icons are used throughout this manual to identify any potential hazards that could cause serious injury to people. Always follow the safety instructions and be aware of the hazard.

This symbol warns of specific hazards which, if not taken into account, may result in personal injury or death.

This symbol warns of specific hazards due to high voltages which, if not taken into account, may result in personal injury or death.

This symbol warns of specific hazards due to high temperatures which, if not taken into account, may result in personal injury or death.

This symbol warns of specific hazards due to hazardous substances which, if not taken into account, may result in personal injury or death.

This symbol warns of specific hazards due to caustic or corrosive substances which, if not taken into account, may result in personal injury or death.

This symbol highlights where you must take special care to ensure the analyzer or to other equipment or property is not damaged.

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1.1.3 Other information provided by the manual

Note: Notes give extra information about the equipment.

> ***Hint:*** *Hints give helpful tips and highlights information which is useful for you to be aware of, for example, specific operating conditions.*

1.2 Product overview

The MultiExact 4100 Analyzers are designed to meet the needs of the control and product quality applications of industrial gas producers and users, who require fast, accurate and reliable gas analysis.

The analyzer can be fitted with up to four sensors, zirconia, paramagnetic, gas filter correlation (GFX), single beam single wavelength infrared (IR) and thermal conductivity (TCD) transducers. We also allowing a single moisture measurement to be brought in from a custom external AquaXact 1688 aluminum oxide probe.

Gas sample measurements are shown on the analyzer display, and can also be output to a serial device connected to the analyzer, or as milliamp (mA) / voltage outputs, or over a selection of digital communications protocols.

The analyzer conforms to the requirements of the NAMUR (Normenarbeitsgemeinschaft für Mess Und Regeltechnik in der Chemischen Industrie) standards NE43 (4 – 20 mA output) and NA64 (status outputs).

The analyzer is simple to operate, with an intuitive user interface. The benchtop analyzer is 141.2 mm (5.6”) high (274.2 mm (10.8”) high with expansion chassis), 432 mm (17”) wide and 544.2 mm (21.4”) deep; the rack mount analyzer is 132.5 mm (5.2”) high (265.5 mm (10.5”) high with expansion chassis), 482 mm (19”) wide and 544.2 mm (21.4”) deep.

The main analyzer unit weighs approximately 14 kg (30.9 lb.), with an expansion chassis weighing approximately 13.7 kg (30.2 lb.) if multiple GFX sensors are chosen. The analyzer is suitable for 19-inch rack, panel or bench mounting.

The analyzer requires little routine maintenance, other than calibration which is essential for the accuracy of sample gas measurements (Section 5.6) and replacement of filter elements (if fitted external to the analyzer).

The MultiExact 4100 product complies with BS EN61326-1:2013, Class A. The MultiExact 4100 is intended for professional measurement and control purposes in industrial process and industrial manufacturing environments or is a component of such equipment. It is not intended for use in domestic applications because the MultiExact 4100 does not meet CISPR 11 class B emission limits for residential locations, which are directly connected to low voltage power supply networks.

1.3 General description

The MultiExact 4100 gas analyzer is a chassis into which up to four gas transducer modules may be fitted. The chassis provides power, gas connections and other support functions to the transducers and calculates associated sample gas concentrations. These concentrations are then displayed on the analyzer display screen and may be directed to the analogue outputs and/or the serial output.

The analyzer also supports up to eight external analogue input signals. The data from the external inputs may be displayed on the screen, output through the analogue outputs and/or the serial output or accessed using Modbus or PROFIBUS. These external input signals can be recorded, trigger low / high alarms and be used to activate relays.

Designed for use in modern industrial and laboratory environments, the analyzer is controlled using an integral microprocessor which provides significant user flexibility.

None of the above are suitable for use with corrosive samples.

Many optional features are available for the MultiExact 4100 analyzer. These may include the following, depending upon analyzer configuration:

- Flow meters to monitor and control sample gas flow through the instrument.
- A sample filter to protect the gas transducer modules from particulate contamination.
- A sample flow switch to monitor one sample flow and alarm when the flow is interrupted.
- Relay output contacts to allow auto-calibration of the analyzer via externally located valves.

Note: Full technical specifications for MultiExact 4100 analyzer is presented at the back of this manual.

Use this manual for:

Installation:	To take commissioning to the point where the analyzer is powered and operational. The installer is advised to read this manual completely before commencing installation.
Configuration:	How to set up the clock, passwords, alarm levels, analogue outputs, relays and other parameters.
Calibration:	How to use the manual and automatic calibration/checking facilities.
Review:	How to display analogue output settings, relay allocation, alarms, faults and analyzer identity without changing the analyzer settings.

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1.4 Recommended calibration intervals

For optimum performance, it is necessary to routinely check the calibration of all the internal gas transducers within the analyzer. The recommended periods for each transducer type are shown in Table 1-1.

Before calibrating the GFx transducer its highly recommended to power on for 24 hours prior and then flow purge gas for 2-6 hours.

Gas transducer module	Low calibration	High calibration
GFX transducer	Weekly	Monthly
IR transducer	Weekly	Daily
MBIR transducer	Weekly	Weekly
Paramagnetic transducer (purity)	Monthly	Weekly
Paramagnetic transducer (control)	Weekly	Weekly
Zirconia transducer	Monthly	Monthly
~~TCD transducer~~	~~Monthly~~	~~Monthly~~

Table 1-1: Recommended calibration periods

The pressure compensation associated with the purity paramagnetic transducer should also be checked annually (see Appendix G).

This manual details the following:

- the requirements for and configuration of calibration ancillaries (e.g. gases)
- the connection of solenoid valves (when auto-calibration is used)
- the potential use of the RS232 output and remote initiation switch
- the use of Modbus or PROFIBUS to initiate calibration.

If the intended, use of this equipment is to monitor process systems critical for Health and Safety purposes it is the sole responsibility of the installer and operator to see that this instrument is commissioned, maintained and calibrated in a manner consistent with the customer's specific application. Continued safe and reliable operation of this equipment is conditional on all installation, operation and maintenance procedures being carried out in accordance with the appropriate manuals, by personnel having appropriate qualifications, experience and training. Failure to observe the requirements of the manual may result in the user being held responsible for the consequences. In no event shall Servomex be liable for any incidental, consequential or special damages of any kind or nature whatsoever,

including but not limited to lost profits arising from or in any way connected with this instruments use.

Note: When the optional external auto-calibration is configured, a manual calibration adjustment or calibration check will use the auto-calibration valves to select the calibration sample gases as required.

1.5 Automatic calibration options

In the case of external auto-calibration, external customer supplied solenoid valves may be controlled by discrete wiring to relays on the analyser (section 0).

The automatic calibration procedure may be started by any of the following:

- A trigger from the internal instrument clock
- An external contact closure
- A Modbus or PROFIBUS command

1.6 Product identification

Figure 1-1: The MultiExact 4100 Gas Analyzer

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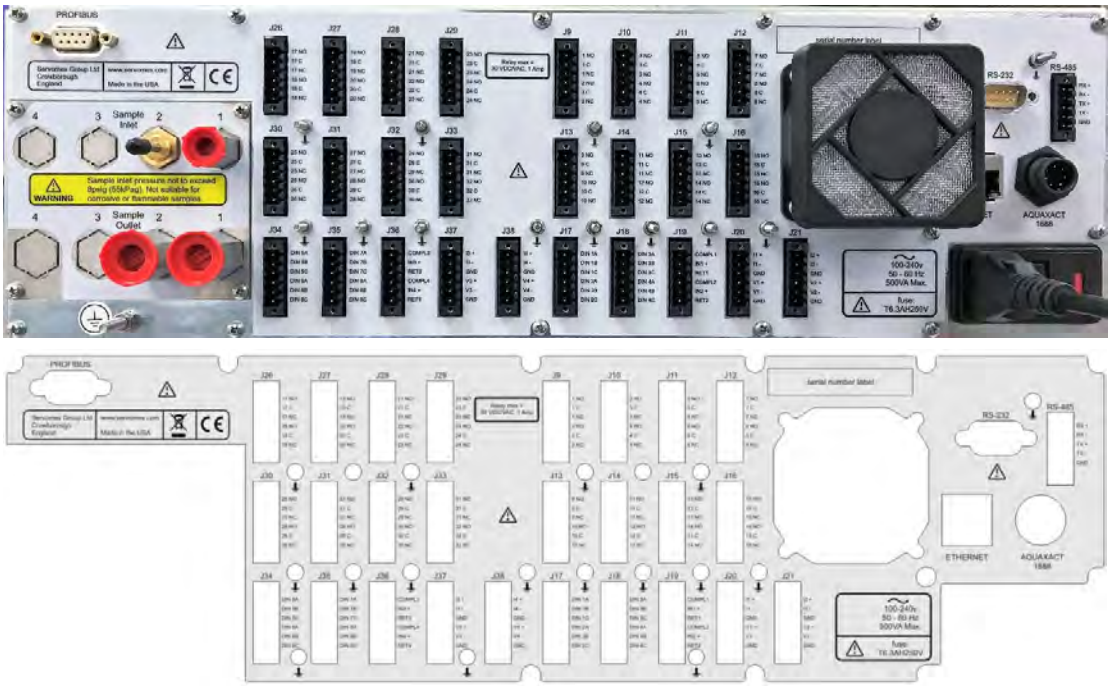

Figure 1-2: Rear of the MultiExact 4100 Gas Analyzer

ID	Description
J9 – J16	Relay I/O connections
J17	DIN (1A-C / 2A-C)
J18	DIN (3A-C / 4A-C)
J19	Option board 1&2 4-20 mA inputs
J20	4 – 20 mA output / voltage output (I1± / V1±)
J21	4 – 20 mA output / voltage output (I2± / V2±)
PROFIBUS	Profibus connector
ETHERNET	Ethernet connector
AQUAXACT 1688	AquaXact 1688 connector

ID	Description
J26 – J33	Relay I/O connections
J34	DIN (5A-C / 6A-C)
J35	DIN (7A-C / 8A-C)
J36	Option board 3&4 4-20mA inputs
J37	4 – 20 mA output / analog voltage output (I3± / V3±)
J38	4 – 20 mA output voltage output (I4± / V4±)
RS-232	RS232
RS-485	RS485 (Modbus)
⏚	Earth (ground) connection

Table 1-2: Rear panel connections

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1.7 Sample requirements

For best performance the flow, or pressure, supplied to the analyzer should be kept at a constant value for both normal sampling and for calibration gas input.

Temperature:	5 to 40°C / 41 to 104°F
Dew point	5°C / 9°F below minimum ambient
Condition:	Oil free, non - condensing, filtered to 2µm
Vent:	Connect each transducer outlet to a separate atmospheric vent, free from any back-pressure.

Pay particular consideration to the toxicity and asphyxiant nature of the sample gas when selecting a vent location.

Flow driven options:	IR	100 (min) - 250 (max) ml/min
	MB IR	100 (min) - 1000 (max) ml/min
	Pm Purity	100 (min) - 250 (max) ml/min
	Pm Control	100 (min) - 250 (max) ml/min
	Zr	200 (min) - 400 (max) ml/min
	GFX	500 (min) - 2500 (max) ml/min
Pressure driven options:	Nominal	5psig / 35kPa
	Minimum	2psig /14kPa, max. 8psig /56kPa

Do not exceed the rated flow or pressure as transducer damage may result.

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2 Unpacking

Read this manual carefully BEFORE you remove the MultiExact 4100 Gas Analyzer from its shipping container, or you attempt to install, commission or use the equipment.

The analyzer is heavy (section 1.2). Take care when handling the instrument. Lift with both hands positioned on either side on the base of the chassis.

1. Remove the analyzer and any other equipment from its packaging.
2. Remove the protective plastic covers from the sample gas inlets and outlets on the rear of the analyzer (Figure 2-1).

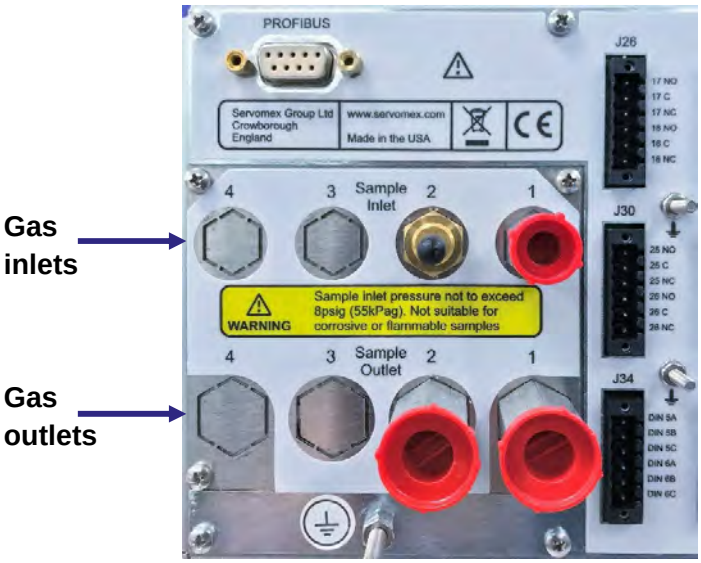

Figure 2-1: Gas inlets and outlets on rear of the analyzer

> ***Hint:*** *If you do not intend to use the analyzer immediately, wait to remove the protective plastic covers until and remove them just before connecting to the process sample pipework..*

3. Inspect the analyzer and the other items supplied, and check that they are not damaged. If any item is damaged, contact Servomex or your local Servomex agent immediately.
4. Check that you have received all the items that you ordered with the packing list. If any item is missing, contact Servomex or your local Servomex agent immediately.

5. If you do not intend to use the analyzer immediately:
   - Refit any protective plastic covers.
   - Place the analyzer and any other equipment supplied back in its protective packaging.
   - Store the analyzer as described in section 10.1.
6. Read section 3 – Safety before proceeding.

> ***Hint:*** *Keep the shipping documentation and packaging for future use, for example when moving the equipment, or returning it for service or repair.*

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3 Safety

3.1 General warnings

Before you attempt to install, commission or use the MultiExact 4100 Analyzer, read this manual carefully.

Do not attempt to install, commission, maintain or use the MultiExact 4100 Analyzer unless you are trained or are an experienced instrument technician.. The analyzer must be maintained by a suitably skilled and competent person.

Do not connect the MultiExact 4100 Analyzer to a power source until all signal and plumbing connections are made.

This analyzer must be operated in a manner consistent with its intended use and as specified in this manual.

The MultiExact 4100 Analyzer is only suitable for installation in safe areas.

The maximum pressure to the analyzer must be limited to 8 psig by means of a suitable release system.

Do not modify the unit, either mechanically or electrically, or the certification of the instrument will be invalidated, and it may not operate safely.

The MultiExact 4100 Analyzer includes few user-serviceable parts which, are called out in the spare list.

Do not use the MultiExact 4100 Analyzer as Personal Protective Equipment (PPE).

Make sure that all floors or platforms where you install the MultiExact 4100 Analyzer are large enough for you to move freely and to change position.

The MultiExact 4100 Analyzer may be attached to equipment that is hot. Always wear the appropriate PPE to minimize the risk of burns.

3.2 Chemical warnings

Sample and calibration gases may be toxic or asphyxiant:

- **Make sure that the external connections are leak free at full operating pressure before you use sample or calibration gases.**
- **Make sure that the sample/bypass outlet pipes are vented to an area where the gases will not be a hazard to people.**
- **Make sure that the analyzer is used in a sufficiently well-ventilated environment, to prevent the build-up of toxic gases.**
- **Make sure that the pipes that you connect to the analyzer are routed so that they do not present a hazard to people.**
- **Never inspect the inlet filter(s), or service or repair the analyzer while such gases are still connected to it.**
- **If the analyzer is to be serviced or repaired, it is important that all pipework is flushed with an inert gas and the analyzer is allowed to freely vent to local atmosphere.**

Where there is a risk of release of potentially harmful gases into the operating environment, always use suitable monitoring equipment.

The MultiExact 4100 is not suitable for use with corrosive samples.

3.3 Electrical warnings

Always observe the appropriate electrical safety codes and regulations.

Make sure that the electrical installation of the analyzer conforms with all applicable local and national electrical safety requirements.

Potentially hazardous AC voltages are present within this instrument. Leave all internal servicing to qualified personnel. Disconnect the AC power source before installing or removing any external connections.

Make sure the analyzer is provided with a sound earth connection via the electrical supply plug.

Make sure the electrical supply coupler or plug is easily accessible for disconnection from the electrical supply.

All signal and electrical supply cables must be rated for temperatures of 70 °C or higher.

The I/O terminals and connections are separated from the analyzer mains circuits by reinforced insulation. The terminals must only be

connected to circuits that are themselves separated from mains voltages by at least reinforced insulation.

Make sure that the cables that you connect to the analyzer are routed so they do not present a trip hazard.

3.3.1 Electromagnetic Compatibility (EMC) considerations

The MultiExact 4100 Analyzer meets the essential requirements of the European EMC Directive (2014/30/EU). The transducer and the 4-20 mA loop are electrically connected, but are isolated from the analyzer housing and sample cell fitting threads.

The analyzer generates and uses small amounts of radio frequency energy. There is no guarantee that interference to radio or television signals will not occur in a particular installation. If interference is experienced, switch off the analyzer to see if the interference disappears. If it does, try one or more of the following methods to correct the problem:

- Reorient the receiving antenna.
- Move the instrument with respect to the receiver.
- Place the analyzer and receiver on different AC circuits.

Always consider the following electromagnetic interference issues when installing the MultiExact 4100 Analyzer:

To provide an acceptable noise environment for the MultiExact 4100 Analyzer or other digital equipment in the proximity of switching inductive loads, Servomex recommend that you place varistors across the inductors to lessen high voltage spikes that occur during transitions.

Circuitry activated by relay contacts should allow for the contact bounce. One simple method is to place a capacitor across the relay contacts.

Route AC power wiring as far from the analyzer and its wiring as possible.

3.4 Markings

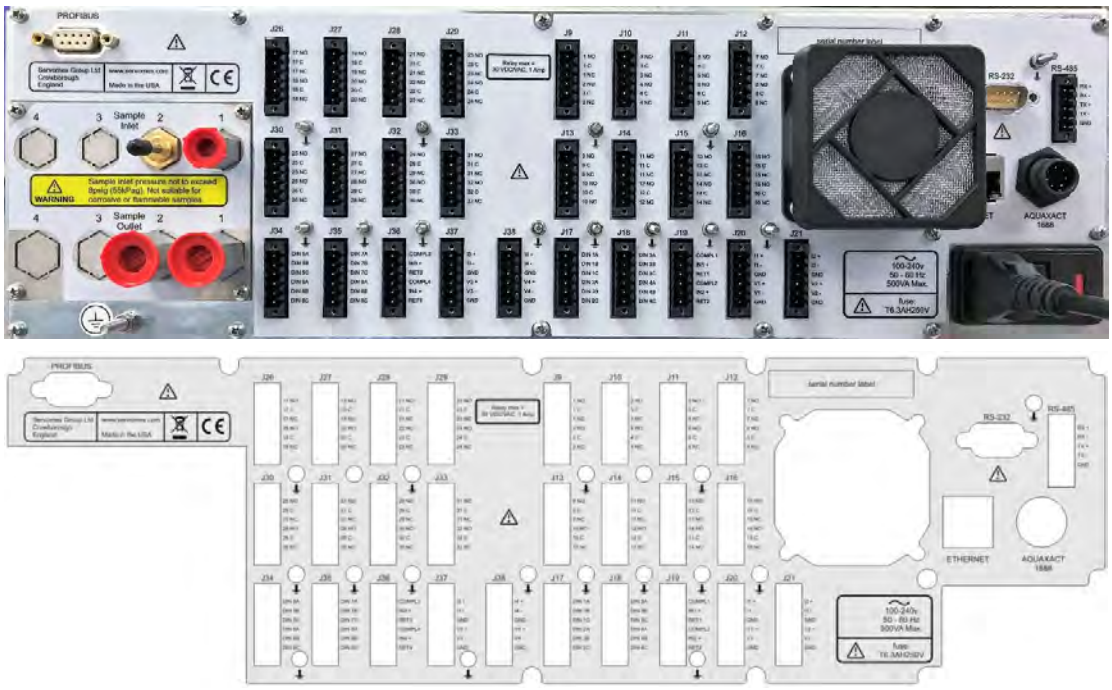

Figure 3-1: Rear of the MultiExact 4100 Analyzer

The MultiExact 4100 Analyzer includes the following external markings on the rear panel.

Do not connect any cables carrying mains voltage or cables that have inadequate insulation between line and mains to any of the I/O connectors.

Earth / ground connections. These are screw terminals used to connect the ground shields of cables plugged into the nearby connectors. Do not connect any voltages to these connections.

This label identifies that:

- **The analyzer is considered to be within the scope of the Waste Electrical and Electronic Equipment (WEEE).**
- **The analyzer is not intended for disposal in a municipal waste stream (such as landfill sites, domestic recycling centers and so on), but must be submitted for material recovery and recycling in accordance with the local regulations which implement the WEEE Directive.**

Follow the appropriate safety instructions and be aware of any warnings about potential hazards.

4 Installation and set-up

Do not attempt to install, commission, maintain or use the MultiExact 4100 Analyzer unless you have been trained or are an experienced instrument technician.

The MultiExact 4100 Analyzer is only suitable for installation in safe areas.

Follow the instructions in this section to safely install the MultiExact 4100 Analyzer.

Make sure that all floors or platforms where you install the MultiExact 4100 Analyzer are large enough for you to move freely and to change position.

Do not install the unit in places subject to extreme mechanical vibration or shock. If you do, measurements may not be accurate, or the analyzer may be damaged.

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4.1 Mechanical Installation

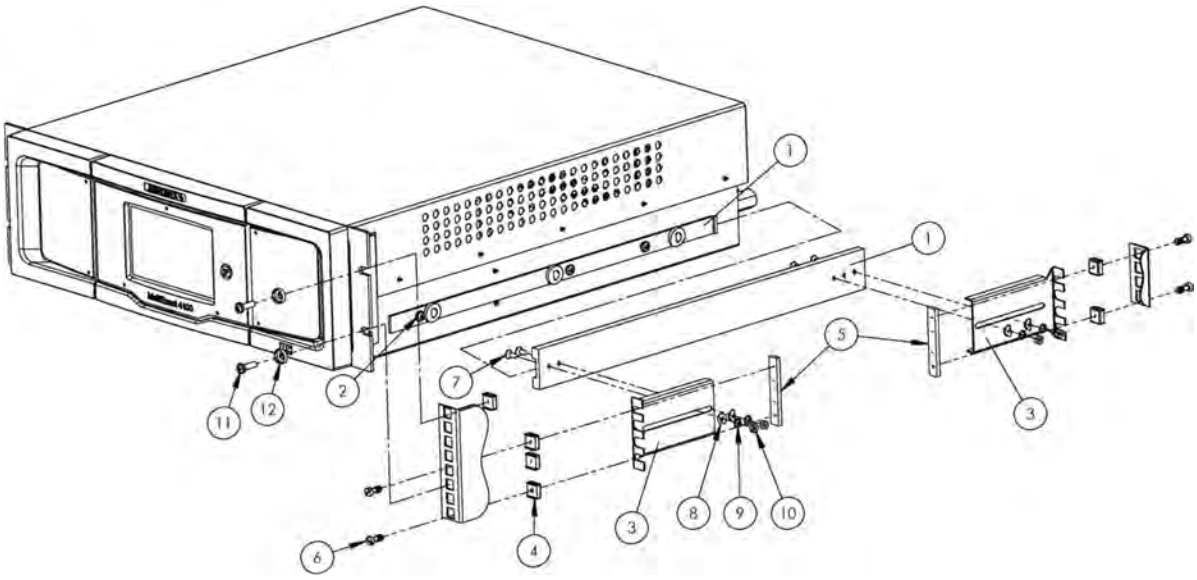
4.1.1 Bench mounting

4 rubber feet beneath the analyzer allow use on a firm level bench or other suitable solid work surface.

4.1.2 Rack mounting

Before installing the analyzer, determine where you will install it in the rack enclosure. The analyzer is 3U in height and has two mounting bolts on each side.

There is also an option for a sliding rack mount (Figure 4-1).



1	Telescopic slide	7	M4 screw
2	M5 screw	8	M4 washer
3	Slide support bracket	9	M4 locking washer
4	Cage nut	10	M4 nut
5	Slide support clamp	11	M5 cross-head screw
6	M5 waisted brass screw	12	Cup washer (plastic)

Figure 4-1: Sliding rack installation

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4.2 Electrical installation

4.2.1 Electrical safety

Make sure that the electrical installation of the analyzer conforms with all applicable local and national electrical safety requirements.

Make sure the electrical supply coupler or plug is easily accessible for disconnection from the electrical supply.

Make sure the analyzer is provided with a sound earth connection via the electrical supply plug.

All signal and electrical supply cables must be rated for temperatures of 70 °C or higher.

Make sure that the cables that you connect to the analyzer are routed so they do not present a trip hazard.

Potentially hazardous AC voltages are present within this instrument. Leave all internal servicing to qualified personnel. Disconnect the AC power source before installing or removing any external connections.

Follow the instructions given below when you install the analyzer. If you do not, the analyzer warranty may be invalidated, the analyzer may not operate correctly, or it may be damaged.

Make sure your electrical supply can provide the necessary maximum power consumption.

4.2.2 Analog output signal connections

The analog output terminals are separated from the analyzer mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by at least reinforced insulation.

To comply with EMC requirements, shielded cables must be used to connect the analog outputs.

Use Table 4-1 to identify which screw terminal (J20, J21, J37, and J38) is connected to which gas transducer position:

Table 4-1: Analog output interface connectors

Screw Terminal	Gas Transducer	Screw Terminal	Gas Transducer

J20	Position / Measurement #1	J37	Position / Measurement #3
J21	Position / Measurement #2	J38	Position / Measurement #4

Connect the cable wires as shown to the pins on J20 (Gas #1), J21 (Gas #2), J37 (Gas #3), J38 (Gas #4) for the outputs available on the transducers using Table 3-2. The (X) in the table below indicates the gas measurement location in position 1, 2, 3, or 4 that matches the connector listed in Table 4-2 with the label on the back of the analyzer:

Note: All pin locations and functions listed in Table 4-2 are for J20, J21, J37, and J38 only which are the analog out gas measurement signals.

Table 4-2: Analog output interface connections

Pin	Use	Output Configuration	Pin	Use	Output Configuration
1	I(X)+	mA current	4	V(X) +	voltage
2	I(X) -	mA current	5	V(X) -	voltage
3	GND	Chassis ground	6	GND	Chassis ground

Connect the cable shielding to the ground point on the rear of the analyzer. The ground points are marked with the ⏚ symbol, or if more convenient the screw terminals at pins 3 and 6 may be used.

4.2.3 Analog input signal connections

The analog input terminals are separated from the analyzer mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by at least reinforced insulation.

To comply with EMC requirements, shielded cables must be used to connect the analog inputs.

The analyzer must supply power for any mA input devices. Do not allow devices on the inputs to supply power or the input readings may not be valid.

Analog input number “X” shares the same isolated reference as the analog output with the same number. This reference is isolated from the rest of the chassis as well as from the other analog inputs and outputs. Do not allow equipment wired to an input number X to be grounded to the same frame as equipment reading from output number X, or both input and output X readings may not be valid.

Refer to Table 4-1 to identify which screw terminal (J20, J21, J37, and J38) is connected to which gas transducer position.

Table 4-3: Analog output interface connectors

Screw Terminal	mA Input	Screw Terminal	mA Input
J19	Input #1, #2	J36	Input #3, #4

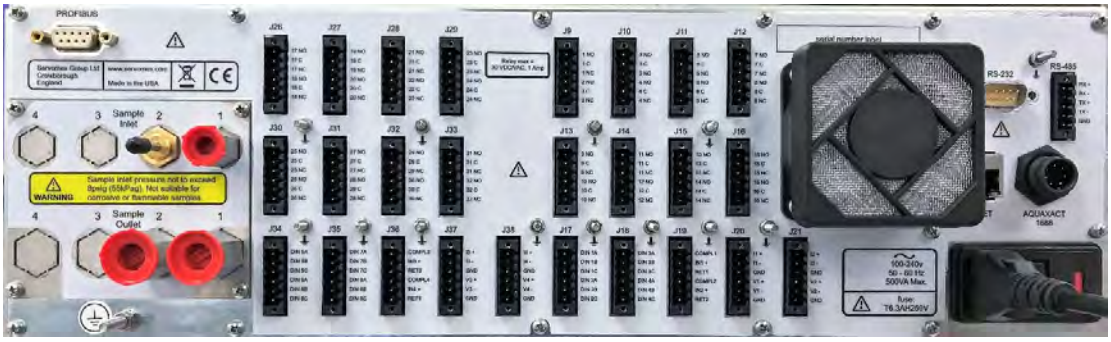
Connect the input cable wires to the pins on J19 (inputs #1 and #2), J36 (inputs #3 and #4), as shown in Table 3-4. The (X) in the table indicates the input location in position 1, 2, 3, or 4 that matches with the label on the back of the analyzer:

Table 4-4: Analog input interface connectors

Pin	Use	Input Configuration	Pin	Use	Input Configuration
1	COMPL(X)	Compliance out	4	COMPL(X)	Compliance out
2	IN(X) +	mA input return	5	IN(X) +	mA input return
3	RET(X)		6	RET(X)	

Connect the cable shielding to the ground point on the rear of the analyzer. The ground points are marked with the ⏚ symbol. Connect an external mA loop device “+” to the COMPL(X) pin and connect the external device “-“ to the IN(X)+ pin. The RET(X) pins cannot currently be used.

