

4000 Series Analyser

Installation Manual

Ref:04000/005C/5
Order as part 04000 005C



Certificate No. 005168
BS EN ISO 9001



UK REGULATIONS

Health and Safety at Work Etc, Act 1974
Control of Substances Hazardous to Health Regulations 1988
Ionising Radiations Regulations 1985

IMPORTANT NOTICE

Servomex ensure that all products despatched to customers have been suitably purged and cleaned prior to packaging, so that no hazards from the use of factory calibration gases or liquids will be present.

No item returned to Servomex or its representatives, for any reason whatsoever, will be accepted unless accompanied by a copy of the following form, fully completed and signed by a responsible person. This is to ensure the safety of Servomex personnel and to comply with the above-listed legislation.

DECONTAMINATION STATEMENT

It is hereby certified that the equipment being returned and described below has been completely decontaminated and poses no possible toxic, corrosive, irritant, flammable, radioactive or biological hazard to any personnel required to unpack, handle, examine, maintain or repair it.

EQUIPMENT: _____

REASON FOR RETURN: _____

COMPANY: _____

SIGNATURE: _____

COMPANY SEAL OR STAMP:

PRINT NAME: _____

POSITION: _____

DATE: _____

The configuration of this analyser is																	
Model and Issue: 04 C1																	
Feature and option code number																	
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Serial number _ _ _ _ _																	

Instrument Configuration

Transducer I1 Type: Serial No: Sample Inlet Position 1	Transducer I2 Type: Serial No: Sample Inlet Position
Transducer I3 Type: Serial No: Sample Inlet Position	Transducer I4 Type: Serial No: Sample Inlet Position
Servomex Order Reference No:	
Software Revision No:	
Completed By:	Date :

WARNINGS, CAUTIONS AND NOTES

This publication includes **WARNINGS, CAUTIONS AND NOTES** which provide information relating to the following:

- | | |
|-------------------|---|
| WARNINGS : | Hazards which could result in personal injury or death. |
| CAUTIONS : | Hazards which could result in equipment or property damage. |
| NOTES : | Alert the user to pertinent facts and conditions. |

NOTE

This manual covers installation, routine maintenance and fault diagnosis on all the 4000 series 'C' models.

The following symbols are used on the rear of the analyser:



Earth (ground) terminal



Caution, refer to operator manual

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SECTION 1 INTRODUCTION

1.1 Introduction

This manual contains information regarding installation and hardware configuration of the Servomex 4000 series analysers.

A separate Quickstart manual is also supplied with the analyser, reference part number 04000/003C. This details software configuration and operation of the analyser. Extra copies may be ordered from Servomex.

Details of the hardware and instructions for servicing, by qualified personnel only, are presented in the 4000 Series Service Manual. This may be ordered from Servomex using part number 4000002C.

Technical assistance and spare parts are available from Servomex outlets (or their local agents) listed on the back cover.

WARNING

The analyser contains no user serviceable parts inside. The instrument enclosure protects the user from electric shock and other hazards. All servicing should be referred to qualified personnel.

Modbus™ is a trademark of AEG-MODICON.

1.2 General description

The Servomex 4000 series analyser is a chassis into which up to four gas sensor modules may be fitted. The chassis provides power, gas connections and other support functions to the sensors and calculates associated sample gas concentrations. These concentrations are then displayed on the analyser display screen and may be directed to the analogue outputs and/or the serial output.

The analyser also supports two external analogue input signals. The data from the external inputs may be displayed on the screen, output to the analogue outputs and/or the serial output or accessed using Modbus.

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

The 4100 analyser is designed to meet the control and product quality monitoring requirements of industrial gas producers and users. It can monitor up to four gas streams simultaneously with independent autocalibration for each stream (provided sufficient extra relays are installed).

The 4200 analyser is intended for monitoring flammable samples, but not those containing hydrogen or acetylene for which the 4210 must be used. Again, up to four gas streams may be monitored simultaneously and independent autocalibration can be used with each stream. The zirconia transducer is not available for these analysers.

The 4900 analyser is a continuous emissions monitoring (CEMs) analyser with a maximum of four transducers with either one or two sample streams. Independent autocalibration is available for each stream or transducer (refer to Section 4.6).

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

A number of optional features are available for the 4000 series. These may include the following, depending upon analyser configuration:

- Flow meters and needle valves (on the 4900C only) to monitor and control sample gas flow through the instrument.
- A sample filter to protect the gas sensor modules from particulate contamination.
- A sample flow alarm to monitor the sample flow and alarm when the flow falls below a defined level. This is only available on the 4900C.
- An autocalibration manifold (for a single sample stream) to allow the instrument to be calibrated without user intervention. On the 4100C this is only suitable for paramagnetic transducers.
- Additional relay output contacts to allow autocalibration of the analyser via externally located valves.
- Additional signal output cards to extend the number of analogue outputs and relay outputs available to the user.

(Full technical specifications for 4000 series is presented at the back of this manual).

Start up and commissioning of the analyser should be performed as follows:

Use this manual for:

Installation	To take commissioning to the point where the analyser is powered and operational. The installer is advised to read this manual completely before commencing installation.
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Use the Quickstart manual for:

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 analyser identity without changing the analyser settings.

1.3 Location of components

Figure 1.1 identifies the location of the key features of the analyser. Note that the identification label (including serial number information) is located on the underside of the unit towards the rear.

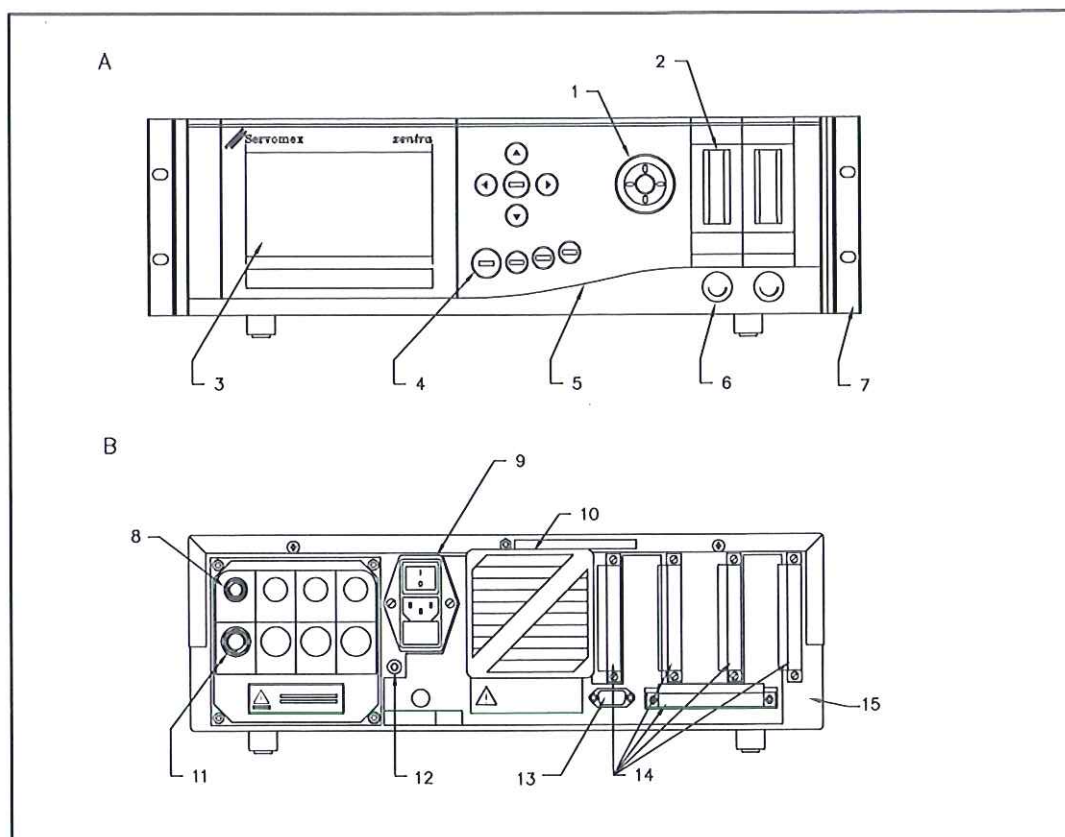


Figure 1.1: Key features of 4000 series analyser

Key	A	FRONT VIEW	8	Sample inlet(s)
	B	REAR VIEW	9	Mains power connector
	1	Sample filter (optional)	10	Fan and filter
	2	Flowmeter(s) (optional)	11	Sample outlet(s)
	3	Display	12	Functional earth
	4	Keypad	13	Serial output/Modbus port
	5	Display adjustment	14	Signal terminals
	6	Needle valve(s) (optional)	15	Screen
	7	Rack mounting brackets		

1.4 Transducer site numbering system

The four internal transducers are assigned site locations represented as I1, I2, I3 and I4 on the display.

In the case of the 4100 and the 4200 analysers, each transducer is served by a discrete sample inlet and outlet connection on the rear panel.

In the case of the 4900 analyser, either one or two sample streams may be specified - consequently only inlets/outlets numbered 1 and 2 will be used.

1.5 Output numbering system

Identification numbers appear on the rear label to identify the terminals where each output appears and on the display when the outputs are being configured. These have a two digit identification number of the following format : Card number. Output No.

e.g.. the outputs fitted as standard on the SIB pcb in card position 1 are:

- | | |
|-----|-----------------|
| 1.1 | Analogue output |
| 1.2 | Analogue output |
| 1.3 | Relay |
| 1.4 | Relay |
| 1.5 | Relay |

1.6 Transducer full scale deflection

The transducer full scale deflection (FSD) is the maximum concentration level that may be measured and displayed with the precision and accuracy specified for that transducer. This may also be termed the measurement range for the transducer. Concentration levels that exceed 120% of the FSD are considered as over range and are indicated by the word 'OVER' on the analyser display.

There are two set up parameters on the analyser that are expressed in terms of the FSD:

- Calibration tolerances for the transducers.
- Alarm hysteresis.

When defining minimum output ranges, the relevant transducer noise specification should be considered; refer to Section 7. (Table 1.1 lists all available transducer types and FSD values).

NOTE

The following abbreviations are used throughout this manual:

Gfx	Gas filter correlation infra-red transducer
IR	Pulsed infra-red transducer
Pm	Paramagnetic transducer
Zr	Zirconia transducer

1.7 Conversion of transducer measuring units

As supplied, the standard transducers within the analyser will measure in the units indicated in Table 1.1. It is possible to change these units by the use of a linear scale factor (refer to Quickstart manual). The user should note that the **4000 series software prime measurement is in percentage**, therefore trace level 'vpm' (volume parts per million) measurements already have a scale factor of 10,000 entered as a default.

Example: to convert vpm SO₂ to mg/m³, a multiplier of 2.86 is used. As the software actually converts from percentage levels, the overall scale factor entered as part of the analyser configuration will be 28600.

Table 1.1: Transducer FSD values and availability in product range:				
Transducer	FSD	4100	4200 4210	4900
Gfx1210 CO Standard sensitivity	3000vpm CO	-	-	✓
Gfx1210 CO High sensitivity	500vpm CO	✓	✓	✓
Gfx 1210 SO ₂ Standard sensitivity	2500vpm SO ₂	-	-	✓
Gfx 1210 SO ₂ High sensitivity	1000vpm SO ₂	-	-	✓
Gfx 1210 NO High sensitivity	1000vpm NO	-	-	✓
Gfx1210 CO ₂ High sensitivity	100vpm CO ₂	✓	✓	-
Gfx 1210 CH ₄ High sensitivity	500vpm CH ₄	✓	✓	✓
Gfx 1210 N ₂ O High sensitivity	500vpm N ₂ O	✓	✓	✓
IR 1520 100% CO ₂	100% CO ₂	✓	✓	✓
IR 1520 50% CO ₂	50% CO ₂	✓	✓	✓
IR 1520 25% CO ₂	25% CO ₂	✓	✓	✓
IR 1520 10% CO ₂	10% CO ₂	✓	✓	✓
IR 1520 5% CO ₂	5% CO ₂	✓	✓	✓
IR 1520 2.5% CO ₂	2.5% CO ₂	✓	✓	✓
IR 1520 1% CO ₂	1% CO ₂	✓	✓	✓
IR 1520 0.5% CO ₂	0.5% CO ₂	✓	✓	✓
IR 1520 0.25% CO ₂	0.25% CO ₂	✓	✓	✓
IR 1521 100% CH ₄	100% CH ₄	-	✓	-
IR 1521 50% CH ₄	50% CH ₄	-	✓	-
IR 1521 25% CH ₄	25% CH ₄	-	✓	-
IR 1521 5% CH ₄	5% CH ₄	-	✓	-
IR 1522 50% CO	50% CO	-	✓	-
IR 1522 25% CO	25% CO	-	✓	-
IR 1522 10% CO	10% CO	✓	✓	✓
IR 1522 2.5% CO	2.5% CO	✓	✓	✓
IR 1522 1% CO	1% CO	✓	✓	✓
Pm 1158 O ₂ Control	100% O ₂	✓	✓	✓
Pm 1111 O ₂ Basic	100% O ₂	✓	-	✓
Pm Purity O ₂ (04100995A)	100% O ₂	✓	-	-
Zirconia 704 O ₂ Trace plus indicative reading above 21% O ₂	210000vpm O ₂	✓	-	-

1.8 Calibration - General

For optimum performance, it will be necessary to routinely check the calibration of all of the internal gas sensors within the analyser. The recommended periods for each sensor type are shown in Table 1.2.

Table 1.2: Recommended calibration periods		
Gas sensor module	Low calibration	High calibration
Gfx sensor	weekly	monthly
IR sensor	weekly	daily
Paramagnetic sensor (purity)	monthly	weekly
Paramagnetic sensor (other)	weekly	weekly
Zirconia sensor	monthly	monthly

In addition, the pressure compensation associated with the purity paramagnetic sensor should be checked annually (the procedure is covered in the Quickstart manual).

The calibration procedure is dealt with in the Quickstart manual. However, this manual details the requirements for and configuration of calibration ancillaries (such as gases) and (when autocalibration is used) the connection of solenoid valves, the potential use of the RS232 output and remote initiation switch and the use of Modbus to initiate calibration.

(When the optional external autocalibration or the optional internal autocalibration manifold are configured and fitted, a manual calibration adjustment or calibration check will use the autocalibration valves to select the calibration sample gases as required).

1.9 Automatic calibration options

All 4000 series analysers include the software necessary to provide automatic calibrations.

In the case of 'external' autocalibration, external (i.e.: customer supplied) solenoid valves may be controlled by interrogating the serial output signal or by discrete wiring to relays on the analyser (ensure that sufficient optional output cards have been installed).

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

- A user keyboard input
- A trigger from the internal instrument clock
- An external contact closure
- A Modbus command

NOTES

SECTION 2 INSTALLATION - GENERAL

2.1 Introduction

NOTE

Sections 2, 3 and 4 provide all the information required to install any 4000 series analyser. The installer is advised to read all sections completely before commencing installation.

Installation will only require the use of standard hand tools.

The analyser is suitable for indoor use and may be configured for either bench mount, panel mount or 19" rack mount.

CE MARKING

The 4000 series analysers carry the CE mark which indicates conformity with the European Directives on CE Marking (93/68/EEC), Electromagnetic Compatibility (EMC 89/336/EEC) and Low Voltage Directive (LVD 73/23/EEC).

The analyser is rated in accordance with IEC 664 for:

'POLLUTION DEGREE 2' where normally only non-conductive pollution occurs.

'INSTALLATION CATEGORY II', which is characterised as being local level (i.e. not distribution level), appliances and portable equipment with over-voltage impulse withstand up to 2500 Volts.

Ambient operating conditions

Parameter	Model	Range
Operating temperature	4100, 4200, 4210	+5°C to +40°C (+41°F to 104°F)
	4900	+5°C to +45°C (+41°F to 113°F)
Storage temperature	All	-20°C to +60°C (-4°F to +140°F)
Atmospheric pressure	All	79 to 124kPaa (11 to 18psia) (for operating altitudes up to 2000m)

Select a location which allows convenient access for installation and maintenance and will minimise ambient temperature fluctuations and vibration.

WARNING

- The 4000 series analyser is not suitable for use in hazardous areas.
- The analyser is not suitable for use with corrosive samples.
- Gases may be toxic or asphyxiant and must be vented to a safe location. (In the case of the 4200 and 4210 models, gases may also be flammable)

CAUTION

Install the analyser so that fan and cover vents are not obstructed.

2.2 Unpacking and inspection

WARNING

The 4000 series analysers weigh up to 22kg (45lb) and care must be taken when handling. It is recommended that they are lifted with hands positioned on either side of the base of the chassis.

The rack mounting brackets (see Figure 2.1 Item 1) are not designed to be used as handles or grips. When removing the instrument from its packing, and for subsequent handling, ensure that the analyser is gripped securely underneath. Lift and remove the analyser from its packing and inspect for any damage incurred during transit. If damage has occurred, inform Servomex or its agent immediately. Retain all packing and shipping information. The shipping carton may be used for future transportation.

After the initial visual inspection, perform the following checks:

- 1 Check that the specification details table in the front of this manual agree with the purchase requirements. Pay particular attention to any inserted instrument modification sheets.
- 2 Check that the accessories are present and undamaged.

Standard accessories provided are:

- Spare mains fuses suitable for electrical power voltage range ordered.
- Two connectors for wiring to standard chassis signal output plugs (PL1 and PL5).
- Electrical power cord with moulded IEC connector or loose IEC connector for wiring during installation.

Optional accessories are:

- Connectors for wiring to each optional signal output plug (PL2 to PL4).
- Spanner and spare filter elements (for those analysers configured with a sample filter).
- Rack mounting slides and kit of parts (See Figure 2.2).

2.3 Bench mount installation

The analyser should be mounted on a sturdy, level surface. The bench mount version has four feet. If the front two are flipped down, the floats in the optional flowmeters may not rotate, however, the flow indication will still be correct.

2.4 Panel mount installation

See Figure 2.1 for panel mounting detail. In panel mounting format the analyser is supplied with a pair of mounting brackets (item 1) suitable for mounting the front of the instrument against a panel.

WARNING

The rack mounting brackets are not intended to provide the sole means of support. The user must provide additional support.

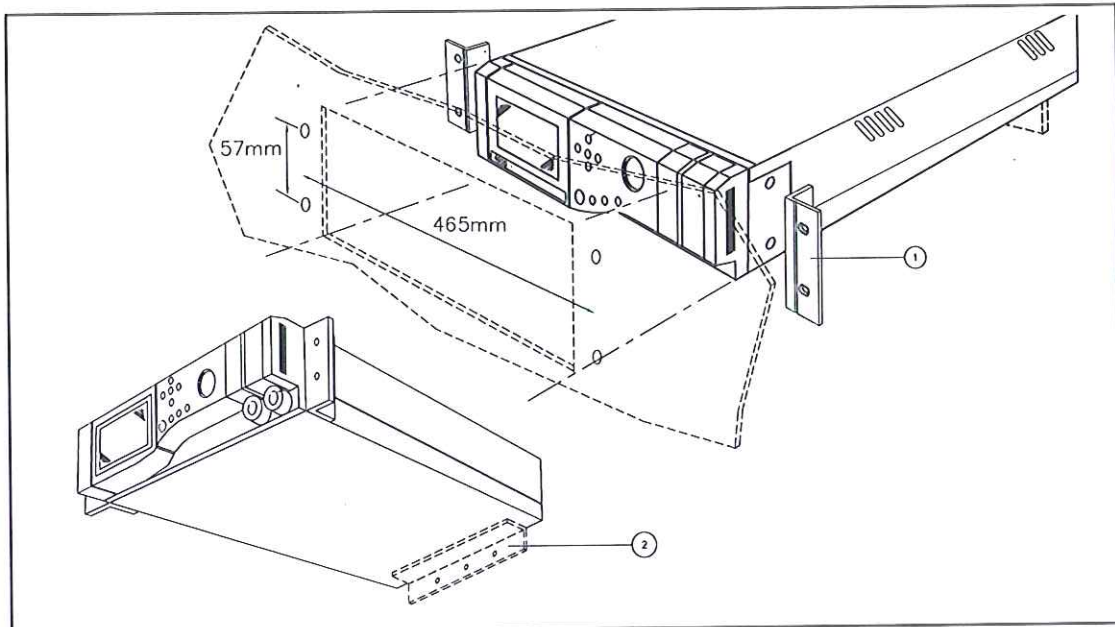


Figure 2.1: Panel mounting detail.

Key: 1 Mounting brackets
 2 Additional Support (customer supplied)

Note: Cut-out dimensions of 447mm x 134mm mounting holes should be M6 or 7mm clearance

2.5 Rack slide mounting installation

The analyser occupies 3U/5.25"/133mm of rack space. Determine at what height the analyser is to be installed in the rack enclosure. The analyser will occupy nine rack flange cage nut positions. Note that intermediate cage nut positions need not be punched out.

If the instrument has been purchased with the rack mounting option then the rack slide inners will already be mounted on the analyser chassis. If the rack mounting kit has been purchased as a spare then the instructions in this section detail fitting. The rack mounting kit contains two slides which have an inner and outer section.