4.2.4 Relay connections



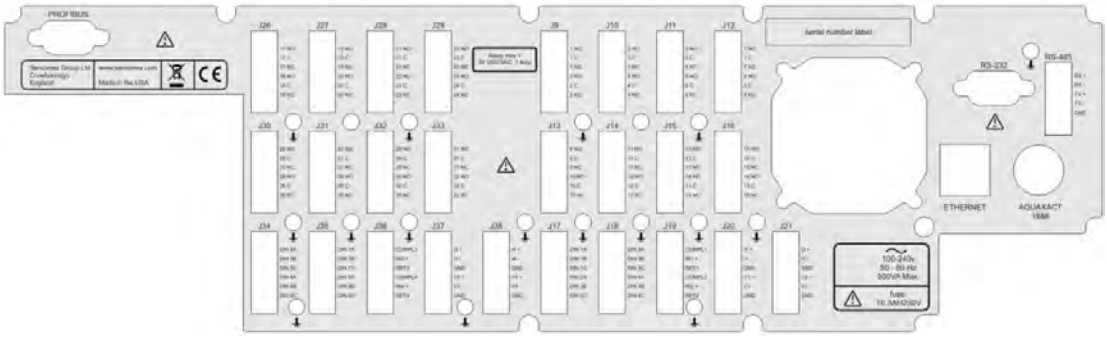


Figure 4-2: Rear of 4100 MultiExact

The relay connections are separated from the analyzer mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by at least reinforced insulation.

Note: The relays do not have default settings unless auto-calibration is selected. Users can create alarms and assign them to any relay (see 4100 MultiExcat Operation manual for details).

Note: When Auto-Cal is ordered, each transducer has 8 relays available with 3 relays preassigned with the 6th assigned to Zero, the 7th to Span and the 8th to the Sample gas. The 1st to the 5th relays do not have default settings and can be assigned to any alarm or function even if it is not related to that particular gas transducer (see 4900 Multigas Operation manual for details).

The analyzer relays are accessible via the connectors J9-16 and J26-33. Connect one end of your cable wire to the screw terminal for the relevant relay connector as shown in Table 4-3. Each connector has two relays assigned to it where the “X” in XNO, XC, XNC represents the relay number, NO is Normally Open, C is Closed and NC is Normally Closed.

Table 4-3: 4100 MultiExact relay connections

Relay	Use	Connector	Relay	Use	Connector
1	1NO, 1C, 1NC	J9	17	17NO, 17C, 17NC	J26
2	2NO, 2C, 2NC	J9	18	18NO, 18C, 18NC	J26
3	3NO, 3C, 3NC	J10	19	19NO, 19C, 19NC	J27
4	4NO, 4C, 4NC	J10	20	20NO, 20C, 20NC	J27
5	5NO, 5C, 5NC	J11	21	21NO, 21C, 21NC	J28
6	6NO, 6C, 6NC	J11	22	22NO, 22C, 22NC	J28

Relay	Use	Connector	Relay	Use	Connector
	Auto-Cal Zero			Auto-Cal Zero	
7	7NO, 7C, 7NC Auto-Cal Span	J12	23	23NO, 23C, 23NC Auto-Cal Span	J29
8	8NO, 8C, 8NC Auto-Cal Sample	J12	24	24NO, 24C, 24NC Auto-Cal Sample	J29
9	9NO, 9C, 9NC	J13	25	25NO, 25C, 25NC	J30
10	10NO, 10C, 10NC	J13	26	26NO, 26C, 26NC	J30
11	11NO, 11C, 11NC	J14	27	27NO, 27C, 27NC	J31
12	12NO, 12C, 12NC	J14	28	28NO, 28C, 28NC	J31
13	13NO, 13C, 13NC	J15	29	29NO, 29C, 29NC	J32
14	14NO, 14C, 14NC Auto-Cal Zero	J15	30	30NO, 30C, 30NC Auto-Cal Zero	J32
15	15NO, 15C, 15NC Auto-Cal Span	J16	31	31NO, 31C,31 NC Auto-Cal Span	J33
16	16NO, 16C, 16NC Auto-Cal Sample	J16	32	32NO, 32C, 32NC Auto-Cal Sample	J33

Connect the wires in your cable to the screw terminals on the relevant connectors as shown in Table 4-4 showing Relay X (J odd numbers) and Relay Y (J even numbers) positions on the jumpers listed in Table 4-3 above:

Table 4-4: Relay Screw Terminal Pin Connection

Pin	Use	Output Configuration
1	(X) NO	Normally Open Relay X
2	(X) C	Close Relay X
3	(X) NC	Normally Closed Relay X
4	(Y) NO	Normally Open Relay Y
5	(Y) C	Close Relay Y
6	(Y) NC	Normally Closed Relay Y

For setting up the Zero Gas relay if Auto-calibration is purchased, connect the wires in your cable to the screw terminals to the relevant connectors J11, J15, J28, and J32 (based upon the number and position of the transducers in the analyzer) shown in Table 4-5 below. “Y” represents the jumper number J11 for gas #1, J15 for gas #2, J28 for gas #3 and J32 for gas #4:

Table 4-5: Zero Gas Relay Screw Terminal Pin Connections for Auto-Calibration

Pin	Use	Output Configuration
4	(Y) NO	Normally Open Relay Y Zero Gas Relay
5	(Y) C	Close Relay Y Zero Gas Relay
6	(Y) NC	Normally Closed Relay Y Zero Gas Relay

For setting up the Span Gas and Sample Gas relays, if Auto-Cal is purchased, connect the wires in your cable to the screw terminals to the relevant connectors of J12, J16, J29, and J33 as shown below to control the Span Gas Relays and / or Sample Gas Relays shown in Table 4-6 below. “X” represents the jumper J12 for gas #1, J16 for gas #2, J29 for gas #3 and J33 for gas #4 and Pins 1 – 3 control the Span Gas Relays while Pins 4 – 6 control the Sample Gas Relays:

Table 4-6: Span and Sample Gas Relay Screw Terminal Pin Connections for Auto-Cal

Pin	Use	Output Configuration
1	(X) NO	Normally Open Relay X Span Gas Relay
2	(X) C	Close Relay X Span Gas Relay
3	(X) NC	Normally Closed Relay X Span Gas Relay
4	(X) NO	Normally Open Relay X Sample Gas Relay
5	(X) C	Close Relay X Span Gas Relay
6	(X) NC	Normally Closed Relay X Span Gas Relay

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4.2.5 Connect the electrical supply

Make sure that your external electrical supply outlet is isolated and locked-out before you connect the conductors in the electrical supply cable.

Only use the power supply cord provided with the unit.

Make sure the analyzer is suitable for use with your electrical supply voltage and frequency (section 7.2). If the analyzer is not suitable, it may not operate correctly, or it may be damaged if you operate it.

The analyzer is supplied with an electrical supply cable, configured for your electrical supply. Connect the electrical supply to the analyzer as follows:

1. Turn the Power Switch on the back of the unit to OFF: press the "**O**"on the On/Off switch shown in Figure 4-3 A.
2. Fit the IEC plug on the end of the electrical supply cable provided to the electrical supply socket on the rear of the analyzer (Figure 4-3 B).

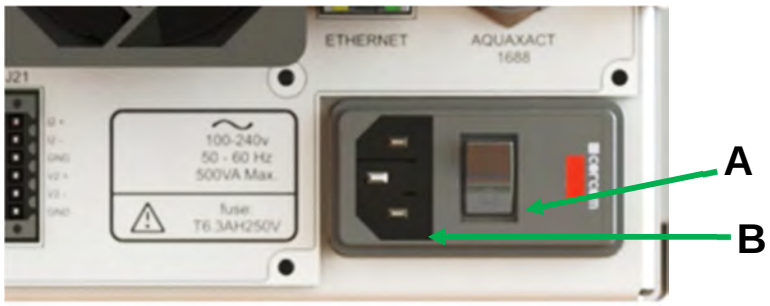

Figure 4-3: Power switch (A) and electrical supply socket (B) on rear of analyzer

3. Plug the other end of the electrical supply cable into your electrical supply outlet.
4. Check the earth (ground) continuity between your electrical supply outlet earth (ground) and the functional earth (ground) terminal on the rear of the analyzer.
5. If a local earth bonding is required, the functional earth stud can be used. The earth ground cable must be kept to less than 3 meters to comply with EMC standards.

This does not replace the earth conductor on the electrical supply socket which must always be connected. Therefore never cut or remove any of the metal pieces off of the supplied plug.

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4.3 Sample / calibration gas connections

The MultiExact 4100 must not be used with flammable gases.

Sample and calibration gases may be toxic or asphyxiant:

- **Make sure that the external connections are leak free at full operating pressure before you use sample or calibration gases.**
- **Make sure that the sample/bypass outlet pipes are vented to an area where the gases will not be a hazard to people.**
- **Make sure that the analyzer is used in a sufficiently well-ventilated environment, to prevent the build-up of toxic gases.**
- **Make sure that the pipes that you connect to the analyzer are routed so that they do not present a hazard to people.**

It is essential that all gases supplied to zirconia transducers are filtered to 2 µm local to the analyzer and that great care is taken to ensure that there is no possibility of ingress of dirt or any other kinds of particle during connection or operation.

It is essential that the analyzer is isolated from the sample system until any cleaning solvents are fully purged from the pipelines. Failure to take this precaution may lead to contamination of the transducer, which will be observed as an offset and drift in output.

Hint:	*This section gives simple instructions about connecting the sample and calibration gas pipelines to the analyzer.*

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4.3.1 Introduction

Sample and calibration gases pass into and out of the chassis via a gland plate mounted on the rear of the chassis.

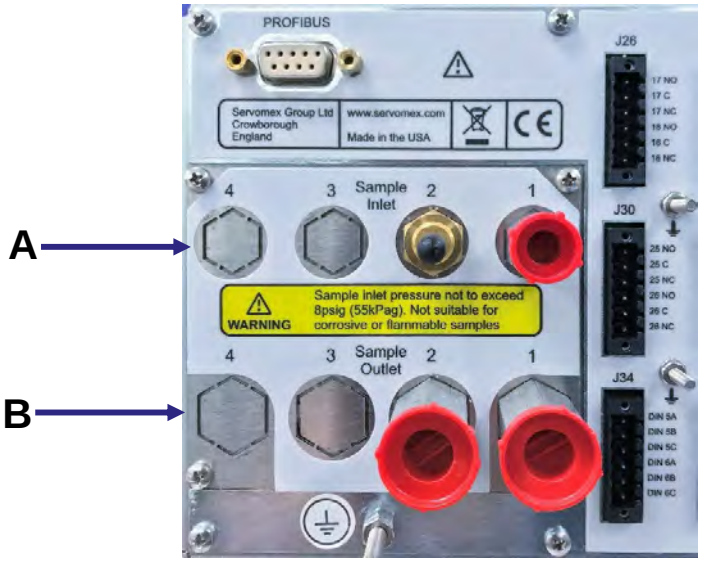

Figure 4-4: Gas inlets and outlets on rear of analyzer

It is essential that all gases supplied to zirconia transducers are filtered to 2 µm local to the analyzer and that great care is taken to ensure that there is no possibility of ingress of dirt or any other kinds of particle during connection or operation.

4.3.2 Gas connections

Connect your sample/calibration gas inlet and outlet pipelines to the Sample Inlet 1 (**Error! Reference source not found.** A) and Sample Outlet 1 (**Error! Reference source not found.** B) fittings on the rear of the analyzer. Do not over-tighten the fittings. **Error! Reference source not found.** shows the inlet and outlet fitting connections for the Standard system.

The actual connection depends on the analyzer variant and the transducer selection. Refer to Appendix G to Appendix L.

Table 4-7 shows the MultiExact 4100 sample port vs transducer type.

Gas transducer module type	Sample inlet	Sample outlet	Low Cal gas	High Cal gas
Zirconia	1/8" OD* stainless-steel stub	1/4" NPT female	N/A	N/A
Series IR	1/8" NPT female	1/4" NPT female	N/A	N/A
Paramagnetic	1/8" NPT female	1/4" NPT female	N/A	N/A
Infrared GFX	1/8" OD* stainless-steel stub	1/4" NPT female	N/A	N/A

Table 4-7: MultiExact 4100 sample port vs transducer type

Note: An external filter may be specified, in which case the inlet connections will be 'Swagelok' 1/8" OD female compression. The filter should be fitted directly to the analyzer inlet or, if preferred, at a convenient point in the sample inlet line.

4.3.3 Gas Flow Rate

Optional rotameter flow meters can be installed to measure the flow of gas through the analyzer. If two gas stream inlet / outlets are configured, then float meter 1 on the front panel shows the flow on stream #1 while float meter 2 shows the flow on stream #2 (**Figure 4-5**).

The flow rate is obtained by observing the scale indication at the **top** of the float. The rotameters are used only for visually validating that is flow going through the analyzer and is not exceeding the flow rate of the transducer (sec. 1.7) to which it is monitoring.

Flow control to the analyzer must be provided by the end user using mass flow controllers, manual adjustable valves like needle valves, or electronically controlled metering valves.

An optional internal flow switch can be configured with the analyzer for either the GFx 1210D or 3601P O2 Purity Paramagnetic when ordering. The flow switch is a diagnostic indicator to alert locally or remotely when low or no flow conditions exist.

Figure 4-5: Gas Flow Meter location on front panel of the standard analyzer

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4.4 Power up

Sample and calibration gases may be toxic or asphyxiant:

- **Make sure that the external connections are leak free at full operating pressure before you use sample or calibration gases.**
- **Make sure that the sample/bypass outlet pipes are vented to an area where the gases will not be a hazard to people.**
- **Make sure that the analyzer is used in a sufficiently well-ventilated environment, to prevent the build-up of toxic gases.**
- **Make sure that the pipes that you connect to the analyzer are routed so that they do not present a hazard to people.**

It is essential that the analyzer is isolated from the sample system until any cleaning solvents are fully purged from the pipelines. Failure to take this precaution may lead to contamination of the transducer, which will be observed as an offset and drift in output.

The analyzer can now be powered up.

> ***Hint:*** *When the electrical supply to the analyzer is switched on, as series of beeps will be heard, the readings are displayed on screen and the clock in the upper right hand corner of the screen starts running.*

Figure 4-6: On/off switch on the rear of the analyzer

To power up the analyser:

1. Make sure that the ac power is connected to the analyser and that the power supply is switched on.
2. Press **I** on the On/Off switch on the rear of the analyser (1 in Figure 4-6).

When the analyzer is first switched on, the screen displays a software loading progress bar, followed by the Home screen and the warmup signal appears in front of any transducer which operates under isothermal conditions (**Figure 4-7**).

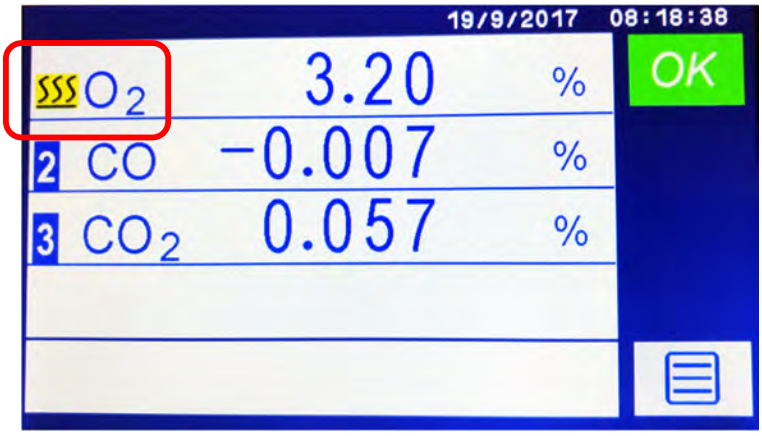

Figure 4-7: Home screen for a 3-transducer analyzer showing the O_2 warming up

> ***Hint:*** **Figure 4-7** *shows the unit in Warm Up mode, indicated by the three wavy lines shown in the upper left corner encircled by the red box.*

Note: Powering on the analzyer 4 hours prior to operation allows temperatures to equilibrate and transducers to achieve operating temperature set point. This is especially important for GFx to power on 24 hours prior to starting purge gas for 2-6 hours before calibration.

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4.5 Auto-calibration overview

Note: Auto-calibration is not available for AquaXact transducers)

The auto-calibration facility allows the instrument's calibration to be updated or checked at a user chosen time and date.

When a manual calibration adjustment or calibration check is engaged it will use the same analyzer relays and auto-calibration valves to select the calibration sample gases as required.

The auto-calibration process can be initiated in four ways:

- by an internal timer;
- by an external contact closure (section 4.5.3);
- by operator request through the user interface;
- or by an external Modbus or PROFIBUS command

Auto-calibration facilities are offered to either measure or check the following:

- Transducer low calibration ('zero' calibration).
- Transducer low and high calibration (both 'zero' and 'span').

In auto-calibration, two user defined gases, cal gas 1 (span gas) and cal gas 2 (zero gas), are provided to the instrument. In some cases, the same gas may be used for low calibration of one transducer while being the high calibration of another. The gases are introduced to the analyzer in three phases:

- Phase 1 cal gas 1
- Phase 2 cal gas 2
- Phase 3 cal gas 1 again as a validation of Phase 1

4.5.1 Auto-calibration valve installation

The auto-calibration function uses relays that can be used to control external valves provided by the user. If the auto-calibration option is ordered the analyzer will be equipped with eight relays for each transducer. The last three relays in each set of eight will be used to supply span, zero and sample gases. As an example, if an analyzer has one transducer, then relays 6, 7 and 8 will be assigned to zero, span and sample respectively.

Note: The MultiExact 4100 requires three externally powered two-way valves for each transducer, and the analyzer switches to each one according to the auto-cal sequence. One is for the process gas, one for the low cal gas, one for the high cal gas.

4.5.2 Auto-calibration / validation sequence

The auto-calibration/validation sequence is:

1. Declare Service In Progress and turn on any Service In Progress relay (if configured).
2. Turn off Sample.
3. Turn on Span Gas.
4. Wait designated time.
5. Calibrate Span.

6. Turn off Span Gas.
7. Turn on Zero or Low Gas.
8. Wait designated time.
9. Calibrate Zero.

10. Turn off Zero or Low Gas.
11. Turn on Span Gas.
12. Wait designated time.
13. Validate reading within designated tolerance.

14. Turn off Span Gas.
15. Turn on Sample Gas.
16. Wait designated time before returning to normal measurement operation.
17. Clear Service In Progress and turn off any Service In Progress relay.

Note: Any of the first three phases (steps 1-5, 6-9 or 10-13) can be skipped by setting the wait interval to zero. The minimum wait time for restoring Sample Gas is 1 second.

4.5.3 External inputs

To activate the auto-calibration, connect pins DIN2B and DIN2C. The voltage input is activated by applying 5 – 24 Vdc with + to DIN1A and – to DIN1B for example.

The contact closure input is activated by a contact closure between DIN1B and DIN1C for example.

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4.5.4 Auto-calibration / validation settings

> > > Auto

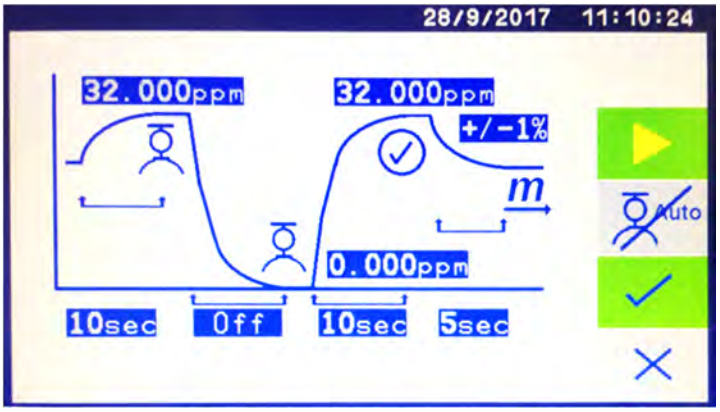

Figure 4-8: Auto-calibration setup screen

The Auto-calibration setup screen allows you to set the sequence, timing and concentrations.

Note: If a span and validation are both selected, the validation gas must be the same as that used for the span.

Note: Touch  *to cancel or turn auto-calibration off.*

Touch each parameter in turn and set the value as required.

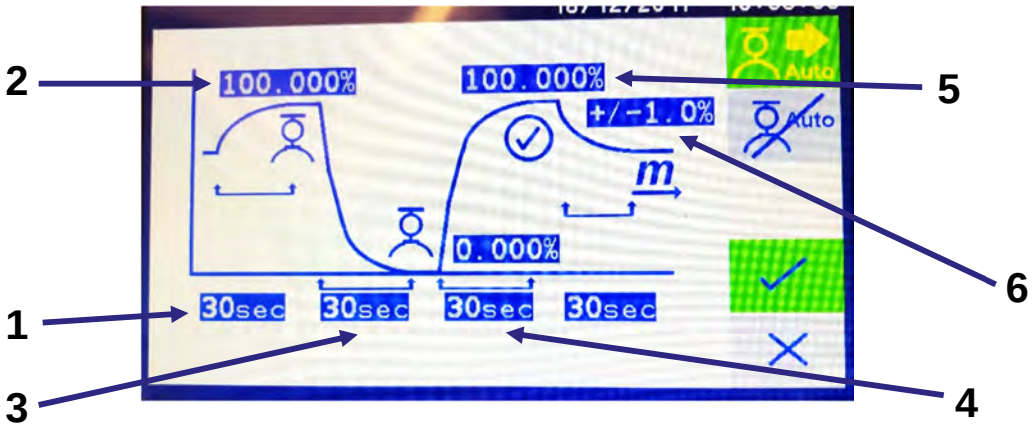

Figure 4-9: Auto-calibration setup screen

In the example in Figure 4-9, the sequence is:

1. Switch to the calibration (span) gas for 30 seconds.
2. Span gas calibration target concentration.
3. Switch to the zero gas or low calibration for 30 seconds.

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4. Switch back to the span gas and wait 30 seconds for span validation.
5. Span gas validation target concentration.
6. Span gas validation target tolerance.. The span gas is specified to be 100% and a pass/fail tolerance is sent to 1.0%, so if measured within ±1.0% of 100%, the process completes successfully, otherwise a failure is reported.
7. The relays are set back to measuring the process gas and the main display is shown.

Note: Each sequence can specify a time for the gas is to flow, or set to OFF, in which case the sequence step is skipped.

Note: The validation pass/fail tolerance (6 in Figure 4-9) is a percentage of the target concentration

Either touch ▶ to run the auto calibration/validation sequence straight away, or touch ✓ to set a time for the auto calibration/validation sequence to start.

Note: Touch ✕ to abort the auto calibration set-up sequence, or to exit the screen.

The next screen allows you to set the Day/Month/Year for the first auto-calibration / Validation event. Touch ✓ to accept entry.

Figure 4-10: Auto-calibration setup screen: set date

In the next screen, set the time for the auto-calibration / validation event. Touch ✓ to accept entry.

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Figure 4-11: Auto-calibration setup screen: set time

In the final screen, set the repeat timing for the auto-calibration / validation event. This can be set to repeat the every X days or every Y hours.

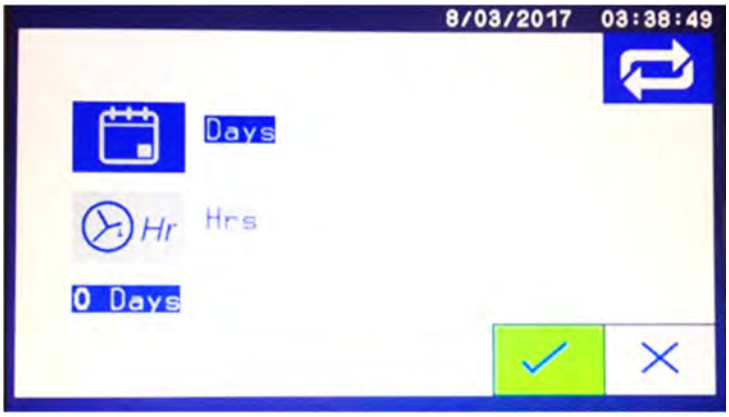

Figure 4-12: Auto-calibration setup screen: repeat every X days

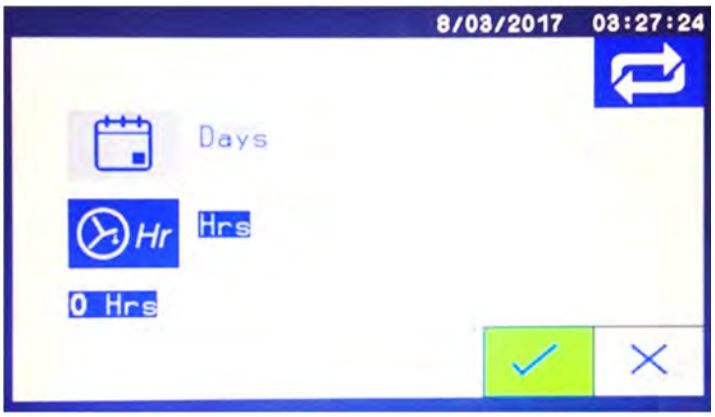

Figure 4-13: Auto-calibration setup screen: repeat every Y hours

Touch ✓ to accept the sequencing and cycle timing.

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4.5.5 Relays used for auto-calibration / validation

Transducer 1:	• Zero or Low Gas Relay #6 • Span (high conc. Calibration gas) Relay #7 • Sample Gas Relay #8
Transducer 2:	• Zero or Low Gas Relay #14 • Span (high conc. Calibration gas) Relay #15 • Sample Gas Relay #16
Transducer 3:	• Zero or Low Gas Relay #22 • Span (high conc. Calibration gas) Relay #23 • Sample Gas Relay #24
Transducer 4:	• Zero or Low Gas Relay #30 • Span (high conc. Calibration gas) Relay #31 • Sample Gas Relay #32

4.5.6 Calibration log file

The analyzer calibration history is saved in the config_files directory in the CalibrationRecord.txt file. This file can be opened with a program such as Excel. The file can be written to a USB drive inserted into the analyzer using the button sequence shown above.

The example in Figure 4-14 shows an auto calibration and validation entry. The measured process result is reported as the 'Before' value. The entered span value is 25ppm and after calibration the validation result is also 25ppm.

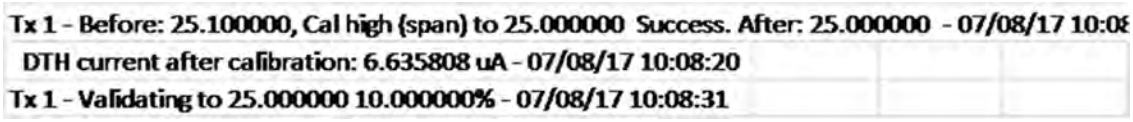

Figure 4-14: Example calibration log file

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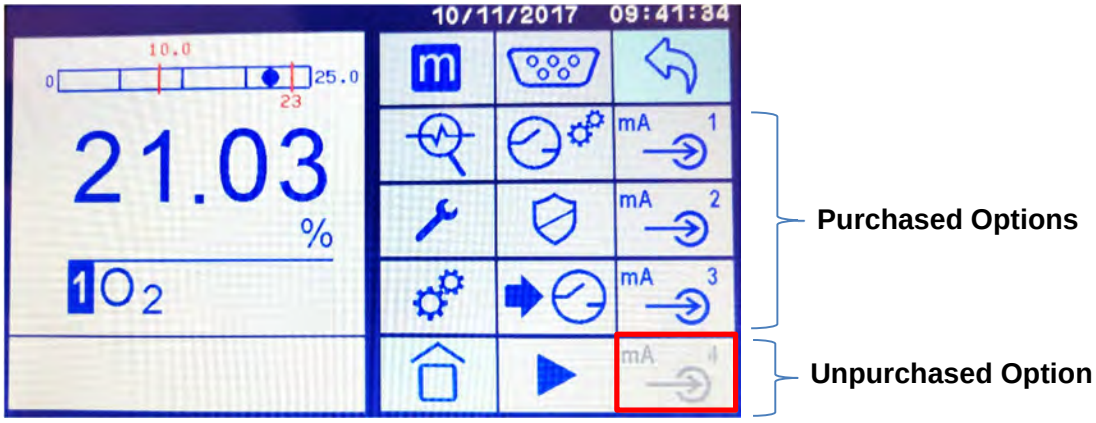
5 User interface

Note: All configuration options referred to in this manual (for example, auto-calibrate / validate) must be specified at the time of purchase. If your analyzer does not have the corresponding product options, then menus and menu options associated with the option will not be available for use and will appear as grey colored icon button.



5.1 Introduction

The user interface is a touchscreen display with icon-driven menus to allow for the operation of the MultiExact 4100 Analyzer. All ME4100 analyzers share common features, but each will have unique features based upon its configuration which are detailed in this manual.

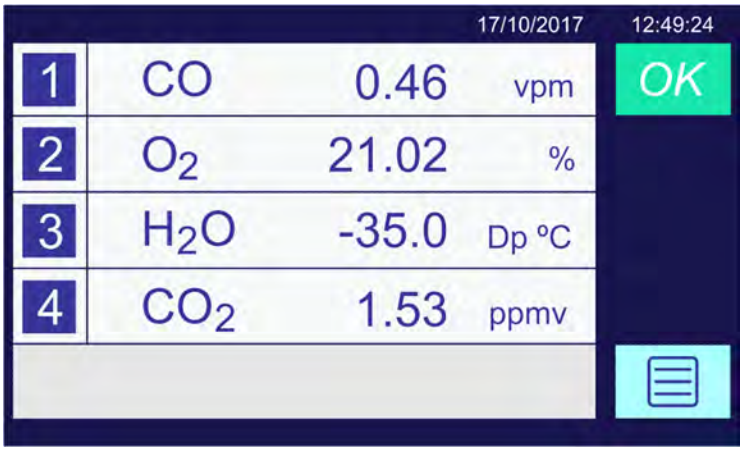


Figure 5-1: Home screen for a 4-transducer analyzer

Figure 5-1 shows the main display for a four-transducer analyzer. If there are three transducers there will be three horizontal bars one for each analyte measured. If there are two transducers the screen will split into two windows as shown in Figure 5-2. If there is

only one transducer or if transducer specific user interactions are taking place there will be one window for the selected transducer.