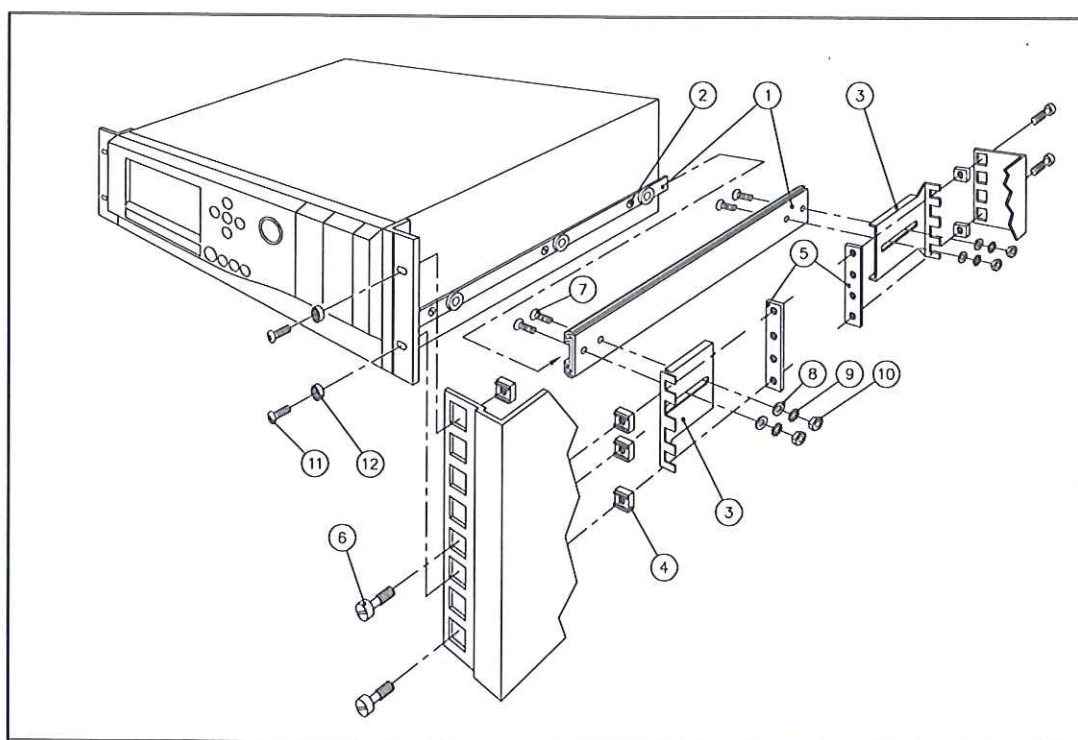


Figure 2.2: Rack installation exploded view

Key:	1	Telescopic slide	7	Screw, M4
	2	Screw M5	8	Washer, M4
	3	Slide support bracket	9	Locking washer, M4
	4	Cage nut	10	Nut, M4
	5	Slide support clamp	11	Screw, plated, cross head, M5
	6	Waisted screw, brass, M5	12	Cup washer, plastic

See Figure 2.2. The 19" optional rack slide mount version is supplied with a mounting kit which includes either long or short slides and rack mounting brackets. Do not attempt to support or carry the analyser by the rack mount brackets. The analyser is suitable for installation in most standard rack types including Schroff and Rittal, thus:

- Remove the inner section from each slide (item 1) and fix one to each side of the chassis using 3 screws (item 2) for 4902 models or 4 screws (item 2) for 4904 models.
- Counting from the bottom cage nut position, install cage nuts (item 4) in positions 1,3,4 and 8 on front two rack enclosure flanges. Install cage nuts in positions 1 and 4 on rear two rack enclosure flanges.
- Insert the two waisted screws (item 6) fully into front cage nuts, positions 1 and 4, on both front and rear rack enclosure flanges.
- Present the slide support clamp (item 5) behind the rack enclosure front flange, and line up with cage nut positions 1 and 4.
- Engage the two waisted screws (item 6) in the slide support clamp, but do not tighten.
- Fit the slide support (item 3) between the cage nuts (item 4) and the slide support clamp (item 5), note that the front slide supports face backwards and the rear slide supports face forwards.
- Tighten the two waisted screws (item 6) to clamp the slide support (item 3) between the cage nuts (item 4) and the slide support clamp (item 5).
- Loosely fit the two rack slide outer sections (item 1), to the slide supports (item 3) in four places using fixings (items 7,8,9,10). Note that the slide outer section item 1 should be mounted so that the slide inner (item 1) slides in from the front.
- Position the rack slide outer sections (item 1) so that the front edge is 35mm behind the rack enclosure front flange. Tighten the fixings (items 7,8,9,10).
- Install the analyser in the rack locating the inner slide section (item 1) inside the outer slide section (item 1).
- Secure the analyser into the rack cabinet using the screws (item 11) and the plastic cup washers (item 12).

NOTES

SECTION 3 INSTALLATION - ELECTRICAL

WARNINGS

- The installer must be satisfied that the 4000 series analyser installation conforms to the relevant safety requirements, National Electrical Code and any other local regulations, and that the installation is safe for any extremes of conditions which may be experienced in the operating environment of the analyser.
- This appliance must be connected to a protective earth.
- To comply with the European Community EMC Directives the interconnecting cables used for all input, analogue output and serial output should be screened or equivalent protection provided.
- For compliance with EMC emissions and susceptibility standards the functional earth must always be connected to a local EMC ground.

3.1 Electrical power connection

Electrical power is connected to the chassis via an IEC appliance adaptor located on the rear of the chassis (refer to Figure 1.1). The analyser will already be configured for the mains voltage range ordered ('85 to 132V' or '170 to 264V').

The analyser should be connected to a clean, single phase electrical power supply meeting the requirements of 'Installation category II', at a voltage within the range selected. The electrical power supply should be fused at a value to protect the power cord. The UK power cord already has a 5A fuse fitted for this purpose otherwise it is recommended that the electrical power supply is fused at 6A.

The user must ensure that when installed in a rack, cabinet or other fixture, the mains switch is readily accessible or where this is impractical, the installation must be provided with a separate means of disconnecting power which complies with the relevant local and national standards.

Should the user connect a different power cord to the one supplied, this must be wired in accordance with national and local regulations. After wiring the power cord, check earth continuity from the power connection earth to the functional earth on the rear of the chassis (see Figure 1.1).

The voltage setting may be changed as follows. The fuse value must be changed when the voltage setting is changed:

- Unplug the mains connector.
- Remove the voltage selector, a screwdriver may be used in the slot at the top of the voltage selector to aid ejection.
- Rotate the voltage selector through 180° so that the required voltage is shown at the bottom of the voltage selector.

- Fit fuse F2 to the right hand side of the voltage selector according to the voltage selected. Voltage selector position 220/240V for 170 to 264V operation fit fuse T3.15A HBC to IEC 127 (Figure 3.1). Voltage selector position 110/120V for 85 to 132V operation fit fuse T5.0A HBC to IEC 127 (Figure 3.2). If a 20mm fuse is used then ensure that the fuse does not extend into the spring clips provided for a 1 inch fuse.

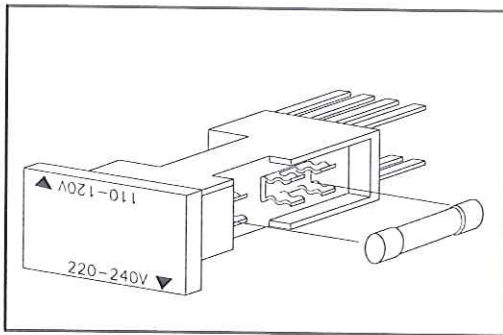


Figure 3.1: Position of F2 in voltage selector for 170V to 264V operation

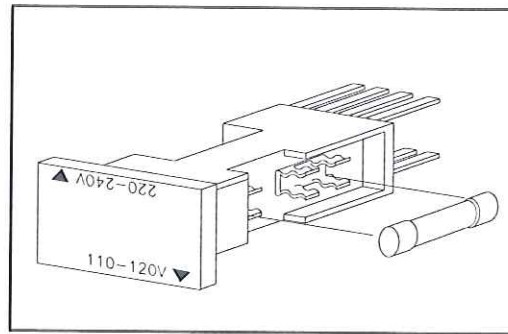


Figure 3.2: Position of F2 in voltage selector for 85V to 132V operation

3.2 Signal connections

CAUTION

The current outputs must not be allowed to exceed 30vrms (42.4vpeak) or 60 volt DC to earth when connected to associated equipment.

It is recommended that the analyser is switched off while signal leads are being connected or disconnected. Signal terminals are located on the rear of the analyser and are identified as sockets PL1 to PL5. Two sockets PL1 and PL5 are always fitted, PL2, PL3 and PL4 sockets are present only when the corresponding option cards are fitted. PL8 is located on the gland plate when the autocal option is fitted.

A loose 14-way socket connector with accessories is provided to make connections to each plug. The plugs and sockets are keyed so that the sockets may only be located in the correct plug position. The loose socket covers have an identification number which corresponds to the mating plug. Ensure that each socket is always fitted with the correct covers. The separate covers on PL1 to PL4 provide segregation between current output and relay wiring. The sockets and cover must always be fitted and secured, even when signals are not required. Figure 3.3 shows the assembly of plugs PL1 to PL4 with segregated covers. The assembly for plug PL5 is similar but with a single 14-way cover provided. Plug PL8 is similar but has only 7-ways.

The loose sockets have screw terminal connections. These will accept a flexible conductor which has a cross sectional area in the range 20 AWG to 16 AWG, 0.5 to 1.5mm² or a solid conductor which has a cross sectional area in the range 20 AWG to 14 AWG, 0.5 to 2.5mm². Solid conductors larger than 18 AWG, 1mm² are difficult to dress inside socket covers and are therefore not recommended.

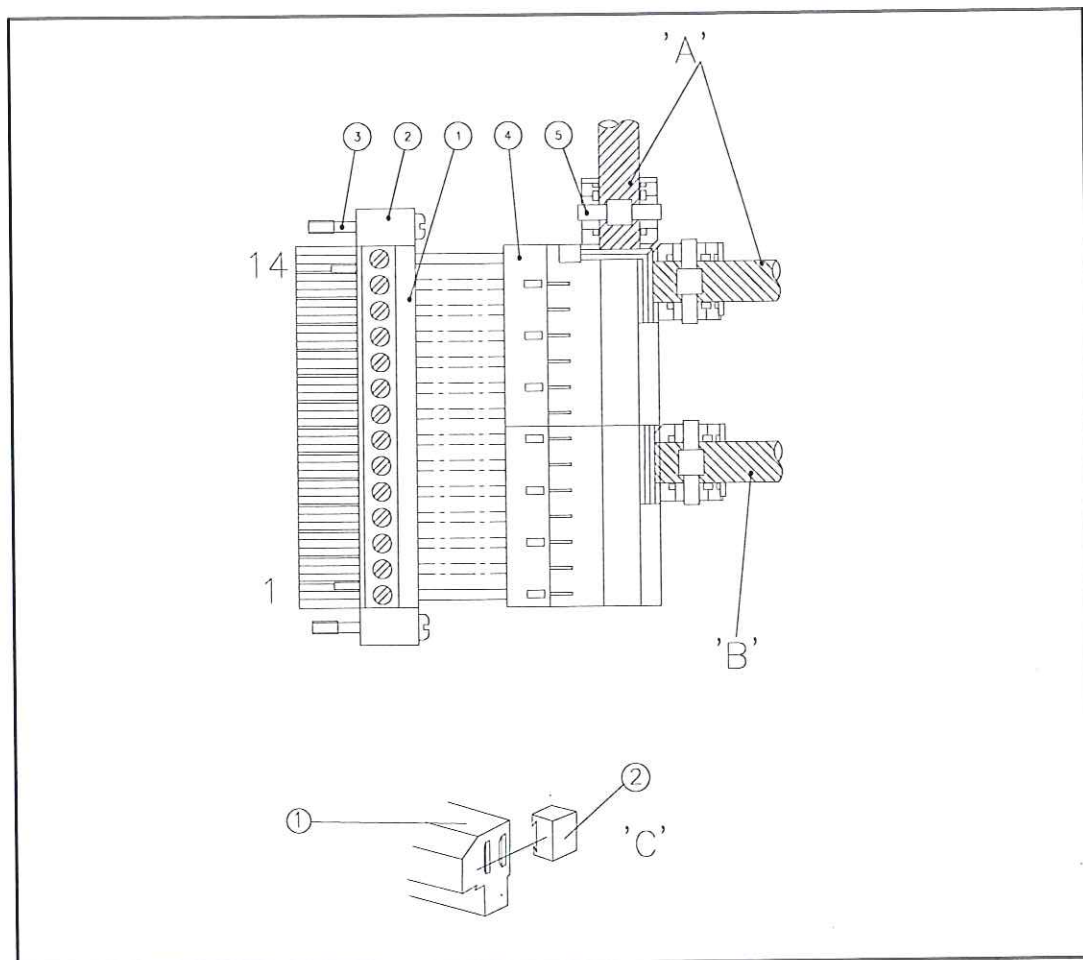


Figure 3.3: Signal socket assembly

Key:	1	Screw terminal block	4	Cover
	2	End block	5	Cable tie
	3	Jacking screw		

Notes	A	Relay cabling may use either entry
	B	Analogue output cabling
	C	Mount item 2 by sliding them onto the dovetails in item 1

For compliance with EMC standards connections to current outputs must use screened or shielded cable, with either separately screened pairs or two pairs with an overall screen. The screens (or drain wire for foil screens) must be terminated at pin 1 or pin 6 (both if separate screened pairs are used).

All mA inputs and associated status lines (plug PL5) must use screened or shielded cables with the screen or drain wire terminated at the terminals marked 'screen' on the connector.

Remaining signal inputs (plug PL5, terminals 11 to 14) must use screened or shielded cables with the screen or drain wire terminated at the screen stud (M4) adjacent to PL5.

The use of screened signal cables is recommended in all installations

After wiring the loose sockets, the covers must be re-fitted for safe operation. To avoid straining the screw terminal connections attach the cable sheath to the cover by trimming and folding out the appropriate section of the cover and securing the cable to it using the cable tie provided. Clip the remaining cover sections into place around the cable.

The loose sockets are provided with end blocks and jack screws which must be fitted and used to secure them to the corresponding plug. Do not over tighten screws.

The signal terminals each have a legend indicating their function.

3.2.1 mA output and relay output connections

Plugs PL1 to PL4 provide the analogue output and relay output electrical connections. Refer to Table 3.1. The option card population may be determined by visual inspection.

Plug PL8 provides additional relay output electrical connections for autocalibration connections only. Refer to Table 3.2.

WARNING

If the external circuits connected to PL1, PL2, PL3, PL4 and PL8 are at a voltage exceeding 30Vrms (42.4V peak) or 60V dc the following precautions must be observed to prevent an electric shock hazard:

- a) The external circuits connected to PL1, PL2, PL3, PL4 and PL8 must not be powered with the connector unplugged.
- b) The analyser must be mounted in a rack, enclosure, cabinet or similar fixture and have the external cabling for PL1, PL2, PL3, PL4 and PL8 secured as close as practical to the connector. This is to prevent strain on the cable pulling the cover from the socket.
- c) Fit covers to loose sockets.

Do not exceed the specified relay rating of 264V rms maximum and 1A maximum.

NOTE

For reliable operation, relays should switch not less than 10mA.

Table 3.1: Signal terminal location PL1 to PL4					
Terminal number		PL4 (optional)	PL3 (optional)	PL2 (optional)	PL1
T o p c o v e r	14	Screen	Screen	Screen	Screen
	13	Relay 4.5A	Relay 3.5A	Relay 2.5A	Relay 1.5A
	12	Relay 4.5A	Relay 3.5B	Relay 2.5B	Relay 1.5B
	11	Relay 4.4A	Relay 3.4A	Relay 2.4A	Relay 1.4A
	10	Relay 4.4B	Relay 3.4B	Relay 2.4B	Relay 1.4B
	9	Relay 4.3A	Relay 3.3A	Relay 2.3A	Relay 1.3A
	8	Relay 4.3B	Relay 3.3B	Relay 2.3B	Relay 1.3B
B o t t o m c o v e r	7	Screen	Screen	Screen	Screen
	6	Screen	Screen	Screen	Screen
	5	mA 4.2 -	mA 3.2 -	mA 2.2 -	mA 1.2 -
	4	mA 4.2 +	mA 3.2 +	mA 2.2 +	mA 1.2 +
	3	mA 4.1 -	mA 3.1 -	mA 2.1 -	mA 1.1 -
	2	mA 4.1 +	mA 3.1 +	mA 2.1 +	mA 1.1 +
	1	Screen	Screen	Screen	Screen

Table 3.2: Optional external autocalibration connections PL8		
Terminal		Function
1	Screen	
2	Relay 0.1B	Default relay contacts for group 1 valve 1
3	Relay 0.1A	Sample / Calibration selection (if fitted)
4	Not Used	
5	Relay 0.2B	Default relay contacts for group 1 valve 2
6	Relay 0.2A	Cal. Gas 1 / Cal. Gas 2 selection (if fitted)
7	Screen	

The standard relay output defaults are as follows:

- 1.3 CAL IN PROG (Calibration in progress)
- 1.4 MAINTENANCE
- 1.5 FAILURE

All other relays are unassigned, except (where external autocalibration is fitted):

- 0.1 GROUP 1 SAMPLE/CAL
- 0.2 GROUP1 CAL1/CAL2

The standard analogue output defaults are:

- 1.1 TXD (transducer) 1
- 1.2 TXD 2
- 2.1 TXD 3
- 2.2 TXD 4

All other extra analogues are unassigned. The R1 defaults for each analogue are:

L=0%FSD, U=100%FSD (Gfx's have variable low ranges, so their R1 limits will need to be individually set in L1), 4-20mA, LOW LIMIT 3.6mA, FREEZE, JAM LOW

3.2.2. Analogue inputs

Plug PL5 provides the electrical connections for the analogue inputs, the autocalibrate initiate input (function detailed in Section 3.4) and the range change input. The connection details for PL5 are summarised in Table 3.3.

Each analogue input signal consists of an analogue current input (for example pins 1 and 2 on PL5 for analogue input 1) plus a digital status input (for example pins 9 and 10 on PL5 for analogue input 1). The status input defines the validity of the analogue input signal. A high input, or open circuit, on the digital signal indicates that the data is invalid. A low input, or short circuit, on the digital signal indicates that the data is valid. Connection in this way ensures that disconnection of the analogue input source or removal of the connector from PL5 will result in an invalid measurement indication. If no suitable status indication is available from the source of the analogue input signal then the status input pin should be shorted to the neighbouring ground pin within the PL5 connector.

NOTE

If the analogue input status signal is not connected then the digital line will be pulled high internally. This indicates that the data is invalid and no reading will be measured.

The external range change input is located at pins 13 and 14 of connector PL5 (see Table 3.3). The second analogue output range for all outputs is obtained by shorting these two pins together or by providing a digital low signal to pin 14.

Table 3.3: Signal terminal location PL5			
Terminal	Function	Terminal	Function
1	Analogue input 1 +ve	8	0V
2	Analogue input 1 -ve	9	Analogue input 1 valid
3	Analogue input 2 +ve	10	0V
4	Analogue input 2 -ve	11	0V
5	Screen	12	Auto calibration initiate
6	Screen	13	0V
7	Analogue input 2 valid	14	Range change

3.2.3. External autocalibration connection

The external autocalibrate initiate input is located at pins 11 and 12 of connector PL5. The autocalibration facility is started by shorting these two pins together or by providing a digital low signal to pin 12.

NOTE

The external autocalibration initiate signal should be applied for at least 2 seconds, (but less than 30s) to ensure that the input has been recognised.

For analysers configured with the external autocalibration option card, an additional output connector, PL8, is fitted into the sample gland plate at the rear of the analyser. This connector supplies two pairs of relay contacts which may be used to control external valves.

The following truth table applies to **any pair** of relay contacts utilised for autocalibration. These relay contacts are rated at 1.0A, 264V AC and 1.0A, 30V DC (non-inductive). Screened cable should be used to connect to solenoid valves of length not exceeding 3m with the screen terminated at the instrument end. It will be necessary to fit a suppression device across the coils of the solenoid valves. For DC supplies a diode is recommended. For AC supplies a 0.047uF capacitor in series with a 100Ω resistor would generally be found satisfactory.

Table 3.4: External autocalibration truth table		
Gas Required	Relay Contacts for Valve 1	Relay Contacts for Valve 2
Sample Gas	De-energised (OPEN)	De-energised (OPEN)
Calibration gas 1	Energised (CLOSED)	De-energised (OPEN)
Calibration gas 2	Energised (CLOSED)	Energised (CLOSED)

Depending on the number of autocalibration groups, at total of 2, 4, 6, or 8 relays will be needed to control up to eight external valves. The relay output electrical connections can be made to any combination of PL1, PL2, PL3, PL4 and PL8. Refer to Quickstart manual for autocalibration set up, this will automatically clear any existing relay allocation. Table 3.1 and 3.2 contain the pin out details.

3.3 Serial data/Modbus connection

The serial data connection is provided via the 9 pin 'D' type connector (PL6) located on the rear of the instrument. Both RS232 and RS485 interfaces are supported as shown in Table 3.5

NOTE	
The RS232 and RS485 interfaces are non-isolated. When using the RS485 interface with other non-isolated equipment, the difference in ground potentials must be no greater than $\pm 7V$.	

For compliance with EMC standards, connections to PL6 must be made using a screened cable. The screen must be terminated at the EMI shielded 'backshell' or conductive cover of the 'D' type connector. Maximum total cable lengths are 3 metres for the RS232 interface, and 1200 metres for the RS485 interface. Note that the 4000 analyser includes RS485 line termination of 120 Ω .