To interact with a specific transducer, touch on the horizontal bar on the home screen display for that transducer.

Note: The remainder of the software descriptions will show a single transducer window. If there are no menu interactions for 60 seconds, the display reverts to the show all results mode.

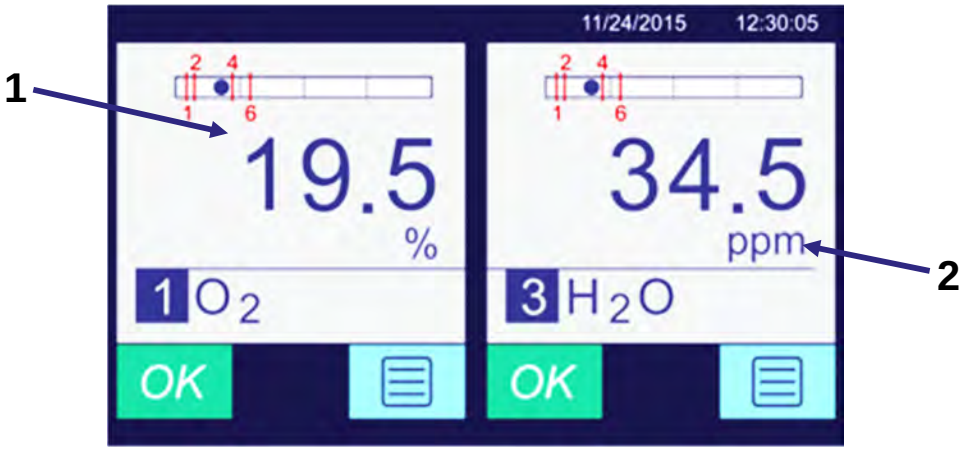


Figure 5-2: The user interface home screen for a two-transducer configuration

The user interface comprises the following:

1	Touchscreen display	Screens and icons are displayed on the touchscreen depending on the information and operation being engaged.
2	Touchscreen icons	The icons displayed depend on the current screen.

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5.2 General techniques

5.2.1 Touchscreen operation

Each screen displays active icons that are relevant to that screen's operation. To use the icon, just touch the screen on top of the icon graphic.

Note: The touchscreen icons turn blue when they are selected or active.

When a screen is selected, more icons are displayed.

5.2.2 Touchscreen icons

The following table shows touchscreen icons that frequently appear on different screens.

Icon	Meaning	Function
	Menu	Displays the Menu screen (Figure 5-2).
	Measurement	Displays the Measurement screen.
	Diagnostics	Displays the Diagnostics screen where system-wide diagnostic tools can be operated.
	Maintenance	Displays the Maintenance screen where system-wide maintenance action can be carried activated.
	Settings	Displays the Settings screen where system-wide parameters can be configured.
	Calibrate	Displays the Calibrate screen where system-wide settings can be configured.
	Alarm settings	Displays the Alarm settings screen where system-wide alarm parameters can be configured.
	Home	Displays the Home screen.
	Accept	Touch this icon to accept any changes made.
	Reject	Touch this icon to reject any changes made or exit a screen.

Main Four Menu Branches

In this manual, the navigation route through the user interface screens is described by a sequence of icons that you must touch to move to the desired screen. For example, to display the Alarms screen, a sub-screen of the Measurement branch, you must:

1. Touch the  icon to display the Menu screen.

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2. Touch the  icon to display the Measurement screen

3. Touch the  icon to display the Alarms screen.

This sequence is shortened to:

5.2.3 System and measurement status icons

The status icon is located at the top right corner of the Home screen. If the system is healthy and happily measuring the green OK icon displays (Figure 5-3).

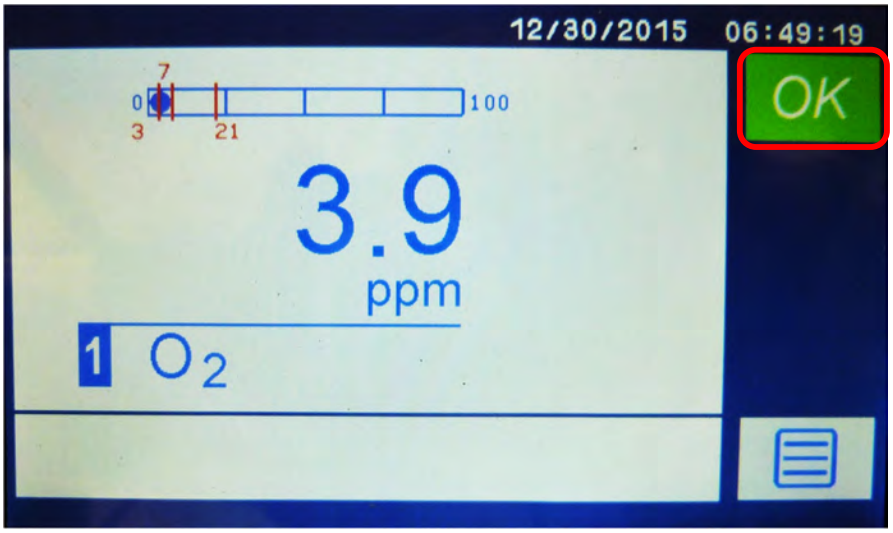

Figure 5-3: Home screen (single transducer)

Note: Touch the green OK icon to display the date and time when the analyzer was last started.

If a problem occurs with the system, the status icon changes to one of the symbols shown in the table below.

Icon	Meaning	Meaning
	Alarm	Indicates that there is an alarm on the system. Touch the icon to display the Alarm Selection screen. An example is shown in Figure 5-4.
	Faults	Indicates a fault with the system, for example a communication failure with the transducer, an over-temperature condition or out of specification where the measured value is out of the maximum range for the An example is shown in Figure 5-4.transducer. Touch the

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icon to display a message in the text bar describing the fault.

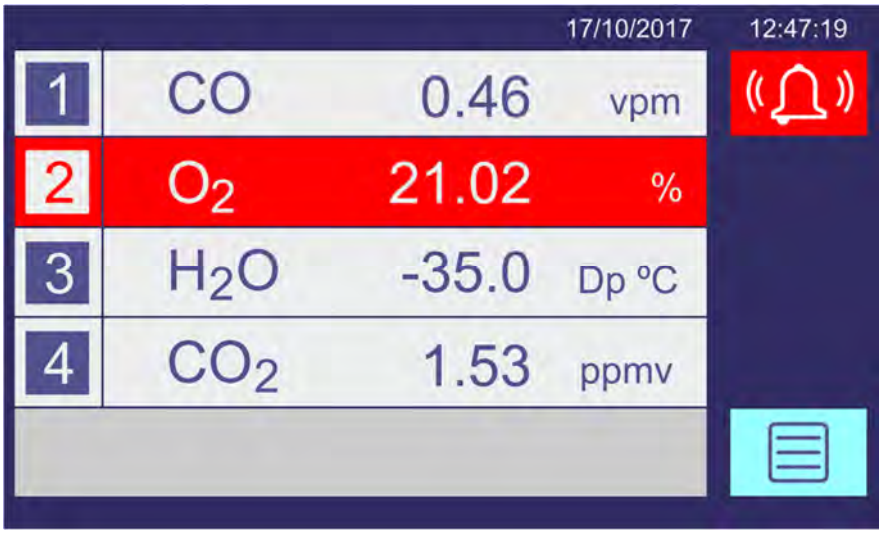

Figure 5-4: Home screen (4 transducer analyzer), showing alarm

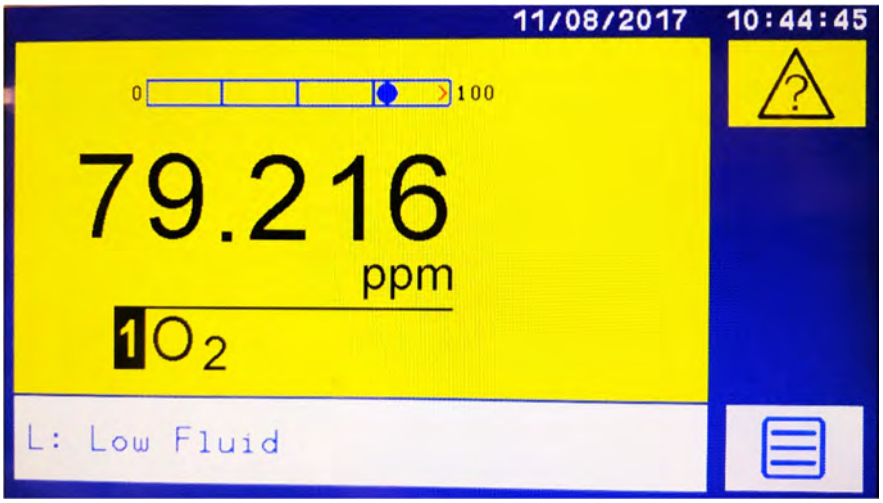

Figure 5-5: Home screen (1 transducer analyzer), showing warning screen with fault description

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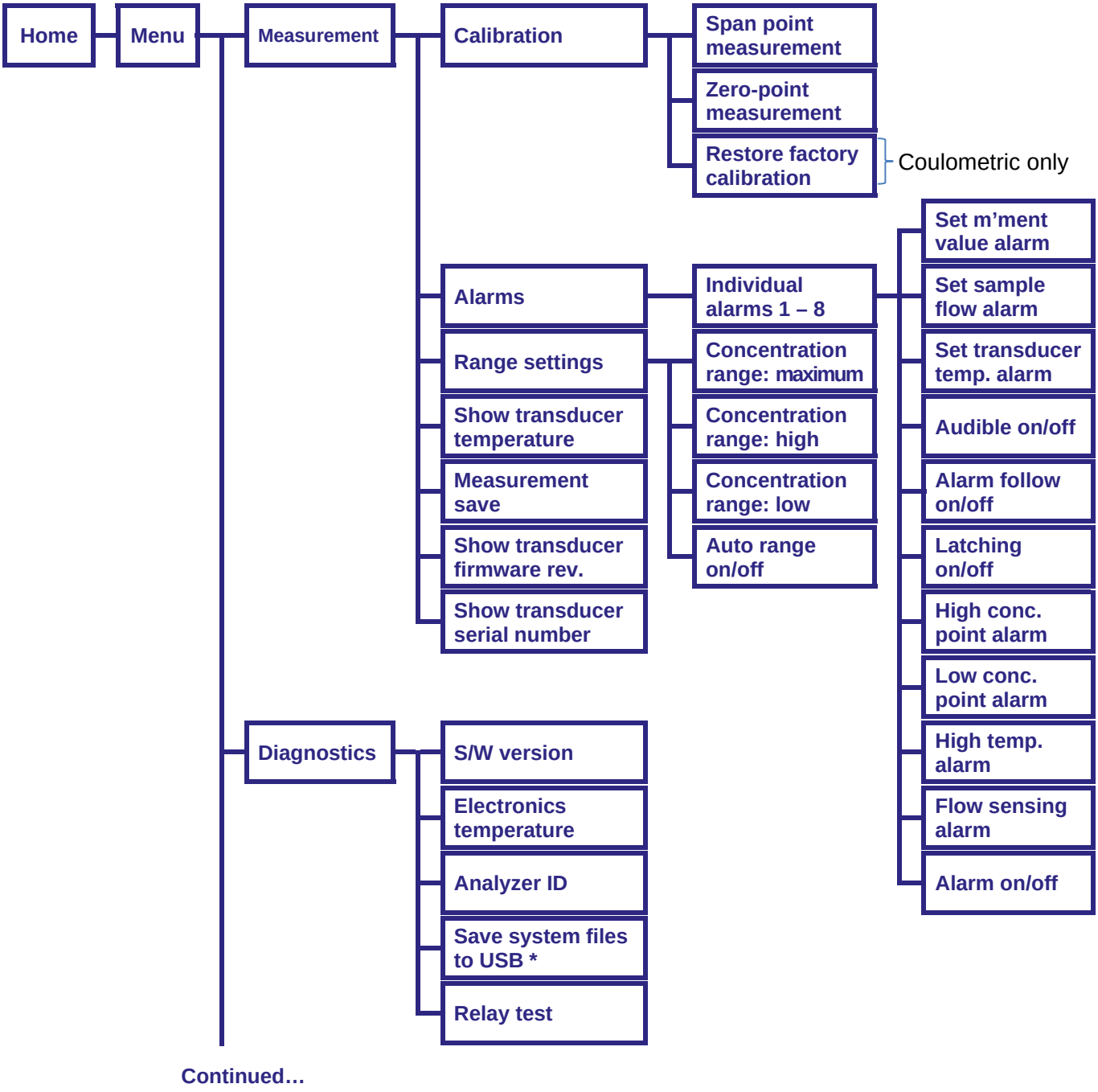
5.3 Menu branch structure

Notes: Alarms 1 – 8 each have their own settings. Only one set is shown.



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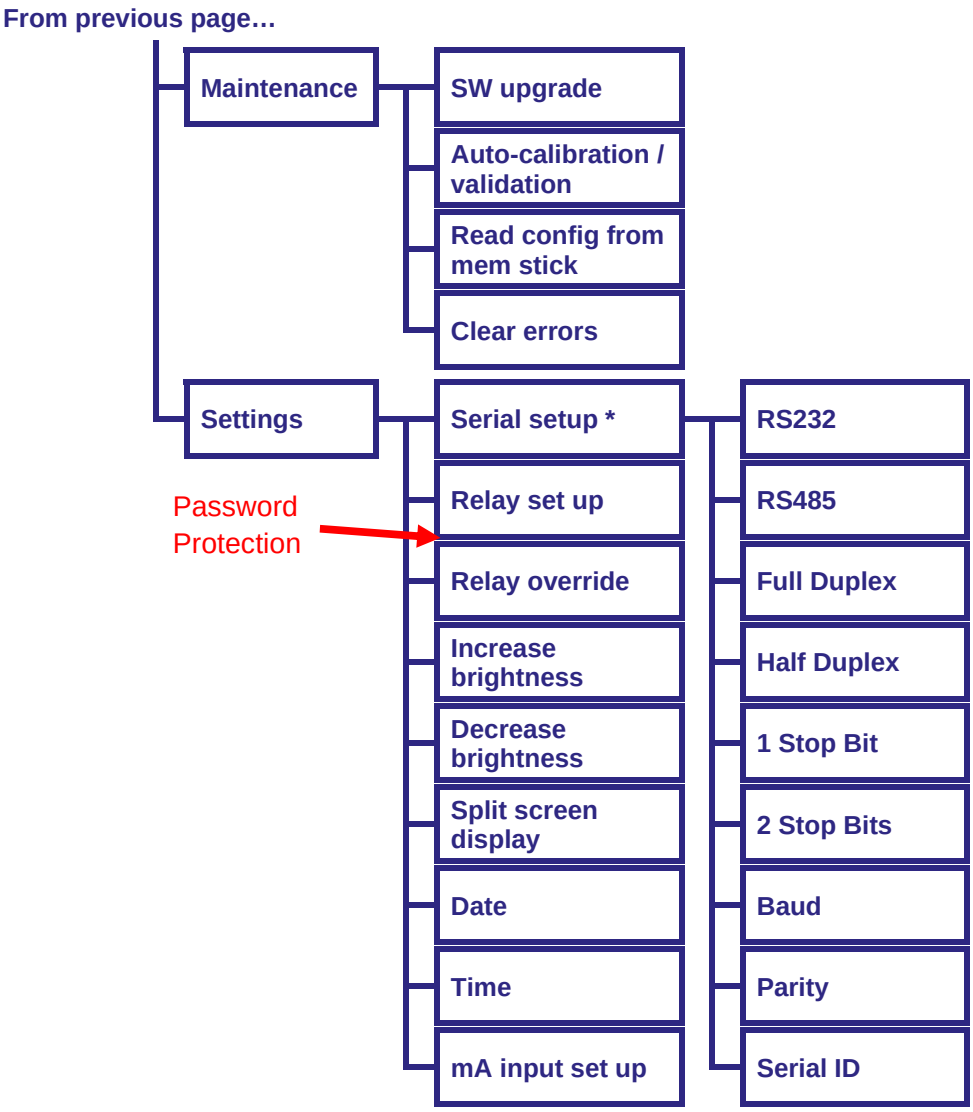

Figure 5-5: User interface menu structure

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5.4 Home screen

The Home screen (Figure 5-6) displays the current measurement and system status.

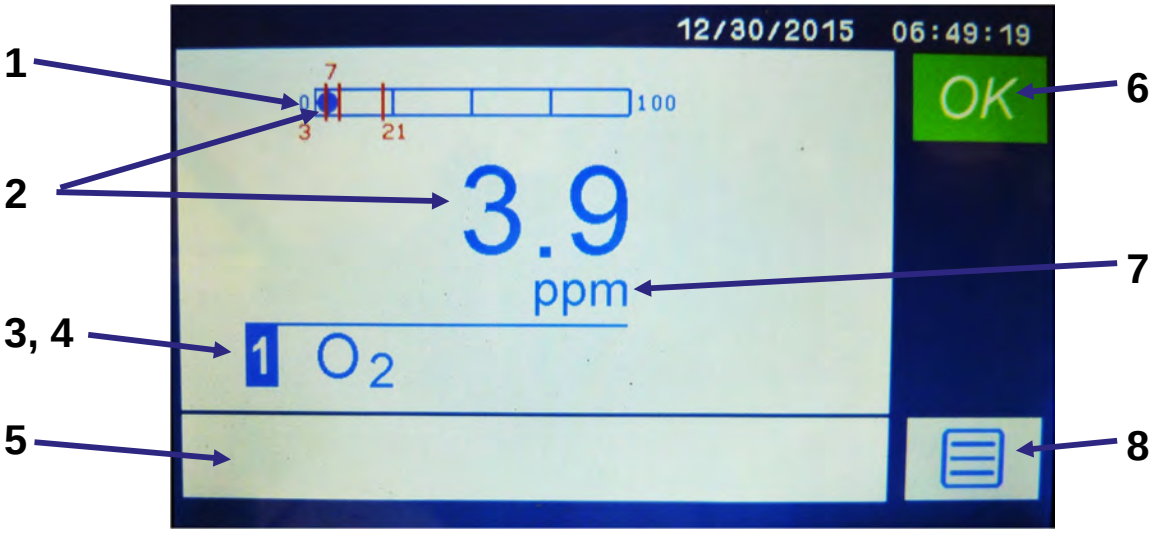

Figure 5-6: Home screen

1	Bar graph showing the operable measurement range boundaries, current measurement and relative to alarm set points	5	Information area where messages such as error codes, IP address, and diagnostic information are displayed.
2	Current measurement	6	System status
3	Transducer number *Note: 1 is always shown.*	7	Measurement units
4	Analyte being measured	8	Menu icon (section 5.5)

> ***Hint:*** *If no icon is pressed for 1 minute in any other menu branch, the measurement screenor home screen is automatically displayed. You will also then have to re-enter the password to access any password-protected screens.*

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5.5 Menu screen

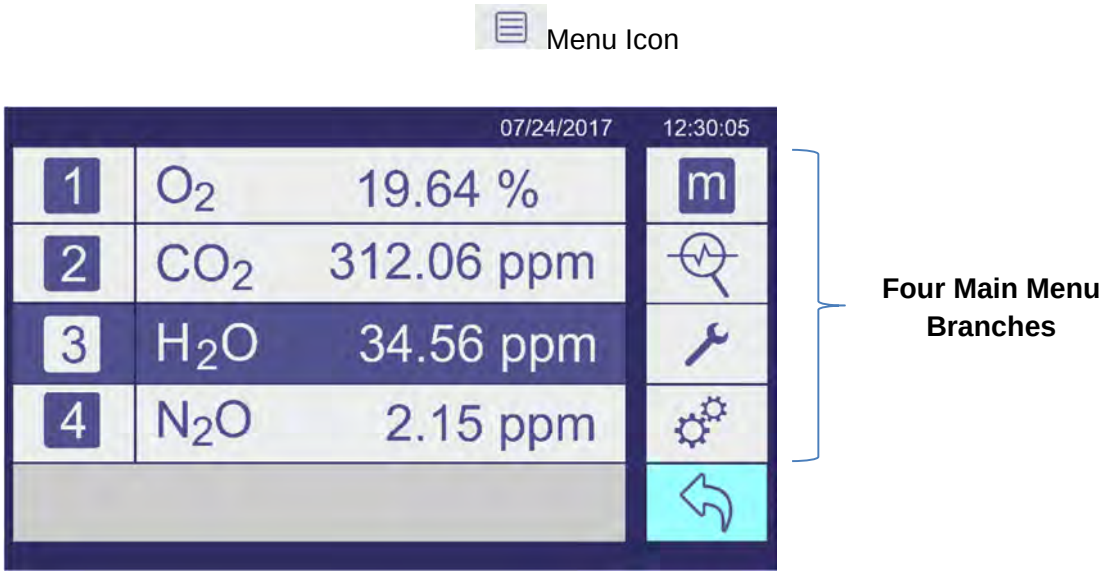

Figure 5-7: Menu screen

Icon	Meaning	Function
m	Measurement	Displays the Measurement screen where measurement and alarm settings can be adjusted for each transducer installed (section 5.6).
	Diagnostics	Displays the Diagnostics screen where system-wide diagnostic tools can be found (section 5.11).
	Maintenance	Displays the Maintenance screen where system-wide maintenance actions can be initiated (section 5.12).
	Settings	Displays the Settings screen where system-wide parameters can be defined (section 5.13).
	Return to the Home screen	Touch this to close the menu options and return to the Home or measurement screen (section 0).

Note: The first column of icons on each menu screen is the same for all analyzers. Once one of the four menu branches are selected that relevant icon changes blue to show which menu screen is active.

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5.6 Measurement branch screen

The Measurement screen has three pages (Figure 5-8 to **Error! Reference source not found.**) where a second column of icons appears.

Note: Page 1 displays first.

To go to the subsequent pages, press the  *icon.*

To go back to the previous page, press the  *icon.*

Figure 5-8: Measurement screen – page 1

Figure 5-9: Measurement screen – page 2

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Figure 5-10: Measurement screen – page 3

The measurement branch icons are listed below:

Icon	Meaning	Function
	Calibrate menu	To define the calibration settings for the system.
	Alarm menu	To define the alarm settings for the system.
	Range setting	To define the limits of the range bar.
	mA output set up	To set up the mA outputs.
	Measurement save option	To setup the measurement save option.
	Transducer firmware revision	To display the transducer firmware revision.
	Transducer serial number	To display the transducer serial number.

Note: The transducer firmware revision, temperature and serial number display in a text box at the bottom of the screen when the relevant button is pressed.

5.7 Configure measurement alarms

5.7.1 Display the Alarms screen

> >

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The Alarms screen shows how each of the eight alarms is currently configured. There are options for 0, 2, 4 and eight alarms for each transducer.

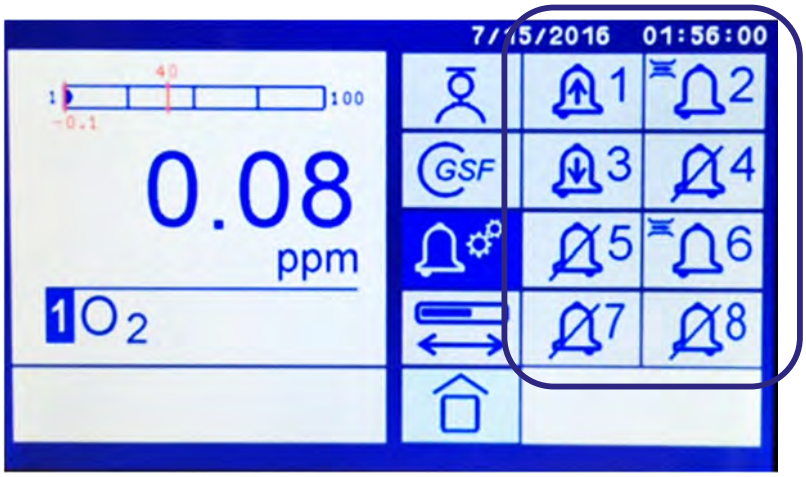

Figure 5-34: Alarms screen showing 8 alarms which have been set

Note: During a calibration, an alarm will only be activated if the alarm 'Follow' option is set to yes (section 5.7.2).

5.7.2 Alarm settings

Up to eight separate measurement alarms are available for each sample gas measurement for which the analyzer is configured, and you can configure each alarm to operate in one of the four modes listed in Table 5-1:.

To configure an alarm:

1. Touch an individual alarm icon on the Alarms screen (Figure 5-).

Figure 5-35: Alarm icons on alarm screen

2. The Alarm setup screen for that particular alarm is displayed.

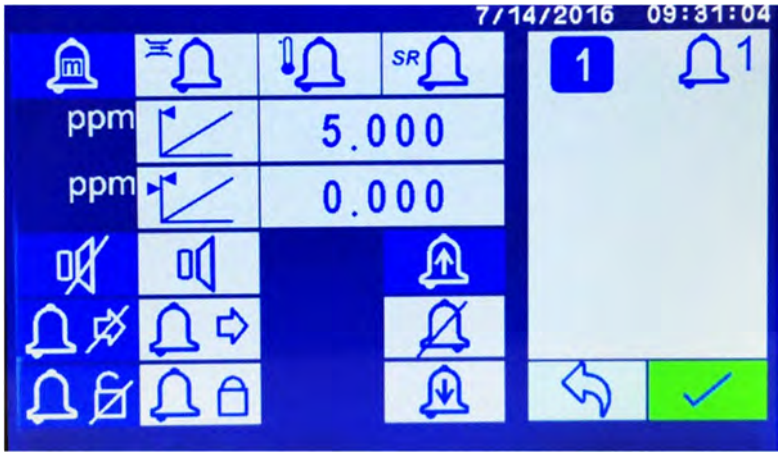

Figure 5-36: Alarm setup screen

3. Press the required icon to configure the alarm (Table 5-1):

Note: The selected icon is highlighted in blue. For example,  *indicates that alarm sound on is selected.*

Icon	Description
	Alarm type. Alarms can be set to one of the following alarm types:
	Measurement alarm. An alarm condition is activated when a condition exceeds the limits set in the alarm mode.
	Flow alarm. An alarm condition will be activated when the sample gas flow drops below 0.1 L/min. The flow alarm only functions if the optional flow switch was ordered with the analyzer.
	Span reference alarm An alarm condition
	Transducer temperature alarm *(IR1520 transducers only)*. An alarm condition will be activated when the transducer measurement is higher than 45 °C. If the transducer exceeds 45°C for 30 minutes, the transducer automatically turns off.

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Icon	Description
	Alarm mode. In Figure 5-, Alarms 1 is set to high alarm, Alarm 3 is a low alarm, Alarm 2 and 6 are flow alarms and Alarms 4, 5, 7 and 8 are unconfigured.
	Unconfigured. The alarm is not used (i.e. an alarm condition will not be activated under any circumstances).
	Low alarm. An alarm condition will be activated when a sample measurement is lower than the pre-set alarm level.
	High alarm. An alarm condition will be activated when a sample measurement is higher than the pre-set alarm level.
	Threshold value (for high or low alarms). This is the value of the measurement that will raise the alarm. To set the alarm threshold value, touch the number to the right of the icon. Use the number keypad that displays to type in the threshold value. *Note: Touch the*  *icon to delete the last digit typed in.* Touch the  icon to accept the value or touch the  icon to cancel the entry.
	Hysteresis value (for high or low alarms) (see section 5.7.3). To set the alarm threshold value, touch the number to the right of the  icon. Use number keypad that displays to type in the threshold value. Touch the  icon to accept the value or touch the  icon to cancel the entry.

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Icon	Description
	Audible alarm. Touch one of the following icons to select the required option: *Note: The selected option is colored blue.*
	The alarm is not audible.
	An audible alarm will sound if the alarm settings are triggered. To silence the alarm, touch the the  icon.
	Alarm following. This determines whether alarms will be raised during calibration. Touch one of the icons to select the required option:
	The alarm is not followed. The alarm will not be seen. This is the default option during calibration.
	The alarm is followed. The alarm will be seen, even during calibration.
	Alarm latching.
	Alarm latching off. Once the alarm condition has been activated, the alarm condition remains activated only until a subsequent sample measurement which would not trigger the alarm is made. The alarm condition is then deactivated. To unlatch any 'latched' measurement alarm(s), touch the  icon. All latched alarms will be unlatched and the Measurement screen displayed again.
	Alarm latching on. Once the alarm condition has been activated, the alarm condition remains activated (even if subsequent sample measurements would not trigger the alarm) until the alarm is manually unlatched.

Table 5-1: Alarm configuration

4. Press the  icon to save the alarm, or the  icon to return to the alarms screen.

   Note: On the Home screen, the alarm is displayed as a red line on the bar graph (Figure 5-).

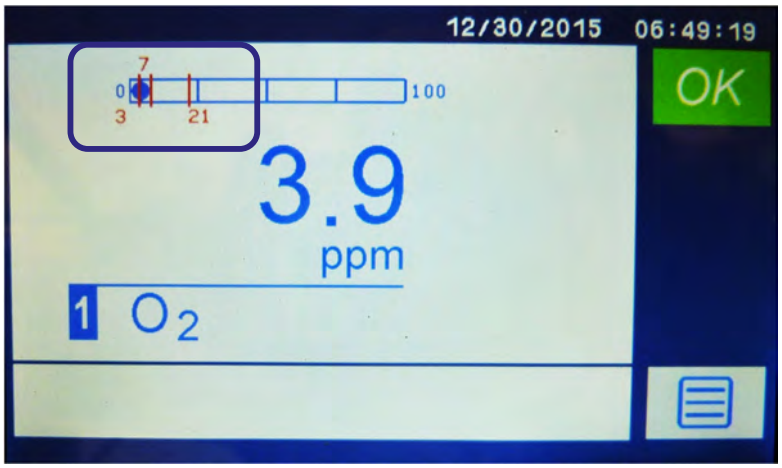

Figure 5-37: Home screen showing alarm settings on the bar graph

5. When the alarm has been set, assign the relay for that alarm (section 5.15).
6. Repeat this for each alarm required.

5.7.3 Hysteresis levels

The hysteresis level associated with a measurement alarm determines when an alarm condition (once activated) is deactivated, and this depends on the alarm mode, as follows:

Alarm mode	Effect of hysteresis
Low alarm	Once the low alarm condition has been activated, the alarm condition will not be deactivated until a sample measurement is above (alarm level + hysteresis level).
High alarm	Once the high alarm condition has been activated, the alarm condition will not be deactivated until a sample measurement is below (alarm level – hysteresis level).

For example:

- If a 'low' alarm has an alarm level of 15% and a hysteresis level of 1%, the alarm is activated when a sample measurement is < 15%, and the alarm is not deactivated until a sample measurement is > 16%.

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- If a 'high' alarm has an alarm level of 3 ppm and a hysteresis level of 1 ppm, the alarm is activated when a sample measurement is > 3 ppm, and the alarm is not deactivated until a sample measurement is < 2 ppm.

5.7.4 Activated alarms

While a measurement alarm condition is activated:

- The screen changes to flashing red (Figure 5-).
- The Alarm Status icon appears at the upper right of the screen (1 in Figure 5-).
- The appropriate alarm relay will be triggered.

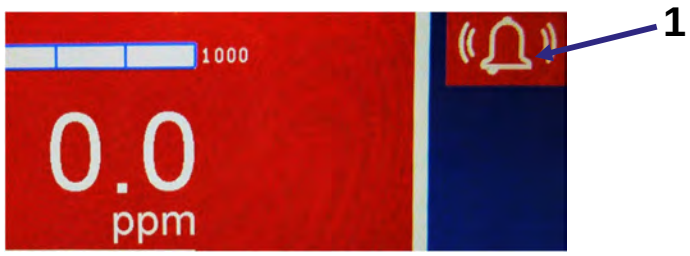

Figure 5-38: Measurement alarm condition

To view the details of the activated alarm (1 in Figure 5-):

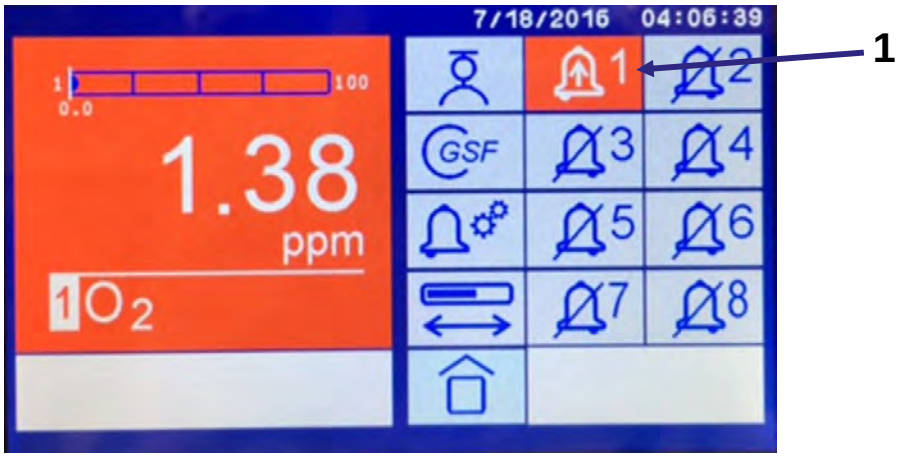

Figure 5-39: Alarms screen showing triggered alarm

Hint:	*Ensure that the measurement alarm and hysteresis levels are not too close to the expected sample measurements. (If they are, minor – and potentially acceptable – variations in your sample gas concentrations will result in spurious alarms.)*

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> ***Hint:*** *If you configure one measurement alarm as 'low' and configure the other alarm as 'high', ensure that the 'high' alarm and hysteresis levels are higher than the 'low' alarm and hysteresis levels. (If you do not, the analyzer can be permanently in an alarm condition, until you correct the levels.)*

5.8 Configure the measurement record option

The measurement record option allows the operator to save time-stamped concentration readings as a text file. It is possible to configure multiple record files if there are two or more transducers.

Three-time intervals are possible: seconds, minutes and hours. If data recording is set to seconds file sizes will accumulate quickly so, high resolution data recording should only be implemented for short periods of time.

To store a result:

1. Press the clock icon to toggle through the time options until the required time page displays.
2. Type **1** on the numeric pad to select 1 second, 1 minute or 1 hour, depending on the time interval selected.
3. Press the  icon to start the logging.
4. To stop the logging, set the time interval to zero by typing **0** on the numeric pad.
5. The log must be saved onto a memory stick before it can be viewed. Open the analyser door and insert a memory stick into the USB socket on the right-hand side of the interior.
6. Navigate to the Diagnostics page and press the USB icon:

Several system files including the measurement logs will be written onto the memory stick.

50	27/7/2016	09:34:09
50	27/7/2016	09:44:09
50	27/7/2016	09:54:09
50	27/7/2016	10:04:10
50	27/7/2016	10:14:10
50	27/7/2016	10:24:10
51	27/7/2016	10:34:10
51	27/7/2016	10:44:10

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51	27/7/2016	10:54:10
51	27/7/2016	11:04:10

Note: Column 1 is the ppm measured value; column 2 is the date; column 3 is the time.

5.9 Range settings

Figure 5-40: Range setting screen

5.9.1 Auto-range

To turn on auto-range, touch the  icon in the center of the range setting screen.

To turn off auto-range, touch the  icon in the center of the range setting screen.

5.9.2 Setting a custom maximum range

To set a new maximum indicator bar and serial output range for the transducer, touch the  icon.

The numerical display will continue to show the results up to the intrinsic maximum range of the transducer, but the serial output stops at the user set maximum.

If auto-range is turned off, and the user range high value is exceeded, the range does not switch to the intrinsic full range of the transducer. For example, if the transducer intrinsic range is 0-100ppm and the user defined maximum range is set to 0-10ppm. The voltage or milliamp output would stop at 10ppm. The actual values (0-100ppm) would still be displayed on the numeric front panel.

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Another example: The transducer intrinsic range is 0-100ppm. The user has redefined the maximum output range to 0-10ppm and had also set the user range to 0-1ppm. If auto range is on and the value goes over 1ppm, the output auto ranges to 0-10ppm. If auto range is off, the output stops at 1ppm. The actual values (0-100) would still be displayed on the numeric front panel.

5.9.3 Setting display / 4-20 mA or 0-10V ranges

The 4-20 mA output range is determined by the minimum and maximum range values set using the upper ( ) and lower ( ) range icons on the right of the range setting screen.

Any over-range is automatically detected, so for example, if a range of 0-100 is set on a 0-10000 transducer and the reading exceeds 100, the transducer automatically switches to the full range (0-10000) for both the display and 4-20mA output unless auto-ranging has been turned off (section 5.9.1).

5.10 Manual calibration

> ***Hint:*** *The required frequency of calibration depends on the reliance that you place upon the accuracy and consistency of the measurements made by the analyzer. Adjust the frequency according to your requirements and the drift characteristics of your analyzer. Refer to transducer specific information in the Appendices.*

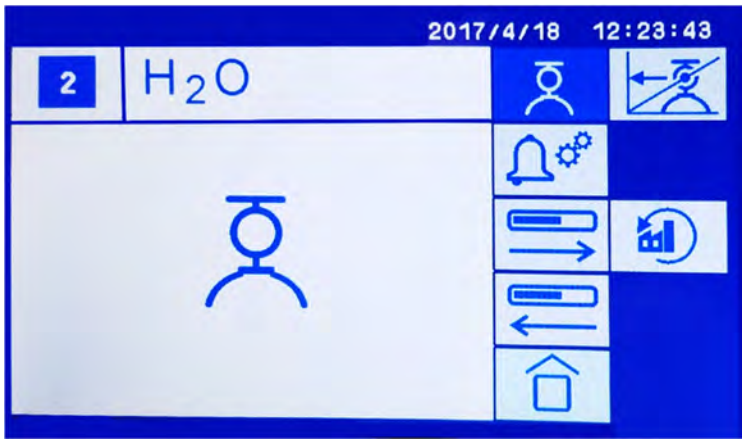

Figure 5-41: Calibration screen

Icon	Description
	Span calibration point.
	Zero calibration point.

To manually calibrate the analyzer high span:

1. Make sure that your equipment is configured to correctly route your calibration gas supply to the analyzer sample gas inlet.
2. Route the calibration gas and wait 15 minutes. If the display does not change for one minute, touch the icon for the high span measurement  icon.

   The screen will display the target value along with the last span value that was used to calibrate. If the target value is not correct for the calibration gas you are using, change the target value to the required value using the numeric keypad (Figure 5-).

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3. Press 

Figure 5-42: Enter the value using the keypad

4. Press the  icon to start the calibration (Figure 5-).

Figure 5-43: Start calibration

5. Repeat steps 2 to 4 of this section to calibrate the zero-point measurement  .

Note: To restore the factory calibration settings, press the  *icon. Take care as any changes that you have made to the calibration will be lost if you restore the factory calibration.*

Note: After selecting the type of calibration and entering the target value, the current reading stays on screen along with the  *icon. This allows the user to switch to the zero or span gas after starting the procedure, i.e. it lets the Service In Progress to take effect before the reading begins to change as a result of the gas being switched. When calibration is finished it reverts back to the screen displaying the gas reading, to allow the user to see the post-calibration reading, switch the gas back to sample before exiting, and release the Service*

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*In Progress indicators. It also allows the user to re-do that calibration. When the procedure is finished the user must explicitly touch the **Back** button to terminate Service In Progress and bring up the measurement screen.*

Note: If the auto-calibration / validation option has been purchased, the pre-assigned relays will be activated during a manual span and zero calibration process, and at completion, the sample gas relay will be activated.

5.10.1 Display diagnostics

Instrument diagnostics are provided at the transducer level. They may provide additional details during transducer troubleshooting for experienced users and service technicians. The procedure to display diagnostics is below and a more detailed can be found in section 9 Troubleshooting and in the individual transducer Appendices.

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5.11 Diagnostics branch screen

Note: Page 1 displays first.

To go to the subsequent pages, press the  *icon.*

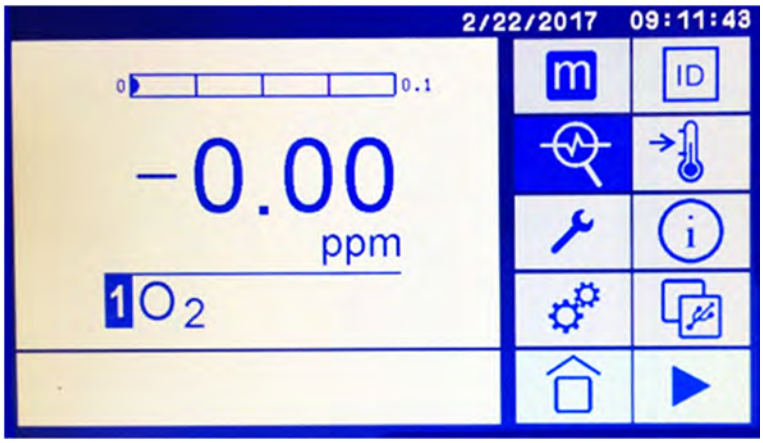

Figure 5-11: Diagnostics screen – page 1

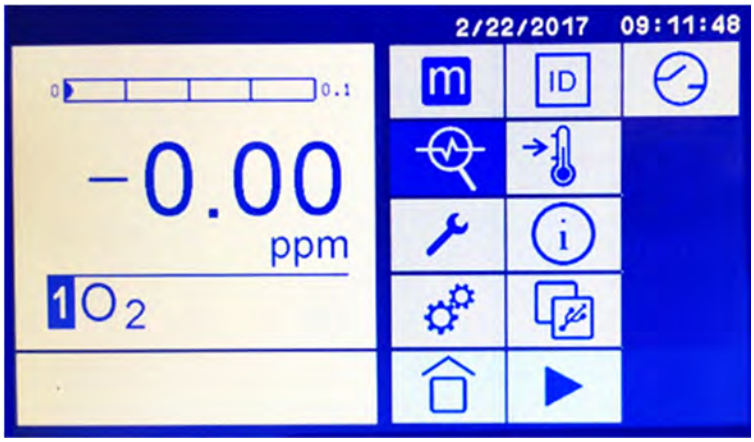

Figure 5-12: Diagnostics screen – page 2

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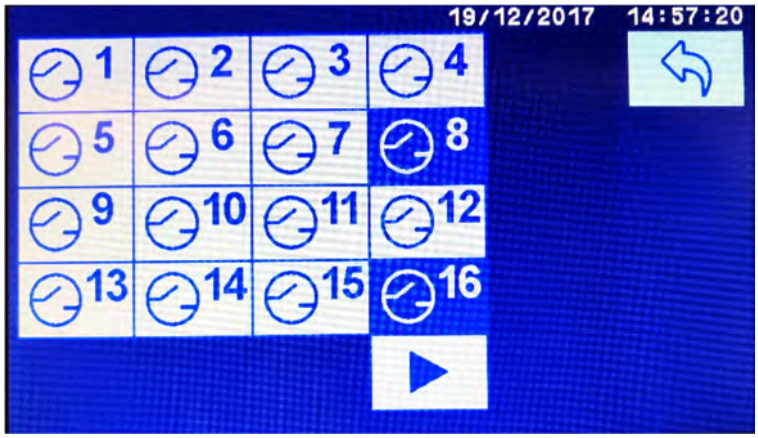

Figure 5-13: Diagnostics screen – page 3

Note: Page 3 displays first.

To go back to the previous page, press the  *icon.*

The diagnostics icons are listed below:

Icon	Meaning	Function
	Software revision number	To display the software revision number.
	Electronics temperature	To display the temperature of the internal chassis electronics.
	Analyzer serial number	To display the serial number of the analyzer.
	Save configuration files to USB	To save the instruments configuration files to a USB memory device.
	Relay test menu	To display a screen showing all relays which can be individually tested to help debug an installation (Figure 5-13). Press an individual relay icon in page 3 (Figure 5-13) to open and close it. If a relay is closed, its icon background is dark blue; if a relay is open, its icon has a white background.

Note: When leaving the relay test page, all relays are set back to the state they were in before entering the relay test page. For example, if relay #1 is set to an alarm and that alarm is triggered relay 1 will show as closed when entering the relay test screen and will be set as closed on exiting the relay test screen even if temporarily made open by pressing the #1 relay test button.

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Relays also automatically switch back to their normal state when the user interface times out and returns to the Measurement screen.

Note: The firmware revision and temperature display in a text box at the bottom of the screen when the relevant button is pressed.

5.11.1 Save configuration

> >

NOTE: the USB memory device should contain no other folders named config_files in the top-level directory to avoid overwriting or uploading an incorrect configuration.

1) Insert the USB flash drive into the analyzer's USB port
2) Press the menu icon
3) Press the diagnostic icon
4) Press the configuration save icon

5.12 Maintenance branch screen

>

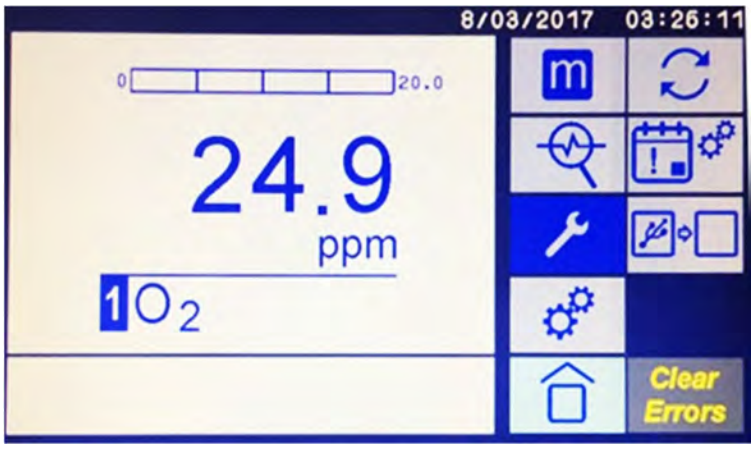

Figure 5-14: Maintenance screen

The maintenance icons are listed below:

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Icon	Meaning	Function
	Update firmware	To update the firmware.
	Auto calibration / validation *(optional)*	To set up the auto calibration / validation parameters
	Read config files from USB memory device	To upload configuration files from a USB memory device.
	Clear errors	This clears any error warnings such as Failed Calibration.

5.12.1 Firmware update

NOTE: the USB memory device will need to have the two firmware upgrade files in the top-level directory. They must be the only two files with names ending in XXX.key and XXXins.enc

1) Insert the flash drive with the firmware upgrade into the analyzer's USB port
2) Press the menu icon
3) Press the maintenance icon
4) Press the firmware upgrade icon
5) The upgrade will commence automatically and when complete, the analyzer will restart

5.12.2 Update configuration

NOTE: the USB memory device should contain no other folders named config_files in the top-level directory to avoid an error during the update.

1) Insert the flash drive into the analyzer's USB port
2) Press the Menu icon
3) Press the maintenance icon
4) Press the copy configuration icon
5) The configuration will uploaded from USB memory device to the instrument

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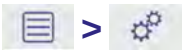
5.13 Settings branch screen



Note: Page 1 displays first.

To go to the subsequent pages, press the  icon.

Figure 5-15: Settings screen – page 1

Figure 5-16: Settings screen – page 2

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Figure 5-17: Settings screen – page 3 (inputs)

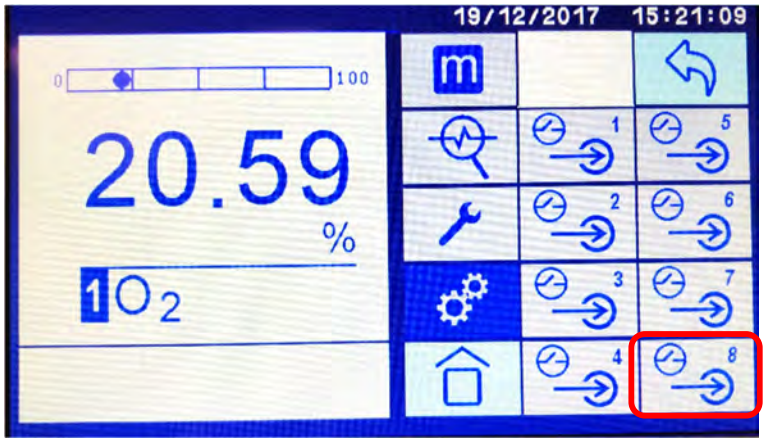

Figure 5-18: Settings screen – page 4 (digital inputs)

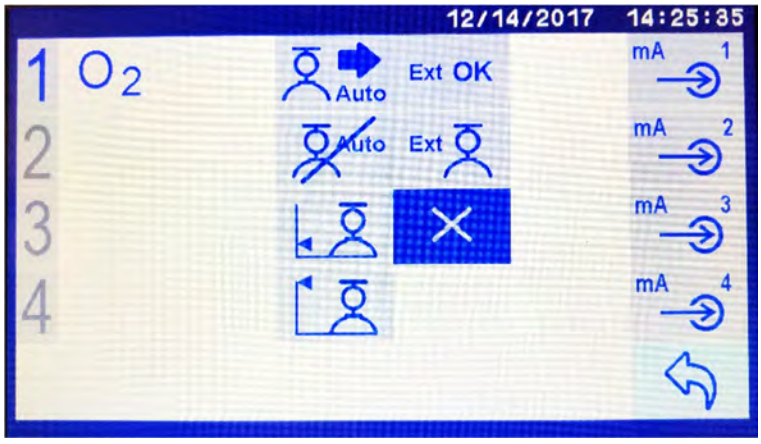

Figure 5-19: Settings screen – page 5 (digital inputs)

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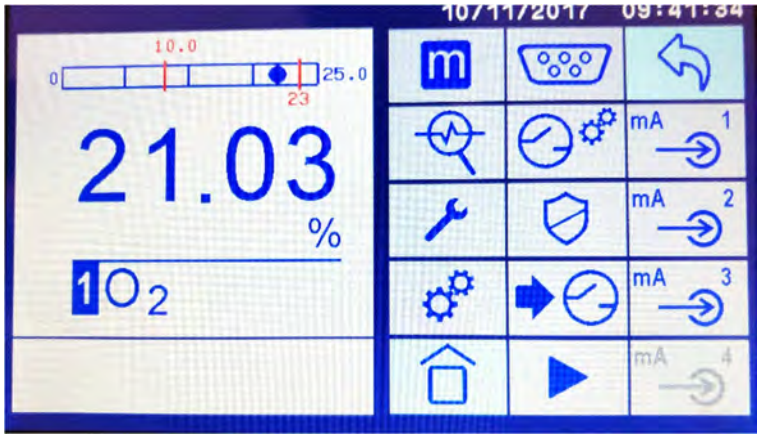

Figure 5-20: Settings screen – page 6 (analog inputs)

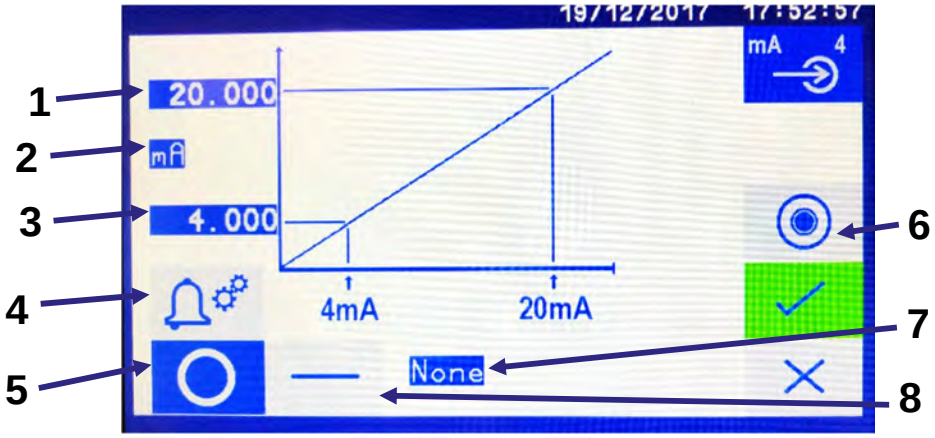

Figure 5-21: Settings screen – page 7 (analog inputs)

1	Maximum range of analog input	5	Turn On analog input
2	Units of analog input	6	Record analog input
3	Minimum range of analog input	7	Analyte being measured
4	Set and alarm for the analog input	8	Turn Off analog input

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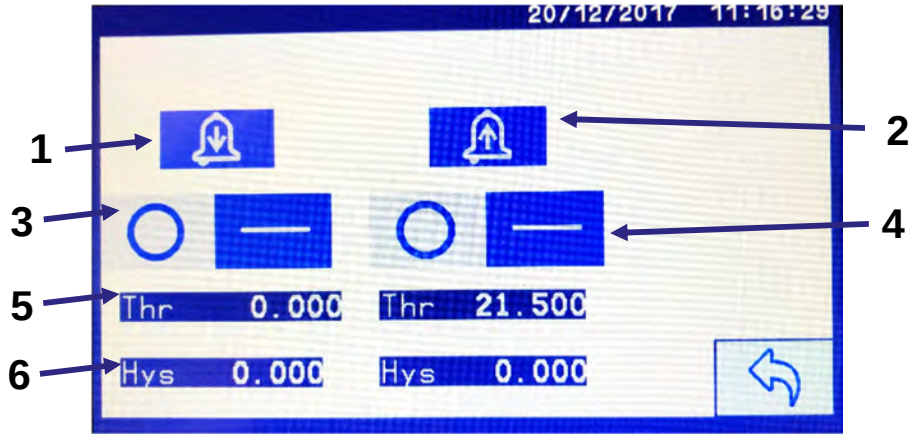

Figure 5-22: Settings screen – page 8 (analog alarm inputs)

1	High alarm	4	Turn alarm Off
2	Low alarm	5	Alarm threshold set point
3	Turn alarm On	6	Alarm hysteresis set point

Figure 5-23: Settings screen – page 9 (password protection)

Note: If no passwords are set then the protected icons and operations will not prompt to have a password entered. Once a master and/or operator password is set all protected icons and operations will prompt for a password. If you forget your passwords a remote recovery service password can be provided with a call to your local customer service center.

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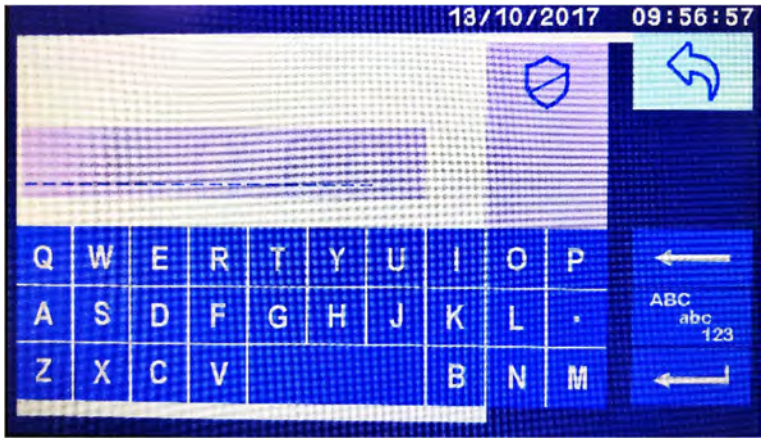

Figure 5-24: Settings screen – page 10 (password protection)

The password protection operations are listed below:

Function	Level
SINGLE RELAY ASSIGNMENT	MASTER
PASSWORDS	MASTER
MANUALLY SWITCHING RELAYS	OPERATOR
LOCK TO SINGLE DISPLAY	OPERATOR
CALENDAR	MASTER
CLOCK	MASTER
PUMP OFF	OPERATOR
INSTALL CONFIG FROM USB	MASTER
CLEAR ERRORS	MASTER
SCHEDULED EVENT SETUP	MASTER
SAVE DATA TO USB	OPERATOR
TEST_RELAYS	MASTER
CALIBRATION	OPERATOR
ALARM SELECTION FOR EDIT	OPERATOR
RANGE SETTING	MASTER
MILLIAMP OUTPUT	MASTER
GSF ENTRY OR SELECTION	MASTER

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XINT INPUT	MASTER
TRANSDUCER PRESSURE COMPENSATION	MASTER
RECORD CONTROLS	MASTER
ADAPTIVE FILTERING ON/OFF	MASTER
SENSOR ON/OFF	MASTER
SUPPRESS NEGATIVE	MASTER
AQUAXACT TIP REPLACE	MASTER
AQUAXACT UNITS SELECT	OPERATOR

Figure 5-25: Settings screen – page 11

Note: Page 1 displays first.

To go back to the previous page, press the  *icon.*

The settings icons are listed below:

Icon	Meaning	Function
	Serial port set up	To set up serial communications parameters.
	Relay set up	To set up the relays.
	Password	To set up the password security.

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	Master Password	To set the analyzer master level password
	Operator Password	To set the analyzer operator level password
	Manually set relays	Allows relays to be assigned static on/off values
	Split screen	To show two screens together. This toggles with the single screen icon below.
	Single screen	To show a single screen. This icon toggles with the split screen icon above.
	Date set up	To set up the date for the system.
	Time set up	To set up the time for the system.
	Inputs screen	To set up analog and digital inputs screen
	Digital inputs	To set up digital inputs screen
	Analog inputs	To set up analog inputs screen
	Digital input 8	To set up digital input 8
	Start AutoCal	Digitally Initiate AutoCal
	Stop AutoCal	Digitally Stop AutoCal
	External Cal	Analog mA input signal is in calibration
	Start Hi Cal	Digitally Start a Hi Calibration
	Start Low Cal	Digitally Start a Low Calibration
	External OK	Analog mA input signal is operating correctly
	Record	Record the analog input measurement
	High Alarm	High Alarm Settings page.
	Low Alarm	Low Alarm settings page

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	Increase brightness	To increase the screen brightness.
	Decrease brightness	To decrease the screen brightness.