Table 3.5: Serial output connections PL6		
Interface	Terminal	Function
RS232	2	Received data (RXD)
	3	Transmitted data (TXD)
	5	Signal common/ground
RS485	1	RS485- (B)
	6	RS485+ (A)

The serial data connection can be used in one of two ways. With the analyser configured to "Continuous" communications mode (refer to Quickstart manual) a data frame is transmitted at user-defined intervals. With the mode set to "MODBUS ASCII" or "MODBUS RTU" the analyser becomes a Modbus slave responding to commands or data requests from a Modbus master.

These communications modes are described in more detail in the following sections.

3.4 Continuous mode

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 Table 3.6 and 3.7. However, it is a list of process variables (or '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;G;H;I;J;K;L;M;.....;N;<CR><LF>

The frame frequency and generic communications parameters are configured in the analyser software (refer to Quickstart manual), note 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 seconds from 1 to 9999 seconds. If the value is set to zero then the transmission of data down the serial port stops and will not restart until a non zero value is entered.

Table 3.6: Serial output data frame, start and end sequences

Field	Number of characters	Function	Entry/format
A	8	date	DD-MM-YY
B	8	time	HH:MM:SS
C	2	analyser failure and maintenance fault status	first character F for failure, second character M for maintenance (spaces = OK)
D	8	Autocalibration 'flags', two characters for each of the four calibration groups	first character: group 1, S for sample, C for calibration gas
			second character: group 1, 1 for cal gas 1, 2 for cal gas 2
			etc, for groups 2, 3 then 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)
F-M	measurement sequences, refer to Table 3.7		
N	4	check sum	e.g.: 096A
-	-	end code, <CR> and <LF>	ASCII code 13 and 10

Table 3.7: Serial output data frame, measurement sequences			
Field	Number of characters	Function	Entry/format
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	first character F for failure, second character M for maintenance (spaces = OK)
L	1	calibration status	C in calibration, or space
M	1	warming up status	W warming up, or space
The above will be repeated for each measurement, (including derived) concluding with external inputs E1 and E2, before returning to end sequence.			

3.5 Modbus mode

The analyser supports both Modbus ASCII and Modbus RTU protocols (refer to Quickstart manual). Note that the serial port settings are shared by all communication modes and must be configured to valid settings for the mode in use.

Both RS232 and RS485 connections are provided and may be selected through the user interface (see Quickstart manual). The RS485 option also allows multidrop operation where more than one analyser may be connected to a single serial port on the Modbus master.

NOTE

In RS485 multidrop mode, each analyser must have a unique Modbus slave address. This can be set through the user interface.

In RS232 mode, a dedicated connection to the Modbus master is required and multidrop operation is not possible.

Appendix B describes how to access analyser data and control autocalibration using the Modbus protocol.

3.6 EMC Installation

The chassis must be securely bonded to the local EMC ground. In most installations this will be the back plate, cabinet walls or other access point to the local equipotential common bonding network. Connection to the analyser should be made using the shortest possible length of heavy-gauge braid. The braid should be clamped between the cable clamping washers provided on the functional earth terminal. This is an M5 stud located to the rear of the analyser, see Figure 1.1.

Interconnecting cables used for all input, analogue output and serial output should be screened, or equivalent protection provided, as described in Sections 3.2 and 3.3.

All cables should be routed along a low resistance parallel earth conductor to divert earth currents and allow the screened cables to be grounded at both ends.

The whole EMC ground bonding network should follow best practice so that the back plate, cabinet walls, parallel earth conductors and other structural elements of the installation form an equipotential common bonding network. The network should be connected as directly as possible preferably using metal-to-metal bonding at multiple points. Bonds should make good reliable low-resistance connections.

NOTES

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SECTION 4 INSTALLATION – GAS CONNECTIONS

4.1 Introduction

Sample and calibration gases pass into and out of the chassis via a gland plate mounted on the rear of the chassis. The sample gland plate with or without external autocalibration provides up to four sample inlets and a corresponding outlet for each inlet, and an optional interface connector, PL 8. When optional internal paramagnetic autocalibration solenoid valves are used a manifold is mounted on the sample gland plate which provides ports for sample inlet and outlet, and inlets for low and high calibration gases for gas sensor module 1 only.

CAUTION

- The condition of the gases supplied to the analyser depend on the analyser configuration. Full details are given in Section 7.
- Failure to comply with the specifications will result in damage to the analyser.

4.2 Calibration gases

The gas mixtures recommended for calibration of the instrument will depend on the gas components measured by the transducers fitted to the gas stream and the measurement ranges of the transducers. The recommended gases are limited by the long term storage stability of the components of the mixture. Certain gas mixtures should be avoided as these will not be stable with time. For example gas mixtures containing (all of the following) O₂ and NO are not stable and should not be used.

Note, the 4900 analyser permits several sensors to be on a single sample stream. In such cases the selection of calibration gases for use with either internal or simultaneous external autocalibration will either have to facilitate the requirements of several transducers at the same time or be controlled by their own relay/solenoid. Examples of calibration gases (particularly for use with Gfx arrangements) are shown in Table 4.1, below.

Table 4.1: 4900C calibration gas examples		
Gas components measured	Calibration gas 1	Calibration gas 2
CO only <u>or</u> CO+O ₂	"zero grade" N ₂ [*]	CO in air gas mix
CO+CO ₂ <u>or</u> CO+CO ₂ +O ₂	"zero grade" N ₂	CO+CO ₂ in air gas mix
NO only <u>or</u> NO+O ₂	NO in N ₂ gas mix	Air
NO+CO ₂ <u>or</u> NO+CO ₂ +O ₂	NO in N ₂ gas mix	CO ₂ in air gas mix
SO ₂ only <u>or</u> SO ₂ +O ₂	"zero grade" N ₂ [*]	SO ₂ in air gas mix
CO+NO <u>or</u> CO+NO+O ₂	NO in N ₂ gas mix	CO in air gas mix
CO+SO ₂ <u>or</u> CO+SO ₂ +O ₂	"zero grade" N ₂ [*]	CO, SO ₂ in air gas mix
NO+SO ₂ <u>or</u> NO+SO ₂ +O ₂	NO in N ₂ gas mix	SO ₂ in air gas mix

Note: the following presumes that background gases, in the typical sample stream, will have no effect on the sensor readings. If this is not the case, calibration gases should be modified accordingly.

4.2.1 Gfx transducer low and high calibration

The low calibration gas for Gfx gas sensor modules may be specified between -5vpm and +5vpm 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 sensors are configured as 'dual range' units, it is recommended that the high calibration gas is selected at the top end of the range used.

4.2.2 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.

4.2.3 Paramagnetic transducer low and high calibration

The low calibration gas for paramagnetic gas sensor modules may be specified between -3% and +3% oxygen. This is to allow for the situation where the background gas affects the paramagnetic zero (see Appendix A). Zero grade nitrogen is recommended.

The high calibration gas can be in the range 5 to 100% oxygen. For purity measurements a high calibration gas with approximately 100% oxygen is recommended, for other paramagnetic transducers 21% (air) is adequate.

This gas can also be used to calibrate the Pm Pressure sensor.

NOTE

Pure dry air can be used, but not if it has been passed through molecular sieve driers since its composition may have been altered significantly.

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

CAUTION

It is essential that all gases supplied to zirconia transducers are filtered to $2\mu\text{m}$ local to the analyser and that great care is taken to ensure that there is no possibility of ingress of dirt, swarf or any other kinds of particle during connection or operation.

4.3 Gas connections

Gas connections are made to the rear of the analyser. The actual connection depends on the analyser variant and the sensor selection. Refer to Table 4.2 through Table 4.4.

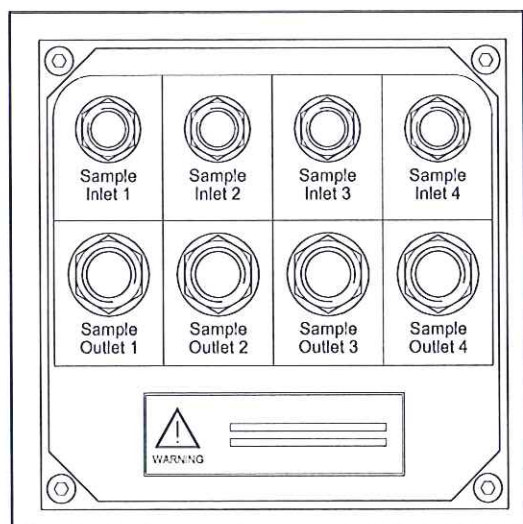


Figure 4.1: Sample gland plate without autocalibration

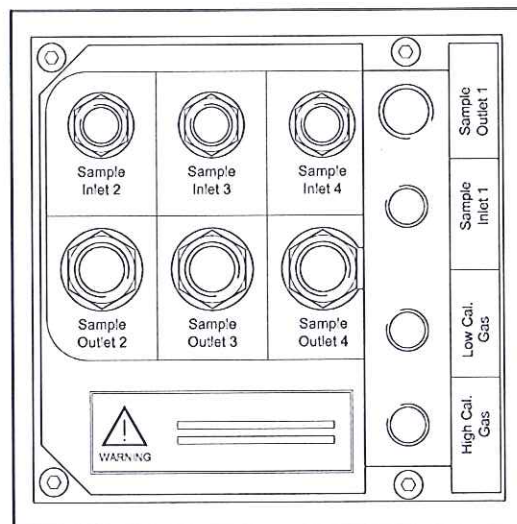


Figure 4.2: Sample gland plate with internal autocalibration

Note, the gland plate for external autocalibration is similar to Figure 4.1, except that an additional electrical connector (PL 8) is installed underneath the gas ports.

Table 4.2: 4100C and 4200C sample port vs transducer type				
Gas sensor 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
1520 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
Internal auto cal	1/8" NPT female	1/4" NPT female	1/8" NPT female	1/8" NPT female

*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 analyser inlet or, if preferred, at a convenient point in the sample inlet line.

Table 4.3: 4210C sample port type				
Gas sensor module type	Sample inlet	Sample outlet	Low cal gas	High cal gas
All sensor types	1/8" OD* stainless steel stub	1/8" OD* stainless steel stub	N/A	N/A

*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 analyser inlet or, if preferred, at a convenient point in the sample inlet line.

Table 4.4: 4900C sample port type				
Gas sensor module type	Sample inlet	Sample outlet	Low cal gas	High cal gas
Standard	1/8" NPT female	1/4" NPT female	N/A	N/A
With internal Auto Calibration	1/8" NPT female	1/4" NPT female	1/8" NPT female	1/8" NPT female

WARNING

- **Verify that connections are leak free at full operating pressure before applying sample or calibration gases. These gases may be flammable, toxic or asphyxiant.**
- **Consideration should be given to the flammable, toxic and asphyxiant nature of the sample gas when selecting a vent location.**

4.4 Reading flowmeters

The optional flow monitors are provided to control and measure the flow of sample gas through the analyser. The flow monitor consists of an optional needle valve (4900C only) and a rotameter type flowmeter. The reading of the flow rate through the flowmeter is obtained by observing the scale indication at the **top** of the float.

4.5 Autocalibration overview

The autocalibration facility allows the instrument's calibration to be updated or checked without user intervention.

When external autocalibration valves or an internal autocalibration manifold are fitted, a manual calibration adjustment or calibration check will use the autocalibration valves to select the calibration sample gases as required.

The autocalibration process can be initiated in four ways:

- by an internal timer;
- by an external contact closure (refer to Section 3.4);
- by operator request through the user interface;
- or by an external Modbus command.

Autocalibration 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 autocalibration two user defined gases (cal gas 1 and cal gas 2) are provided to the instrument. These gases may be either for low or high calibration of the transducers. 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 analyser in three phases:

Phase 1	cal gas 1
Phase 2	cal gas 2
Phase 3	cal gas 1 again.

Any of the transducers connected to any sample inlet may be autocalibrated, either simultaneously or, by the use of calibration groups (see later in this section), completely independently.

NOTE

In the 4900C analyser, internal autocalibration can only be configured to calibrate all of the transducers on stream 1.

The following parameters must be set up for either autocalibration or autocheck:

- The time and date must be correctly set before using autocalibration.
- Selection of 'LOW' or 'LOW & HIGH' autocalibration (zirconia sensors cannot have a high autocalibration).
- LOW and HIGH calibration gas concentrations.
- Autocalibration period (i.e. time interval between successive autocalibrations; minimum one hour, maximum 59 days + 24 hours).
- Date and time of start of cycle (first autocalibration).
- Flush Time - this may be set, to suit the installation, to a value between 0.5 and 16 minutes so that each gas concentration stabilises before being read. After each flush time the gas will flow for an additional minute to allow the new 'calibrated' level to be viewed or recorded.
- Selection of autocalibration or autocheck.
- Calibration gas relays (if analyser relays are to be used, the alternative being control by external monitoring of the RS-232 output).
- It is necessary to specify which calibration gas (1 or 2) is used for the LOW calibration of each sensor.

Calibration groups

Autocalibration allows up to four independently programmable transducer groups. Groups of transducers are programmed independently but only one autocalibration can be performed at any one time. A queuing mechanism is used to ensure that autocalibrations are performed as soon as possible, if another autocalibration was taking place at the intended start time.

Autocalibrations initiated by the internal timer, the user interface or by Modbus commands may specify an individual calibration group. Autocalibrations initiated by an external contact closure will be carried out on all groups in sequence (it effectively causes all groups to be placed in the queue in sequence). Autocalibration will only be performed for non-empty groups that are enabled, and have their gas control relays assigned. This input will be ignored if an autocalibration is already in progress.

4.6 Autocalibration valve installation

As a general guide, two **externally powered** three way valves are required for each transducer to be calibrated. One switches between sample gas and the second 'calibration' valve (which switches between calibration gas 1 and calibration gas 2).

Autocalibration valves may be controlled either by the RS232 output (see Section 3.3) or by relays on the rear panel of the analyser (refer to Section 3.2 and Section 3.6).

Figure 4.3 and Figure 4.4 show typical installations and assume that, in the de-energised states, the lower port on the valves will be normally open (NO). The latter figure actually demonstrates the potential to utilise independent autocalibration even when several transducers are on a single sample stream (ref 4900C).

NOTE

The CAL1/CAL2 valve is only used during calibration. In the case of fully independent autocalibration, it is permitted to connect all CAL1/CAL2 valves to one relay, and configure the software accordingly. However, a dedicated SAMPLE/CAL solenoid/relay is required for each group.

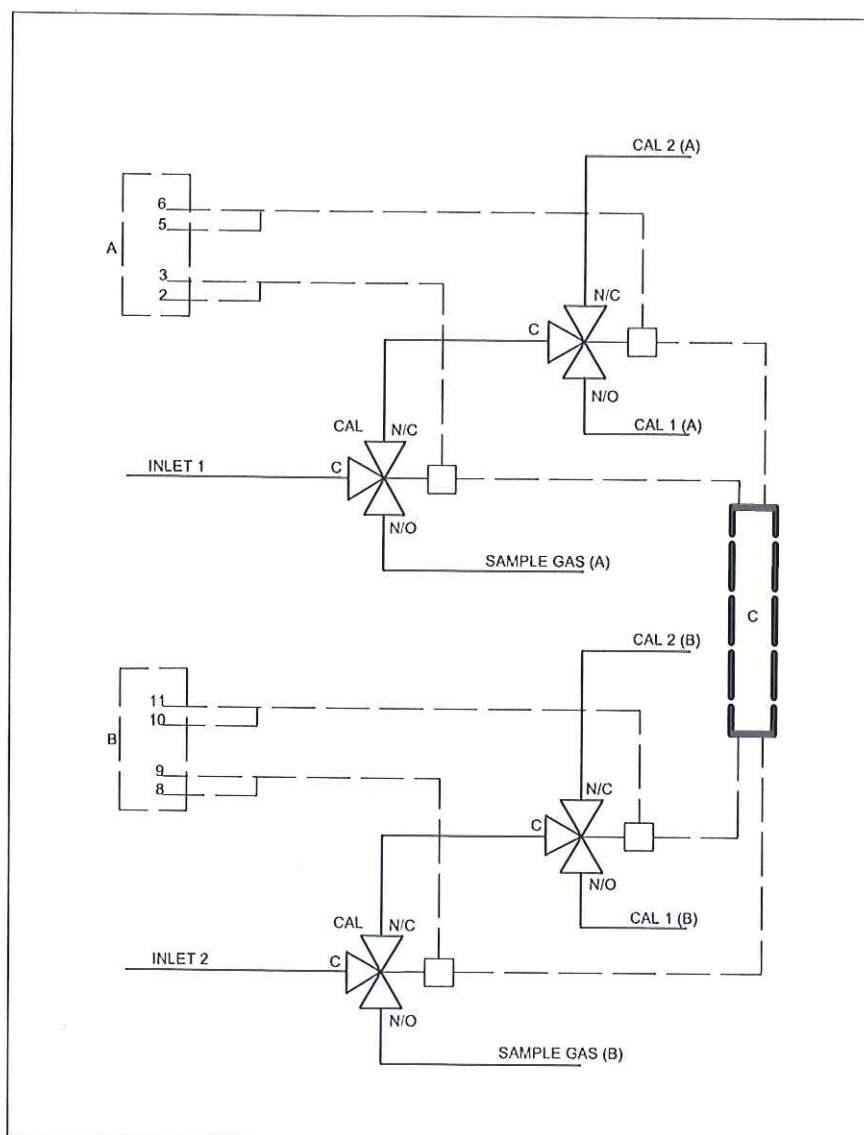


Figure 4.3: External autocalibration - parallel systems

Key:

- INLET 1, gas connection to analyser inlet 1
- INLET 2, gas connection to analyser inlet 2
- SAMPLE A, gas connection to sample gas 1
- SAMPLE B, gas connection to sample gas 2
- CAL1 (A), gas connection to calibration gas 1 associated with transducer 1
- CAL2 (A), gas connection to calibration gas 2 associated with transducer 1
- CAL1 (B), gas connection to calibration gas 1 associated with transducer 2
- CAL2 (B), gas connection to calibration gas 2 associated with transducer 2
- A, wiring to analyser option board, in this example PL8 (external autocal)
- B, wiring to analyser option board, in this example PL1, 2, 3 or 4
- C, external power supply

A similar arrangement may be used for up to four inlet ports.

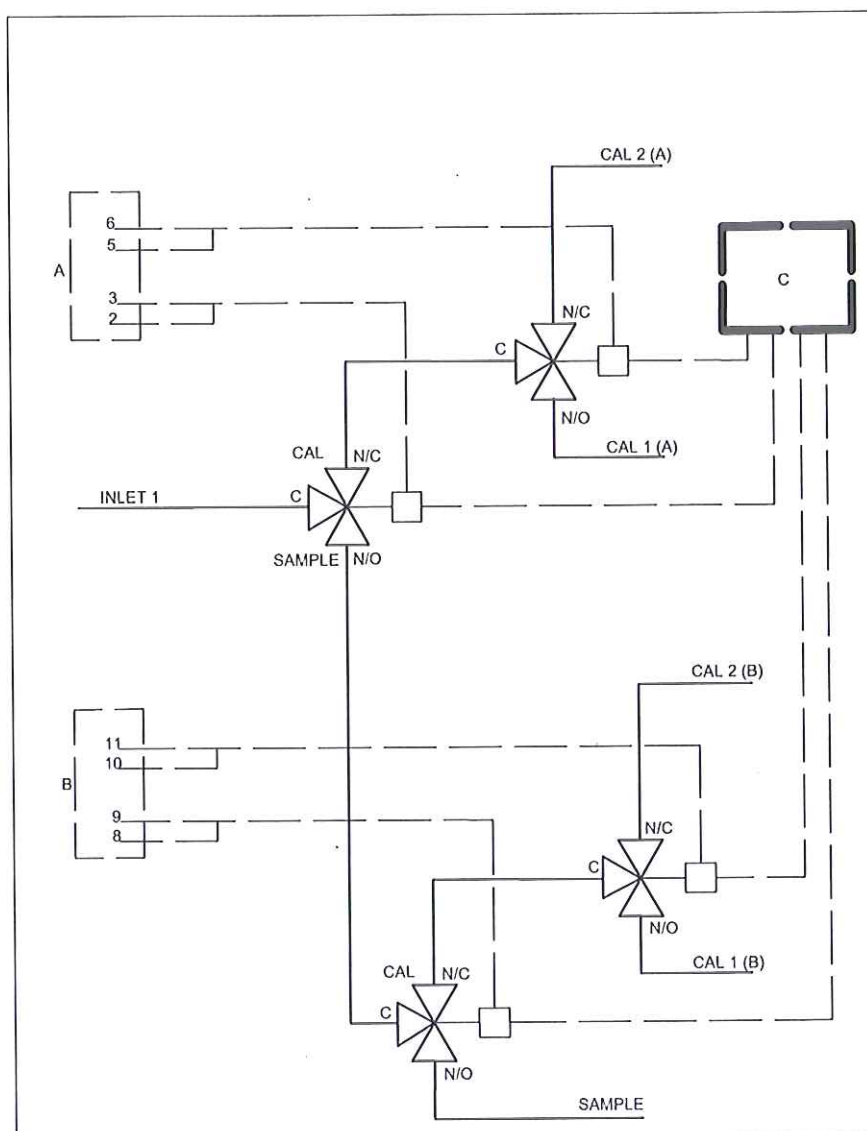


Figure 4.4: External autocalibration - stream systems

Key: INLET 1, gas connection to analyser inlet 1
SAMPLE, gas connection to sample gas
CAL1 (A), gas connection to calibration gas 1 associated with transducer 1
CAL2 (A), gas connection to calibration gas 2 associated with transducer 1
CAL1 (B), gas connection to calibration gas 1 associated with transducer 2
CAL2 (B), gas connection to calibration gas 2 associated with transducer 2
A, wiring to analyser option board, in this example PL8 (external autocal)
B, wiring to analyser option board, in this example PL1, 2, 3 or 4
C, external power supply

A similar arrangement may be used for up to four transducers on up to two inlet ports.