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Touchscreen icon glossary

Icon	Meaning	Para.	Icon	Meaning	Para.
	Alarm menu	5.7.1		Analyzer serial number	5.11
	Alarm: off	5.7.2		Auto-calibration / validation	4.5.2
	Alarm: low concentration point	5.7.2		Auto range: off	5.9
	Alarm: high concentration point	5.7.2		Auto range: on	5.9
	Alarm: flow	5.7.2		Calibrate menu	5.7.2 J.1
	Alarm: high temperature	5.7.2		Calibration: restore factory calibration	J.1
	Alarm: low span reference	5.7.2		Calibrate: single point calibration value *(AquaXact 1688 only)*	J.1
	Alarm: flow sensing	5.7.2		Clear errors	5.12
	Alarm: not audible	5.7.2		Concentration range setting	5.9
	Alarm: audible	5.7.2		Concentration range: high	5.9
	Alarm: not followed	5.7.2		Concentration range: low	5.9
	Alarm: followed	5.7.2		Concentration range: maximum	5.9
	Alarm: latching off	5.7.2		Date set up	5.14.1
	Alarm: latching on	5.7.2		Diagnostics menu	5.11
	Alarm: measurement	5.7.2		Firmware update	5.12
	Alarm: span ref.	5.7.2		Follow	5.17
	Alarm: temperature	5.7.2		Not follow	5.17

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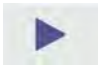
Icon	Meaning	Para.	Icon	Meaning	Para.
	Home screen	5.4	*RS232/485 are for DF310E & AquaXact Controller only:*		
	mA output screen	5.13		RS232 communications	A.3
	Maintenance menu	5.12		RS485 communications	A.3
	Measurement menu	5.6		RS232/485 comms: Baud rate	A.3
	Measurement: zero point	5.10		RS232/485 comms: Duplex: Full	A.3
	Measurement: span point	5.10		RS232/485 comms: Duplex: Half	A.3
	Moisture units	J.5		RS232/485 comms: Parity	A.3
	Next page			RS232/485 comms: Stop bits: 1	A.3
	*AquaXact 1688 only:* Pressure	J.6		RS232/485 comms: Stop bits: 2	A.3
	*AquaXact 1688 only:* Pressure: pipeline	J.6		RS232/485 comms: RS485 function	A.3
	*AquaXact 1688 only:* Pressure: transmitter	J.6		RS232/485 comms: RS485 function: DF communications	A.3
	*AquaXact 1688 only:* Pressure correction: on	J.6		RS232/485 comms: RS485 function: None	A.3
	AquaXact 1688 only: Pressure correction: off	J.6		RS232/485 comms: RS485 function: Modbus	A.3
	Read config files from USB device	5.12		RS232/485 comms: RS485 – Modbus: Word swapping on	A.3
				RS232/485 comms: RS485 – Modbus: Word swapping off	A.3

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Icon	Meaning	Para.	Icon	Meaning	Para.
	Relay setup	5.13		Status: alarm	5.7.2
	Relay test	5.11		Status: system health OK	5.4
	Repeat (auto-calibration / validation)	4.5.2		Suppress negative numbers: on/off	5.6
	Save: Measurement save option	5.6		Temperature: Electronics	5.11
	Save: System files to USB	5.11		Temperature: Transducer	5.6
	Serial set up	App A		Time set up	5.14.2
	Settings menu	5.13		*AquaXact 1688 only:* Tip replacement	J.2
	Screen brightness: increase	5.13		Transducer firmware revision	5.6
	Screen brightness: decrease	5.13		Transducer serial number	5.6
	Software revision number	5.11			

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5.14 Settings

5.14.1 Set the date

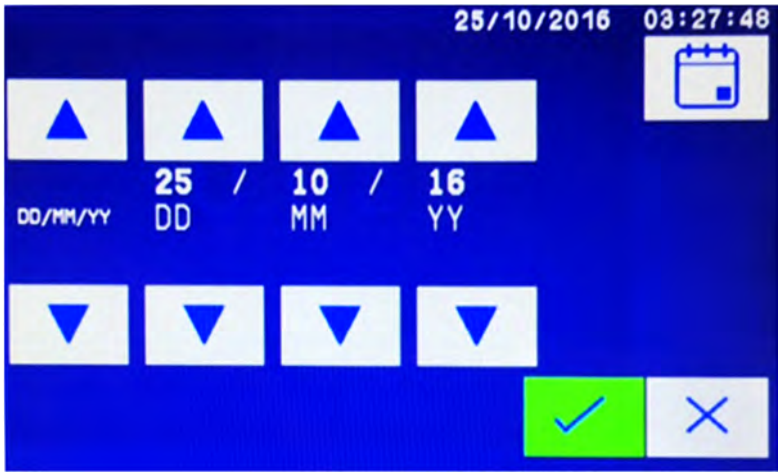

Figure 5-20: Set the date screen

1. Touch the left-hand up or down arrows to select how the date will be displayed (either dd/mm/yy or mm/dd/yy).
2. Touch the second up or down arrows to select the month (where 1 is January, and 12 is December).
3. Touch the middle up or down arrows to select the date (from 1 to 31).
4. Touch the right-hand up or down arrows to select the year.
5. Touch the  icon to accept the value or the  icon to leave the screen without updating the value.

5.14.2 Set the time

1. Touch the left-hand up or down arrows to increase or decrease the hour (where from 00 to 23).
2. Touch the middle up or down arrows to increase or decrease the minute (from 00 to 59).
3. Touch the right-hand up or down arrows to increase or decrease the seconds (from 00 to 59).
4. Touch the  icon to accept the value or the  icon to leave the screen without updating the value.

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5.15 Configure the relays

> >

The relays are configured using the relay configuration menus in the Settings Menu. The first page of these menus shows the number of relays purchased as options (Figure 5-21).

Note: There can be up to eight relays per transducer.

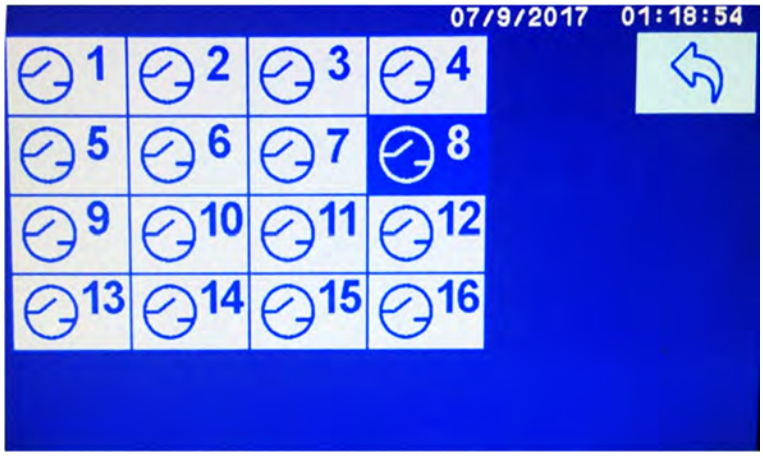

Figure 5-21: Available relays on the system

Touch a relay icon to display the Activity Assignment Menu (Figure 5-22).

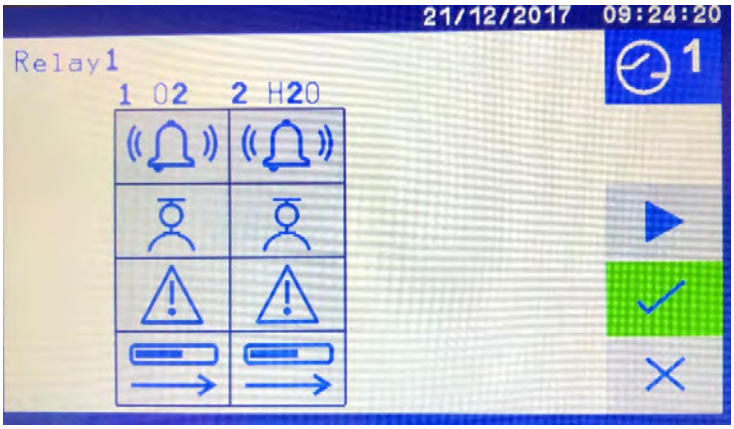

Figure 5-22: Activity Assignment Menu

A relay can be assigned to one or more activities:

	Alarm		System alarm
	Calibration in progress		Out of range state

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Note: The activities that will trigger the relay have a dark blue background.

If an alarm relay is chosen, an alarm assignment screen appears (Figure 5-23) and one or more customer set alarms can be selected. These are configured separately (section 5.7).

Figure 5-23: Alarm assignment screen

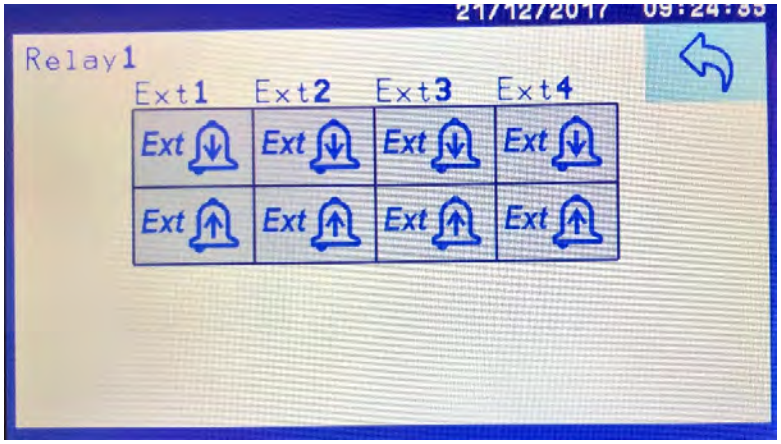

Figure 5-30: Relay hi / low alarm assignment screen for external mA inputs

Touch the  icon to return to the relay assignment page

Touch the  icon to save the relay information.

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5.16 Manual relay switching

> >

To manually switch a relay, press the required relay button (Figure 5-).

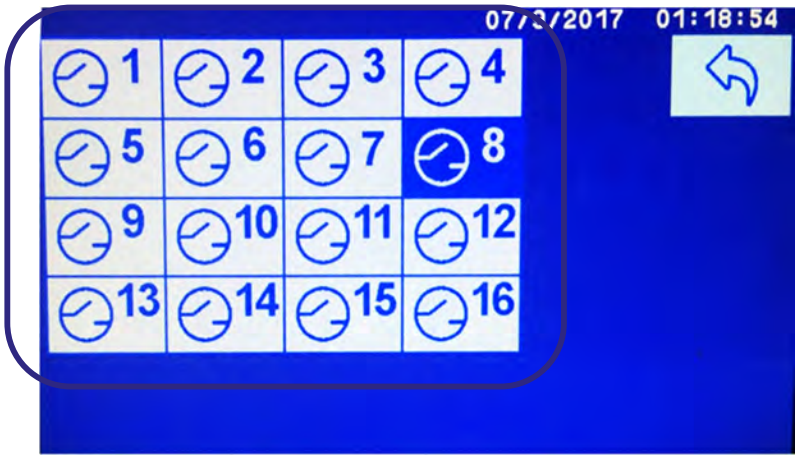

Figure 5-31: Available relays on the system

The relay button cycles through three states:

- Normal Operation (i.e. as assigned)
- Force On
- Force Off

Relays power up in their designated state: Normal, On, or Off. The button sequence is Normal, On, Off, Normal…, starting with whatever state it happens to be in.

Normal Operation:	If any assigned condition wants the relay on, it will be turned on. The icon colors will be inverse (light on a blue background) if the relay is on, otherwise blue on a light background.
Force On:	This forces the relay on regardless of any assigned conditions. The color will be light on a black background.
Force Off:	This forces the relay off regardless of any assigned conditions. The color will be dark gray on a light background.

Note: Force On and Force Off are true user overrides and are permanent until the relay is switched back to Normal Operation.

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5.17 Configure and use the mA outputs

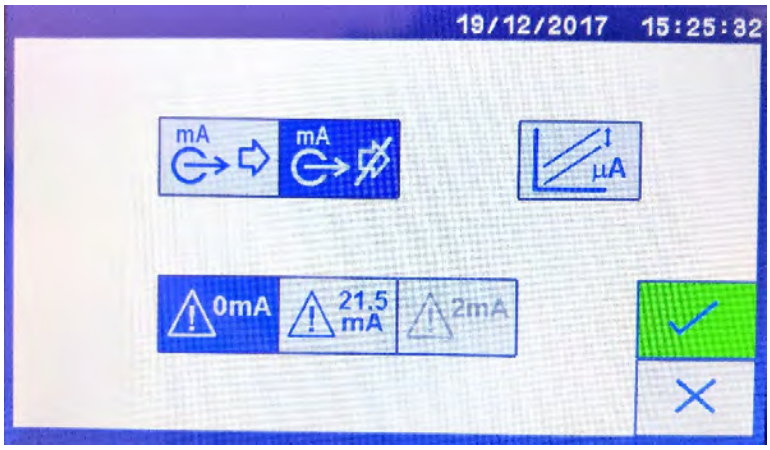

Figure 5-32: mA output screen

Figure 5-33: mA output adjustment screen

When the mA output screen appears, select either to follow or not follow:

Icon	Meaning	Function
	Follow	The mA output continues to follow the measured concentration during calibration.
	Not follow	The mA output freezes during calibration.
	mA output adjustment	Tweak the mA output with + or - adjustment

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Jam condition 	A jam condition happens when the incoming data has a Fatal Flag or when the Transducer has a Communications Fault which is when data has stopped. The options are 0 or 21.5 mA, depending on your analyser. *Note: The 0 mA and 21.5 mA options are MultiExact 4100 specific.*

Touch the ✓ icon to save the mA output information or the ✕ icon to quit the screen without saving.

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6 Operation

Sample and calibration gases must be as specified in section 1.7. If the pressure/flow rates are outside the ranges specified in section 1.7, you must regulate the gases externally, before they enter the analyzer.

6.1 Check the relay signal outputs

Hint: *Relays assigned for gas stream switching will not be energized during the relay test functions as this could cause hazardous gas flows.*

6.2 View flow levels

The optional flow meters are visible via front panel, and are calibrated for use with air / N_2. If the molecular weight of the background gas is much different from N_2, the flowmeter reading is not accurate. Most other gases have molecular weights within ± 25 percent of air. Since the required flow rate is not extremely critical most gases produce reasonably correct readings. The exceptions are light gases such as Helium, whose flow rates should be set to approximately one-third that of Nitrogen.

6.3 Switch off the analyser

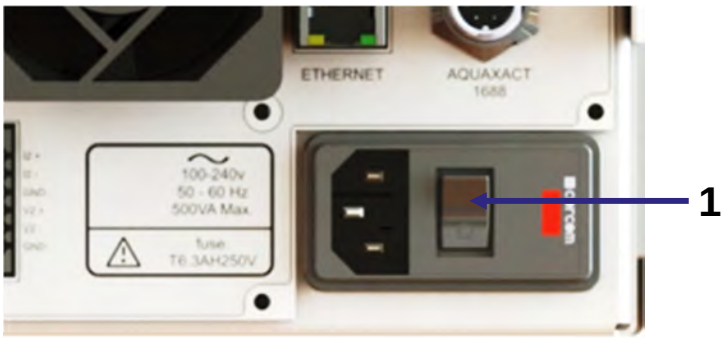

Figure 6-1: On/off switch on the rear of the analyzer

To switch off the analyser, press **O** on the On/Off switch on the rear of the analyser (1 in Figure 6-1).

After you have switched off the analyzer, when required or as necessary (for example, if you need to carry out plant/factory maintenance and will not use the analyzer for several days):

- Ensure the gas inlet and outlets are blocked off (closed valve or protective caps supplied).
- Disconnect the electrical supply cable from the analyzer.

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7 Technical specification

The protection, accuracy, operation and condition of the equipment may be impaired if the analyzer is not installed in accordance with the requirements of this and other sections of the manual.

7.1 Mechanical specification

Dimensions:	*(width x Height x length)*
Rack mountable analyzer:	
Bench top:	432 x 141.2 x 544.2 mm 17 x 5.6 x 21.4 inches
Bench top with expansion chassis:	432 x 274.2 x 544.2 mm 17 x 10.8 x 21.4 inches
Rack mount:	482 x 132.5 x 544.2 mm 19 x 5.2 x 21.4 inches
Rack mount with expansion chassis:	482 x 265.5 x 544.2 mm 19 x 10.5 x 21.4 inches
Weight:	Main unit: 14kg (30.9 lb.) approx. Expansion chassis: 13.7 kg (30.2 lb.) approx.

7.2 Electrical specification

Electrical supply:	
Voltage:	100 to 240 Vac, 50 to 60 Hz *(± 10% maximum fluctuation)*
Supply fuse rating / type:	6.3 AH / 250V. Size 20 x 5 mm
Maximum power consumption:	500 VA
Interface signal relay ratings	30 V (dc or ac) / 1A *Note: The relay output signals are volt-free signals*
mA output (active):	
Maximum load resistance:	1 kΩ
Isolation voltage (to earth):	500 V (dc or ac)
Output range:	

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Normal sample measurement:	4 to 20 mA
Fault condition:	0 mA, 2 mA. User selectable *(section 5.15)*

Voltage output (active):

Minimum load resistance:	100 kΩ
Isolation voltage (to earth):	250 V (dc or ac)
Output range:	
Normal sample measurement:	0 to 10 V
Fault condition:	Fault condition selected as an option at the time of purchase.
Under range:	Not applicable

Signal / voltage / mA / RS485 output terminals suitable for:

Flexible conductors:	0.5 to 1.5 mm^2 (20 to 16 AWG)
Solid conductors:	0.5 to 1.0 mm^2 (20 to 18 AWG)

7.3 Maximum voltage ratings

Common mode compared to chassis ground reference:

Signals:	Maximum voltage rating:
I1+, I1-, I2+, I2-, I3+, I3-, I4+, I4- V1+, V1-, V2+, V2-, V3+, V3-, V4+, V4- IIN1+, IIN1-, IIN2+, IIN2- IIN3+, IIN3-, IIN4+, IIN4- DIN3A, DIN3B, DIN4A, DIN4B J17(ALL)	250 Vac
All relays C, NC, NO	40 Vac
J6 (ALL) J8(ALL) J18 (ALL)	15 Vdc

Differential mode between pairs:

Signals:	Maximum voltage rating:
All relays C, NC, NO	30 Vac, dc
IIN1+, IIN- or IIN2+, IIN2- or	40 Vdc wrt V1-, V2-, V3-. V4-

Signals:	Maximum voltage rating:
IIN3+, IIN3- or IIN4+, IIN4-	
DIN3A, DIN3B or DIN4A, DIN4B	24 Vdc
RS485TX+, RS485TX-	15 Vdc
RS485RX+, RS485RX-	15 Vdc
RS232TX, RS232RX	15 Vdc
J17 pin to pin	9 Vdc

7.4 Environmental limits

The equipment is suitable for indoor use only.

Ambient temperature range:

Operation:	5 to 40°C / 41 to 104°F
Storage:	0 to 50°C / 32 to 122°F

Operating ambient pressure range:	101.3 kPa ± 10% (1.013 bar ± 10%)
Operating ambient humidity range:	10 to 90% RH, non-condensing
Operating altitude range:	-500 metres (below sea level) to 2000 metres (above sea level)
Ingress protection:	IP20

8 Routine maintenance

The MultiExact 4100 Analyzer does not contain any user serviceable parts.

Do not attempt to maintain or service the MultiExact 4100 Analyzer unless you are trained and know what you are doing. The analyzer must be maintained by a suitably skilled and competent person.

Do not open or attempt to remove the analyzer cover yourself. If you do, you will invalidate any warranty on the analyzer, and the analyzer may not operate safely or provide accurate measurements.

Sample and calibration gases may be toxic or asphyxiant.

Never inspect the inlet filter(s), or service or repair the analyzer while such gases are still connected to it.

If the analyzer is to be serviced or repaired, it is important that all pipework is flushed with an inert gas and the analyzer is allowed to freely vent to local atmosphere.

Read the storage/maintenance section in the AquaXact 1688 appendix

8.1 Cleaning the analyzer

When necessary, use a damp (but not wet) cloth to wipe clean the outer surfaces of the analyzer (to prevent the entry of dust or other particulates into the interior of the analyzer).

8.2 Routine checks

You only need to carry out simple maintenance procedures annually. Carry out the following regular checks to ensure continuous and safe operation of the monitor.

8.2.1 Inspect / replace the fuse

Ensure that the electrical supply is isolated / locked-out from the analyzer. If you do not, there will be a danger of injury or death from electric shock.

Fire Hazard: Only use the same type and rated fuse as recommended.

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If you think that an electrical supply fuse has failed, use the following procedure to inspect the fuses and replace them if necessary:

1. Open the fuse panel on the rear of the analyzer (Figure 8-1). To do this, carefully insert a small screwdriver into the gap on the right of the panel and press the clip to open the panel.

Figure 8-1: Open the fuse panel

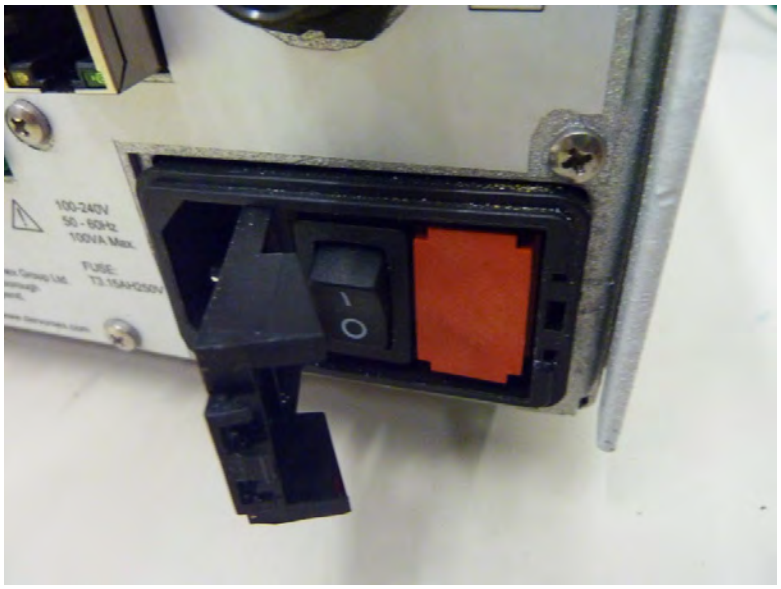

Figure 8-2: Fuse panel opened

2. Pull the red fuse holder out of the panel (Figure 8-3).

   Both live and neutral lines have fuse protection. The neutral fuse is shown (1 in Figure 8-3); the live fuse is located in the underside of the red fuse holder (2 in Figure 8-3).

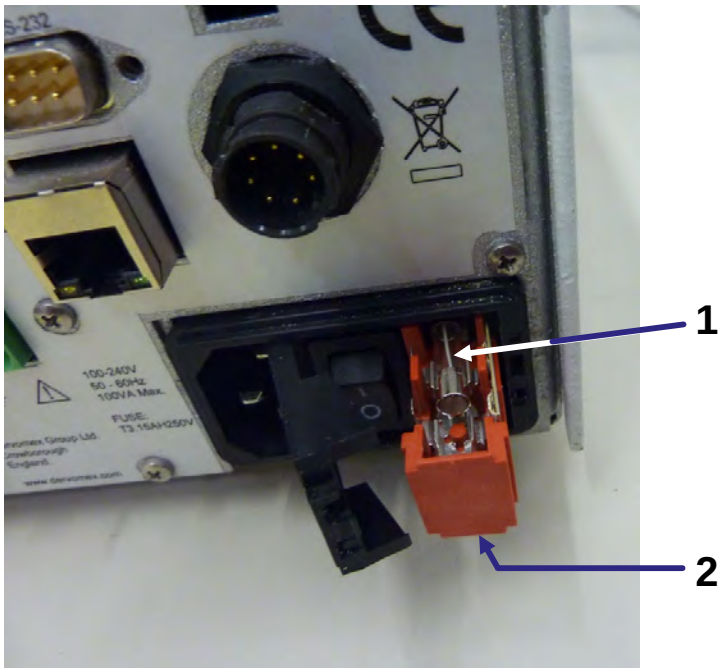

Figure 8-3: Pull out the red fuse holder

3. Remove the top (neutral) fuse from the holder and check the continuity across the fuse.

   If there is continuity, the fuse has not failed, so refit it into the fuse holder.

   If there is no continuity, fit a new fuse into the fuse holder.

   Make sure the fuses are the correct type and rating. The fuse type and rating is shown on the rear panel to the left of the mains connector.

   Make sure you fit the fuse in the correct position in the fuse holder as shown in Figure 8-3.

4. Repeat step 3 for the bottom (live) fuse which is located on the underside of the red fuse holder.
5. Push the fuse holder back into the fuse panel and close the panel door. It will click into place.

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8.3 Preventative maintenance

To minimize unscheduled analyzer downtime, ensure the proper operation of the analyzer and to comply with the guidelines of applicable regulatory bodies, we recommend that you utilize an annual preventative maintenance program for your analyzer.

The preventative maintenance program consists of an annual inspection of the analyzer, and repair of any faults, to ensure that the analyzer meets its original factory specification.

Contact Servomex or your local Servomex agent to arrange for a preventative maintenance contract.

9 Troubleshooting

The following section will help to resolve many of the common operational situations that occur with the analyser. Try the possible remedies in the order listed.

9.1 Error codes

The following codes may be displayed in the event of a problem or error. The table gives a suitable remedy.

Code	Meaning	Possible remedy
B: Bad command	Internal Software Error	Power Cycle
C: Comms fault	Data not received from transducer	Check transducer cable
D: Data fault	Data not received from transducer	Check transducer cable
E: Out of spec	The reading exceeds the maximum range	Check plumbing
S: Calibrating	Calibrating Failed	Recalibrate
T: Overtemp	Transducer temperature is over range	Reduce ambient temperature
X: Electronics fault	Critical Electrical Fault	Contact Servomex

9.2 Jam conditions

See section 5.14 “Configure and use the mA outputs."

9.2.1 Display diagnostics

Instrument diagnostics are provided at the transducer level. They may provide additional details during transducer troubleshooting for experienced users and service technicians. The procedure to display diagnostics is below and a more detailed can be found in section 9 Troubleshooting and in the individual transducer Appendices.

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10 Storage and disposal

10.1 Storage

Refit any protective plastic covers and place the analyzer and any associated equipment in its original packaging before storage. Alternatively, seal it inside a waterproof plastic bag, sack, or storage box.

Store the analyzer and any associated equipment in a clean, dry area. Do not subject it to excessively hot, cold, or humid conditions (section 7.3).

10.2 Disposal

Dispose of the analyzer and any associated equipment safely, and in accordance with all of your local and national safety and environmental requirements.

> ***Hint:*** *If you send the analyzer to Servomex or your local Servomex agent for disposal, it must be accompanied by a correctly completed decontamination certificate and a Return Authorization Number (RAN) (Appendix D).*

10.2.1 Disposal in accordance with the Waste Electrical and Electronic Equipment (WEEE) Directive

The label shown in Figure 10-1 is fitted to the analyzer.

Figure 10-1: The WEEE label

This label identifies that:

- The analyzer is considered to be within the scope of the Waste Electrical and Electronic Equipment (WEEE).
- The analyzer is not intended for disposal in a municipal waste stream (such as landfill sites, domestic recycling centers and so on), but must be submitted for material recovery and recycling in accordance with the local regulations which implement the WEEE Directive.

For additional information and advice on the disposal of the analyzer in accordance with the requirements of the WEEE Directive, contact Servomex or your local Servomex agent.

11 Spares

Do not use spares other than those specified below, and do not attempt to carry out any maintenance procedures other than those specified in this manual. If you do, you can damage the analyzer and invalidate any warranty.

The standard spares available for the analyzer are shown below. You can order these spares from Servomex or your Servomex agent.

Part number	Description
081000KITA	**ME4100 One Year Service Kit**
	Filter Element, Fan
	External Stainless-Steel Filter Kit
	4 Main Fuses (2 per analyzer needed)
	Back Panel Connector Set
081000KITB	**ME4100 Two Year Service Kit**
	Filter Element, Fan
	External Stainless-Steel Filter Kit
	4 Main Fuses (2 per analyzer needed)
	Back Panel Connector Set
	Tubing/Fittings Refurb Kit -Service Center Only

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12 Warranty

Servomex instruments are warranted to be free from defects in workmanship and materials. Liability under this warranty is limited to servicing, calibrating, and replacing any defective parts of the instrument returned to an authorized Servomex Service Center for that purpose. Fuses are specifically excluded from any liability.

This warranty is effective from the date of delivery to the original purchaser. The equipment must be determined by Servomex to have been defective for the warranty to be valid.

This warranty applies as follows:

- one year for electronics
- one year for mechanical failures to the transducer

If damage is determined to have been caused by misuse or abnormal conditions of operation, the owner will be notified, and repairs will be billed at standard rates after approval.

Servomex Group Limited warrants each instrument manufactured by them to be free from defects in material and workmanship at the F.O.B. point specified in the order, its liability under this warranty being limited to repairing or replacing, at the Seller's option, items which are returned to it prepaid within one year from delivery to the carrier and found, to the Seller's satisfaction, to have been so defective.

In no event shall the Seller be liable for consequential damages. NO PRODUCT IS WARRANTED AS BEING FIT FOR A PARTICULAR PURPOSE AND THERE IS NO WARRANTY OF MERCHANTABILITY.

Additionally, this warranty applies only if: (i) the items are used solely under the operating conditions and in the manner recommended in the Seller's instruction manual, specifications, or other literature; (ii) the items have not been misused or abused in any manner or repairs attempted thereon; (iii) written notice of the failure within the warranty period is forwarded to the Seller and the directions received for properly identifying items returned under warranty are followed; and (iv) with return, notice authorizes the Seller to examine and disassemble returned products to the extent the Seller deems necessary to ascertain the cause of failure. The warranties stated herein are exclusive. THERE ARE NO OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED, BEYOND THOSE SET FORTH HEREIN, and the Seller does not assume any other obligation or liability in connection with the sale or use of said products.