4.7 Power up

WARNING

Conditions for safe use with flammable samples (4200 and 4210):

Do not operate the power switch on the rear panel of the analyser if the unit is known to contain a flammable sample mixture.

The 4200 or 4210 must not be used in the event a display failure is observed.

The analyser may now be powered up. Please refer to the Quickstart manual for details of analyser set-up.

SECTION 5 ROUTINE MAINTENANCE

5.1 Replacing fan filter element

The external fan filter element should be checked every six months in laboratory conditions, for environments with a high dust content this period should be reduced. The filter element is washable and in laboratory or light dust conditions may be washed and refitted rather than replaced.

- Remove power from the analyser and unclip the filter cover complete with filter element and plastic gauze.
- Remove the plastic gauze and old filter element from the cover.
- Fit new filter into cover followed by plastic gauze.
- Clip cover back onto fan.

CAUTION

After washing the filter, ensure that it is completely dry before refitting.

5.2 Replacing the sample filter element

The front panel sample filter elements should be replaced every six months. External filter elements may be replaced annually, or more frequently if necessary.

WARNING

Sample and calibration gases may be toxic or flammable. Stop sample flow into analyser to avoid releasing gas into atmosphere when sample filter cap is removed.

1. Stop sample flow to analyser.
2. Use spanner (provided for front panel filter) to unscrew sample filter cap. Support the body of the external unit as necessary.
3. Remove old filter element and, on front panel filters only, the rubber 'O' ring. (The external element may be tapped lightly on the side to break it loose from the tapered seating area).
4. Fit new sample filter and (internal units only) rubber 'O' ring. Check that rubber 'O' ring is properly seated on the filter cap. (The external element should be tapped lightly with a smooth faced tool to reseal).
5. Fit sample filter cap and tighten using spanner.
6. Verify that there are no leaks by testing with a proprietary leak detection solution.

5.3 Cleaning

The exterior of the analyser should be regularly cleaned using a slightly damp cloth. Remove power before cleaning. Ventilation holes must be kept clear. Do not use solvents or abrasive cleansers to clean the analyser.

5.4 Toxic/flammable samples - routine leak test

WARNING

If toxic and /or flammable samples are being analysed it is essential to check the analyser and associated sample lines/system for leaks (every 6 months). MAX pressure that may be applied to each module is 8psig (5psig for the 4900C), however, this must be applied and removed slowly to both the inlet and outlet simultaneously to avoid damage to the measuring sensors.

SECTION 6 SPARES

Spare parts may be ordered from Servomex (addresses shown on the back cover of the manual). When ordering spares always give the model and serial number of your analyser. The analyser serial number is on the identification label on the underside of the analyser, and can be displayed via the user interface (refer to Quickstart manual).

WARNING

There are no user serviceable parts inside the analyser. Refer servicing to qualified personnel. Removal of the enclosure lid may invalidate the instrument warranty.

The following spares are required to maintain normal operation of the analyser.

Part Number	Description	Quantity
S4100KITA	Spares kit, one years operation	1EA
S4100KITB	Spares kit, two years operation	1EA
2377-3848	Stainless steel element for external filter	A/R

The spares, overleaf, are available for specific maintenance of the analyser.

Part Number	Description	Quantity
04000003C	QuickStart operator manual, English	1 ea
04000013C	QuickStart operator manual, French	1 ea
04000023C	QuickStart operator manual, German	1 ea
04000033C	QuickStart operator manual, Spanish	1 ea
04000005C	Installation manual, English	1 ea
04000015C	Installation manual, French	1 ea
04000025C	Installation manual, German	1 ea
04000035C	Installation manual, Spanish	1 ea
04000002C	Service manual, English	1 ea
S4000976	Kit, four tip up feet.	1 pk
S4000978	Mains fuses for 170-264V operation	1 pk
S4000979	Mains fuses for 85-132V operation	1 pk
S4000986	Kit socket 14W signal	1 ea
2388-1981	Filter element, 80mm Sq fan	1 pk
S4000984	Rack mount kit, short chassis	1 ea
S4000985	Rack mount kit, long chassis	1 ea
S4000987	Kit, internal fine filter cap and 'o' ring	1 ea
S4000988	Kit, internal filter elements 6µM	1 pk
2377-3831	Stainless Steel filter unit, complete (external)	1 ea

SECTION 7 TECHNICAL SPECIFICATIONS

7.1 Introduction

This section includes the technical specifications for all versions of the 4000. **The user must ensure that the relevant sub-sections are used for reference.**

It may be noted that similar transducer options are available in different analyser variants, in some cases the specifications for these will be application dependent.

(This performance specification has been written, and verified, in accordance with the international standard IEC 1207-1:1994 "Expression of performance of gas analysers").

7.2 Generic 4000 series analyser performance

7.2.1 Environmental specifications

Operating temperature:	4100C	5 to 40°C / 41 to 104°F
	4200C/4210C	5 to 40°C / 41 to 104°F
	4900C	5 to 45°C / 41 to 113°F
Storage temperature:	All analysers	-20 to 60°C / -4 to 140°F
Relative humidity:	10 to 90% HR, non-condensing.	
Atmospheric pressure:	79 to 124kPaa / 11 to 18psia (for operating altitudes to 2000m)	
Installation category:	II (local level power distribution with over voltage to withstand up to 2500Volts) in accordance with IEC 664	
Pollution degree	2 (normally electrically non-conducting pollutants) in accordance with IEC 664	
Warm up time:	Typically 1 hour from cold start at 20°C/68°F.	

7.2.2 Power supply

85 to 132Vac, 47 to 62Hz, 350VA maximum

170 to 264Vac, 47 to 62Hz, 350VA maximum

7.2.3 Design standards

The analyser complies with the "CE Marking Directive" 93/68EEC and conforms to the following normalised European standards for performance, product safety and electromagnetic compatibility:

EN61010-1

Safety requirements for electrical equipment for measurement, control and laboratory use.

EN61326+A1

Electrical equipment for measurement, control and laboratory use - EMC requirements.

7.2.4 Analogue outputs

Two isolated 0-20mA/4-20mA output with full zero and span adjustment as standard.

The user may define a second range by means of an external contact closure.

A maximum total of eight, two range outputs are available by selecting option cards.

Maximum impedance for each output is 1K Ω .

Maximum output current for each output is 20.5mA.

Maximum output voltage for each output is 27V.

7.2.5 Alarms

Three "volt free" single pole relay contacts rated at 264Vac/30Vdc @ 1.0Amp as standard.

Nine further general purpose relays are available by selecting option cards, however only four concentration alarms may be assigned to one transducer.

(Two similar relays are available as part of the 'external autocalibration' option. These contacts are used exclusively to control solenoid valves).

7.2.6 Serial data/Modbus connection

Single RS232/RS485 serial port, user configurable from 2400 to 19200 baud. This may be used as an ASCII data logging output or for communication using the Modbus protocol.

7.2.7 Analogue inputs

Two 'floating' (maximum common mode voltage 13V) 4-20mA/0-20mA linear inputs.

Associated digital input per channel to indicate data validity.

Intrinsic Error <0.02mA.

7.2.8 Digital inputs

Analogue input 1 valid.

Analogue input 2 valid.

Analogue outputs range change (contact closure).

Auto calibration initiate (contact closure).

7.2.9 Sample wetted materials

The following tables list sample wetted materials, firstly by sensor type, then by analyser model and configuration.

Table 7.1: Sample wetted materials						
Material	Sensor type:					
	Paramagnetic			Zirconia	1210 series GFx	1520 series IR
	Basic	Control	Purity			
Stainless Steel 303	✓	✓	✓	✓	✓ *	✓ *
Stainless Steel 316	✓	✓	✓	✓	✓	✓
Viton	✓	✓	✓	✓	✓	✓
Polypropylene			✓			
Borosilicate glass	✓	✓	✓			
Platinum	✓	✓	✓			
Platinum Iridium alloy	✓	✓	✓			
Electroless Nickel		✓	✓			
Polyphenylenesulphide (PPS) carbon/PTFE filler	✓					
Stainless Steel 310				✓		
Alumina				✓		
Yttria Stabilised Zirconia				✓		
Nickel Iron				✓		
Sealing glass				✓		
Gold				✓	✓	
Calcium Fluoride					✓	
Nickel					✓	
Sapphire						✓
Epoxy resin						✓

*not in 4210 analysers

Table 7.2: Sample wetted materials, continued		
Feature	Analyser	Additional materials
Flow driven options	4100 4200	Polypropylene
Pressure driven options	4100 4200	Polysulphone Polypropylene
Stream systems	4900	Polysulphone Polypropylene Nylon*
Flowmeters	4100 4200 4900	Borosilicate Glass Duralumin
Needle valves	4900	Brass Fomblin Grease (suitable for oxygen service)
Flow alarm	4900	Glass Nylon Silicon Rubber Aluminium
Internal filter	4100 4200 4900	Polycarbonate Glass Fibre
External filter	4100 4200 4210	316 Stainless Steel
Internal Autocal	4100 4900	Aluminium PVDF

* - not in sample streams that include a Gfx

For the 4100 analyser go to page 7.5.

For the 4200 analyser go to page 7.9.

For the 4210 analyser go to page 7.12.

For the 4900 analyser go to page 7.15.

7.3 4100C analyser performance

WARNING

This analyser (4102C and 4104C) is not suitable for use with flammable or corrosive samples.

Internal autocal is unsuitable for use with toxic samples.

If toxic samples are present, the maximum pressure to the analyser must be limited to 8psig by means of a suitable pressure release system.

Sample requirements

For best performance the flow, or pressure, supplied to the analyser 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: Each sensor outlet should be connected to a separate atmospheric vent, free from any back-pressure.
(Consideration should be given to the toxicity and asphyxiant nature of the sample gas when selecting a vent location).

a) Flow driven options:

IR :	100 (min) - 250 (max) ml/min
Pm Purity:	100 (min) - 250 (max) ml/min
Pm Control:	100 (min) - 250 (max) ml/min
Pm Basic:	10 (min) - 100 (max) ml/min
Zr:	200 (min) - 550 (max) ml/min
Gfx:	500 (min) - 2500 (max) ml/min

b) All pressure driven options:

nominal	5psig / 35kPa
min.	2psig / 14kPa, max. 8psig / 56kPa

CAUTION

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

Table 7.3: 4100C performance specification, oxygen				
Gases measured	Pm1111E O ₂ Basic	Pm1158 O ₂ Control	4100995 O ₂ Purity	Zr 704 O ₂ Trace
Range	0-25%	0-100%	0-100%	0-210000 vpm***
Min.rec.o/p range	0-5%	0-5%	0-0.5%	0-5 vpm
Intrinsic error	<0.15%	<0.15%	<0.02%	<0.1 vpm O ₂ **
Linearity error	<0.1%	<0.05%	<0.05%	<0.1 vpm O ₂ †
	inherently linear, dependant on calibration gases			
Repeatability	<0.1%	<0.1%	<0.01%	<0.1vpm O ₂ †
Response (T90)	<15 s at 100ml/min	<15 s at 200ml/min	<12 s at 200ml/min	<15 s at 400ml/min
Zero drift / week	0.1% O ₂	0.05% O ₂	0.01% O ₂	<1% of reading or 250 vpb*
Span drift / week	0.1% O ₂	0.1% O ₂	0.02% O ₂	<1% of reading or 250 vpb*
Output fluctuation (peak to peak)	<0.1% O ₂	<0.05% O ₂	<0.01% O ₂ (in the range 99-100%)	<0.5% of reading or 10 vpb*†
Cross sensitivity	no effects in target applications			5vpm H ₂ , 5vpm CO, 5vpm CH ₄ all <1 vpm O ₂
Ambient pressure coefficient	directly proportional to analyser vent pressure		<0.003% of reading for a 1% change in analyser vent pressure	no effect
Ambient temp. coeff./ 10°C change	2% of reading or 0.5% O ₂	1% of reading or 0.1% O ₂	0.2% of reading or 0.02% O ₂	1% of reading or 10 vpb*
Inlet sample pressure effect from 2 to 8psig	<2% of reading or 0.2% O ₂ *	<2% of reading or 0.1% O ₂ *	<0.1% O ₂	<0.15% of reading or 0.1% vpm*
Sample flow effect over full flow range	<2% of reading or 0.2% O ₂ *	<2% of reading or 0.1% O ₂ *	<0.1% O ₂	<0.15 vpm or <2 % of reading*

* whichever is the larger

† in the range 0-100vpm

** derived, dependant on calibration gases

*** indicative reading given above 21% O₂

Table 7.4: 4100C performance specification, Gfx				
Gases measured	Gfx 1210 CO Trace	Gfx 1210 CO ₂ Trace	Gfx 1210 N ₂ O Trace	Gfx 1210 CH ₄ Trace
Range (higher are available)	0-50 vpm	0-10 vpm	0-50 vpm	0-50 vpm
Min.rec.o/p range	0-10 vpm	0-5 vpm	0-10 vpm	0-10 vpm
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*
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*
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*
Response (T90)	<20sec at 2000ml/min			
Zero drift / week	1vpm	0.2vpm	1vpm	1vpm
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*
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*
Ambient pressure coefficient	0.25%	0.4%	0.5%	1%
	Of reading per 1% change in analyser vent pressure			
Ambient temp. coeff./ 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 N ₂ O *	3% of reading or 1.5 vpm CH ₄ *
Inlet sample pressure effect from 2 to 8psig	<0.5 vpm CO	<0.25 vpm CO ₂	<1vpm N ₂ O for	<1.5% of reading or 0.5 vpm CH ₄ *
Sample flow effect range 1.5 to 2.5l/min	<1% of reading or 0.25 vpm CO*	<1% of reading or 0.25 vpm CO ₂ *	<1% of reading or 0.5 vpm N ₂ O*	<1.5% of reading or 0.5 vpm CH ₄ *

* whichever is the larger

Table 7.5: Gfx trace measurement cross sensitivity information			
Gfx 1210 CO	Gfx 1210 CO ₂	Gfx 1210 N ₂ O	Gfx 1210 CH ₄
2% H ₂ O ~ 0.5 vpm	no effects in target applications	500vpm CO ₂ ~ 0.5 vpm 10vpm CO ~ 0.5 vpm 2% H ₂ O ~ 0.5 vpm	1% O ₂ ~ 0.5 vpm 0.2% CO ~ 0.5 vpm 0.5% H ₂ O < 1 vpm

Table 7.6: 4100C performance specification, IR		
Gases measured	1520 CO ₂	1522 CO
Range	see Table 7.7 below	
Min.rec.o/p range	80% of selected range	
Intrinsic error	1% of selected range	
Linearity error	1% of selected range	
Repeatability	1% of selected range	
Response (T90)	<20sec at 200ml/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*	
Ambient pressure coefficient	0.2% of reading per mbar	
Ambient temp. coeff./10°C change	1% of selected range +/- <2.0% of reading	
Inlet sample pressure effect from 2 to 8psig	1.5% of selected range or <3% of reading*	
Sample flow effect range 50 to 200ml/min	1.5% of selected range or <3% of reading*	

* whichever is the larger

Table 7.7: 152X measurement ranges in 4100C									
Gases measured	Full scale measurement range %								
	0.25	0.5	1.0	2.5	5	10	25	50	100
1520 CO ₂	✓	✓	✓	✓	✓	✓	✓	✓	✓
1522 CO			✓	✓		✓			

7.4 4200C analyser performance

WARNING

This analyser (4202C and 4204C) is not suitable for use with hydrogen, acetylene or corrosive samples.

The auto-ignition temperature of each flammable gas in the sample must be greater than 135°C.

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

Sample requirements

For best performance the flow, or pressure, supplied to the analyser 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:	Each sensor outlet should be connected to a separate atmospheric vent, free from any back-pressure. (Consideration should be given to the toxicity, flammability and asphyxiant nature of the sample gas when selecting a vent location).
a) Flow driven options:	
IR :	100 (min) - 250 (max) ml/min
Pm Control:	100 (min) - 250 (max) ml/min
Gfx:	500 (min) - 2.500 (max) ml/min
b) All pressure driven options:	
nominal	5psig / 35kPa
min.	2psig / 14kPa, max. 8psig / 56kPa

CAUTION

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

Table 7.8: 4200C performance specification, oxygen and IR				
Gases measured	Pm1158 O ₂ Control	1520 CO ₂	1521 CH ₄	1522 CO
Range	0-100%	see Table 7.9		
Min.rec.o/p range	0-5%	80% of selected range		
Intrinsic error	<0.15%	1% of selected range		
Linearity error	<0.05% inherently linear, dependant on cal. gases	1% of selected range		
Repeatability	<0.1%	1% of selected range		
Response (T90)	<15 sec at 200 ml/min	<20sec at 200ml/min		
Zero drift / week	0.05% O ₂	2% of selected range		
Span drift	0.1% O ₂ / week	1% of selected range/ day		
Output fluctuation (peak to peak)	<0.05% O ₂	0.5% of selected range or 1% of reading*		
Ambient pressure coefficient	directly proportional to analyser vent pressure	0.2% of reading per mbar		
Ambient temp. coeff./ 10°C change	1% of reading or 0.1% O ₂	1% of selected range +/- <2.0% of reading		
Inlet sample pressure effect from 2 to 8psig	<2% of reading or 0.1% O ₂ *	1.5% of selected range or <3% of reading*		
Sample flow effect over full flow range	<2% of reading or 0.1% O ₂ *	1.5% of selected range or <3% of reading*		

* whichever is the larger

Table 7.9: 152X measurement ranges in 4200C									
Gases measured	Full scale measurement range %								
	0.25	0.5	1.0	2.5	5	10	25	50	100
1520 CO ₂	✓	✓	✓	✓	✓	✓	✓	✓	✓
1521 CH ₄					✓		✓	✓	✓
1522 CO			✓	✓		✓	✓	✓	

Table 7.10: 4200C performance specification, Gfx				
Gases measured	Gfx 1210 CO Trace	Gfx 1210 CO ₂ Trace	Gfx 1210 N ₂ O Trace	Gfx 1210 CH ₄ Trace
Range (higher are available)	0-50 vpm	0-10 vpm	0-50 vpm	0-50 vpm
Min.rec.o/p range	0-10 vpm	0-5 vpm	0-10 vpm	0-10 vpm
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*
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*
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*
Response (T90)	<20sec at 2000ml/min			
Zero drift / week	1vpm	0.2vpm	1vpm	1vpm
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*
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*
Ambient pressure coefficient	0.25%	0.4%	0.5%	1%
	Of reading per 1% change in analyser vent pressure			
Ambient temp. coeff./ 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 N ₂ O *	3% of reading or 1.5 vpm CH ₄ *
Inlet sample pressure effect from 2 to 8psig	<0.5 vpm CO	<0.25 vpm CO ₂	<1 vpm N ₂ O for	<1.5% dof reading or 0.5 vpm CH ₄ *
Sample flow effect range 1.5 to 2.5l/min	<1% of reading or 0.25 vpm CO*	<1% of reading or 0.25 vpm CO ₂ *	<1% of reading or 0.5 vpm N ₂ O*	<1.5% of reading or 0.5 vpm CH ₄ *

* whichever is the larger

Table 7.11: Gfx trace measurement cross sensitivity information			
Gfx 1210 CO	Gfx 1210 CO ₂	Gfx 1210 N ₂ O	Gfx 1210 CH ₄
2% H ₂ O ~ 0.5 vpm	no effects in target applications	500vpm CO ₂ ~ 0.5 vpm 10vpm CO ~ 0.5 vpm 2% H ₂ O ~ 0.5 vpm	1% CO ₂ ~ 0.5 vpm 0.2% CO ~ 0.5 vpm 0.5% H ₂ O < 1 vpm

7.5 4210C analyser performance

WARNING

This analyser (4212C and 4214C) is not suitable for use with corrosive samples.

The auto-ignition temperature of each flammable gas in the sample must be greater than 135°C.

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

Sample requirements

For best performance the flow supplied to the analyser 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:	Each sensor outlet should be connected to a separate atmospheric vent, free from any back-pressure. (Consideration should be given to the toxicity, flammability and asphyxiant nature of the sample gas when selecting a vent location).
Flow driven options:	
IR :	100 (min) - 250 (max) ml/min
Pm Control:	100 (min) - 250 (max) ml/min
Gfx:	500 (min) - 2.500 (max) ml/min

Pressure driven options are not available.

CAUTION

Do not exceed the rated flow as sensor damage may result.

Table 7.12: 4210C performance specification, oxygen and IR				
Gases measured	Pm1158 O ₂ Control	1520 CO ₂	1521 CH ₄	1522 CO
Range	0-100%	see Table 7.13		
Min.rec.o/p range	0-5%	80% of selected range		
Intrinsic error	<0.15%	1% of selected range		
Linearity error	<0.05% inherently linear, dependant on cal. gases	1% of selected range		
Repeatability	<0.1%	1% of selected range		
Response (T90)	<15 sec at 200ml/min	<20sec at 200ml/min		
Zero drift / week	0.05% O ₂	2% of selected range		
Span drift	0.1% O ₂ / week	1% of selected range/day		
Output fluctuation (peak to peak)	<0.05% O ₂	0.5% of selected range or 1% of reading*		
Ambient pressure coefficient	directly proportional to analyser vent pressure	0.2% of reading per mbar		
Ambient temp. coeff./ 10°C change	1% of reading or 0.1% O ₂	1% of selected range +/- <2.0% of reading		
Sample flow effect over full flow range	<2% of reading or 0.1% O ₂ *	1.5% of selected range or <3% of reading*		

* whichever is the larger

Table 7.13: 152X measurement ranges in 4210C									
Gases measured	Full scale measurement range %								
	0.25	0.5	1.0	2.5	5	10	25	50	100
1520 CO ₂	✓	✓	✓	✓	✓	✓	✓	✓	✓
1521 CH ₄					✓		✓	✓	✓
1522 CO			✓	✓		✓	✓	✓	

Table 7.14: 4210C performance specification, Gfx				
Gases measured	Gfx 1210 CO Trace	Gfx 1210 CO ₂ Trace	Gfx 1210 N ₂ O Trace	Gfx 1210 CH ₄ Trace
Range (higher are available)	0-50 vpm	0-10 vpm	0-50 vpm	0-50 vpm
Min.rec.o/p range	0-10 vpm	0-5 vpm	0-10 vpm	0-10 vpm
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*
Linearity error	1% of reading or 0.5vpm*	1% of reading or 0.1vpm*	1% of reading or 0.5vpm*	1% of reading or 0.5vpm*
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*
Response (T90)	<20sec at 2000ml/min			
Zero drift / week	1vpm	0.2vpm	1vpm	1vpm
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*
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*
Ambient pressure coefficient	0.25%	0.4%	0.5%	1%
	Of reading per 1% change in analyser vent pressure			
Ambient temp. coeff./ 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 N ₂ O *	3% of reading or 1.5 vpm CH ₄ *
Sample flow effect range 1.5 to 2.5l/min	<1% of reading or 0.25 vpm CO*	<1% of reading or 0.25 vpm CO ₂ *	<1% of reading or 0.5 vpm N ₂ O*	<1.5% of reading or 0.5 vpm CH ₄ *

* whichever is the larger

Table 7.15: Gfx trace measurement cross sensitivity information			
Gfx 1210 CO	Gfx 1210 CO ₂	Gfx 1210 N ₂ O	Gfx 1210 CH ₄
2% H ₂ O ~ 0.5vpm	no effects in target applications	500vpm CO ₂ ~ 0.5vpm 10vpm CO ~ 0.5vpm 2% H ₂ O ~ 0.5vpm	1% CO ₂ ~ 0.5vpm 0.2% CO ~ 0.5vpm 0.5% H ₂ O < 1vpm

7.6 4900C analyser performance

WARNING

This analyser (4902C and 4904C) is not suitable for use with flammable or corrosive samples.

If toxic samples are present, the maximum pressure to the analyser must be limited to 5psig by means of a suitable release system.

Sample requirements

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

Temperature:	5 to 60°C / 41 to 140°F
Dew point:	5°C / 9°F below minimum ambient
Condition:	Oil free, non - condensing, filtered to 1µm
Vent:	Each gas outlet should be connected to a separate atmospheric vent, free from any back-pressure. (Consideration should be given to the toxicity and asphyxiant nature of the sample gas when selecting a vent location).
Inlet Flow:	500 (min) - 1500 (max) ml/min (for each stream)
Inlet Pressure:	Up to 1psig (7kPa) to provide specified flow rate.

CAUTION

Do not exceed the rated sample flow as sensor damage may result.

Do not exceed the sample temperature and dew point criteria as analyser sensor damage will result.

Table 7.16: 4900C performance specification, oxygen and IR				
Gases measured	Pm1111E O ₂ Basic	Pm1158 O ₂ Control	1520 CO ₂	1522 CO
Range	0-25%	0-25%	see Table 7.5	
Min.rec.o/p range	0-5%	0-5%	80% of selected range	
Intrinsic error	<0.15%	<0.05%	1% of selected range	
Linearity error	<0.1%	<0.05%	1% of selected range	
	inherently linear, dependant on calibration gases			
Repeatability	<0.1%	<0.05% of reading or 0.01%*	1% of selected range	
Response (T90) at 1500ml/min	<15 sec	<15 sec	<30 sec	
Zero drift / week	0.1% O ₂	0.05% O ₂	2% of selected range	
Span drift	0.1% O ₂ / week	0.05% O ₂ / week	1% of selected range/ day	
Output fluctuation (peak to peak)	<0.1% O ₂	<0.01% O ₂	0.5% of selected range or 1% of reading*	
Ambient pressure coefficient	directly proportional to analyser vent pressure		0.2% of reading per mbar	
Ambient temp. coeff./ 10°C change	2% of reading or 0.5% O ₂	1% of reading or 0.1% O ₂ *	1% of selected range +/- <2.0% of reading	
Sample flow effect over full flow range	<2% of reading or 0.2% O ₂ *	<2% of reading or 0.1% O ₂ *	1.5% of selected range or <3% of reading*	

* whichever is the larger

Table 7.17: 152X measurement ranges in 4900C									
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 7.18A: 4900C performance specification, Gfx				
Gases measured	Gfx 1210 SO ₂ standard sensitivity	Gfx 1210 SO ₂ high sensitivity	Gfx 1210 CO standard sensitivity	Gfx 1210 CO high sensitivity
Range	0-200 vpm † 0-2500 vpm	0-100 vpm 0-1000 vpm	0-200 vpm 0-3000 vpm	0-50 vpm 0-500 vpm
Min.rec.o/p range	0-200 vpm	0-100 vpm	0-200 vpm	0-50 vpm
Intrinsic error	1% of reading or 5 vpm*	1% of reading or 2 vpm*	1% of reading or 2 vpm*	1% of reading or 0.5 vpm*
Linearity error	1% of reading or 5 vpm*	1% of reading or 2 vpm*	1% of reading or 2 vpm*	1% of reading or 0.5 vpm*
Repeatability	1% of reading or 5 vpm*	1% of reading or 2 vpm*	1% of reading or 2 vpm*	1% of reading or 0.5 vpm*
Response (T90)	<30sec at 1500ml/min			
Zero drift / week	10vpm	4vpm	4vpm	1vpm
Span drift / week	2% of reading or 10 vpm*	2% of reading or 4 vpm*	2% of reading or 4 vpm*	2% of reading or 1 vpm*
Output fluctuation (peak to peak)	1% of reading or 5 vpm*	1% of reading or 2 vpm*	1% of reading or 2 vpm*	1% of reading or 0.5 vpm*
Ambient pressure coefficient	0.75%	0.65%	0.25%	0.25%
	Of reading per 1% change in analyser vent pressure			
Ambient temp. coeff./ 10°C change	3% of reading or 15 vpm *	3% of reading or 5 vpm *	3% of reading or 4 vpm *	3% of reading or 1 vpm *
Sample flow effect range 0.5 to 1.5l/min	<1% of reading or 5 vpm SO ₂ *	<1% of reading or 2 vpm SO ₂ *	<1% of reading or 2 vpm CO*	<1% of reading or 0.5 vpm CO*

* whichever is the larger

† TÜV validated range

Table 7.19A: 4900C measurement cross sensitivity information				
O ₂	Gfx 1210 SO ₂ 'Std'	Gfx 1210 SO ₂ 'High'	Gfx 1210 CO 'Std'	Gfx 1210 CO 'High'
20% CO ₂ ~ 0.06%	20% CO ₂ ~ 5 vpm 0.5% H ₂ O ~ -15 vpm	20% CO ₂ ~ 2 vpm 0.5% H ₂ O ~ 15 vpm	20% CO ₂ ~ 2 vpm 2% H ₂ O ~ 0.5 vpm	20% CO ₂ ~ 1 vpm 2% H ₂ O ~ 0.5 vpm

Note: Normal sign of cross-interference is shown above, but effects can be positive or negative (same magnitude).

Table 7.18B: 4900C performance specification, Gfx			
Gases measured	Gfx 1210 N ₂ O Trace	Gfx 1210 NO Trace	Gfx 1210 CH ₄ Trace
Range	0-50 vpm 0-500 vpm	0-100 vpm 0-1000 vpm	0-50 vpm 0-500 vpm
Min.rec.o/p range	0-10 vpm	0-100 vpm	0-10 vpm
Intrinsic error	1% of reading or 0.5 vpm*	1% of reading or 2 vpm*	1% of reading or 0.5 vpm*
Linearity error	1% of reading or 0.5 vpm*	1% of reading or 2 vpm*	1% of reading or 0.5 vpm*
Repeatability	1% of reading or 0.5 vpm*	1% of reading or 2 vpm*	1% of reading or 0.5 vpm*
Response (T90)	<30sec at 1500ml/min		
Zero drift / week	1vpm	2vpm	1vpm
Span drift / week	2% of reading or 1 vpm*	2% of reading or 2 vpm*	2% of reading or 1 vpm *
Output fluctuation (peak to peak)	1% of reading or 0.5 vpm*	1% of reading or 2 vpm*	1% of reading or 0.5 vpm*
Ambient pressure coefficient	0.5%	0.3%	1%
	Of reading per 1% change in analyser vent pressure		
Ambient temp. coeff./ 10°C change	3% of reading or 1vpm N ₂ O *	3% of reading or 3vpm *	3% of reading or 1.5vpm CH ₄ *
Sample flow effect range 0.5 to 1.5l/min	<1% of reading or 0.5 vpm N ₂ O*	<1% of reading or 2 vpm NO*	<1.5% of reading or 0.5 vpm CH ₄ *

* whichever is the larger

Table 7.19B: 4900C measurement cross sensitivity information		
Gfx 1210 N ₂ O	Gfx 1210 NO	Gfx 1210 CH ₄
500 vpm CO ₂ ~ 0.5 vpm	20% CO ₂ ~ 2 vpm	1% CO ₂ ~ 0.5 vpm
10 vpm CO ~ 0.5 vpm	0.5% H ₂ O ~ -2 vpm	0.2% CO ~ 0.5 vpm
2% H ₂ O ~ 0.5 vpm		0.5% H ₂ O <1 vpm

Note: Normal sign of cross-interference is shown above, but effects can be positive or negative (same magnitude)

APPENDIX A EFFECTS OF VARIATIONS IN SAMPLE COMPOSITION

Oxygen is a paramagnetic gas, i.e. it is attracted into a magnetic field. Virtually all other gases are diamagnetic, i.e. they are repelled by a magnetic field. Servomex oxygen analysers are calibrated on a scale which is normalised for nitrogen at 0 and oxygen at 100. For high accuracy measurements it may be necessary to introduce a zero offset into the calibration to compensate for the background gas. The Table below presents, for many common gases, the data required to calculate the zero offset.

For example, an analyser calibrated with nitrogen as the zero gas will, when 100% carbon dioxide is passed through it, give a reading of -0.30% oxygen. If it is required to measure oxygen in carbon dioxide then this will give an error. There are two ways to compensate for this:

1. CO_2 is used as the zero gas.
2. N_2 is used as the zero gas and the zero is offset to a value equal but opposite to the reading produced by the background gas.

In the example above this is -0.30% and the value +0.30 is entered as the gas zero instead of 0.00.

If the background gas is a mixture then the proportional sums of the zero offsets are used.

E.g. For a background gas with a composition of 12% CO_2 , 5% CO, 5% n-Octane, 78% N_2 , the zero offset will be:

12% CO_2	= 12% of -0.30	=	-0.04
5% CO	= 5% of +0.07	=	+0.00
5% n-Octane	= 5% of -2.78	=	-0.14
78% N_2	= 78% of 0.00	=	+0.00
Total:		=	-0.18

(Where -0.30, +0.07 and -2.78 are the zero offsets of 100% carbon dioxide, carbon monoxide and n-octane respectively relative to pure nitrogen. See following table)

In this case gas zero should be set to +0.18.

Note 1 Nitrogen dioxide exists in equilibrium with dinitrogen tetroxide. The relative proportions vary greatly with temperature. As nitrogen dioxide is paramagnetic and dinitrogen tetroxide is diamagnetic, the relative molar susceptibility of the equilibrium gas also varies. The data given in the Table are for cell temperatures of either 60°C or 110°C. Neither of these temperatures may actually be the temperature of the process.

Note 2 Servomex Application Note AP01 lists the zero offsets for a range of technically important gases at cell temperatures of 60°C and 110°C.

Gas	Formula	Molar mag.susc $\times 10^{-6}$	Zero offset (x 0.01 %)			
			20°C	50°C	60°C	110°C
Acetaldehyde	CH ₂ CHO	-22.70	-0.31	-0.34	-0.35	-0.40
Acetic acid	CH ₃ CO ₂ H	-31.50	-0.56	-0.62	-0.64	-0.74
Acetone	CH ₃ COCH 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 ₂ CHCH ₂ OH	-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 ₆ H 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 ₄ H ₆	-35.60	-0.68	-0.75	-0.77	-0.89
1,3 Butadiene	C ₄ H ₆	-30.60	-0.54	-0.59	-0.61	-0.70
n-Butane	C ₄ H ₁₀	-50.30	-1.11	-1.22	-1.26	-1.45
iso-Butane	(CH ₃) ₂ CHCH ₂	-51.70	-1.15	-1.26	-1.30	-1.50
1 Butene	CH ₃ CH ₂ CH=CH ₂	-41.10	-0.84	-0.93	-0.96	-1.10
n-Butyl acetate	CH ₃ COOC ₄ H ₉	-77.50	-1.89	-2.09	-2.15	-2.47
iso-Butylene	(CH ₃) ₂ CH=CH ₂	-44.40	-0.94	-1.03	-1.06	-1.22
1 Butyne (Ethylacetylene)	CH ₃ C ₃ H 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
Chlorine	Cl ₂	-40.50	-0.82	-0.91	-0.94	-1.08
Chloro ethanol	ClCH ₂ CH ₂ OH	-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) ₂ CHC ₆ H ₅	-89.53	-2.24	-2.47	-2.55	-2.93
Cyclohexane	C ₆ H ₁₂	-68.13	-1.62	-1.79	-1.84	-2.12
Cyclopentane	C ₅ H ₁₀	-59.18	-1.36	-1.50	-1.55	-1.70
Cyclopropane	C ₃ H ₆	-39.90	-0.81	-0.89	-0.92	-1.05
Diacetylene	C ₄ H 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 ₂ H ₅) ₂ O	-55.10	-1.25	-1.37	-1.41	-1.63
2,2 Difluoro 1 chloroethane	CClH ₂ CHF ₂	-52.40	-1.17	-1.29	-1.33	-1.52
1,2 Difluoro 1,2 dichloroethylene	CFCI=CFCl	-60.00	-1.39	-1.53	-1.58	-1.81
Difluoro dichloro methane (Freon 12)	CCl ₂ F 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) ₂ NH	-39.90	-0.81	-0.89	-0.92	-1.05
Dimethylether	CH ₃ OCH ₃	-26.30	-0.41	-0.46	-0.47	-0.54
Dimethylethylamine	(CH ₃) ₂ NC ₂ H ₅	-63.60	-1.49	-1.64	-1.69	-1.95
Enflurane (Ethrane)	C ₃ H ₂ F ₅ ClO	-80.10	-1.97	-2.17	-2.24	-2.57
Ethane	C ₂ H ₆	-26.80	-0.43	-0.47	-0.49	-0.56
Ethanol	C ₂ H ₅ OH	-33.60	-0.62	-0.69	-0.71	-0.82
Ethyl acetate	CH ₃ COOC ₂ H ₅	-54.20	-1.22	-1.34	-1.39	-1.59
Ethyl amine	C ₂ H ₅ NH ₂	-39.90	-0.81	-0.89	-0.92	-1.05
Ethyl benzene	C ₆ H ₅ C ₂ H ₅	-77.20	-1.88	-2.08	-2.14	-2.46
Ethyl bromide	C ₂ H ₅ Br	-54.70	-1.23	-1.36	-1.40	-1.61
Ethyl chloride	C ₂ H ₅ Cl	-46.00	-0.98	-1.08	-1.12	-1.28
Ethylene	C ₂ H ₄	-18.80	-0.20	-0.22	-0.22	-0.26
Ethylene glycol	(CH ₂ OH) ₂	-38.80	-0.77	-0.85	-0.88	-1.01
Ethylene oxide	(CH ₂) ₂ O	-30.70	-0.54	-0.60	-0.61	-0.71
Ethyl mercaptan	C ₂ H ₅ OSO ₃ H	-47.00	-1.01	-1.11	-1.15	-1.32

Gas	Formula	Molar mag.susc x 10 ⁻⁶	Zero offset (x 0.01 %)			
			20°C	50°C	60°C	110°C
Fluorochlorobromomethane	CFCIBr	-58.00	-1.33	-1.46	-1.51	-1.74
Fluorodichloromethane (Freon 21)	CHCl ₂ F	-48.80	-1.06	-1.17	-1.21	-1.39
Fluorene	CF ₃ CH ₂ OCHCH ₂	-56.70	-1.29	-1.42	-1.47	-1.69
Freon 114	C ₂ Cl ₂ F ₄	-77.40	-1.89	-2.08	-2.15	-2.47
Furan	C ₄ H ₄ O	-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 ₂ HBrClF 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 ₇ H ₁₆	-85.24	-2.12	-2.33	-2.40	-2.76
n-Hexane	C ₆ H 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	HBr	-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 ₂ Se	-39.20	-0.79	-0.87	-0.89	-1.03
Hydrogen sulphide	H ₂ S	-25.50	-0.39	-0.43	-0.44	-0.51
Isoflurane (Forane)	C ₃ H ₂ F ₅ ClO	-80.10	-1.97	-2.17	-2.24	-2.57
Isoprene	C ₅ H ₈	-44.80	-0.95	-1.04	-1.08	-1.24
Ketene	CH ₂ CO	-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
Methanol	CH ₃ OH	-21.40	-0.27	-0.30	-0.31	-0.35
Methoxyfluorane	CHCl ₂ CF ₂ OCH ₃	-87.10	-2.17	-2.39	-2.47	-2.83
Methyl acetate	CH ₃ COCH ₃	-42.60	-0.88	-0.97	-1.00	-1.15
Methyl cyclopentane	C ₆ H ₁₂	-70.20	-1.68	-1.85	-1.91	-2.20
Methylene chloride	CH ₂ Cl ₂	-46.60	-1.00	-1.10	-1.14	-1.31
Methylethylketone	CH ₃ COCH ₂ CH ₃	-45.50	-0.97	-1.07	-1.10	-1.26
Methyl fluoride	CH ₃ F	-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 ₃ I	-57.20	-1.31	-1.44	-1.48	-1.71
Methyl iso-butyl ketone (MIBK)	C ₄ H ₉ COCH ₃	-69.30	-1.66	-1.82	-1.88	-2.16
Methyl mercaptan	CH ₃ SH	-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 ₆ H ₅ Cl	-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 ₆ H ₅ NO 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 ₆ H ₄ CH ₃ NO ₂	-72.30	-1.74	-1.92	-1.98	-2.28
para-Nitrotoluene	C ₆ H ₄ CH ₃ NO ₂	-76.90	-1.88	-2.07	-2.13	-2.45
Nitrous oxide	N ₂ O	-18.90	-0.20	-0.22	-0.23	-0.26
n-Nonane	C ₉ H ₂₀	-108.13	-2.78	-3.06	-3.16	-3.63
n-Octane	C ₈ H 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 ₅ H ₁₂	-64.40	-1.51	-1.67	-1.72	-1.98
n-Pentane	C ₅ H ₁₂	-63.10	-1.48	-1.63	-1.68	-1.93
0.01%Phenol	C ₆ H ₅ OH	-60.21	-1.39	-1.54	-1.58	-1.82
Phosphine	PH ₃	-26.00	-0.40	-0.45	-0.46	-0.53

Gas	Formula	Molar mag.susc $\times 10^{-6}$	Zero offset (x 0.01 %)			
			20°C	50°C	60°C	110°C
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	$(\text{CH}_3)_2\text{CHOH}$	-47.60	-1.03	-1.13	-1.17	-1.34
Propene	$\text{CH}_3\text{CH}=\text{CH}_2$	-31.50	-0.56	-0.62	-0.64	-0.74
n-Propyl acetate	$\text{CH}_3\text{COOC}_3\text{H}_7$	-65.90	-1.56	-1.72	-1.77	-2.03
Propyl amine	$\text{C}_3\text{H}_7\text{NH}_2$	-52.40	-1.17	-1.29	-1.33	-1.52
Propyl chloride	$\text{C}_3\text{H}_7\text{Cl}$	-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	$\text{OCH}_2\text{CHCH}_3$	-42.50	-0.88	-0.97	-1.00	-1.15
iso-Propyl ether	$(\text{CH}_3)_4\text{CHOCH}$	-79.40	-1.95	-2.15	-2.21	-2.54
Propyl fluoride	$\text{C}_3\text{H}_7\text{F}$	-52.20	-1.16	-1.28	-1.32	-1.52
Pyridine	$\text{N}(\text{CH})_5$	-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	$\text{C}_6\text{H}_5\text{CH}=\text{CH}_2$	-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
Tetrachloroethylene	$\text{Cl}_2\text{C}=\text{CCl}_2$	-81.60	-2.01	-2.22	-2.28	-2.63
Tetrahydrofuran	$\text{C}_4\text{H}_8\text{O}$	-52.00	-1.16	-1.27	-1.31	-1.51
Toluene	$\text{C}_6\text{H}_5\text{CH}_3$	-66.11	-1.56	-1.72	-1.78	-2.04
1,1,2 Trichloroethane (Freon 113)	$\text{CHCl}_2\text{CH}_2\text{Cl}$	-66.20	-1.57	-1.73	-1.78	-2.05
Trichloroethylene	$\text{CHCl}=\text{CCl}_2$	-65.80	-1.55	-1.71	-1.77	-2.03
Trifluorochloroethylene	$\text{C}_2\text{F}_3\text{Cl}$	-49.10	-1.07	-1.18	-1.22	-1.40
Trimethylamine	$(\text{CH}_3)_3\text{N}$	-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	$\text{CO}(\text{NH}_2)\text{OC}_2\text{H}_5$	-57.00	-1.30	-1.43	-1.48	-1.70
Vacuum	-	0.00	0.35	0.38	0.39	0.45
Vinyl bromide	$\text{CH}_2=\text{CHBr}$	-44.80	-0.95	-1.04	-1.08	-1.24
Vinyl chloride	$\text{CH}_2=\text{CHCl}$	-35.60	-0.68	-0.75	-0.77	-0.89
Vinyl fluoride	$\text{CH}_2=\text{CHF}$	-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	$(\text{CH}_3)_2\text{C}_6\text{H}_4$	-77.78	-1.90	-2.09	-2.16	-2.48

APPENDIX B MODBUS PROFILE

The analyser supports Modbus slave communication through the serial data connector (PL6). This supports an RS232 or RS485 multidrop link to a Modbus master. The implementation of Modbus is based on the "Modicon Modbus Protocol Reference Guide PI-MBUS-300 Rev. J" dated June 1996.