12.1 Maintenance policy

In cases when equipment fault is suspected, please notify your representative of the problem and provide them with model and serial numbers.

If the problem cannot be resolved, then ask for a Return Authorization Number (RAN) and shipping instructions. The issue of an RAN does not automatically imply that the equipment is covered by our warranty - that will be determined after we receive the equipment.

Pack the equipment in a suitable box with sufficient padding, include the RAN number on your paperwork, and send the equipment, prepaid, to the designated address. Servomex will not accept equipment returned without a RAN, or with reversed shipping or import/export charges.

If the warranty has expired, or the damage is due to improper use or exposure of the equipment, Servomex will provide an estimate and wait for approval before commencing repairs.

For your convenience a Return Authorization Request Form is provided in Appendix D. Fill out the form and sent it back to Servomex to obtain a RAN.

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Appendix A Options for RS485 / RS232

A.1 Introduction

The MultiExact 4100 has options for RS232 or RS485 serial communications. If RS232 is purchased, the connection is via the 9-pin D-type RS-232 serial connector on the back plane (Figure A-1). If RS485 is purchased, the connection is via the RS-485 connector on the back plane (Figure A-1).

Make sure that the electrical installation of any equipment connected to the analyzer conforms with all applicable local and national electrical safety requirements.

The RS232 output is separated from the analyzer mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by at least reinforced insulation.

To comply with EMC requirements, you must use a screened cable to connect to the RS232 output. The screen must also be connected to the analyzer enclosure.

A.2 Connections

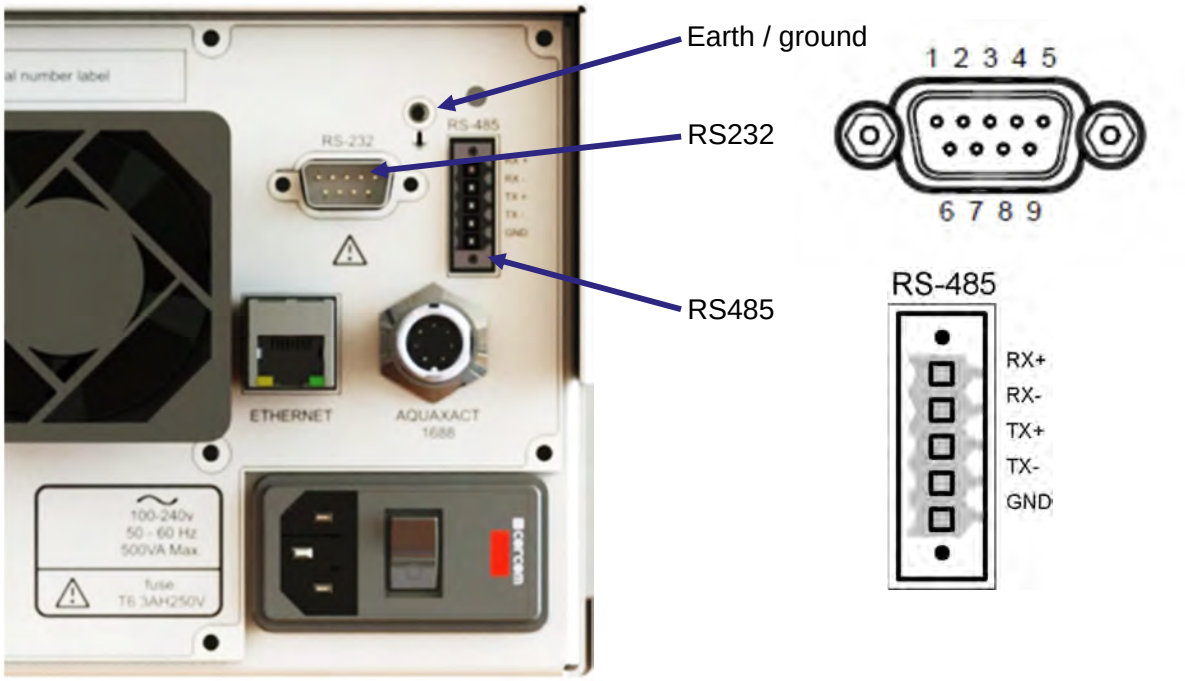

Figure A-1: Rear panel of the analyzer showing RS232 and RS485 connectors

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A.3 Set up parameters

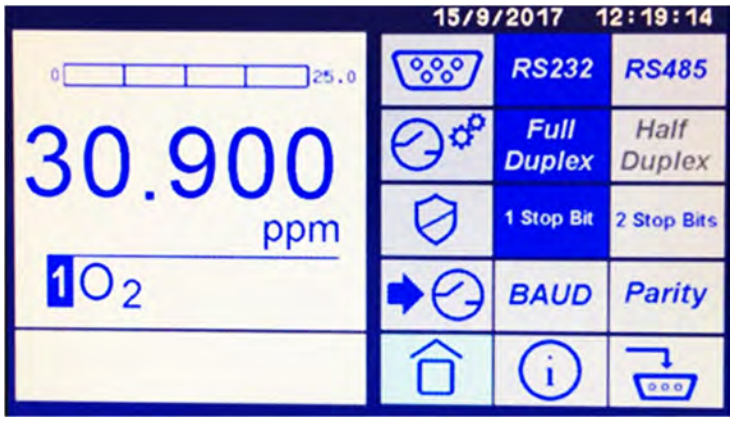

Figure A-2: Serial parameter setup page

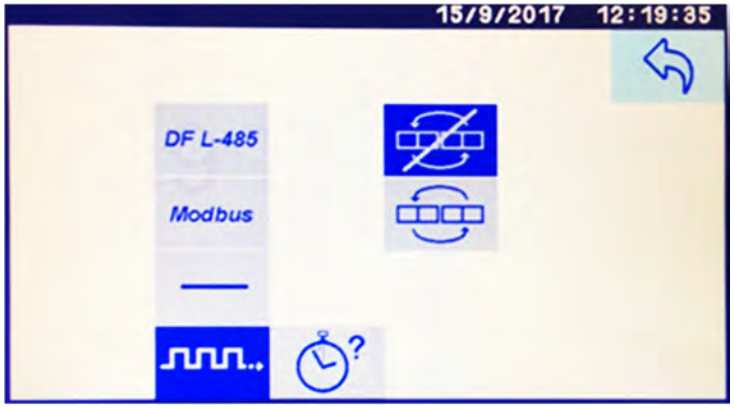

Figure A-3: Serial parameter page 2

The serial parameter icons are listed below:

Icon	Meaning	Function
RS232	RS232 communications	To select RS232.
RS485	RS485 communications	To select RS485.
Full Duplex	Full Duplex	To select full duplex.
Half Duplex	Half Duplex	To select half duplex.

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Icon	Meaning	Function
	1 stop bit	To set 1 stop bit.
	2 stop bits	To set 2 stop bits.
	Baud rate	To set the baud rate.
	Parity	To set the parity.
	RS485 function	To assign RS485 function. A second screen (Figure A-3) displays the following functions:
	RS485 function: DF communications	To assign RS485 function to legacy DF communications.
	RS485 function: Modbus	To assign RS485 function to Modbus (Appendix C).
	RS485 function: None	No RS485 function.
	RS485 function: periodic stream	To assign a periodic stream of measurement results of all transducers.
	RS485 function: output frequency setup	To set the intervals for the output frequency (in seconds) via a numerical entry screen.
	RS485 – Modbus: Word swapping on	To switch on Modbus word swapping.
	RS485 – Modbus: Word swapping off	To switch off Modbus word swapping.

A.4 Streaming RS232 output

In continuous mode, a data frame is transmitted by the serial output port at a user-defined interval. The format of the data frame is given in the following tables; however, it is a list of process variables (fields) preceded by a start character, separated by semi-colons and terminated by carriage return and line feed, i.e. A;B;C;D;E;F;…..;N;<CR><LF>

The frame frequency and generic communications parameters are configured in the analyser software. The frame frequency sets up the frequency of transmission of the data frame down the serial communications port. For example, if the value is set to 15 seconds, then the output data frame will be transmitted once every 15 seconds. The frequency is set in steps of one second from 1 to 9999 seconds. If the value is set to zero, the transmission of data down the serial port stops and will not restart until a non-zero value is entered.

Field		Number of characters	Function	Entry/format
A		8	Date	**DD-MM-YY**
B		8	Time	**HH:MM:SS**
C		2	Analyzer failure and maintenance fault status	1st character: **F** for failure 2nd character: **M** for maintenance (Spaces = OK)
D		8	Auto-calibration flags: 2 characters for each of the 4 calibration groups	1st character: Group 1, **S** for sample, **C** for calibration gas 2nd character: Group 1, **1** for cal gas 1, **2** for cal gas 2 Repeat for groups 2, 3 and 4
E		2	Number of process measurements or variables	**03** to **07**. The following fields will be repeated for each transducer and any derived measurements. The last two variables will always be the two external inputs E1, E2
Measurement sequences (see note below)	F	2	Measurement identity	e.g. **I1**, **D1**, **E1**
	G	6	Measurement name	e.g. **Oxygen**
	H	6	Value	e.g. **20.9**
	I	3	Units	e.g.**%**
	J	4	Alarms	One character for each alarm. **1**, **2**, **3**, **4** raised = alarm Space = OK
	K	2	Failure and maintenance fault status	1st character: **F** for failure 2nd character: **M** for maintenance (Spaces = OK)
	L	1	Calibration status	**C** in calibration, or space
	M	1	Warming up status	**W** in warming up, or space
N		4	Checksum	e.g. **096A**
-		-	End code: <CR> and <LF>	ASCII code 13 and 10

Table A-1: Serial output data frame, start, measurement and end sequences

Note: Fields F-M are repeated for each measurement (including derived) concluding with external inputs E1 and E2, before returning to the end sequence of N and the end codes.

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Appendix B Compliance and standards

B.1 Applicable EU Directives

Low Voltage Directive: 2014/35/EU

Electromagnetic Compatibility (EMC) Directive: 2014/30/EU

B.2 Applicable standards

EN 61010-1:2010

EN 61326-1:2013 / IEC 61326-1:2012

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Appendix C Implementation guide for Modbus communications

C.1 Introduction

This appendix details the implementation and use of the Modbus protocol in the MultiExact 4100 analyzer.

C.2 References

Document "MODBUS over Serial Line Specification & Implementation guide V1.0 Nov 02" Modbus web site modbus.org.

C.3 Modbus setup

The Modbus setup form will allow the user to configure the following parameters:

Default values are in **Bold**.

Parameter	Options	Comments
Address	1 to **247**	Slave address of unit.
Mode	ASCII or **RTU**	Select serial transmission mode.
Baud rate	2400, 4800, 9600, **19200**, 38400	
Parity	Odd, **Even**, None	

C.4 Supported function codes

For simplicity, only the following function codes will be supported:

Function	Description	Usage
01	Read coils	Read calibration status, pump state, etc.
02	Read discrete inputs	Read faults and alarm states.
03	Read holding registers	Read settings.
04	Read input registers	Read measurements, units, etc.

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Function	Description	Usage
05	Write single coil	Change modes, perform calibration etc.
06	Write single register	Change single setting.
08	Sub Function 00 = Return query data	Diagnostic to test communications.
16	Write multiple registers	Change multiple settings.

C.5 Exception codes

If an error occurs while processing a message one of the following exception codes will be returned by the instrument:

Code	Condition	Meaning
01	Illegal function	Requested function code is not supported.
02	Illegal data address	The combination of data address and transfer length is invalid for this function.
03	Illegal data value	A value contained in the query data field is not an allowable value. This indicates a fault in the structure of the remainder of a complex request. This does NOT mean that a value to be stored in a register is incorrect as Modbus has no means of determining what is legal for any register.
04	Slave device failure	An unrecoverable error occurred while the unit was attempting to perform the requested action.

C.6 Addressing

Addresses in Modbus ADU (application data unit), run from 1 – N, whereas addresses in the Modbus PDU (protocol data unit) run from 0 – N. This appendix gives addresses in the ADU model. Depending on the particular Modbus master, addresses may have to be entered as they are given or have 1 subtracted from them. For example, to read register 101 an address of 100 may be needed.

C.7 Floating point numbers

Floating point numbers (e.g. 12.34, –1012.32, etc.), are digitally represented using the IEEE–754 format. Single precision floating point numbers are used throughout and they require 32 bits of data. Since a Modbus register holds 16 bits it takes 2 registers to represent a floating-point number. We default to having the most significant word of the float, bits 16 – 31, in the first register, and the least significant word, bits 0 – 15, in the next register.

Note: This order can be reversed by setting a coil in the system control mapping. Refer to Section C.9 – Base address 2001, Floating point order. This changes the order of the Modbus registers when dealing with 32-bit floating point numbers:

0 = Big-endian, e.g. 40001 = high word, 400002 = low word (default)

1 = Little-endian, e.g. 40001 = low word, 400002 = high word

C.8 System data

				Supports Function Code							
Base Address	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
3001	0	0-9	Instrument Serial Number			✓					
		10-19	Analyzer Firmware			✓					
3021	1	0-9	Reserved			✓					
		10-19	Reserved			✓					
3041	2	0-9	Option Board Digital Firmware			✓					
		10-19	Option Board Analog Firmware			✓					
3061	3	0-9	Reserved			✓					
		10-19	Bootloader Firmware			✓					
3981	49	0	NumberOfInternalTransducers			✓					
		1	NumberOfExternalTransducers			✓					
		2	NumberOfTransducers			✓					
		3	NumberOfMeasurements			✓					
		4	NumberOfAins			✓					
		5	NumberOfAouts			✓					

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				Supports Function Code							
Base Address	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
		6	NumberOfAlarms			✓					
		7	NumberOfRelays			✓					
		8	NumberOfDins			✓					
		9	Number of legacy pressure devices			✓					
		10	Number of legacy flow alarms			✓					
		11	Number of Legacy Heaters			✓					
		12	Number of Legacy Sample Heater			✓					
		13	Number of Field Buses			✓					
		14	Number Of Ovens			✓					
		15	Number Of Network Cards			✓					
		16	NumberOfResources			✓					

C.9 System Settings

				Supports Function Code							
Base Address	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
2001	0	0	Floating point order	✓				✓			
		1	User interface busy	✓							
		2	Disable user interface	✓				✓			
		3	Audible alarm	✓				✓			
		4	ResponseDelay			✓			✓		✓
		5	Language			✓			✓		✓
		6	Date format			✓			✓		✓
		7	Decimal format			✓			✓		✓

				Supports Function Code							
Base Address	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
		8	Backlight Time			✓			✓		✓
		9	clock: Hrs			✓			✓		✓
		10	clock: Mins			✓			✓		✓
		11	clock: Seconds			✓			✓		✓
		12	date: Year			✓			✓		✓
		13	date: Month			✓			✓		✓
		14	date: Day			✓			✓		✓
		15	CalLink			✓			✓		✓
2021	1	0	Temperature Units			✓			✓		✓
		1	Pressure Units			✓			✓		✓
		2	Flow Units			✓			✓		✓
		3	Moisture Units			✓			✓		✓
		4	Distance Units			✓			✓		✓
		5	Current Units			✓			✓		✓
		6	Voltage Units			✓			✓		✓
		7	Resistance Units			✓			✓		✓
		8	Reserved			✓			✓		✓
		9	Reserved			✓			✓		✓
		10	Time Units			✓			✓		✓

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C.10 System Control

Base Address	Block	Base Address Offset	Parameter	Supports Function Code 1	2	3	4	5	6	8	16
1	0	0	Service in Progress						✓		✓
0=Not In Service Mode, 1=Service Mode. Instrument MUST be set to Service in Progress before any calibration or override actions are performed.											

C.11 Measurements

Base Address	Block	Base Address Offset	Parameter	Supports Function Code 1	2	3	4
1001	0	0	Number Of Measurements			✓	
	0	1	Repeat (safeguard)			✓	
	0-49	2(n-1) + 2	Measurement n			✓	

C.12 Transducer calibration data

Base Address	First Block Number	Block	Base Address Offset	Parameter	Supports Function Code 1	2	3	4	5	6	8	16
4721	0	Tx (n)	0	AutovalState			✓					
			1	AutovalGas			✓					
			2	AVFinishing			✓					
			3	AVFailState			✓					
			4	Number of Cal / Val Points			✓					
			5	Select Cal/Val point			✓			✓		✓
			6	LastCal/Val Point n Reading			✓					

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					Supports Function Code							
Base Address	**First Block Number**	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
			8	LastCalPoint n Target			✓					
			10	LastCalPoint n Delta			✓					
			12	Last Cal point n Time			✓					
			13	Last Cal point n Date			✓					
			15	Cal point passed/failed			✓					
AVFinishing 0=Not Finishing, 1=Finishing												
AVFailState 0=Not in Fail State, 1=In Fail State												

C.13 Transducer live info

					Supports Function Code							
Base Address	**First Block Number**	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
4161	0	Tx (4n-1)	0	Transducer Type			✓					
			1	Tag Number			✓					
			2	Name			✓					
			11	Measurement			✓					
			13	Pressure Compensated Measurement			✓					
			15	Filtered Measurement			✓					
			17	Transducer temperature			✓					
4181	1	Tx (4n)	0	Alarm Active	✓							
			1	Fault	✓							
			2	Service in progress	✓							
			3	Out of Specification	✓							

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					Supports Function Code							
Base Address	**First Block Number**	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
			4	Maintenance required	✓							
			5	Transducer maintenance fault	✓							
			6	Transducer error	✓							
			7	Transducer fatal fault	✓							
			8	WarmingOn	✓							
			9	Reserved	✓							
			10	Reserved	✓							
			11	Calibration fault	✓							
			12	Communication fail	✓							
			13	Transducer not detected	✓							
			14	Autoval/cal failed	✓							
			15	Remote calibration/val denied	✓							
4201	2	Tx (4n+1)	0	Clipping Active	✓							
			1	Remote service in progress	✓							
			2	Transducer calibration mode	✓							
			3	Auto validation / calibration	✓							
			4	Incorrect transducer type	✓							

C.14 Transducer settings

					Supports Function Code							
Base Address	**First Block Number**	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
4481	0	Tx (n)	0	Name			✓					
			9	Units			✓					
4561	4		0	Reserved			✓			✓		✓
			2	Reserved			✓			✓		✓
			4	Unit selection (scaling Factor)			✓			✓		✓
			6	PMR			✓					
			8	Cross Interference correction			✓			✓		✓
			10	Reserved								
4641	112		0	Reserved			✓			✓		✓
			1	Reserved			✓			✓		✓
			3	Reserved			✓			✓		✓
			4	Reserved			✓			✓		✓
			6	Reserved			✓			✓		✓
			7	Reserved			✓			✓		✓
			9	Reserved			✓			✓		✓
			10	Reserved			✓			✓		✓
			12	Reserved			✓			✓		✓
			13	Reserved			✓			✓		✓
			15	Reserved			✓			✓		✓
			16	Reserved			✓			✓		✓

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C.15 Resource settings

Base Address	First Block Number	Block	Base Address Offset	Parameter	Supports Function Code 1	2	3	4	5	6	8	16
9081	0	Relay (n)	0	Active State			✓			✓		✓
			1	Override State			✓			✓		✓
			2	Override			✓			✓		✓
			3-19	Reserved								
9721	32	Relay (n)	0-19	Reserved								

C.16 Resource live info

Base Address	First Block Number	Block	Base Address Offset	Parameter	Supports Function Code 1	2	3	4	5	6	8	16
8741	0	0	0	Chassis temperature	✓			✓				

C.17 Transducer control

Base Address	Block	Base Address Offset	Parameter	Supports Function Code 1	2	3	4	5	6	8	16
4001	0	0	Calibration mode on/off	✓				✓			
		1	Start auto val					✓			
		2	Stop auto val					✓			
		3	Capture and enable baseline subtraction	✓				✓			
4021	1	0	Invoke calibration n			✓			✓		✓
		1	Calibration point n gas			✓					
		2	Sample Gas selection			✓			✓		✓

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Appendix D Profibus

This appendix contains installation and operation instructions and data tables available with the Profibus option.

D.1 Safety

Read the rest of this manual carefully before you use this appendix.

D.2 Description

The Profibus option adds DPv0 synchronous and DPv1 asynchronous communication capabilities to the MonoExact 4100 Analyser. The Profibus option board provides the following features:

- Supports DPv0/DPv1 profibus communication with RS485 transmission.
- DPv1 communications with class I and class II Master devices.
- Separate DPv0 modules to optimize bus load.
- Profibus Address can be set from the User Interface.

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D.3 Electrical installation

Follow the Profibus Installation Guidelines when connecting the Profibus.

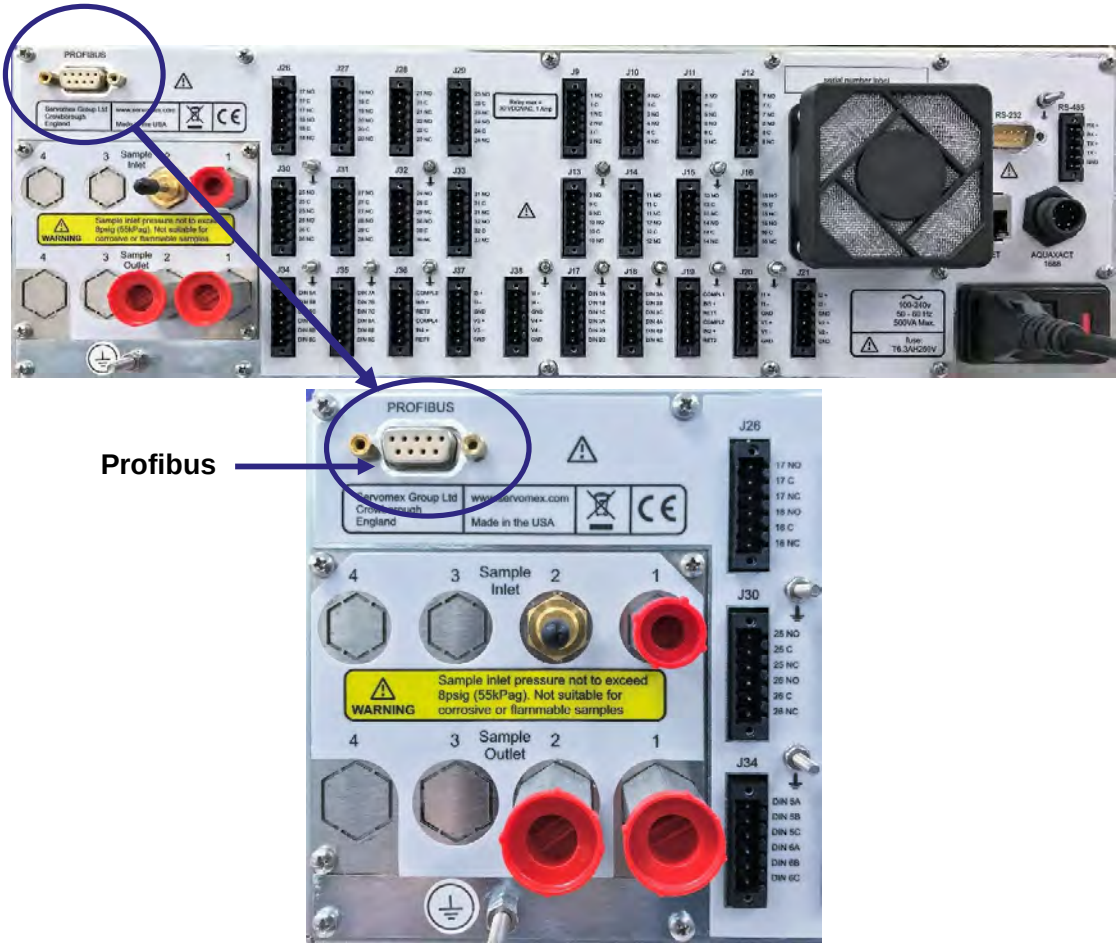

Figure 12-1: Profibus connection on rear of the analyzer

There are no internal termination resistors, if the device is at the end of the segment, termination resistors should be on the connector, or the segment should have an active termination unit.

1. Use recommended Profibus cable, optimized for RS485 transmission.
2. Standard Profibus 9-pin sub-D connector is used for profibus, the connector is labelled as “Profibus” on the back of the analyzer.

Profibus connector (Comms 1)		
Pin No	**Signal**	**Definition**
3	TxD-P	Data line plus (B-Line)
4	RTS	PROFIBUS Ready To Send signal
5	DGND	Data Ground
6	VP	+5V supply for terminating resistors
8	TxD-N	Data line minus (A-Line)
Case	Shield	Ground Connection

3. To ensure correct operation follow the Profibus Installation Guidelines. For information on the profibus installation guidelines, refer to www.profibus.com.

D.4 Profibus settings

D.4.1 Confirming Profibus availability

If the analyzer was ordered with the Profibus option, the Profibus connector will be populated and its presence confirms the unit is configured for serial communications via Profibus.

D.4.2 Setting the Profibus address

The default profibus address for the analyser is set to 126.

Use the following feature to change the profibus address of the analyser.

After changing the address, turn the unit off and on again for it to respond to the new address.

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D.4.3 Monitoring profibus line status

The user interface provides information on the profibus line status.

The three available reports are:

Wait for parameterization:	There are no communications between the analyser and the profibus master device.
Wait for configuration:	Initial parameterization message received, waiting for configuration data from the profibus master.
Data exchange:	The analyser and the profibus master device are communicating, using DPv0 cyclic messages.

D.5 Profibus DPV0 features

D.5.1 DPv0 modules

The synchronous messaging structure of the DPv0 network requires all variables to be repeated in every message. This means the PLC must be programmed to parse incoming and outgoing messages to extract required data. These protocol limitations mean that only frequently required parameters, which are important to be remotely accessible, are made available for DPv0 access.

The MultiExact 4100 is capable to operate with different module configurations enabling the user to optimize network traffic. For example, if detailed status information is not required, the user can choose to omit the Measurement Status modules in the configuration.

The analyser can support up to 8 modules, and the user can choose to include these modules in any order. The Profibus master can configure the MultiExact 4100 to include the following modules:

Module name	Type	Size
Measurement 1	Input and Output	6 Input, 6 Output Bytes
Measurement 2	Input and Output	6 Input, 6 Output Bytes
Measurement 3	Input and Output	6 Input, 6 Output Bytes
Measurement 4	Input and Output	6 Input, 6 Output Bytes
Measurement 1 Status	Input	6 Input Bytes
Measurement 2 Status	Input	6 Input Bytes
Measurement 3 Status	Input	6 Input Bytes
Measurement 4 Status	Input	6 Input Bytes

Example configuration 1:

Slot	Module	Input byte data offset	Output byte data offset
1	Measurement One	0	0
2	Measurement One Status	6	6
3	Measurement Two	12	12

Example configuration 2:

Slot	Module	Input byte data offset	Output byte data offset
1	Measurement Three	0	0
2	Measurement One	6	6
3	Measurement One Status	12	-
4	Measurement Two	18	12
5	Measurement Two Status	24	-

D.6 Profibus master device configuration

Refer to your profibus master device's operator manual to configure DPv0 communications with the MultiExact 4100.

NGIC3218.gsd can be used as the GSD file to configure the master device. A CD, which contains this file, is provided with the analysers that include the profibus option. The file can also be downloaded from "www.servomex.com ".

D.6.1 Data format

Endianness:	All data transfers are word aligned, and the analyser uses Big-Endian order, as specified in profibus standards. In Big-Endian order, the Most Significant Byte (HI) comes before the Least Significant Byte (LOW). Bit order follows the same rule and bit 0, is the least significant bit.
Floating Point Numbers:	All floating-point numbers (e.g. 12.34, -1012.32, etc.), are digitally represented using the IEEE-754 format. Single precision floating point numbers are used throughout and since they require 32 bits of data, they occupy 2 words. The most significant word is transferred first.
Low/Hi Byte:	The LOW byte of a word is the least significant byte. The Most significant Byte is called the HIGH Byte.

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D.6.2 Measurement module data map

Measurement modules contain measurement data related to the measurement modules. All four module mappings are the same.

Profibus DPv0 inputs			
Word	**# Word**	**R/W**	**Name**
0	2	R	Measurement as seen on the measurement display. 32 -bit Floating point data in IEEE-754 format.
2	1	R	Status Word (See Below)

Measurement status word			
Byte	**Bit**	**Name**	**Definition**
LO	0	Warming State	0=Not warming; 1=Warming.
	1	Heater Fault	0=normal; 1=fault
	2	Sample Heater Fault	0=normal; 1=fault
	3	Calibration Fault	0=normal; 1=fault
	4	Communication alarm	0=normal; 1=fault
	5	Transducer not detected	0=transducer detected; 1=transducer not detected
	6	Autoval/cal failed	An autocal or autoval operation has failed to complete
	7	Remote calibration/val denied	0=normal; 1=A remote request for calibration or validation has been denied
HI	0	Alarm	0=normal; 1=alarm active
	1	Fault	0=normal; 1=fault
	2	Service in Progress	0=normal; 1=service in progress
	3	Out of Specification	0=normal; 1=out of specification
	4	Maintenance Required	0=normal; 1=maintenance required
	5	Transducer maintenance fault	0=normal; 1=transducer maintenance fault

Measurement status word			
Byte	**Bit**	**Name**	**Definition**
	6	Transducer error	0=normal; 1=Transducer is indicating an error code
	7	Transducer fatal fault	0=normal; 1=Transducer has identified a condition requiring return for service

Profibus DPv0 outputs				
Word	**Byte**	**Bit**	**R/W**	**Name**
0	LOW	0-7	W	Reserved
	HI	0	W	Calibration mode on/off (Tx control)
		1	W	Start auto validation (Tx control)
		2	W	Stop auto validation
		3	W	Enable baseline subtraction
1			W	Invoke calibration n
2			W	Sample Gas Selection n

D.6.3 Measurement status data map

Measurement Status modules, contains status related to measurements. All four module mappings are the same.

Profibus DPv0 inputs			
Word offset	**# Words**	**R/W**	**Name**
0	1	R	Calibration and Validation Word (See Table Below)
1	1	R	Calibration point n gas
2	1	R	Transducer status word 1

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Calibration and validation status word			
Byte	**Bit**	**Name**	**Definition**
LO	0-2	Auto Validation State	000=Idle; 001=Pre-warning; 010=Inerting; 011=Flushing; 100=Validating
	3-5	Auto Validation Gas	000=zero gas; 001=span gas; 011=sample gas
	6	Auto Validation finishing	0=not finishing; 1=finishing
	7	Auto Validation fail state	0=normal, 1=failed
HI	0	Calibration mode on/off	0= off (normal); 1= on (alarms masked, jamming etc). Write 1 to turn calibration mode on.
	1	Cal point passed/failed	0= failed; 1= passed
	2	Reserved	Reserved
	3	Enable Baseline Subtraction	0=disabled; 1=enabled
	4-7	Reserved	Reserved

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D.6.4 DPv1 communications

The analyser is able to communicate using DPv1 asynchronous profibus communications with Class I and Class II masters. The following table shows the available data for DPv1 communication with Index and Slot numbers.

The user module/slot configuration on the profibus master device will not affect the DPv1 slot numbers, only Slot 1 is used.

Write requests are only accepted if the specified data lengths in the requests are same as the data lengths defined in slot/index table.

Slot	Index	R/W	# Words	Data
1	1	R	72	Measurement 1 Data
1	2	R/W	34	Measurement 1 Control
1	11	R	72	Measurement 2 Data
1	12	R/W	34	Measurement 2 Control
1	21	R	72	Measurement 3 Data
1	22	R/W	34	Measurement 3 Control
1	31	R	72	Measurement 4 Data
1	32	R/W	34	Measurement 4 Control
1	240	R/W	8	Resource Control
1	241	R	32	Relay Data
1	242	R	21	Resource Data
1	243	R/W	96	Relay Settings
1	250	R	20	System Data
1	251	R	18	System Settings

The field definitions for these indexed data spaces follow sequentially (definitions within a table also follow as commented).

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Measurement data 1 - 4		
Word	**Name**	**Comments**
0	Tag Number	16-bit user tag for this measurement
1-9	Name	Text Name for measurement 18 bytes
10-11	Measurement	32-bit IEEE float of displayed measurement
12-13	Pressure compensated	Pressure compensated measurement
14-15	Filtered measurement	Filtered measurement
16-17	Temperature	Chassis temperature
18-19	Faults and Alarms	Defined in Faults & Alarms table immediately below
20	Auto Validation State	Defined in Calibration 1-4 table below
21	Auto Validation Gas	Defined in Calibration 1-4 table below
22	Auto Validation Finishing	Defined in Calibration 1-4 table below
23	Auto Validation Fail State	Defined in Calibration 1-4 table below
24	Number of Cal / Val Points	Defined in Calibration 1-4 table below
25	Select Cal/Val Point*	Defined in Calibration 1-4 table below
26-27	Last Cal/Val Point n reading	
28-29	Last Cal Point n Target	32-bit float
30-31	Last Cal Point n Delta	32-bit float
32	Last Cal Point n Time	16-bit integer (hhmm)
33-34	Last Cal Point n Date[2]	32-bit integer (yymmdd)
35	Cal point passed/failed	

Measurement faults and alarms				
Word	**Byte**	**Bit**	**Name**	**Comments**
0	LOW	0	Warming On	
		1	Heater fault	
		2	Sample heater fault	
		3	Calibration fault	
		4	Communication fail	
		5	Transducer not detected	
		6	Autoval / cal failed	
		7	Remote calibration/val denied	
	HI	0	Alarm Active	
		1	Fault	
		2	Service in progress	
		3	Out of specification	
		4	Maintenance required	
		5	Transducer maintenance fault	
		6	Transducer error	
		7	Transducer fatal fault	
1	LOW	0-7	Reserved	
	HI	0	Clipping Active	
		1	Remote service in progress	
		2	Transducer calibration mode	
		3	Auto validation/calibration	
		4	Incorrect transducer type	
		5-7	Reserved	

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Measurement 1-4 control				
Word	**Byte**	**Bit**	**Name**	**Comments**
0	HI	0	Calibration mode on/off	
		1	Start auto validation	
		2	Stop auto validation	
		3	Enable baseline subtraction	
		4-7	Reserved	
	LOW	0-7	Reserved	
1		1	Invoke calibration n	
2		2	Calibration point n gas	
3		3	Sample Gas Selection	
4		4	Select Cal/Val point	
5-6		5	Cross Interference correction/ GSF	
7-16		6	Reserved	

Resource control 1 - 4		
Byte	**Name**	**Comments**
0	cLegacy Pressure 1[8]	Defined in Legacy Pressure n table
1	cLegacy Pressure 2[8]	
2	cLegacy Pressure 3[8]	
3	cLegacy Pressure 4[8]	
4	cLegacy Flow 1[8]	Defined in legacy flow n table
5	cLegacy Flow 2[8]	
6	cLegacy Flow 3[8]	
7	cLegacy Flow 4[8]	

Legacy pressure n		
Bit	**Name**	**Comments**
0	Calibrate pressure mode	
1	Calibrate pressure low	
2	Calibrate pressure high	

Legacy flow n		
Bit	**Name**	**Comments**
0	Calibrate flow mode	
1	Calibrate zero flow	
2	Calibrate normal flow	

Relay data		
Bit	**Name**	**Comments**
0	iRelay 01 status[8]	(State-CardNotDetected-ServiceInProgress)
:	iRelay n status[8]	
31	iRelay 32 status[8]	

Relay info n		
Bit	**Name**	**Comments**
0	State	
1	Card not detected	
2	Service in progress	

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Resource data (Slot 1 Index 242)		
Byte	**Name**	**Comments**
0	iAOUT 1 status[8]	
1	iAOUT 2 status[8]	
2	iAOUT 3 status[8]	
3	iAOUT 4 status[8]	
4	iAIN 1 status[8]	
5	iAIN 2 status[8]	
6	iAIN 3 status[8]	
7	iAIN 4 status[8]	
8	iDin Card Not Detected[8]	
9	iLegacy Pressure 1 status [8]	
10	iLegacy Pressure 2 status [8]	
11	iLegacy Pressure 3 status [8]	
12	iLegacy Pressure 4 status [8]	
13	iLegacy Flow Alarm 1 status[16]	
14	iLegacy Flow Alarm 2 status[16]	
15	iLegacy Flow Alarm 3 status[16]	
16	iLegacy Flow Alarm 4 status[16]	
17-20	Chassis Temperature	

Resource data (Slot 1 Index 243)		
Byte	**Name**	**Comments**
0	iRelay 01 Active State	Rsc settings
1	iRelay 01 Override State	
2	iRelay 01 Override	
3	iRelay 02 Active State	
4	iRelay 02 Override State	
5	iRelay 02 Override	
:	iRelay n Active State	
:	iRelay n Override State	
:	iRelay n Override	
93	iRelay 32 Active State	
94	iRelay 32 Override State	
95	iRelay 32 Override	

System data (Slot 1, Index 250)		
Word	**Name**	**Comments**
0-9	hInstrument Serial Number[10]	Sys Data

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System settings (Slot 1, Index 251)		
Word	**Name**	**Comments**
0	hService in Progress	Sys Control
1	System Controls	Sys Settings
2	hResponse Delay	
3	hClock: Hrs	
4	hClock: Mins	
5	hClock: Seconds	
6	hDate: Year	
7	hDate: Month	
8	hDate: Day	

System controls word			
Byte	**Bit**	**Name**	**Definition**
LOW	0-7	Reserved	
HI	0	Floating point order	
	1	User Interface busy	
	2	Disable user interface	
	3-7	Reserved	

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D.7 Troubleshooting

D.7.4 The analyzer is not detected by the profibus master device

- Check that the profibus cable is connected to the analyser, and the master device.
- Check that the termination resistors on the end points of the network are active.
- Check that the analyser node address is set up correctly on the master device.

  Settings →

- Check that there are no other devices configured to use the same address as the analyser.
- Make sure that if there is more than one master device on the system, the correct master device is configured and connected to the analyser.
- On the profibus master device, make sure that the correct gsd file has been used to configure the analyser, and at least one module is included in the configuration. Refer to your master device's manual to make sure all steps for the configuration have been followed.
- Some profibus master devices are configured to stop reporting cyclic data as soon as an extended diagnostic error message is received. In this case either these faults have to be cleared on the analyser, or the master device has to be configured to continue normal operation when diagnostic bits are reported.
- Make sure that the profibus baud rate selected at the profibus master device, is suitable for the cabling setup.
- Make sure that the profibus master is running.
- Using the Status menu on the analyser, make sure that there is no "Profibus card not detected" fault. This fault will require servicing of the analyser - Contact Servomex or your local Servomex representative.

D.7.5 The communication starts, but there are frequent line drops

- Make sure that the ‘Profibus Cabling Guidelines’ have been followed. Refer to www.profibus.com for the latest guidelines.
- If possible decrease the network baudrate.

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Appendix E Return Authorization Request

Servomex must approve and sign a Return Product Authorization Number (RPA) to any instrument being returned. The RPA must appear on all paperwork and packaging.

The issuance of a RPA does not automatically imply that the instrument is covered by our warranty.

In order to serve you better and to protect our employees from any potentially hazardous contaminants, Servomex must return, unopened and at the sender's expense, all items that do not have a RPA.

OSHA Hazard Communication Standard 29CFR 1920.1200 mandated that we take specific steps to protect our employees from exposure to potential hazards. Therefore, a letter certifying that the equipment has been decontaminated must accompany all equipment exposed to hazardous contamination.

To obtain a RPA, fill out this form and email it to americas_service@servomex.com or call Toll Free: +1 800 862 0200.

Customer information:	
Company name:	
Address:	
Contact name:	
Phone:	
Fax:	
Equipment information:	
Part or model number:	MultiExact 4100
Serial number:	
Original purchase date:	
PO number:	
Reason for return: **(Failure and hook-up description if applicable)**	
Process material(s) and/or environments (including radiation) to which the equipment has been exposed:	
Has the equipment been decontaminated?	
Does a letter stating that the equipment has been decontaminated accompany the equipment?	

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Appendix F Available Transducer FSD Values

Transducer	FSD
GFX1210 CO High sensitivity – low range	50 ppm CO
GFX1210 CO High sensitivity	500 ppm CO
GFX1210 CO_2 Standard sensitivity	500 ppm CO_2
GFX1210 CO_2 High sensitivity	100 ppm CO_2
GFX 1210 CH_4 High sensitivity	500 ppm CH_4
GFX 1210 N_2O High sensitivity	500 ppm N_2O
IR MB1520 MB1520711	100% CO_2
IR MB1520 MB152071250% CO_2	50% CO_2
IR MB1520 MB1520713B	30% CO_2
IR MB1520 MB1520713A	20% CO_2
IR MB1520 MB1520714	10% CO_2
IR MB1520 MB1520715	5% CO_2
IR MB1520 MB1520717	1% CO_2
IR MB1520 MB1520718	5000 ppm CO_2
IR MB1520 MB1520719A	2000 ppm CO_2
IR MB1522 MB1522714	10% CO
IR MB1522 MB1522715	5% CO
IR MB1522 MB1522716A	2% CO
IR MB1522 MB1522717	1% CO
IR MB1522 MB1522718	5000 ppm CO
IR MB1522 MB1522719	2000 ppm CO
Pm 1158 O_2 Control	100% O_2
Pm Purity O_2	100% O_2
Zirconia 704 O_2 Trace plus indicative reading above 21% O_2	210000 ppm O_2

Table 12-1: Transducer FSD values

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Appendix G Infrared (IR) transducers specific information

G.1 IR transducer low and high calibration

Typically zero grade nitrogen is recommended for low calibration.

It is recommended that the high calibration gas is in the range 80 to 110% of the transducer's FSD.

Gas transducer module	Low calibration	High calibration
IR transducer	Weekly	Daily

Table G-1: Recommended calibration periods for IR transducers

Gases measured	1521 CO_2 1522 CO
Range	See Table G-3
Minimum recommended output range	80% of selected range
Intrinsic error	1% of selected range
Linearity error	1% of selected range
Repeatability	1% of selected range
Response (T90)	<20 seconds at 200 ml/min
Zero drift / week	2% of selected range
Span drift / day	1% of selected range
Output fluctuation (peak to peak)	0.5% of selected range or 1% of reading, whichever is the larger.
Ambient pressure coefficient	0.2% of reading per mbar
Ambient temperature coefficient / 10 °C change	1% of selected range ± <2.0% of reading
Inlet sample pressure effect from 2 to 8 psig	1.5% of selected range or <3% of reading, whichever is the larger.
Sample flow effect range 50 to 200 ml/min	1.5% of selected range or <3% of reading, whichever is the larger.

Table G-2: MultiExact 4100 IR transducer performance specification

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Gases measured	Full scale measurement range (%)								
	0.25	0.5	1.0	2.5	5	10	25	50	100
1520 CO_2	✓	✓	✓	✓	✓	✓	✓	✓	✓
1522 CO			✓	✓		✓			

Table G-3: MultiExact 4100 IR measurement ranges

Appendix G2: Nondispersive IR Single Beam Dual Wavelength (MB152* type) Transducer

G.2 Transducer low and high calibration

Zero grade nitrogen is recommended for low calibration. It is recommended that the high calibration gas is in the range 80 to 100% of the transducer's FSD.

Table 0-2: Recommended calibration periods for SBDW NDIR transducers

Gas transducer module	Low calibration	High calibration
MB152* NDIR transducer	Weekly	Weekly

Table 0-3: SBSW NDIR transducer performance specification

Gases measured	IR MB1520 CO_2 / IR MB1522 CO
Range	See Table F-1
Minimum recommended output range	80% of selected range
Intrinsic error Linearity error Repeatability	1% of selected range
Lower Detection Limit (LDL)	<1% of selected range[#]
Response (T90)	<20 seconds at 0.7 l/min
Zero drift / week	<2% of selected range
Span drift / week	<2% of selected range
Output fluctuation (peak to peak)	0.5% of selected range or 1% of reading, whichever is the larger
Ambient pressure coefficient	<0.2% of reading per mbar
Zero temperature coefficient / 10 °C change	<2% of selected range
Span temperature coefficient / 10 °C change	<2% of selected range ± <1.0% of reading
Sample flow effect range over full flow range	1.5% of selected range or <3% of reading, whichever is the larger
[#] For 1% CO2 range, <3% of range	

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Table 0-4: SBDW NDIR measurement ranges

Gases measured	Full Scale Measurement Range (%)									
	0.2	0.5	1.0	2	5	10	20	30	50	100
MB1520 CO_2	✓	✓	✓		✓	✓	✓	✓	✓	✓
MB1522 CO	✓	✓	✓	✓	✓	✓				

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Appendix H Paramagnetic transducer information

Gas transducer module	Low calibration	High calibration
Paramagnetic transducer (purity)	Monthly	Weekly
Paramagnetic transducer (other)	Weekly	Weekly

Table H-1: Recommended calibration periods for paramagnetic transducers

Transducer	FSD
Pm O_2 Control	100% O_2
Pm Purity O_2	100% O_2
Zirconia 704 O_2 Trace plus indicative reading above 21% O_2	210000 vpm O_2

Table H-2: Paramagnetic transducer FSD values

Gases measured	O_2 control	O_2 purity
Range	0 – 100%	0 – 100%
Minimum recommended output range	0 – 5%	0 – 0.5%
Intrinsic error	< 0.15%	< 0.01%
Linearity error	< 0.05%	< 0.05%
	Inherently linear, dependent on calibration gases	
Repeatability	< 0.1%	< 0.01%
Response (T90)	< 15 s at 200 ml/min	< 12 s at 200 ml/min
Zero drift / week	< 0.05% O_2	< 0.01% O_2
Span drift / week	< 0.1% O_2	< 0.02% O_2
Output fluctuation (peak to peak)	< 0.05% O_2	< 0.01% O_2 (in the range 99 – 100%)
Cross sensitivity	No effects in target applications	
Ambient pressure coefficient	Directly proportional to analyzer vent pressure	<0.003% of reading for a 1% change in analyzer vent pressure

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Gases measured	O_2 control	O_2 purity
Ambient temperature coefficient / 10 °C change	1% of selected range or 0.1% O_2	0.2% of selected range or 0.02% O_2
Inlet sample pressure effect from 2 to 8 psig	< 2% of selected range or 0.1% O_2, whichever is the larger.	< 0.1% O_2
Sample flow effect range 50 to 200 ml/min	< 2% of selected range or 0.1% O_2, whichever is the larger.	< 0.1% O_2

Table H-3: MultiExact 4100 paramagnetic transducer performance specification

H.1 Overview of measurement errors for paramagnetic O_2 transducer

For an O_2 transducer, the composition of any typical background gas in the gas sample will have an impact on the analyzer measurement accuracy.

Table H-4 gives 4 examples of cross-interference errors (O_2 measurement errors) in gases which contain 100% of a specific background gas, for an analyzer which has been 'Lo' calibrated with N_2 (nitrogen) and 'Hi' calibrated with O_2.

Background gas	Error
Argon	-0.22%
Carbon dioxide	-0.26%
Halothane	-1.93%
Helium	-0.29%

Table H-4: Example cross-interference measurement errors

Note that the error is directly proportional to the concentration of the background gas in the sample being measured and in most cases can be ignored. A detailed listing of these measurement errors for a wide variety of background gases are listed in section H.2.

XINT is a reported concentration adjustment that can be set in the Paramagnetic Measurement menus. It is a scaling factor that is used to correct the current transducer reading. The default value is 1.0. If required the operator can change this value to compensate for the background gas. For example: If you are measuring oxygen in a background of carbon dioxide -0.26 should be entered as the XINT value.

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Figure H-1: XINT icon

If XINIT compensation is to be used, care must be taken to ensure that the value used for the background gases is correct. Also, during a calibration, no XINT compensation is applied and it is assumed that the calibration gas sample has negligible cross-interference.

Do not install the unit in places subject to extreme mechanical vibration or shock. If you do, measurements may not be accurate, or the analyzer may be damaged.

H.2 Pressure compensation for paramagnetic O_2 transducer

Note: The MultiExact 4100 in general does not provide pressure compensation; it must be calibrated at the process flow and pressure conditions under which it is used.

The O2 purity measurement does provide pressure compensated and instructions for enabling the pressure compensated measurements are below.

Figure H-1: O_2 pressure compensation screen

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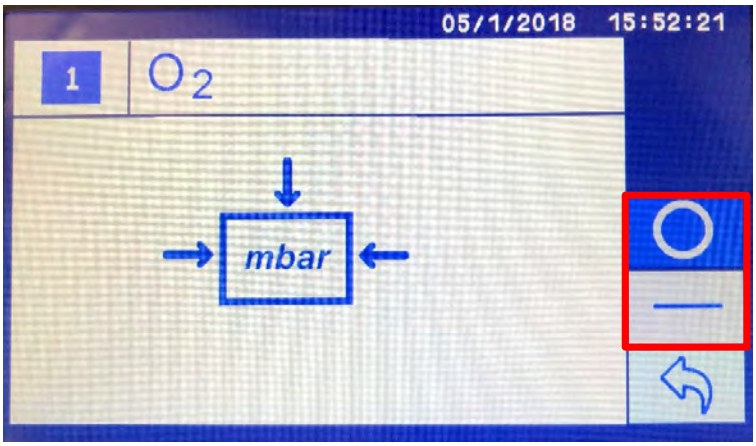

Figure H-2: mA output screen

Simply use the off — and on ○ icons to activate pressure compensation. A pressure sensor within the sample stream will correct all O_2 measurements for the difference in pressure recorded during the last span calibration and live measurements.

So, with pressure compensation on all sample measurements will be normalized to the pressure recorded during the last span calibration thereby ensuring the most accurate measurement possible is made by the analyzer.

H.2 Cross interference offsets (for paramagnetic transducer)

Pure gas	Formula	Molar mag. susc x 10^{-6}	Cross interference offsets			
			Control = 20 °C		Purity = 60 °C	
			20 °C	50 °C	60 °C	110 °C
Acetaldehyde	CH_2CHO	–22.70	–0.31	–0.34	–0.35	–0.40
Acetic acid	CH_3CO_2H	–31.50	–0.56	–0.62	–0.64	–0.74
Acetone	CH_3COCH_3	–33.70	–0.63	–0.69	–0.71	–0.82
Acetylene	HCCH	–20.80	–0.25	–0.28	–0.29	–0.33
Acrylonitrile	CH_2=CHCN	–24.10	–0.35	–0.39	–0.40	–0.46
Allyl alcohol	CH_2CHCH_2OH	–36.70	–0.71	–0.79	–0.81	–0.93
Ammonia	NH_3	–18.00	–0.17	–0.19	–0.20	–0.23
Argon	Ar	–19.60	–0.22	–0.24	–0.25	–0.29
Benzene	C_6H_6	–54.84	–1.24	–1.36	–1.41	–1.62
Boron chloride	BCl_3	–59.90	–1.38	–1.53	–1.57	–1.81
Boron trifluoride	BF_3	–19.00	–0.20	–0.22	–0.23	–0.26
Bromine	Br_2	–73.50	–1.78	–1.96	–2.02	–2.32
1,2 Butadiene	C_4H_6	–35.60	–0.68	–0.75	–0.77	–0.89
1,3 Butadiene	C_4H_6	–30.60	–0.54	–0.59	–0.61	–0.70
N-Butane	C_4H_{10}	–50.30	–1.11	–1.22	–1.26	–1.45
iso-Butane	$(CH_3)_2CHCH_2$	–51.70	–1.15	–1.26	–1.30	–1.50
1 Butene	CH_3CH_2CH=CH_2	–41.10	–0.84	–0.93	–0.96	–1.10
N–Butyl acetate	$CH_3COOC_4H_9$	–77.50	–1.89	–2.09	–2.15	–2.47
iso–Butylene	$(CH_3)_2CH$=CH_2	–44.40	–0.94	–1.03	–1.06	–1.22
1 Butyne (Ethylacetylene)	$CH_3C_3H_2$	–43.50	–0.91	–1.00	–1.03	–1.19
Carbon dioxide	CO_2	–21.00	–0.26	–0.29	–0.30	–0.34
Carbon disulphide	CS_2	–42.20	–0.87	–0.96	–0.99	–1.14
Carbon monoxide	CO	–9.80	0.06	0.07	0.07	0.08
Carbon tetrachloride	CCl_4	–66.60	–1.58	–1.74	–1.79	–2.06
Carbon tetrafluoride	CF_4	–31.20	–0.55	–0.61	–0.63	–0.72

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Pure gas	Formula	Molar mag. susc x 10^{-6}	Cross interference offsets			
			Control = 20 °C		Purity = 60 °C	
			20 °C	50 °C	60 °C	110 °C
Chlorine	Cl_2	–40.50	–0.82	–0.91	–0.94	–1.08
Chloroethanol	$ClCH_2CH_2OH$	–51.40	–1.14	–1.25	–1.29	–1.49
Chloroform	$CHCl_3$	–59.30	–1.37	–1.51	–1.55	–1.78
Cumene	$(CH_3)_2CHC_6H_5$	–89.53	–2.24	–2.47	–2.55	–2.93
Cyclohexane	C_6H_{12}	–68.13	–1.62	–1.79	–1.84	–2.12
Cyclopentane	C_5H_{10}	–59.18	–1.36	–1.50	–1.55	–1.70
Cyclopropane	C_3H_6	–39.90	–0.81	–0.89	–0.92	–1.05
Diacetylene	C_4H_2	–37.50	–0.74	–0.81	–0.84	–0.96
Dichloroethylene	$(CHCl)_2$	–49.20	–1.07	–1.18	–1.22	–1.40
Diethyl ether	$(C_2H_5)_2O$	–55.10	–1.25	–1.37	–1.41	–1.63
2,2 Difluoro 1 chloroethane	$CClH_2CHF_2$	–52.40	–1.17	–1.29	–1.33	–1.52
1,2 Difluoro 1,2 dichloroethylene	CFCl=CFCl	–60.00	–1.39	–1.53	–1.58	–1.81
Difluoro dichloro methane (Freon 12)	CCl_2F_2	–52.20	–1.16	–1.28	–1.32	–1.5
Dimethoxy methane	$CH_2(OCH_3)_2$	–47.30	–1.02	–1.12	–1.16	–1.33
Dimethylamine	$(CH_3)_2NH$	–39.90	–0.81	–0.89	–0.92	–1.05
Dimethylether	CH_3OCH_3	–26.30	–0.41	–0.46	–0.47	–0.54
Dimethylethylamine	(CH3)2NC2H5	–63.60	–1.49	–1.64	–1.69	–1.95
Enflurane (Ethrane)	C3H2F5ClO	–80.10	–1.97	–2.17	–2.24	–2.57
Ethane	C2H6	–26.80	–0.43	–0.47	–0.49	–0.56
Ethanol	C_2H_5OH	–33.60	–0.62	–0.69	–0.71	–0.82
Ethyl acetate	$CH_3COOC_2H_5$	–54.20	–1.22	–1.34	–1.39	–1.59
Ethyl amine	$C_2H_5NH_2$	–39.90	–0.81	–0.89	–0.92	–1.05
Ethyl benzene	$C_6H_5C_2H_5$	–77.20	–1.88	–2.08	–2.14	–2.46
Ethyl bromide	C_2H_5Br	–54.70	–1.23	–1.36	–1.40	–1.61
Ethyl chloride	C_2H_5Cl	–46.00	–0.98	–1.08	–1.12	–1.28

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Pure gas	Formula	Molar mag. susc x 10^{-6}	Cross interference offsets			
			Control = 20 °C		Purity = 60 °C	
			20 °C	50 °C	60 °C	110 °C
Ethylene	C_2H_4	–18.80	–0.20	–0.22	–0.22	–0.26
Ethylene glycol	$(CH_2OH)_2$	–38.80	–0.77	–0.85	–0.88	–1.01
Ethylene oxide	$(CH_2)_2O$	–30.70	–0.54	–0.60	–0.61	–0.71
Ethyl mercaptan	$C_2H_5OSO_3H$	–47.00	–1.01	–1.11	–1.15	–1.32
Fluorochlorobromomethane	CFClBr	–58.00	–1.33	–1.46	–1.51	–1.74
Fluorodichloromethane (Freon 21)	$CHCl_2F$	–48.80	–1.06	–1.17	–1.21	–1.39
Fluroxene	$CF_3CH_2OCHCH_2$	–56.70	–1.29	–1.42	–1.47	–1.69
Freon 114	$C_2Cl_2F_4$	–77.40	–1.89	–2.08	–2.15	–2.47
Furan	C_4H_4O	–43.09	–0.90	–0.99	–1.02	–1.17
Germanium tetrachloride	$GeCl_4$	–72.00	–1.73	–1.91	–1.97	–2.26
Halothane	$C_2HBrClF_3$	–78.80	–1.93	–2.13	–2.19	–2.52
Helium	He	–1.88	0.29	0.32	0.33	0.38
N–Heptane	C_7H_{16}	–85.24	–2.12	–2.33	–2.40	–2.76
N–Hexane	C_6H_{14}	–73.60	–1.78	–1.96	–2.02	–2.32
Hydrogen	H_2	–3.98	0.23	0.26	0.26	0.30
Hydrogen bromide	Br	–35.30	–0.67	–0.74	–0.76	–0.88
Hydrogen chloride	HCl	–22.60	–0.31	–0.34	–0.35	–0.40
Hydrogen cyanide	HCN	–14.50	–0.07	–0.08	–0.08	–0.09
Hydrogen iodide	HI	–48.20	–1.05	–1.15	–1.19	–1.37
Hydrogen selenide	H_2Se	–39.20	–0.79	–0.87	–0.89	–1.03
Hydrogen sulphide	H_2S	–25.50	–0.39	–0.43	–0.44	–0.51
Isoflurane (Forane)	$C_3H_2F_5ClO$	–80.10	–1.97	–2.17	–2.24	–2.57
Isoprene	C_5H_8	–44.80	–0.95	–1.04	–1.08	–1.24
Ketene	CH_2CO	–15.70	–0.11	–0.12	–0.12	–0.14
Krypton	Kr	–28.80	–0.49	–0.54	–0.55	–0.63
Methane	CH_4	–17.40	–0.16	–0.17	–0.18	–0.20