The following facilities are provided:

- Access to measurement data
- Access to derived measurement data
- Access to external analogue input data
- Access to measurement status and alarm information
- Access to analyser status information
- Initiation of individual autocalibration groups
- Progress indication of autocalibration
- Ability to stop current autocalibrations
- Diagnostic and error functions

These are described below.

NOTE

Measurement data is in IEEE 754 floating point format. Each value requires 2 registers as follows:

Register N = High word
Register N + 1 = Low word

Measurement data

Measurement data from each of the four possible transducer positions is available in a block of input registers that can be read using Modbus function code 04.

Registers	Name	Comments
30001 – 30002	I1 Measurement	Measurement 1 value in IEEE 754 floating point format
30003 – 30005	I1 Name	A 6 character string containing the measurement 1 name
30006 – 30007	I1 Units	A 3 character string containing the measurement 1 units

30008 – 30009	I2 Measurement	Measurement 2 value in IEEE 754 floating point format
30010 – 30012	I2 Name	A 6 character string containing the measurement 2 name
30013 – 30014	I2 Units	A 3 character string containing the measurement 2 units

30015 – 30016	I3 Measurement	Measurement 3 value in IEEE 754 floating point format
30017 – 30019	I3 Name	A 6 character string containing the measurement 3 name
30020 – 30021	I3 Units	A 3 character string containing the measurement 3 units

30022 – 30023	I4 Measurement	Measurement 4 value in IEEE 754 floating point format
30024 – 30026	I4 Name	A 6 character string containing the measurement 4 name
30027 – 30028	I4 Units	A 3 character string containing the measurement 4 units

Derived measurement data

Derived measurement data associated with each of the four possible transducer positions is available in a block of input registers that can be read using Modbus function code 04.

Registers	Name	Comments
30029 - 30030	D1 Measurement	Derived measurement 1 value in IEEE 754 floating point format
30031 - 30033	D1 Name	A 6 character string containing the derived measurement 1 name
30034 - 30035	D1 Units	A 3 character string containing the derived measurement 1 units

30036 - 30037	D2 Measurement	Derived measurement 2 value in IEEE 754 floating point format
30038 - 30040	D2 Name	A 6 character string containing the derived measurement 2 name
30041 - 30042	D2 Units	A 3 character string containing the derived measurement 2 units

30043 - 30044	D3 Measurement	Derived measurement 3 value in IEEE 754 floating point format
30045 - 30047	D3 Name	A 6 character string containing the derived measurement 3 name
30048 - 30049	D3 Units	A 3 character string containing the derived measurement 3 units

30050 - 30051	D4 Measurement	Derived measurement 4 value in IEEE 754 floating point format
30052 - 30054	D4 Name	A 6 character string containing the derived measurement 4 name
30055 - 30056	D4 Units	A 3 character string containing the derived measurement 4 units

Analogue input data

Analogue input data from the two external mA inputs is available in a block of input registers that can be read using Modbus function code 04.

Registers	Name	Comments
30057 – 30058	E1 Measurement	External mA input 1 value in IEEE 754 floating point format
30059 – 30061	E1 Name	A 6 character string containing the external mA input 1 name
30062 – 30063	E1 Units	A 3 character string containing the external mA input 1 units

30064 – 30065	E2 Measurement	External mA input 2 value in IEEE 754 floating point format
30066 – 30068	E2 Name	A 6 character string containing the external mA input 2 name
30069 – 30070	E2 Units	A 3 character string containing the external mA input 2 units

Status and alarm information

Read-only access to measurement status and alarm information is provided in a block of discrete inputs that can be read with function code 02.

Discrete Input	Description	+ Offset							
		0	1	2	3	4	5	6	7
10001	Measurement I1	Fault	Maintenance	Calibration	Warming up	Alarm 1	Alarm 2	Alarm 3	Alarm 4
10009	Measurement I2	Fault	Maintenance	Calibration	Warming up	Alarm 1	Alarm 2	Alarm 3	Alarm 4
10017	Measurement I3	Fault	Maintenance	Calibration	Warming up	Alarm 1	Alarm 2	Alarm 3	Alarm 4
10025	Measurement I4	Fault	Maintenance	Calibration	Warming up	Alarm 1	Alarm 2	Alarm 3	Alarm 4
10033	Derived D1	Fault *	Maintenance *	Calibration *	Warming up *	Alarm 1	Alarm 2	Alarm 3	Alarm 4
10041	Derived D2	Fault *	Maintenance *	Calibration *	Warming up *	Alarm 1	Alarm 2	Alarm 3	Alarm 4
10049	Derived D3	Fault *	Maintenance *	Calibration *	Warming up *	Alarm 1	Alarm 2	Alarm 3	Alarm 4
10057	Derived D4	Fault *	Maintenance *	Calibration *	Warming up *	Alarm 1	Alarm 2	Alarm 3	Alarm 4
10065	External mA 1	Invalid	0	0	0	Alarm 1	Alarm 2	Alarm 3	Alarm 4
10073	External mA 2	Invalid	0	0	0	Alarm 1	Alarm 2	Alarm 3	Alarm 4

* Note that derived measurement status flags are copies of corresponding primary measurement status flags.

In the above table, the Modbus "address" of an individual flag may be calculated by adding the appropriate offset to the discrete input value. For example, the Modbus address of the Calibration flag on Measurement I4 is $10025 + 2 = 10027$.

Analyser status and autocalibration progress

Read-only access to analyser status and autocalibration information is provided in a separate block of discrete inputs that can be read with function code 02.

Discrete Input	Description	Comments											
11001	Analyser Fault flag												
11002	Analyser Maintenance flag												
11003 – 11008	Not assigned	These inputs return 0											
11009	Group 1 Sample/Cal	For each calibration group, the Sample/Cal and Cal1/Cal2 flags indicate the required solenoid valve state: <table><tr><th rowspan="2">Status State</th><th colspan="2">Status Flag</th></tr><tr><th>Sample/Cal</th><th>Cal1/Cal2</th></tr><tr><td>0</td><td>Sample gas</td><td>Cal gas 1</td></tr><tr><td>1</td><td>Calibration gas</td><td>Cal gas 2</td></tr></table>	Status State	Status Flag		Sample/Cal	Cal1/Cal2	0	Sample gas	Cal gas 1	1	Calibration gas	Cal gas 2
Status State	Status Flag												
	Sample/Cal		Cal1/Cal2										
0	Sample gas		Cal gas 1										
1	Calibration gas		Cal gas 2										
11010	Group 1 Cal1/Cal2												
11011	Group 2 Sample/Cal												
11012	Group 2 Cal1/Cal2												
11013	Group 3 Sample/Cal												
11014	Group 3 Cal1/Cal2												
11015	Group 4 Sample/Cal												
11016	Group 4 Cal1/Cal2												

Starting/stopping autocalibration

Using the following block of coils, an autocalibration on a specific calibration group may be started, or all calibrations may be stopped.

Coil	Description
00001	Start Calibration Group 1
00002	Start Calibration Group 2
00003	Start Calibration Group 3
00004	Start Calibration Group 4

00009	Stop all autocalibrations (however initiated)
-------	---

The action will be requested when a coil state is changed from a **0** to a **1**. This request is treated in the same way and subject to the same rules as a request initiated from the keypad. The Modbus master is responsible for subsequently returning the state to **0**.

Coil states may be written using function codes 05 or 15. If desired, their current state may be read back with function code 01.

Diagnostic functions

Modbus function code 08 provides a diagnostic capability for checking communication between the master and the analyser. Following the function code is a 2-byte sub function code that specifies the test to be performed, followed by data.

This implementation only supports sub function code 00 which causes the data passed in the query field to be looped back.

Exception codes

If a communications error (e.g. framing error, checksum error) is detected during the receipt of a Modbus message, that message is ignored and no response is generated.

All correctly received Modbus messages are checked for a valid function code and data address. If a problem is detected the following exception responses are returned.

Where a request to write a coil state is received, the data field is validated against the Modbus standard. Invalid data is rejected and results in an exception response.

The exception codes are as follows:

Condition	Exception Code
Requested function code is not supported	01
Register or coil address outside of supported range	02
Invalid data	03

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1 Ú V O D

1.1 Upozornenia, Výstrahy a Poznámky

Táto publikácia obsahuje **UPOZORNENIA**, **VÝSTRAHY** a **POZNÁMKY**, ktoré poskytujú informácie týkajúce sa nasledovného:

UPOZORNENIA

Na riziká, ktoré by mohli mať za následok zranenia alebo smrť.

VÝSTRAHY

Týkajúce sa rizík, ktoré by mohli spôsobiť škody na zariadení či majetku.

POZNÁMKY

Upozornenia pre užívateľa na prípadné situácie a okolnosti.

1.2 O tomto manuále

Tento manuál obsahuje konfiguráciu a prevádzku softwaru. Ďalšie kópie tohto manuálu sa dajú objednať, referenčné číslo 04000/003C.

- Adresy pre technickú podporu a náhradné diely nájdete na zadnej časti obálky.
- Inštalačný manuál je doplnený o analyzér, ktorý obsahuje technickú špecifikáciu, rutinnú údržbu, a informácie o náhradných dieloch, referenčné číslo 04000/005C.
- Servisný manuál je dostupný pre používanie kvalifikovaným personálom, referenčné číslo 04000/002C.

KLÚČ K OBRÁZKOM

Obrázok A Pohľad spredu na analyzér

- | | |
|----------------------------------|--|
| 1. Vzorkovací filter (nepovinné) | 4. Klávesnica |
| 2. Prietokomery (nepovinné) | 5. Nastavenie kontrastu displeja |
| 3. Displej | 6. Vzorkov. ihlové ventily (nepovinné) |

Obrázok B Displej Xentra

- | | |
|-----------------------------------|-------------------------|
| 1. Názvy | 7. Ikona Alarmu |
| 2. Umiestnenie modulu (2 písmená) | 8. Ikona Zahrievania |
| 3. Hodnota merania (6 písmen) | 9. Ikona Autokalibrácie |
| 4. Technické jednotky (3 písmená) | 10. Ikona Údržby |
| 5. Názov merania (6 písmen) | 11. Ikona Zlyhania |
| 6. Merania | |

Obrázok C Typická Autokalibračná Sekvencia

(V tomto príklade kalibračný plyn 1 je plyn 'nula', kalibračný plyn 2 je plyn 'rozpätia'.)

1. Spustenie autokalibrácie, kalibračný plyn 1 je privedený do analyzéra
2. Meranie kalibračného plynu 1
3. Kalibračný plyn 2 je privedený do analyzéra
4. Meranie kalibračného plynu 2
5. Kalibračný plyn 1 je znovu aplikovaný do analyzéra
6. Opätovné premeranie kalibračného plynu 1
7. Vzorkovací plyn je privedený do analyzéra aby vypláchol senzor ("následný preplach")

Obrázok D Mapa menu rozhrania pre užívateľa

UPOZORNENIE

Užívateľ by mal dbať na to, aby prístroje Xentra neobsahovali vnútri žiadne prevádzkyschopné časti. Kryt nástrojov chráni užívateľa pred elektrickým šokom a iným nebezpečenstvom. V prípade potreby akéhokoľvek servisného zásahu obráťte sa na kvalifikovaných pracovníkov.

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1.3 Úvod k užívateľskému rozhraniu

Užívateľské rozhranie pozostáva z klávesnice a veľkého LCD monitora. Počas normálnej prevádzky sa na LCD zobrazuje buď predvolený displej merania alebo displej obrazovkového editora založeného na menu.

Displej merania Xentra

Zobrazenie na displeji merania je predvolené, a môže byť nakonfigurované užívateľom tak, aby zobrazovalo merania vykonávané analyzérmi. Status prístroja plus objavenie sa alarmu alebo chyby sa takisto zobrazí prostredníctvom ikon v spodnej časti obrazovky. Riadok zobrazenia pre každé meranie pozostáva zo štyroch polí:

- 1) Umiestnenie modulu definuje identitu snímača pre každé meranie. Písmeno "I" udáva modul vnútorného plynového senzora, písmeno "E" vonkajší snímač (dodaný užívateľom) a písmeno "D" označuje odvodené meranie (ako v prípade celkových oxidov dusíka – pozri časť 3.9). Za písmenom nasleduje číslo definujúce umiestnenie modulu plynového senzora.
- 2) Pole meranej hodnoty je 6-miestne číslo, ktoré uvádza koncentráciu, ktorá bola nameraná.
- 3) Pole technických jednotiek je definované užívateľom a je definované 3 znakmi, ktoré uvádzajú jednotky merania.
- 4) Pole názvu merania má 6 znakov a uvádza meno, alebo číslo štítku.

Klávesnica Xentra

Zobrazenie môžeme kedykoľvek vrátiť na zobrazenie merania a to tým, že stlačíme klávesu 'MEASURE' (Meranie). Ak nie je stlačená žiadna klávesa, Xentra sa vráti do displeja merania po jednej minúte. Tento časový limit je predĺžený na 20 minút počas výberu kalibrácie.

Pre návrat do prednastaveného displeja merania, stlačte kedykoľvek klávesu 'MEASURE' (Meranie).

Stlačením klávesy 'MENU' aktivujete najvyššiu úroveň menu Xentra. Neovplyvní to aktivitu kontinuálneho merania analyzéra.

V rámci displejov menu, užívateľ označí požadovanú voľbu pomocou šípiek (▲▼◀▶) a potom stlačí klávesu 'ENTER' aby spustil výber označeného menu, alebo aby potvrdil dokončenie zadávania textu alebo čísiel.

Stlačením klávesy 'QUIT' (Ukončiť) sa preruší aktuálna aktivita a vrátite sa do predchádzajúcej úrovne menu.

Klávesa 'EDIT' (Úpravy) je skratka prístupu k editovacím funkciám displeja merania.

POZNÁMKA

Ak sú zadávané dáta neplatné, stlačenie klávesy bude ignorované.

Pri zadávaní numerickej informácie alebo textu, šípky vpravo a vľavo sa používajú na presun medzi písmenami a číslami a šípky hore a dole na zmenu každého písmena alebo čísla. Negatívne zobrazovanie (biely text na čiernom pozadí) naznačuje pozíciu aktívneho slova, písmena, alebo čísla.

Ak klávesy Measure, Menu alebo Quit sa použijú na ukončenie zadávania dát, (a nie klávesa Enter) potom zadané dáta budú stratené.

Ikony na Obrazovke Xentra

<i>Ikona autokalibrácie</i>	sa zobrazí keď je aktívna autokalibrácia.
<i>Ikona alarmu</i>	sa zobrazí ak je dosiahnutá ktorákoľvek z alarmových úrovní koncentrácie.
<i>Ikona zahrievania</i>	sa zvyčajne zobrazí pri zapnutí prístroja. Ak senzor do určeného času nezaznamená dosiahnutie normálnych teplotných prevádzkových podmienok, ikona sa vypne a rozsvieti sa ikona zlyhania.
<i>Ikona zlyhania</i>	sa zobrazí v prípade že nastane akékoľvek vážne zlyhanie v rámci analyzéra.
<i>Ikona údržby</i>	sa zobrazí ak nastane situácia, ktorá si vyžaduje pozornosť operátora.

Menu displej Xentra

Ak chcete vstúpiť do menu, stlačte klávesu 'MENU'. Xentra potom ponúkne najvyššiu úroveň menu, ktoré Vás potom navedie do iných menu. Celková štruktúra menu je zobrazená na obrázku D.

Počas akejkoľvek operácie v menu, Xentra stále vykonáva základné merania, a všetky relevantné výstupy, alarmy a diagnostika zostávajú aktívne.

Zadávanie dát

Ak sa vyžaduje zadávanie alfanumerických textových dát, klávesy šípok hore a dole dovoľujú skrolovanie a výber ktorejkoľvek dostupnej položky v skupine znakov Xentra.

Zadávanie numerických dát môže byť nastavené na :-

- i) Akékoľvek číslo v rozsahu od 0 do 9
- ii) Znamienko mínus (**len ako prvý znak**)
- iii) Desatinná čiarka – pozícia desatinnej čiarky môže byť zmenená oproti tej, ktorá je prednastavená. Môže byť použitá akákoľvek jej pozícia **okrem posledného znaku napravo**.

Ak sú zapísané neplatné dáta, zadanie bude ignorované a displej sa vráti na začiatok do zobrazenia kde sa zapisujú relevantné dáta. **Nevygeneruje sa však žiadny varovný odkaz.**

Ochrana heslom

Určité operácie si vyžadujú použitie hesla. Existujú dve heslá; heslo riadiaceho pracovníka, ktoré umožňuje prístup do funkcií SETUP (Nastavenia) a CALIBRATION (Kalibrácia), a heslo operátora, ktoré umožňuje prístup len k funkcii CALIBRATION (Kalibrácia). **Výrobcom nastavené heslá sú 4000**, ale v prípade potreby môžu byť zmenené. Pozri časť 2.3.

2 POČÍATOČNÁ KONFIGURÁCIA

2.1 Postup pri zapínaní a vypínaní

Pri zapínaní sa objaví sekvencia odkazov. Táto sekvencia začne zobrazením: 'SYSTEM OK' a bude pokračovať zobrazovaním celej rady obrazoviek, ktoré budú dávať detailné informácie o analyzéri, jeho konfigurácii a softvéri, a potom sa na displeji objaví: 'MEASURING' (Meranie).

Ak si užívateľ neželá prechádzať odkazy pri zapínaní, tak ich môže obísť stlačením klávesy merania počas doby, keď je na obrazovke odkaz 'SYSTEM OK'.

Teraz by sa mal objaviť displej merania. "Kontrast" displeja môže byť upravený, ak je to potrebné, použitím malého plochého skrutkovača. Pre umiestnenie ovládača tejto funkcie pozri obrázok A, prístup k nemu je zo spodnej strany predného štítu..

Ikona zahrievania (pozri Obrázok B) môže byť indikovaná na displeji až kým všetky zahrievané moduly plynových senzorov nebudú na svojej patričnej operačnej teplote. To môže trvať do 6 hodín. Snímanie určitých modulov plynových senzorov môže byť počas doby zahrievania nahradené radom hviezdíčiek ('*****').

Za účelom vypnutia odpojte vzorkovací plyn, prepláchnite čistiacim plynom (napr. dusíkom), potom vytiahnite zo zdroja.

2.2 Všeobecný prístup k funkciám analyzéra

Odporúča sa, aby užívateľ používal mapu menu (Obrázok D) a našiel si tam požadovanú funkciu. Potom, použitím klávesnice a displeja, môže sa držať cesty ako je naznačená na mape. Často bude potrebné zadať heslo, a heslo nastavené výrobcom je 4000.

Na displeji monitora: ENTER PASSWORD 0000	Kurzor bude najprv na číslici najviac vľavo. Použité šípku hore a zvýšte prvú číslicu na 4. Na displeji by teraz malo byť zobrazené 4000. Stlačte ENTER
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2.3 Nastavenie hesiel

Chodíte cez SETUP/UTILITY do NEW PASS - stlačte ENTER	
Na displeji monitora	Operácia
SUPERVISOR OPERATOR	zvoľte buď heslo nadriadeného alebo operátora a potom stlačte 'ENTER'
NEW OPERATOR (NEW SUPERVISOR) PASS = 0000	použitím šípok špecifikujte nové heslo; keď je zobrazená hodnota správna, stlačte 'ENTER'
NEW PASS IS ???? ACCEPT YES/NO	vyžaduje sa potvrdenie, zvoľte 'YES' alebo 'NO' a potom stlačte 'ENTER'
SUPERVISOR OPERATOR	Aby ste sa vrátili do displeja merania, stlačte 'MEASURE' (Meranie)

2.4 Nastavenie času a dátumu

Čas a dátum musia byť nastavené správne predtým, než bude nastavená autokalibrácia, a kvôli tomu, aby sa do záznamov logov histórie správne zaznamenali čas a dátum. Čas a dátum sa uchováva v pamäti minimálne dva dni počas toho keď je analyzér vypnutý.