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Pure gas	Formula	Molar mag. susc x 10^{-6}	Cross interference offsets			
			Control = 20 °C		Purity = 60 °C	
			20 °C	50 °C	60 °C	110 °C
Methanol	CH_3OH	–21.40	–0.27	–0.30	–0.31	–0.35
Methoxyfluorane	$CHCl_2CF_2OCH_3$	–87.10	–2.17	–2.39	–2.47	–2.83
Methyl acetate	CH_3COCH_3	–42.60	–0.88	–0.97	–1.00	–1.15
Methyl cyclopentane	C_6H_{12}	–70.20	–1.68	–1.85	–1.91	–2.20
Methylene chloride	CH_2Cl_2	–46.60	–1.00	–1.10	–1.14	–1.31
Methylethlyketone	$CH_3COCH_2CH_3$	–45.50	–0.97	–1.07	–1.10	–1.26
Methyl fluoride	CH_3F	–25.50	–0.39	–0.43	–0.44	–0.51
Methyl formate	$HCOOCH_3$	–32.00	–0.58	–0.64	–0.66	–0.75
Methyl iodide	CH_3I	–57.20	–1.31	–1.44	–1.48	–1.71
Methyl iso–butyl ketone (MIBK)	$C_4H_9COCH_3$	–69.30	–1.66	–1.82	–1.88	–2.16
Methyl mercaptan	CH_3SH	–35.30	–0.67	–0.74	–0.76	–0.88
Molybdenum hexafluoride	MoF_6	–26.00	–0.40	–0.45	–0.46	–0.53
Monochlorobenzene	C_6H_5Cl	–70.00	–1.68	–1.85	–1.90	–2.19
Neon	Ne	–6.70	0.15	0.17	0.17	0.20
Nitric oxide	NO	1461.00	42.56	42.96	42.94	41.62
Nitrobenzene	$C_6H_5NO_2$	–61.80	–1.44	–1.59	–1.63	–1.88
Nitrogen	N_2	–12.00	0.00	0.00	0.00	0.00
Nitrogen dioxide	NO_2	150.00	5.00	16.00	20.00	35.00
Ortho–Nitrotoluene	$C_6H_4CH_3NO_2$	–72.30	–1.74	–1.92	–1.98	–2.28
para–Nitrotoluene	$C_6H_4CH_3NO_2$	–76.90	–1.88	–2.07	–2.13	–2.45
Nitrous oxide	N_2O	–18.90	–0.20	–0.22	–0.23	–0.26
N–Nonane	C_9H_{20}	–108.13	–2.78	–3.06	–3.16	–3.63
N–Octane	C_8H_{18}	–96.63	–2.45	–2.70	–2.78	–3.19
Oxygen	O_2	3449.00	100.0	100.0	100.0	100.0
Ozone	O_3	6.70	0.54	0.60	0.61	0.71
iso–Pentane	C_5H_{12}	–64.40	–1.51	–1.67	–1.72	–1.98

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Pure gas	Formula	Molar mag. susc x 10^{-6}	Cross interference offsets			
			Control = 20 °C		Purity = 60 °C	
			20 °C	50 °C	60 °C	110 °C
N–Pentane	C_5H_{12}	–63.10	–1.48	–1.63	–1.68	–1.93
0.01%Phenol	C_6H_5OH	–60.21	–1.39	–1.54	–1.58	–1.82
Phosphine	PH_3	–26.00	–0.40	–0.45	–0.46	–0.53
Phosphorous oxychloride	$POCl_3$	–69.00	–1.65	–1.82	–1.87	–2.15
Propane	C_3H_8	–38.60	–0.77	–0.85	–0.87	–1.00
iso–Propanol	$(CH_3)_2CHOH$	–47.60	–1.03	–1.13	–1.17	–1.34
Propene	$CH_3CH=CH_2$	–31.50	–0.56	–0.62	–0.64	–0.74
N–Propyl acetate	$CH_3COOC_3H_7$	–65.90	–1.56	–1.72	–1.77	–2.03
Propyl amine	$C_3H_7NH_2$	–52.40	–1.17	–1.29	–1.33	–1.52
Propyl chloride	C_3H_7Cl	–56.10	–1.27	–1.40	–1.45	–1.66
Propylene	C_3H_6	–31.50	–0.56	–0.62	–0.64	–0.74
Propylene oxide	OCH_2CHCH_3	–42.50	–0.88	–0.97	–1.00	–1.15
iso–Propyl ether	$(CH_3)_4CHOCH$	–79.40	–1.95	–2.15	–2.21	–2.54
Propyl fluoride	C_3H_7F	–52.20	–1.16	–1.28	–1.32	–1.52
Pyridine	$N(CH)_5$	–49.21	–1.08	–1.19	–1.22	–1.40
Silane	SiH_4	–20.50	–0.25	–0.27	–0.28	–0.32
Silicon tetrachloride	$SiCl_4$	–88.30	–2.20	–2.43	–2.50	–2.88
Styrene	$C_6H_5CH=CH_2$	–68.20	–1.62	–1.79	–1.85	–2.12
Sulphur dioxide	SO_2	–18.20	–0.18	–0.20	–0.20	–0.23
Sulphur hexafluoride	SF_6	–44.00	–0.92	–1.02	–1.05	–1.21
Tetrachoroethylene	$Cl_2C=CCl_2$	–81.60	–2.01	–2.22	–2.28	–2.63
Tetrahydrofuran	C_4H_8O	–52.00	–1.16	–1.27	–1.31	–1.51
Toluene	$C_6H_5CH_3$	–66.11	–1.56	–1.72	–1.78	–2.04
1,1,2 Trichloroethane (Freon 113)	$CHCl_2CH_2Cl$	–66.20	–1.57	–1.73	–1.78	–2.05
Trichloroethylene	$CHCl=CCl_2$	–65.80	–1.55	–1.71	–1.77	–2.03
Trifluorochloroethylene	C_2F_3Cl	–49.10	–1.07	–1.18	–1.22	–1.40

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Pure gas	Formula	Molar mag. susc x 10^{-6}	Cross interference offsets			
			Control = 20 °C		Purity = 60 °C	
			20 °C	50 °C	60 °C	110 °C
Trimethylamine	$(CH_3)_3N$	–51.70	–1.15	–1.26	–1.30	–1.50
Tungsten fluoride	WF_6	–40.00	–0.81	–0.89	–0.92	–1.06
Urethane	$CO(NH_2)OC_2H_5$	–57.00	–1.30	–1.43	–1.48	–1.70
Vacuum	–	0.00	0.35	0.38	0.39	0.45
Vinyl bromide	$CH_2=CHBr$	–44.80	–0.95	–1.04	–1.08	–1.24
Vinyl chloride	$CH_2=CHCl$	–35.60	–0.68	–0.75	–0.77	–0.89
Vinyl fluoride	$CH_2=CHF$	–28.80	–0.49	–0.54	–0.55	–0.63
Water	H_2O	–13.00	–0.03	–0.03	–0.03	–0.04
Xenon	Xe	–43.90	–0.92	–1.02	–1.05	–1.20
Xylene	$(CH_3)_2C_6H_4$	–77.78	–1.90	–2.09	–2.16	–2.48

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Appendix I 1210 GFX transducer information

I.1 GFX transducer low and high calibration

Powering on the analyzer 4 hours prior to operation allows temperatures to equilibrate and transducers to achieve operating temperature set point. Before calibrating the GFx transducer its highly recommended to power on for 24 hours prior and then flow purge gas for 2-6 hours.

The low calibration gas for GFX gas transducer modules may be specified between -5 vpm and +5 vpm of the measured component. Zero grade nitrogen is recommended.

The high calibration gas can be in the range 6 to 110% of the transducer's FSD. As GFX transducers are configured as 'dual range' units, it is recommended that the high calibration gas is selected at the top end of the range used.

Gas transducer module	Low calibration	High calibration
1210 GFX transducer	Weekly	Monthly

Table I-1: Recommended calibration periods for GFX transducers

Transducer	FSD
GFX 1210 CO High sensitivity – low range	50 vpm CO
GFX 1210 CO High sensitivity	500 vpm CO
GFX 1210 CO_2 High sensitivity	100 vpm CO_2
GFX 1210 CH_4 High sensitivity	500 vpm CH_4
GFX 1210 N_2O High sensitivity	500 vpm N_2O

Table I-2: GFX 1210 transducer FSD values

Gases measured	GFX CO trace *	GFX CO_2 trace	GFX CO_2 trace *	GFX N_2O trace *	GFX CH_4 trace
Range *(higher are available)*	0 – 50 vpm	0 – 10 vpm	500 vpm	0 – 50 vpm	0 – 50 vpm
Min. recommended output range	0 – 10 vpm	0 – 5 vpm	50 vpm	0 – 10 vpm	0 – 10 vpm

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Gases measured	GFX CO trace *	GFX CO_2 trace	GFX CO_2 trace *	GFX N_2O trace *	GFX CH_4 trace
Intrinsic error	< 1% of reading, or 0.5 vpm**	1% of reading, or 0.1 vpm**	< 1% of reading, or 0.5 vpm**	1% of reading, or 0.5 vpm**	1% of reading, or 0.5 vpm**
Linearity error	1% of reading, or 0.5 vpm**	1% of reading, or 0.1 vpm**	< 1% of reading, or 0.5 vpm**	1% of reading, or 0.5 vpm**	1% of reading, or 0.5 vpm**
Repeatability	1% of reading, or 0.5 vpm**	1% of reading, or 0.1 vpm**	< 1% of reading, or 0.5 vpm**	1% of reading, or 0.5 vpm**	1% of reading, or 0.5 vpm**
Response (T90)	< 20 seconds at 2000 ml/min				
Zero drift / week	1 vpm	0.2 vpm	1 vpm	1 vpm	1 vpm
Span drift / week	2% of reading, or 1 vpm**	2% of reading, or 0.2 vpm**	< 2% of reading, or 1 vpm**	2% of reading, or 1 vpm**	2% of reading, or 1 vpm**
Output fluctuation (peak to peak)	1% of reading, or 0.5 vpm**	1% of reading, or 0.1 vpm**	< 1% of reading, or 0.5 vpm**	1% of reading, or 0.5 vpm**	1% of reading, or 0.5 vpm**
Ambient pressure coefficient	0.25%	0.4%	0.4%	0.5%	1%
	Of reading per 1% change in analyser vent pressure				
Ambient temperature coefficient / 10 °C change	3% of reading, or 1 vpm CO **	3% of reading, or 0.25 vpm CO_2 **	< 3% of reading, or 1 vpm CO_2 **	3% of reading, or 1 vpm N_2O **	3% of reading, or 1.5 vpm CH_4 **
Inlet sample pressure effect from 2 to 8 psig	< 0.5 vpm CO	< 0.25 vpm CO_2	1 vpm CO_2	< 1 vpm N_2O	< 1.5% of reading, or 0.5 vpm CH_4 **
Sample flow effect range 1.5 to 2.5 L/min	< 1% of reading, or 0.25 vpm CO **	< 1% of reading, or 0.25 vpm CO_2 **	< 1% of reading, or 1 vpm CO_2 **	< 1% of reading, or 0.5 vpm N_2O **	< 1.5% of reading, or 0.5 vpm CH_4 **

Table I-3: MultiExact 4100 GFX transducer performance specification

* also for O_2 background

** whichever is the larger

GFX 1210 CO	GFX 1210 CO_2	GFX 1210 N_2O	GFX 1210 CH_4
2% H2O ~ 0.5 vpm	No effects in target applications	500vpm CO2 ~ 0.5 vpm 10vpm CO ~ 0.5 vpm 2% H2O ~ 0.5 vpm	1% O2 ~ 0.5 vpm 0.2% CO ~ 0.5 vpm 0.5% H2O < 1 vpm

Table I-4: 1210 GFX transducer trace measurement cross-sensitivity information

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Appendix J AquaXact 1688 transducer specific information

J.1 AquaXact calibration

Servomex recommend that you replace the transducer tip annually.

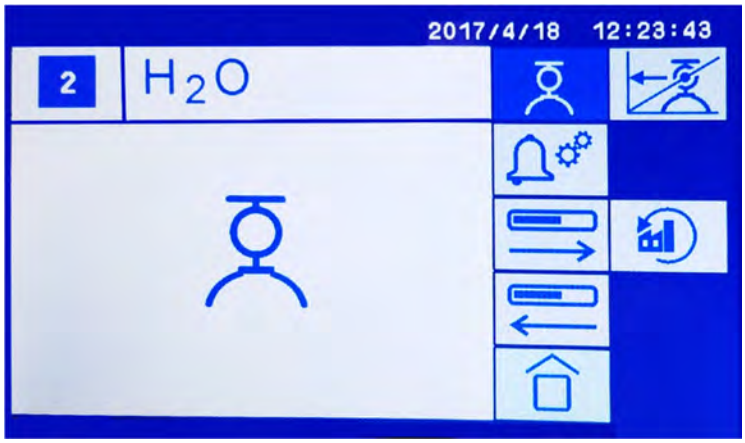

Figure J-1: Calibration screen

The AquaXact offers a single point calibration. Press the  icon to display the numeric keypad where you can type in the calibration value. The calibration value must always be in °C dew-point.

Praxair has a table of ppm and corresponding dew points that customers can use if they normally run in ppm. Refer to the website: https://www.praxairdirect.com/Specialty-Gas-Information-Center/Techical%20Data/Dew-Point.html

After the calibration is performed the system can take up to five minutes to stabilize. It will report values in the units that the customer has previously set before the calibration.

To restore the factory calibration settings, press the  icon.

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J.2 Correct connection of AquaXact digital cable

The AquaXact digital cables have a right angle connector on the probe end and a straight connector on the analyzer end. The cable is shielded with the shield connected only to the straight connector (the analyzer end). This means that the two ends of the cable are **not** interchangeable. The straight end is for connection to the analyzer, and the right angle end for connection to the transmitter.

J.3 Replacing the transducer tip

Do not store replacement tips for more than 12 months before use to assure the calibration is still valid.

Each transducer tip comes with a USB memory drive that contains the calibration information for the tip.

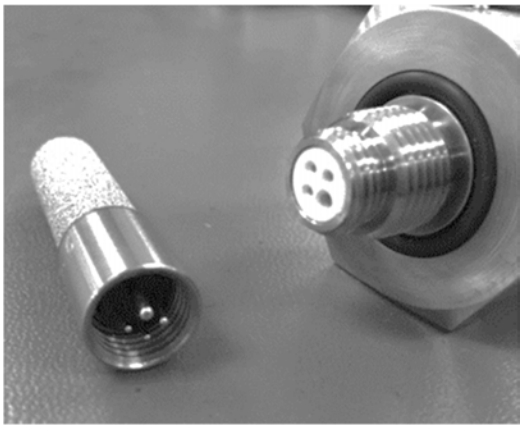

Figure J-2: Transducer tip

To change a transducer tip:

1. Remove the transmitter.
2. Unscrew the old transducer sensor tip and replace it with the new one. Make sure it is secure.
3. Press the tip replacement icon (Figure J-3).

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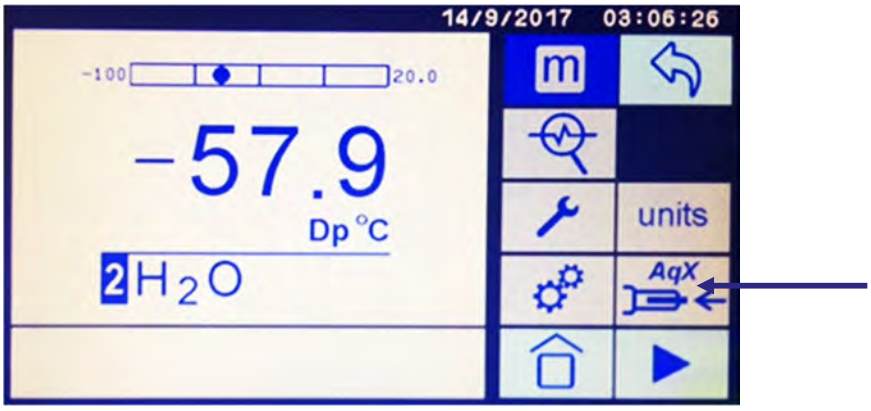

Figure J-3: Tip replacement icon

4. The serial number screen displays (Figure J-4).

Figure J-4: Enter transducer tip details

5. Insert the USB drive into the slot.
6. Type in the 6-digit serial number of the tip, followed by  . The transducer tip serial number is etched on the removable tip barrel (fig. J-2).

Note: If the file identified by the serial number is not found, an error will sound and the display reverts to the previous screen.

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J.4 Touchscreen icon glossary

Icon	Meaning	Para.	Icon	Meaning	Para.
units	Moisture units	J.5	—	Pressure correction: off	J.6
	Pressure	J.6	AqX	Tip replacement	J.2
	Pressure: pipeline	J.6		Calibrate	J.1
	Pressure: transmitter	J.6		Calibrate: single point calibration value	J.1
	Pressure correction: on	J.6		Restore factory defaults	J.1

J.5 Moisture units

> m > ▶ > ▶

The units used to report the moisture results can be set using the Units icon which is located on the third page of the measurement menu.

The units that can be set are ppm, dew point degrees Centigrade or dew point degrees Fahrenheit.

Figure J-5: Units icon

Note: If the units are changed, the range settings must be reset to correspond to the new units.

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J.6 Process and sample system pressures

> m >

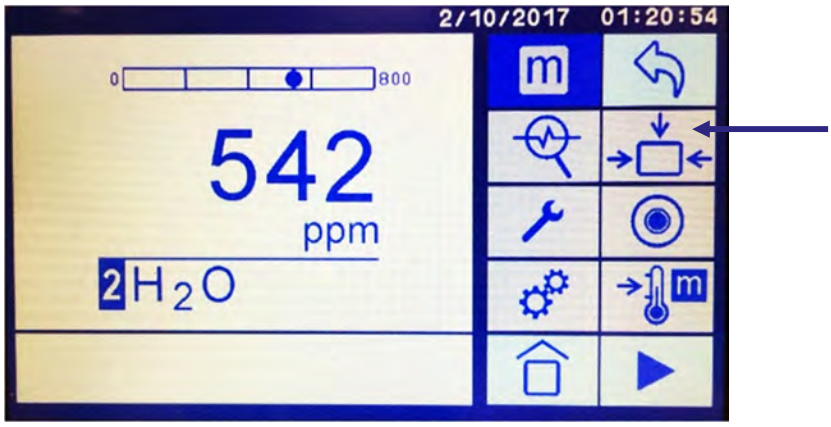

Figure J-6: Pressure compensation icon

As a default the dew point is reported at ambient pressure rather than process pressure (i.e. one atmosphere of pressure).

To calculate the process pressure dew point, the process pressure and the pressure at the dew point transmitter must be entered.

Touch the pressure compensation icon to display the next page (Figure J-7).

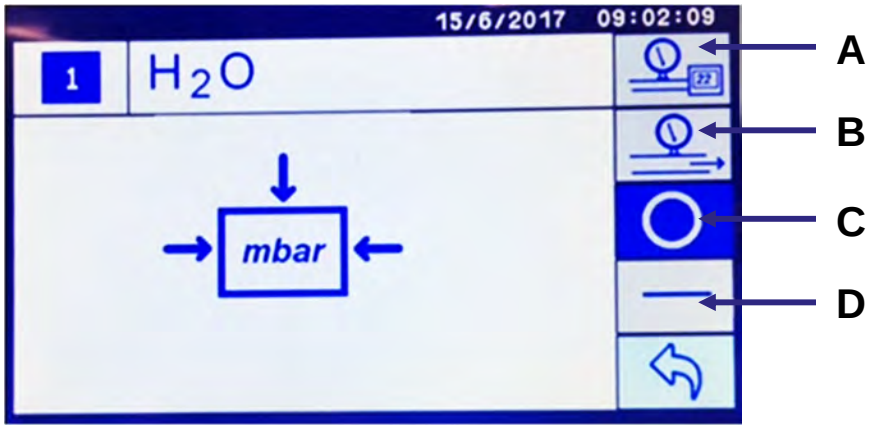

Figure J-7: Transmitter (A) and process stream (B) pressure icons

Touch the pressure at transmitter (A in Figure J-7) and the pressure in process stream (B in Figure J-7) icons in turn to display the current value and to enter a new value.

Type in pressure values in mbar on the number pad that displays, followed by the ↵ key.

Note: The default value is atmospheric pressure (1013.25 mbar).

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To turn the pressure correction on, press the  icon (C in Figure J-7).

To turn the pressure correction off, press the icon (D in Figure J-7).

J.7 Specifications

Dimensions:	*Includes transducer and connector* *Diameter x length* 31.5 x 136 mm 1.24 x 5.36 inches
Mass:	175 grams
Enclosure:	Stainless steel
Operating temperature:	-22 to +158 °F (-30 to +70 °C)
Mechanical connections:	5/8”-18 threads. Adapters for other threads are available.
Electrical connections:	Industrial Standard 9.4mm 7-pin connector IP65
Cable:	The digital seven conductor cable or the two conductor 4-20mA cable must be shielded to meet CE requirements; for ambient temperatures above 60 °C make sure that wiring temperature rating exceeds the maximum expected ambient temperature.
Maximum digital cable length:	200 metres.
Power requirements:	13 Vdc (min) to 33 Vdc (max), the instrument draws 4 - 20mA depending on measured dew point
Input resolution:	0.1 ºC dew point
Engineering units:	Factory programmed: °C dew point, °F dew point, ppmV
Controls:	Digital RS485 with AquaXact Controller
Outputs:	Analog and digital outputs are available: The 4-20 mA is linear to the engineering units and the range is digitally programmable. Output resolution is 0.1 °C dew point or ~0.25 µA whichever is greater. In the digital mode the AquaXact 1688 can be remotely operated, the dew point & temperature can be read.

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Alarms:	The 4-20 mA signal or the digital output may be used by an external device to operate relays.
Isolation:	The transducer is connected to the current loop but, isolated from the AquaXact 1688 housing and installation

J.8 Transducer

Type:	Thin film high capacitance Al_2O_3
Dew point range:	-100 °C to +20 °C
Accuracy:	± 3 °C
Repeatability:	± 0.5 °C
Typical Response time:	See the graph in xx
Temperature range:	-20 °C to +70 °C
Sample pressure range:	0 to 500 psig
Sample flow range:	2 to 15 l/min
Storage temperature:	-40 °C to +80 °C
Mechanical:	Encapsulated in 100µ sintered stainless steel
Calibration method:	NIST/NPL traceable multi-point factory calibration

J.9 Approvals / classifications

CE: CE for electromagnetic compatibility, accredited laboratory tested and certified.

J.10 Storage and maintenance

All Servomex AquaXact 1688 Al_2O_3 transducers and replacement tips are shipped in glass storage bottles in order to maintain transducer integrity. The storage bottle is partially filled with a desiccant to keep the transducer dry and ready for use.

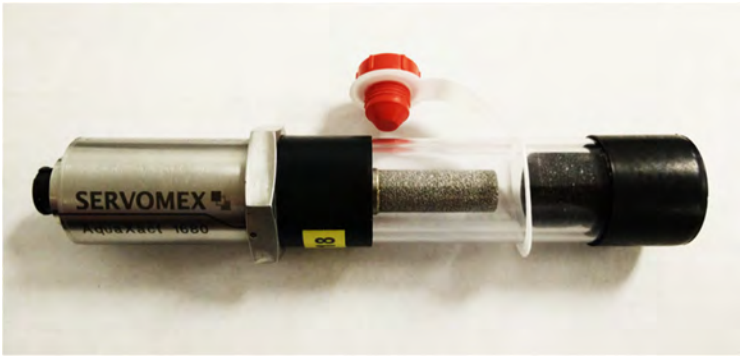

Figure J-8: AquaXact 1688 Al_2O_3 transducer glass storage bottle

The storage bottle can be used for long term storage provided the correct procedures are followed.

The AquaXact ultra-thin film transducer technology is based on the ability of the transducer to react to changes in the partial water-vapor pressure in the surrounding gas stream. In a constant moisture level environment, the rate of absorption and desorption of water molecules reaches equilibrium with the surrounding gas stream based on the partial water vapor pressure in the gas environment. Once equilibrium is achieved, the change in the dielectric strength of the aluminum oxide layer based on the amount of water present in the layer is accurately sensed as a change in capacitance of the transducer. The ability to absorb and desorb water molecules in the aluminum oxide layer is based on a certain level of water molecules being present in different chemical structures within the aluminum oxide which act as receptor sites.

Because the desiccant in the storage bottle continues to absorb moisture as long as the transducer remains sealed in the bottle the transducer can dry down to extremely low levels. Holding the transducer at extremely low moisture levels for long periods of time (more than 3 months) can cause the transducer response to be sluggish when first put into service.

The slow response phenomenon after a long storage period is driven by the fact that the desiccant continues to absorb water molecules. As a result after a long storage period in this environment the majority of the water molecules in the chemical structures of the aluminum oxide layer have been removed, reducing the ability of the senor to absorb water. When the transducer is then exposed to a gas stream with a partial water vapor pressure within its normal detection range, the transducer first has to ‘rehydrate’ before it can start to respond normally.

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Appendix K Zirconia transducer specific information

K.1 Zirconia transducer low and high calibration

The low calibration gas must be a high quality certified mixture of pure background gas (usually nitrogen N6.0) containing trace oxygen. Mixtures containing between 100 and 1000vpm oxygen are preferred, however, lower concentrations may be used. The minimum low cal set point is between 8ppm – 5000ppm depending on range used.

The high calibration gas must be pure dry air containing 209500 vpm oxygen (i.e. 20.95% volume).

Gas transducer module	Low calibration	High calibration
Zirconia transducer	Monthly	Monthly

Table K-1: Recommended calibration periods for Zirconia transducers

Transducer	FSD
Zirconia 704 O_2 Trace plus indicative reading above 21% O_2	210000vpm O_2

Table K-2: Zirconia transducer FSD values

Performance specification	ZR 704 O_2 trace
Range	0 – 210000 ppm ***
Minimum recommended output range	0 – 5 ppm
Intrinsic error	< 0.1 ppm O_2 **
Linearity error	< 0.1 ppm O_2 +
Repeatability	< 0.1 ppm O_2 +
Response (T90)	< 10 s at 400 ml/min
Zero drift / week	± 250 ppb *
Span drift / day	< 1% of reading or 250 ppb *
Output fluctuation (peak to peak)	< 0.5% of reading or 10 ppb +
Cross-sensitivity	15 ppm H_2 80 vpm CO 100 ppm CH_4 All < 1 ppm O_2

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Performance specification	ZR 704 O_2 trace
Ambient pressure coefficient	No effect
Ambient temperature coefficient / 10 °C change	±1% of reading or 10 ppb *
Inlet sample pressure effect from 2 to 8 psig	± 0.15 ppm or 2 % of reading *
Sample flow effect range 50 to 200 ml/min	± 0.15 ppm or 2% reading *

Table K-3: MultiExact 4100 Zirconia transducer performance specification

* whichever is the larger
** derived, dependent of calibration gas
*** indicative reading given above 21 % O_2
\+ in the range of 0-100 vpm

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Appendix L TCD transducer specific information (discontinued sensor 2020)

L.1 TCD transducer calibration

Gas transducer module	Low calibration	High calibration
TCD transducer	Monthly	Monthly

Table L-1: Recommended calibration periods for TCD transducers

High calibration setpoint	90 to 110% of range *	
Low calibration setpoint	-10 to 10% of range *	
Gas and ranges available	0 – 1% 0 – 2% 0 – 5% 0 – 10% 0 – 20%	0 – 30% 0 – 50% 0 – 100% 80 – 100% 90 – 100%
Minimum calibration difference between low and span	85 % of range *	
High calibration tolerance level	± 10% *	
Low calibration tolerance level	± 10% *	

* Range and background gas as per analyser specification.

Table L-2: TCD transducer calibration gases

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L.2 TCD performance data

The display indication given below is the default indication. You can configure the analyzer to provide other display indications (see Section 5.10).

Performance data has been determined in accordance with EN61207.

Gas and ranges available	0-1%	0-2%	0-5%	0-10%	0-20%	0-30%	0-50%	0-100%	80-100%	90-100%
Ar in N_2				✓	✓		✓	✓	✓	✓
Ar in O_2				✓	✓		✓	✓	✓	✓
N_2 in Ar				✓	✓		✓	✓		
He in N_2		✓	✓	✓	✓	✓	✓	✓		
He in O_2		✓	✓	✓	✓	✓	✓	✓		

Performance specification	
Display indication	%
Resolution	0.01%
Repeatability	0.5% of range
Linearity	± 1% of range
Intrinsic error (accuracy)	± 1% of range
Drift per month	± 1% of range
Output fluctuation	± 0.5% of range
Response time	T90 15 seconds *
Flow effect	< 0.1% **
Temperature coefficient	± 1% of range per 10 °C

* For 150 ml min^{-1}. Flow driven.100 – 200 ml min^{-1} or pressure driven 2 – 8 psig.

** Over defined flow range.

Table L-3: MultiExact 4100 TCD transducer performance specification

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Appendix M Sample wetted materials information

Material	Transducer type					
	Paramagnetic		Zirconia	1210 series GFX	1520 series IR	MB1520 Series IR
	Control	Purity				
Stainless Steel 303	✓	✓	✓	✓ *	✓ *	
Stainless Steel 316	✓	✓	✓	✓	✓	
Aluminum alloy 6063						✓
Viton	✓	✓	✓	✓	✓	✓
Polypropylene		✓				
Nitrile NBR						✓
Borosilicate glass	✓	✓				✓
Platinum	✓	✓				
Platinum Iridium alloy	✓	✓				
Electroless Nickel	✓	✓				
Polyphenylenesulphide (PPS)carbon/PTFE filler						
Stainless Steel 310			✓			
Alumina			✓			✓
Yttria Stabilsed Zirconia			✓			
Nickel Iron			✓			
Sealing glass			✓			
Gold			✓	✓		✓
Calcium Fluoride				✓		
Nickel				✓		✓
Sapphire					✓	✓
Copper-Zinc						✓
Solder						✓
Epoxy resin					✓	✓

Table M-1: Sample wetted materials

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Feature	Additional materials
Flow driven options	Polypropylene
Pressure driven options	Polysulphone Polypropylene
Flowmeters	Borosilicate Glass Duralumin
Flow alarm	Glass Nylon Silicon Rubber Aluminium
Internal filter	Polycarbonate Glass Fibre
External filter	316 Stainless Steel

Table M-2: Additional materials

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