Chodíte cez SETUP/UTILITY do CLOCK - stlačte ENTER	
Na displeji monitora	Operácia
TIME = 12:54 DATE = 10/12/01	aktuálny čas/dátum sa dočasne zobrazí, (nevyžaduje sa žiadny úkon)
CHANGE DATE, TIME YES/NO	zvoľte 'YES' alebo 'NO', potom stlačte 'ENTER'
SET CLOCK SET YEAR 0000	nastavte použitím šípok, keď sa zobrazí správna hodnota, stlačte 'ENTER'
SET MONTH 00	"
SET DAY 00	"
SET HOUR 00	"
SET MINUTE 00	"
SELECT FORMAT DDMMYY/MMDDYY	zvoľte formát a potom stlačte 'ENTER'
TIME = 12:57 DATE = 10/12/01	nový čas/dátum sa dočasne zobrazí (nevyžaduje sa žiadny úkon)

3 HLAVNÁ KONFIGURÁCIA

3.1 Názov komponentu a definícia jednotky

Názov každého merania môže byť zmenený (dĺžka maximálne šesť znakov).

Predvolený znak je '|'; nezobrazuje sa, je však použitý, aby označil maximálny povolený počet znakov. Ak je zadaný menší počet ako maximálny počet znakov, prvé '|' sa berie ako posledný znak.

Všetky merania Xentra sú založené na percentuálnej koncentrácii. Aby ste tieto hodnoty mohli prekonvertovať do vpm, napríklad, je použitá 'mierka' (10,000). Užívateľ môže predefinovať jednotky merania tým, že upraví túto mierku. **Táto mierka bude aplikovaná na zobrazenú hodnotu, všetky výstupy, alarm a kalibračné konfigurácie.**

Jednotky merania a názov komponentu sú zobrazené zarovnané sprava v poliach pre tri a šesť znakov. Ak ich chcete zarovnať vľavo alebo do stredu, môžete pridať správny počet medzier na ktorýkoľvek koniec reťazca znakov.

Chodíte cez SETUP/UTILITY do LABELS - stlačte ENTER	
Na displeji monitora	Operácia
I1 COMPONENT NAME 	môže byť použitá akákoľvek kombinácia 6 a menej znakov, napr. "Oxygen" alebo "AT-123" použite šípky na zmenu znaku a v prípade že názov je správny, stlačte 'ENTER'
I1 ENG UNIT (Factory set to '%' or 'vpm')	tento zápis iba definuje štítok, ktorý nasleduje za hodnotou merania, v skutočnosti neovplyvňuje hodnotu merania (pozri nižšie) Znaky zmeňte tak ako je uvedené vyššie.
I1 SCALE FACTOR 1.000 (Eg: 1.000 for percent 10000 for vpm)	tento zápis môže byť použitý na zmenu mierky kalibrácie zadanú výrobcom. Táto mierka bude aplikovaná lineárne na zobrazenú hodnotu, všetky výstupy, alarm a kalibračné konfigurácie. Hodnotu zmeňte tak ako je uvedené vyššie

3.2 Alarmy

Xentra má štyri nastavenia alarmu koncentrácie pre každé meranie (označované ako AL1, AL2, AL3 a AL4). Každý môže byť aktivovaný alebo deaktivovaný, a pre každý aktivovaný alarm je potrebné nastaviť stavy nasledujúcich parametrov:-

- i) FREEZE (Pozastaviť) aby sa predišlo spusteniu alarmu počas kalibrácie, alebo FOLLOW (Sledovať) aby alarmy mohli byť aktivované kalibračnými plynmi.
- ii) HIGH (Vysoká) alarm vysokej koncentrácie alebo LOW (Nízka) alarm nízkej koncentrácie.
- iii) LEVEL (Úroveň) koncentrácie, pri ktorej sa má objaviť alarm.
- iv) HYSTERESIS (Hysteréza) - (dead band – oblasť necitlivosti) alarmu, sa môže použiť na vyhnutie sa 'vybráciám' ak typická koncentrácia vzorky je blízko alarmovej úrovne.

Chodíte cez SETUP do SET ALARM - stlačte ENTER	
Na displeji monitora	Operácia
SELECT MEASURE I1 Oxygen %	zvoľte požadované meranie, (ako príklad je uvedené % kyslíka), stlačte 'ENTER'
I1 Oxygen SELECT AL1/2/3/4	zvoľte požadovaný alarm, stlačte 'ENTER'
I1 Oxygen AL1 ENABLE/DISABLE	zvoľte požadovaný stav, stlačte 'ENTER'
I1 Oxygen AL1 FREEZE/FOLLOW	zvoľte požadovaný stav, stlačte 'ENTER'
I1 Oxygen AL1 HIGH/LOW ALARM	zvoľte požadovaný stav, stlačte 'ENTER'
I1 Oxygen AL1 LO LEVEL = 00.000%	nastavte hodnotu na požadovanú alarmovú úroveň, ak je správna, stlačte 'ENTER'
I1 Oxygen AL1 LO HYST =00.000%	nastavte hodnotu na požadovanú hysterézu, ak je správna, stlačte 'ENTER'
I1 Oxygen SELECT AL1/2/3/4	zvoľte iné alarmy ako je potrebné, a zopakujte ako je uvedené hore. Keď sú nastavené všetky alarmy pre modul senzoru plynu, použite 'QUIT' (Ukončiť) pre výber ďalšieho modulu

POZNÁMKA

Signál alarmu vysokej hodnoty sa spustí, keď koncentrácia vzorky stúpne nad úroveň alarmu. Alarm sa prestane signalizovať keď vzorka klesne pod úroveň alarmu nižšiu ako je hodnota hysterézy.

Signál alarmu nízkej hodnoty sa spustí keď koncentrácia vzorky klesne pod úroveň alarmu. Alarm sa prestane signalizovať keď vzorka stúpne nad úroveň alarmu vyššiu ako je hodnota hysterézy.

3.3 Umiestnenie relé

S výnimkou priradených externých autokalibračných relé, každé relé môže byť nastavené tak, aby zareagovalo na *akúkoľvek kombináciu* nasledovného :-

- i) Zlyhanie snímačov I1 až I4, ak sú inštalované, a miliampérových vstupov E1 a E2.
- ii) Vyžaduje sa údržba pre snímače I1 až I4, ak sú inštalované.
- iii) Prebieha kalibrácia snímačov I1 až I4.
- iv) Akýkoľvek alarm koncentrácie.
- v) Závaža na ráme, vyžaduje sa údržba rámu.
- vi) Zahrievanie, pre snímače I1 až I4, ak existujú.

Akékoľvek existujúce umiestnenie relé môže byť zmenené alebo zrušené (vymazané). Ak dôjde k vymazaniu, relé zostanú nefunkčné.

POZNÁMKA

Nepovinné relé dodané špecificky pre vonkajšiu autokalibráciu **alebo** akékoľvek relé konfigurované na ovládanie externých ventilov, budú použité výhradne pre tento účel. Pokusy o zmenu takejto konfigurácie cez funkciu 'umiestnenie relé' sú blokované a budú mať za následok zobrazenie odkazu "RELAY ASSIGNED TO AUTOCAL" (Relé určené na autokalibráciu).

Identita každého relé je v súlade so štandardom číslovacieho systému výstupov Xentra, tak ako je to uvedené v inštalačnom manuále, ktorý tiež obsahuje zoznam prednastavených umiestnení relé.

Chodíte cez SETUP/ASSIGN do RELAYS - stlačte ENTER	
Na displeji monitora	Operácia
SELECT RELAY 1.3 ASSIGNED ALEBO 1.3 UNASSIGNED	použite šípky na zvolenie požadovaného relé, potom stlačte 'ENTER'
RELAY ASSIGNMENT 1.3 EDIT/CLEAR ALEBO 1.3 ASSIGN? Y/N	Zvoľte 'EDIT' na úpravu umiestnenia, alebo znovu-pridelenia vymazaného relé, ALEBO zvolte 'CLEAR' na vymazanie relé, potom stlačte 'ENTER'
1.3 I1 Oxygen AL1 HI 10.000 % Y/N alebo 1.3 CAL IN PROG YES/NO alebo 1.3 FAILURE YES/NO alebo 1.3 MAINTENANCE YES/NO alebo 1.3 CHASSIS MAINT or CHASSIS FAILURE YES/NO alebo 1.3 WARM UP YES/NO	displej zobrazí všetky dostupné alarmy a funkcie, ktoré môžu byť zvolené na obsluhu relé (1.3 v tomto príklade) zvoľte 'YES' a stlačte 'ENTER' aby ste prideliť položku k relé ALEBO zvoľte 'NO' a stlačte 'ENTER' aby ste sa posunuli k ďalšej položke Pre alarmy koncentrácie sa zobrazí nastavený bod alarmu, a zobrazí sa tiež H alebo L pre stav HIGH (Vysoká) alebo LOW (Nízka) Úlohy Údržba, Zlyhanie a Zahrievanie môžu byť pridelené pre každý snímač a pre rám
SELECT RELAY 1.3 ASSIGNED ALEBO 1.3 UNASSIGNED	použite šípky na zvolenie ďalšieho relé, potom stlačte 'ENTER'

3.4 Konfigurácia externého analógového vstupu

Dva externé, lineárne analógové vstupy sú súčasťou prístroja, a sú označené ako E1 a E2. Názov a jednotky pre tieto premenné sa dajú zmeniť cez menu LABELS (Štítky), a to podobným spôsobom ako vnútorne snímače (Časť 3.1). V prípade, že chcete zapnúť alebo vypnúť vstupy, môžete použiť doplnujúci príkaz 'ENABLED/DISABLED' (Aktivovaný/Neaktivovaný) v menu SETUP/ASSIGN (Nastavenia/Priradiť).

Mierkovanie vstupu (kalibrácia) sa nastavuje cez menu MAN CAL (Manuálna kalibrácia), pozri časť 4.3.

3.5 Analógové výstupy

Xentra môže mať až do 8 analógových výstupov, v závislosti od počtu nainštalovaných alternatív. Každý výstup má dva rozsahy: R1 (prednastavený rozsah) a R2 (zvolený použitím externého kontaktu). Maximálne rozpätie výstupu je limitované na dvojnásobok celkovej škály rozsahu snímača (s výnimkou Zirconia senzorov).

Pozn.: výkon sa zvyčajne začne znižovať pri hodnotách nad 120%FSD.

Ako vodiaca informácia slúži pre vás to, že minimálne rozpätia výstupu by mali byť aspoň 100-násobkom hladiny šumu snímača; pozri Inštalčný manuál, časť 7).

Parametre pre výstup môžu byť zmenené alebo vymazané. V prípade, že sú vymazané, výstup je nefunkčný. Každý výstup môže byť pridelený ktorémukol'vek plynovému senzoru, a nasledujúce parametre musia byť nastavené pre všetky použité výstupy:

- i) Modul plyn.senzora ku ktorému bude priradený analógový výstup
- ii) Škála (Dolná & Horná hranica) analógového výstupu, rozsah 1.
- iii) Škála (Dolná & Horná hranica) analógového výstupu, rozsah 2.
- iv) 0 až 20 mA alebo 4 až 20 mA. V prípade použitia 4 až 20mA, skutočný minimálny prúd povolený pri normálnej prevádzke musí byť tiež špecifikovaný.
- v) FREEZE (Pozastavte) analógový výstup počas kalibrácie, alebo povoľte FOLLOW(Sledovať) vzorkové koncentrácie kalibrácie.
- vi) Nastavte výstup na JAM LOW alebo JAM HIGH pre prípad že nastane zlyhanie merania. Výstup bude obmedzený buď na nulu alebo 20,5 mA (podľa použitého výstupu) - **toto sa týka len 'Zlyhaní'** (neplatí to v prípade chýb údržby).

POZNÁMKA

Ak je použitý výstup 4-20mA a 'minimálny prúd' je špecifikovaný na menej ako 4mA (v bode iv vyššie), 4mA sú stále najnižšou hranicou rozsahu výstupu (nastavené v ii alebo iii vyššie)

Chodíte cez SETUP/ASSIGN do mA OUTPUT - stlačte ENTER	
Na displeji monitora	Operácia
SELECT mA OUTPUT 1.1 ASSIGNED ALEBO 1.1 UNASSIGNED	použité šípky aby ste zvolili požadovaný výstup, potom stlačte 'ENTER'
mA OUTPUT ASSIGN 1.1 EDIT/CLEAR ALEBO 1.1 ASSIGN ? Y/N	zvoľte 'EDIT' na zmenu umiestnenia, alebo znovu-priradenie vymazaného relé ALEBO zvoľte 'CLEAR' na vymazanie relé, potom stlačte 'ENTER'
SELECT MEASURE I1 Oxygen %	zvoľte meranie, ktoré má byť výstupom, potom stlačte 'ENTER' (I1 Kyslík použitý ako príklad)
1.1 I1 Oxygen R1 L=000.00U=100.00	nastavte <u>L</u> ower(Dolnú) a <u>U</u> pper(Hornú) hranicu pre výstup; desatinná čiarka môže byť posunutá a pre dolnú hranicu môžu byť zadane záporné hodnoty. Keď sú obe hodnoty správne, stlačte 'ENTER'
1.1 I1 Oxygen R1 0-20mA/4-20mA	zvoľte požadovaný stav a stlačte 'ENTER'
1.1 I1 Oxygen R1 LOW LIMIT= 4.0mA	ak je to potrebné, upravte dolnú hranicu prúdu výstupu (rozsah: 0, 3.6 do 4.0), a stlačte 'ENTER'
1.1 I1 Oxygen R1 FREEZE/FOLLOW	zvoľte požadovaný stav, stlačte 'ENTER'
1.1 I1 Oxygen R1 JAM NONE/LOW/HIGH	zvoľte požadovaný stav, stlačte 'ENTER'
1.1 I1 Oxygen R2 L=00.00 U=100.00	zopakujte postup uvedený hore pre rozsah R2
SELECT mA OUTPUT 1.1 ASSIGNED ALEBO 1.1 UNASSIGNED	na zvolenie iného výstupu použité šípky, potom stlačte 'ENTER'

3.6 Definovanie a výber zobrazenia merania na displeji

Od výroby je nastavené jedno zobrazenie merania na displeji. Ak je to potrebné, môže byť definovaných až do päť rôznych zobrazení merania, a zobrazených zaradom. Každé zobrazenie môže byť zadefinované tak, že bude obsahovať maximálne štyri merania, a medzi nimi sa môže rolovať manuálne (stlačením MEASURE - Merať) alebo automaticky (v intervale každých 8 sekúnd).

Použite klávesu EDIT a choďte na DEFINE SCREEN - stlačte ENTER	
Na displeji monitora	Operácia
SELECT SCREEN NUMBER : 1	použite šípky a zvolte požadované zobrazenie na definovanie, potom stlačte 'ENTER'
SELECT MEASURE 1 I1 O2 %	použite šípky a zvolte prvé požadované meranie, potom stlačte 'ENTER'
MORE MEASURES? YES/NO	zvoľte 'YES' ak chcete pridať viac meraní do tohto zobrazenia, alebo 'NO' ak chcete skončiť alebo zvoliť iné zobrazenie na zadefinovanie. Keď ste zadefinovali všetky požadované položky do zobrazení, choďte do menu SELECT SCRN (Zvoliť zobrazenie).
SELECT ORDER 1ST SCREEN IS : 1	použite šípky a zvolte prvé požadované zobrazenie, potom stlačte 'ENTER'
MORE SCREENS? YES/NO	zvoľte podľa požiadavky, stlačte 'ENTER'
AUTOSCROLL ? YES/NO	zvoľte požadovaný stav, stlačte 'ENTER'

Počet zobrazených desatinných miest zobrazených pre každé meranie sa dá zvoliť.

Choďte cez SETUP/UTILITY do DECI - stlačte ENTER	
Na displeji monitora	Operácia
SELECT MEASURE I1 O2 %	použite šípky a zvolte požadovaný modul senzora, potom stlačte 'ENTER'
I1 O2 % DECI PTS=0/1/2/3	zvoľte podľa požiadavky, potom stlačte 'ENTER'

3.7 Reakčný čas

Reakčný čas pre každé meranie sa dá predĺžiť tým, že pripočítate časovú konštantu užívateľa, aby ste znížili šum. Zároveň sa tým ovplyvní aj snímanie a aj analógový výstup. Normálne nastavenie pre túto prídavnú konštantu je 0, maximum je 60 (výber je založený na skúsenosti).

Chodíte cez SETUP/UTILITY do TIME CONSTANT - stlačte ENTER	
Na displeji monitora	Operácia
SELECT MEASURE I1 Oxygen %	použite šípky, zvolte požadovaný modul senzora, potom stlačte 'ENTER'; ak je použitý len jeden modul, táto časť bude vynechaná.
I1 Oxygen % TIME CONST = 00	zvoľte hodnotu medzi 0 a 60, potom stlačte 'ENTER'

3.8 Komunikácie sériových výstupov

Táto časť sa podrobne zaoberá konfiguráciou analyzéra pre komunikácie sériových výstupov RS232. **Pre podrobnejšie informácie o pripojení a interpretácii signálu, pozrite si inštalačný manuál Xentra.**

SET FRAME FREQ – Nastavenie snímkovej frekvencie (ak nie je žiaden prenos zadajte nulu)

Chodíte cez SETUP/UTILITY do SET FRAME FREQ - stlačte ENTER	
Na displeji monitora	Operácia
FRAME FREQUENCY= 0000	použite šípky a zvolte požadovanú frekvenciu, (v sekundách, max. hodnota 9999s), potom stlačte 'ENTER'

SET COMMS PARMS – Nastavenie komunik. parametrov, Prednastavený Súpis

Parameter	Prednastavenie
Stop bit - 1, 1.5 alebo 2	1
Počet dátových bitov - 7 alebo 8	8
Parita - PÁRNE, NEPÁRNE alebo ŽIADNE	PÁRNE
Prenosová rýchlosť (znakov za sekundu) - 9600, 4800, 2400 alebo 19200	9600
Súčinnosť hardwaru (nemenná)	ŽIADNA

Správne parametre požadované prijímačom by mali byť nastavené nasledovne:

Chodíte cez SETUP/UTILITY do SET COMMS PARMS - stlačte ENTER	
Na displeji monitora	Operácia
SELECT STOP BIT 1/1.5/2	zvoľte podľa požiadavky, potom stlačte 'ENTER'
SELECT DATA BITS 8/7	zvoľte podľa požiadavky, potom stlačte 'ENTER'
SELECT PARITY EVEN/ODD/NONE	zvoľte podľa požiadavky, potom stlačte 'ENTER'
SELECT BAUD RATE 9K6/4K8/2K4/19K2	zvoľte podľa požiadavky, potom stlačte 'ENTER'
1,8,E,9K6 ACCEPT ? YES/NO	Potvrdíte 'YES' ak sú špecifikované komunikačné parametre správne alebo 'NO' ak ich chcete zmeniť.

3.9 Kalkulácia celkovej koncentrácie oxidov dusíka (NO_x)

Pre meranie oxidu dusičného (NO) má Xentra zariadenie na kalkuláciu odhadu celkovej úrovne oxidov dusíka (NO_x), na základe nameranej úrovne NO. Tento odhad môže byť zobrazený, a výstup, ako samostatné meranie, identifikovaný na displeji smerovým znakom "D" v poli umiestnenie modulu. **Jednotky a kalibrácia plne závisia od pridruženého merania NO.** Odhad celkového NO_x je odvodený podľa vzorca:

$$[NO_x] = a * [NO] + b * [NO]^2$$

V najjednoduchších procesoch spaľovania je známe, že koncentrácia NO zodpovedá približne 95% z celkového NO_x. V tomto prípade celkový obsah NO_x sa dá odhadovať použitím súčiniteľov (a) 100/95 (= 1.053), a (b) nula (0.00).

Chodíte cez SETUP/UTILITY do DERIVE NO _x - stlačte ENTER	
Na displeji monitora	Operácia
I1 NO _x LINEAR COEF 00.000	nastavte podľa požiadavky, potom stlačte 'ENTER'
I1 NO _x SQUARE COEF 00.000	nastavte podľa požiadavky, potom stlačte 'ENTER'

4 KALIBRÁCIA

4.1 Úvod do Kalibrácie

Kalibrácia analyzéra môže byť skontrolovaná alebo upravená manuálne alebo automaticky. Tieto činnosti budú mať za následok zápis v logu histórie kalibrácie a budú označené ako “CHK” (Kontrola) alebo “CAL” (Kalibrácia).

Pri manuálnej kalibrácii (pojem kalibrácia zahŕňa aj ‘kontrolu’) je operátor vedený sekvenciou odkazov zobrazených na displeji, a každý modul plynového senzora **musí** byť kalibrovaný zvlášť.

Autokalibrácia alebo automatická kontrola sa spoločne označujú ako “autokalibrácia”. Napredovanie môže byť sledované na displeji (pozri obrázok C) a meranie senzora (senzorov), ktorý je kalibrovaný, bude blikať. Cyklus autokalibrácie môže byť iniciovaný tromi spôsobmi:

interným časovačom
externým uzatvorením kontaktu
zápisom klávesnicou

Stlačenie akejkoľvek klávesy počas cyklu umožní, aby bola autokalibrácia zastavená. Ak nastane prerušenie, prebehne konečná sekvencia “následný preplach”. Tá môže byť prerušená rovnakým spôsobom.

POZNÁMKA

Autokalibrácia nemôže byť nakonfigurovaná tak, aby sa vykonala HIGH (Vysoká) kalibrácia (21% kyslíka vo vzduchu) s modulom senzoru plynu zirconia kyslíka.

Prístroj bude reagovať len na iniciovanie autokalibrácie z vnútorného časovača, alebo z externého vstupu, ak nie sú indikované žiadne chyby. Autokalibrácia môže byť iniciovaná z klávesnice, ak nastane nejaká záhada.

Všetky nasledujúce časti vychádzajú z predpokladu, že kalibračné plyny, ako je to odporúčané v inštalačnom manuále, sú dostupné pre analyzér!

Ak sa analyzér ešte stále zahrieva a snažíte sa o manuálnu kalibráciu, objaví sa varovný odkaz s možnosťou pokračovať. Pre optimálny výkon, všetky moduly plynových senzorov by mali dosiahnuť operačnú teplotu predtým, než sa vykoná počiatočná kalibrácia.

Autokalibrácia môže byť nakonfigurovaná na kalibráciu všetkých modulov plynových senzorov zvlášť, alebo v akejkoľvek paralelnej kombinácii.

4.2 Nastavenie hornej a dolnej tolerancie kalibrácie

Na rozsah o ktorý môže byť kalibrácia zmenená môže byť ustanovený limit. Ak bude prekročený počas autokalibrácie, bude prerušená a bude indikovaná záhada. Ak bude prekročený počas manuálnej kalibrácie, objaví sa varovanie s možnosťou pokračovať.

Chodíte cez SETUP/UTILITY do LO & HI TOL - stlačte ENTER	
Na displeji monitora	Operácia
LOW & HIGH TOL	stlačte 'ENTER'
11 Oxygen LO TOL 00.00 %	nastavte požadovanú dolnú toleranciu kalibrácie* potom stlačte 'ENTER'
11 Oxygen HI TOL 00.00 %	nastavte požadovanú hornú toleranciu kalibrácie * potom stlačte 'ENTER'
LOW & HIGH TOL	stlačte QUIT (Ukončiť) aby ste vybrali iný senzor

* Odporúča sa, aby tolerancia nebola vyššia ako 10% FSD senzora - prednastavenie od výroby.

4.3 Manuálna kalibrácia a kontrola

Vo väčšine prípadov sa odporúča aby LOW (Nízka) kalibrácia bola vykonaná predtým, než sa vykoná akákoľvek HIGH (Vysoká) kalibrácia, avšak, **ak sa tieto hranice kalibrujú pre Zirconia senzor, opak je pravdou.**

Poznámky: (aplikujte na kalibračný postup na ďalšej strane)

- † PRESS (tlakové) kalibrácie sa týkajú len senzorov čistoty kyslíka
- * Ak sa modul zahrieva, objaví sa varovanie s možnosťou pokračovať.
- ** Ak sa kalibrácia zmenila o viac ako o toleranciu, objaví sa varovanie s možnosťou pokračovať.
- *** Ak nebola kalibrácia úspešná, objaví sa dočasný odkaz, napr. 'BAD [LOW/HIGH] CAL, CAL IGNORED' (Zlá [nízka/vysoká] kalibrácia, Kalibrácia ignorovaná). Toto naznačuje, že výstup modulu plynového senzora je značne mimo očakávaného rozsahu pre vstupujúci kalibračný plyn. Skontrolujte hodnotu kalibračného plynu.

POZNÁMKA

Ak je nakonfigurovaná autokalibrácia, manuálna kalibrácia aktivuje signalizáciu ventilu, ale relé musia byť najprv zoradené vrámci autokalibrácie.

V tomto príklade kalibrácie bol použitý senzor kyslíka v modulej pozícii 1:

Chod'te cez CALIBRATE do MANUAL CAL - stlačte ENTER	
Na displeji monitora	Operácia
CALIBRATE I1 Oxygen %	zvoľte požadované meranie, potom stlačte 'ENTER'; ak je nainštalovaný len jeden modul, táto časť bude vynechaná
LOW/HIGH/PRESS() HISTORY/CHK L&H	zvoľte 'LOW' (Nízka), potom stlačte 'ENTER' (*)
I1 LOW TARGET Oxygen 00.00%	nastavte na nízku koncentráciu kalibračného plynu, potom stlačte 'ENTER'
LT00.00 LC00.04 I1 Oxygen OK? Y/N	LT je cieľová koncentrácia LC je aktuálna koncentrácia Zaved'te plyn nízkej kalibrácie; keď sa 'LC' stabilizovala, môže byť akceptovaný (**) alebo odmietnutý
LOW CAL IN PROGRESS	dočasný odkaz, nevyžaduje sa žiadny úkon
CAL RESULT LT 00.00 LC 00.00	kalibrované snímanie sa zobrazí na 1 minútu (***) - stlačte QUIT (Ukončiť) aby ste sa dostali do ďalšieho menu
LOW/HIGH/PRESS HISTORY/CHK L&H	kalibrácia dolnej hranice je dokončená, zvoľte ďalšiu funkciu alebo stlačte 'MEASURE' (Meranie) aby ste sa dostali do displeja merania - predpokladajte že bola zvolená 'HIGH' (Vysoká) kalibrácia
I1 HIGH TARGET OXYGEN= 99.98 %	nastavte na vysokú koncentráciu kalibračného plynu, potom stlačte 'ENTER'
HT99.98 HC99.85 I1 Oxygen OK? Y/N	HT je cieľová koncentrácia HC je aktuálna koncentrácia Zaved'te plyn vysokej kalibrácie; keď sa 'HC' stabilizovala, môže byť akceptovaný (**) alebo odmietnutý
HIGH CAL IN PROGRESS	dočasný odkaz, nevyžaduje sa žiadny úkon
CAL RESULT HT99.98 HC99.98	kalibrované snímanie sa zobrazí na 1 minútu (***) - stlačte QUIT (Ukončiť) aby ste sa dostali do ďalšieho menu

Pre manuálne kontroly by sa mali používať tie isté vzorky ako pre úpravu kalibrácie, v tomto príklade kontrolnej kalibrácie bol použitý senzor kyslíka v modulovej pozícii 1:

Chodíte cez CALIBRATE do MAN CAL - stlačte ENTER	
Na displeji monitora	Operácia
CALIBRATE I1 Oxygen %	zvoľte požadované meranie, potom stlačte 'ENTER'; ak je nainštalovaný len jeden modul, táto časť bude vynechaná
LOW /HIGH/PRESS HISTORY/CHK L&H	zvoľte CHK L&H (Kontrola Nízka a Vysoká) a stlačte 'ENTER'
CHECK LOW CHECK HIGH	zvoľte 'LOW' (Nízka) alebo 'HIGH' (Vysoká)
I1 Oxygen CHK L CONC = 0.5%	Zavedte plyn nízkej kalibrácie; keď sa snímanie stabilizovalo, stlačte 'MEASURE' (Meranie) aby ste sa vrátili do displeja merania a zaznačili výsledok kontroly kalibrácie do vyrovnávacej pamäte histórie kalibrácie.
ALEBO I1 Oxygen CHK H CONC = 99.85%	
	Zavedte plyn vysokej kalibrácie; keď sa snímanie stabilizovalo, stlačte 'MEASURE' (Meranie) aby ste sa vrátili do displeja merania a zaznačili výsledok kontroly kalibrácie do vyrovnávacej pamäte histórie kalibrácie.

POZNÁMKA

Nie je možné ukončiť kontrolu kalibrácie bez toho, aby ste zaznačili výsledok do vyrovnávacej pamäte histórie kalibrácie. V súvislosti s platnosťou kontroly kalibrácie nebudú zobrazené žiadne varovania.

4.4 Kalibrácia paramagnetického snímača tlaku

(Použiteľné len pre plynový modul čistoty kyslíka.)

Aby ste mohli vykonať tento úkon, je nevyhnutné vystaviť snímač tlaku dvom rôznym vzorkovacím tlakom, keď sa bude odoberať vzorka plynu kalibrácie HIGH (Vysoká) :-

- i) odplynenie analyzéra do atmosférického tlaku
- ii) odplynenie analyzéra do jemne zvýšeného tlaku 1,25 psig / 8,6kPag nad atmosférickým tlakom

Minimálne zvýšenie tlaku vyžadované pre tento úkon je 1 psig / 6,9kPag, maximálne zvýšenie tlaku je 1,5 psig / 10,3 kPag.

Toto sa môže vykonať **dočasnou inštaláciou** vhodného ihlového ventilu na vzorkovací vývod analyzéra pre paramagnetický modul čistoty, a jeho usporiadením tak, aby sa zabránilo situácii, kedy vývod dosiahne zvýšenie vzorkovacieho tlaku v senzore. Celkový vzorkovací tok by mal však počas tejto procedúry zostať pokiaľ možno konštantný.

UPOZORNENIE

Počas tejto procedúry neprekračujte špecifikovaný maximálny tlak vzorkovacieho prívodu (pri alternatívne pohonu tlakom) ani maximálny prietok prívodu (pri alternatívne pohonu tokom), pretože môže dôjsť k poškodeniu snímača.

POZNÁMKA

Tejto procedúre **musí** predchádzať nízka kalibrácia.

Aby ste dosiahli čo najpresnejšie výsledky, plyn vysokej kalibrácie by mal byť čistý kyslík. Plyny obsahujúce menej ako 15% kyslíka **NESMÚ** byť použité pre kalibráciu snímača tlaku.

Po tejto procedúre **musí** okamžite nasledovať vysoká kalibrácia.

Chodíte cez CALIBRATE do MAN CAL - stlačte ENTER	
Na displeji monitora	Operácia
CALIBRATE I1 Oxygen %	zvoľte požadované meranie, potom stlačte 'ENTER'
LOW/HIGH/PRESS HISTORY/CHK L&H	Vykonajte 'LOW' (Nízku) kalibráciu ako je to popísané v časti 4.3
LOW /HIGH/PRESS HISTORY/CHK L&H	zvoľte 'PRESS' (Tlak), potom stlačte 'ENTER'
MEASURE P OFFSET SPECIFY P OFFSET	zvoľte 'MEASURE P OFFSET' (Meranie odchýlky tlaku), potom stlačte 'ENTER' (Ak nebola vykonaná nízka kalibrácia, objaví sa upozornenie)
O= 98.87 P = 14.70 LOW POINT OK Y/N	Zavedte plyn vysokej kalibrácie bez obmedzenia vývodu, a umožnite snímanie <u>O</u>xxygen (Kyslíka) aj absolútneho <u>P</u>ressure (Tlaku) (psia) na úplnú stabilizáciu potom si poznamenajte výsledky snímania a vzorkovacieho prietoku (snímanie tlaku sa aktualizuje každých 10s) stlačte 'ENTER' ak súhlasíte
APPLY PRESSURE I1 Oxygen	dočasný odkaz; ako plyn HIGH (Vysoká) stále prúdi, zvýšte tlak v senzore tým, že čiastočne uzavriete ihlový ventil vývodu - upravte prívod plynu, aby ste udržali prietok, ktorý ste si poznamenali
O= 107.28 P = 15.95 HIGH POINT OK Y/N	snímanie tlaku by malo byť zvýšené o 1,25 psi keď sa plne stabilizovali obe snímania (kyslík aj tlak) , stlačte 'ENTER' ak súhlasíte. Ak je zmena tlaku neadekvátna, objaví sa upozornenie ('PRESS DIFF LOW')(Rozdiel tlaku nízky) - s možnosťou opakovaného spustenia.
REMOVE PRESSURE I1 Oxygen	Dočasný odkaz Odstráňte obmedzenie z vývodu analyzéra opätovným úplným otvorením ihlového ventilu
P OFFSET psia I1 Oxygen 0.23	Dočasné zobrazenie výslednej hodnoty vyrovnávacieho tlaku
MEASURE P OFFSET SPECIFY P OFFSET	stlačte 'QUIT' (Ukončiť)
LOW/HIGH/PRESS HISTORY/CHK L&H	Vykonajte 'HIGH' (Vysokú) kalibráciu ako je to popísané v časti 4.3 (potom odstráňte ihlový ventil)

4.5 Nastavenie autokalibrácie a automatickej kontroly

S použitím do štyroch Autokalibračných skupín je možné nakonfigurovať kalibráciu, ktorá je **úplne nezávislá** od akejkoľvek konfigurácie senzorov.

Nasledujúce parametre musia byť nastavené buď pre autokalibráciu alebo automatickú kontrolu, odteraz budú označované ako "Autokalibrácia":-

- ! Čas a dátum musia byť správne nastavené pred spustením autokalibrácie.
- ! Zvolenie 'LOW' (Nízkej) alebo 'LOW & HIGH' (Nízkej a Vysokej) autokalibrácie (pamätajte, že Zirconia senzory nemôžu mať vysokú autokalibráciu)
- ! LOW (Nízka) a HIGH (Vysoká) koncentrácia kalibračného plynu
- ! Autokalibračný interval (t.j. čas medzi dvoma po sebe nasledujúcimi autokalibráciami; minimum 1 hodina, maximum 59 dní + 24 hodín).
- ! Dátum a čas začiatku cyklu (prvá autokalibrácia)
- ! Čas preplachu – tento môže byť nastavený tak, aby vyhovoval inštalácii, na hodnotu medzi 0,5 a 16 minútami, aby sa koncentrácia každého plynu stabilizovala predtým, než bude snímaná. Po každom preplachu plyn bude prúdiť ešte ďalšiu minútu, aby sa umožnilo novej 'kalibračnej' úrovni, aby bola prehliadnutá a zaznamenaná
- ! Zvolenie autokalibrácie alebo automatickej kontroly
- ! Relé kalibračného plynu (ak budú použité relé analyzéra)
- ! Je nevyhnutné špecifikovať, ktorý kalibračný plyn (1 alebo 2) bude použitý pre LOW (Nízku) kalibráciu každého senzora.

Autokalibračné skupiny

Autokalibračná skupina (pozostávajúca z jedného až štyroch senzorov) je skupina senzorov, ktoré:

- ! Budú autokalibrované spolu
- ! Zdieľajú tie isté relé kontrolujúce kalibračné plyny a, úsudkom, tie isté kalibračné plyny (ale určenie, ktorý kalibr. plyn is high (vysoká) alebo low (nízka) pre každý senzor nezávisí od skupiny)
- ! Vyžadujú ten istý typ autokalibrácie, t.j. LOW & HIGH, kontrola alebo kalibr.
- ! Vyžadujú ten istý čas preplachu

Skupiny sú nezávislé, ale autokalibrácie nemôžu prebiehať súčasne.

Mechanizmus zoradovania sa používa preto, aby sa zaistilo, že autokalibrácie nebudú zmeškané, avšak **dĺžka radu je ohraničná**. Od užívateľa sa očakáva, že sa bude snažiť vyhybať preplneniu radu čakajúcich autokalibrácií tým, že ich vopred nenaplánuje priveľa.

Obrázok C ukazuje odozvu typického senzora počas autokalibrácie, v ktorom CAL 1 je použité na nastavenie senzora na nízku hodnotu (nula) a CAL 2 na vysokú (rozpätie). Ďalšie vysvetlenie udalostí, ktoré sa objavujú v každej fáze je poskytnuté v inštalačnom manuále spolu s konfiguračnými podrobnosťami pre užívateľov, ktorí používajú výstup RS232 na ovládanie autokalibračných ventilov.

Ak zvolíte automatickú kontrolu, korekcie nie sú kalkulované ani aplikované, avšak rozsah rozdielov pri snímaní je uložený v logoch histórie kalibrácie.

POZNÁMKA

Ak sa počas autokalibračnej procedúry objaví chyba tolerancie mimo kalibrácie, potom táto môže byť odstránená len tak, že sa vykoná následný úspešný jeden cyklus automatickej alebo manuálnej kalibrácie.

Zahrievanie senzora alebo znamenie zlyhania zamedzuje autokalibráciu **všetkých** senzorov v skupine.

Chodíte cez CALIBRATION/AUTOCAL do SET UP AUTO CAL-stlačte ENTER	
Na displeji monitora	Operácia
Všetky parametre špecifické pre senzory budú nastavené ako prvé:	
CONFIG TXD CAL CONFIG CAL GROUP	zvoľte 'CONFIG TXD CAL', potom stlačte 'ENTER'
SELECT MEASURE	zvoľte senzor pre konfiguráciu. Nasledujúce by malo byť nastavené pre všetky snímače
I1 O2 LOW=00.00 %	nastavte na koncentráciu nízkeho plynu, potom stlačte 'ENTER'
I1 O2 HIGH=100.00 %	nastavte na koncentráciu vysokého plynu, potom stlačte 'ENTER' (toto sa nezobrazí ak bolo zvolené 'LOW' (Nízka), pozri ďalšiu stranu)
I1 O2 LOW GAS IS 1/2 ?	zvoľte ktorý plyn (CAL1 alebo CAL2) je nízky plyn pre tento senzor, potom stlačte 'ENTER'
ASSIGN I1 to CAL GROUP 1	zvoľte Autokalibračnú skupinu ku ktorej bude pridelený snímač, potom stlačte 'ENTER'
Keď boli nastavené všetky parametre pre všetky senzory, ktoré budú kalibrované, je nevyhnutné, aby bol každý pridelený do nejakej skupiny:	
CONFIG TXD CAL CONFIG CAL GROUP	zvoľte 'CONFIG CAL GROUP' (Konfigurovať kalibr.skupinu), potom stlačte 'ENTER'

SELECT CAL GROUP	zvoľte skupinu na konfiguráciu, ak k skupine nie sú priradené žiadne senzory, nemôže byť zostavená. Použite možnosť CONFIG TXD CAL a stanovte skupinu.
CAL GROUP 1 ENABLE / DISABLE	nastavte ako je požadované, potom stlačte 'ENTER'. (Ak to nie je umožnené, autokalibrácie a vzdialené autokalibrácie sa neudejú)
SELECT AUTOCAL LOW / LOW & HIGH	nastavte ako je požadované, potom stlačte 'ENTER'
SELECT MODE AUTO CAL/CHK	nastavte ako je požadované, potom stlačte 'ENTER'
SAMPLE/ CAL RELAY 0.1 CURRENT	nastavte ako je požadované, potom stlačte 'ENTER'
CAL 1 /CAL 2 RELAY 0.2 CURRENT	nastavte ako je požadované, potom stlačte 'ENTER'
SET FLUSH TIME 0.5 Min	nastavte ako je požadované, potom stlačte 'ENTER'
ENTER PERIOD DAYS 00	nastavte ako je požadované, potom stlačte 'ENTER'
ENTER PERIOD HOURS 00	nastavte ako je požadované, potom stlačte 'ENTER'
TIME 12:07:16 DATE 10/11/95	Dočasné zobrazenie aktuálneho času a dátumu
ENTER START TIME YEAR 0000	nastavte ako je požadované, potom stlačte 'ENTER'
ENTER START TIME MONTH 00	Ako je uvedené vyššie
ENTER START TIME DAY 00	Ako je uvedené vyššie
ENTER START TIME HOUR 00	Ako je uvedené vyššie
ENTER START TIME MINUTE 00	Ako je uvedené vyššie
TIME 12:00:00 DATE 10/12/95	Dočasné zobrazenie času štartu a dátumu
Zopakujte horeuvedené pre všetky definované Kalibračné skupiny	

Spustenie autokalibrácie alebo automatickej kontroly pomocou klávesnice

Chodíte cez CALIBRATION/AUTOCAL do ONE CYCLE - stlačte ENTER	
Na displeji monitora	Operácia
SELECT CAL GROUP	zvoľte skupinu pre autokalibráciu, potom stlačte 'ENTER'

Spustenie autokalibrácie/automatickej kontroly pomocou externého uzatvorenia kontaktu

Autokalibrácia môže byť spustená uzatvorením externého spínača (pozri inštalačný manuál pre podrobnosti). To spustí kalibráciu u všetkých **aktivovaných** skupín postupne. Tento vstup bude ignorovaný ak autokalibrácia už prebieha.

Deaktivovanie/Aktivovanie autokalibrácie a automatickej kontroly

Zvoľte AKTIVOVAŤ alebo DEAKTIVOVAŤ z možností menu CONFIG CAL GROUP (Konfigurovať kalibračnú skupinu), stlačte ENTER, potom stlačte QUIT (Ukončiť) v odkaze "SELECT AUTOCAL" (Zvoľte autokalibráciu), pozri strana 26.

TAKTIEŽ:

Aby prebehla jednorazová autokalibrácia, v stanovenom čase štartu:-

Nastavte PERIOD DAYS (Cyklus dni) = 00 a PERIOD HOURS (Cyklus hodiny) = 00

Potom, aby ste zase aktivovali časovanú autokalibráciu alebo automatickú kontrolu :-

- i) nastavte PERIOD (Cyklus) na správny čas (nie nula)
- ii) znovu nastavte čas štartu

Poznámka: možnosť ONE CYCLE (Jeden cyklus) v menu je vždy aktivovaná.

5. PREHLIADANIE SÚBOROV KONFIGURÁCIE A HISTÓRIE

5.1 Zobrazenie 'aktuálnych' alarmov a závad

Chod'te cez ALARMS do DISPLAY ALARMS - stlačte ENTER	
Na displeji monitora	Operácia
I1 O2 AL1 99.98 HIGH	objaví sa prvý alarm, ak existujú aj ďalšie alarmy, zobrazí sa šípka; použite klávesy šípiek na prístup k nim

Chod'te cez FAULTS/FAILURE do DISPLAY FAILURES - stlačte ENTER	
Na displeji monitora	Operácia
I1 CELL TEMP LOW	objaví sa prvá závada, ak existujú aj ďalšie závady, zobrazí sa šípka; použite klávesy šípiek na prístup k nim

Chod'te cez FAULTS/MAINTENANCE do DISPLAY MAINT - stlačte ENTER	
Na displeji monitora	Operácia
I1 LO CAL TOL FAIL	objaví sa prvá závada, ak existujú aj ďalšie závady, zobrazí sa šípka; použite klávesy šípky na prístup k nim

5.2 Zobrazenie nastavení alarmu

Chod'te cez SETUP/DISPLAY do ALARMS - stlačte ENTER	
Na displeji monitora	Operácia
SELECT MEASURE I1 Oxygen	použité šípky a zvolte požadované meranie. Potom stlačte 'ENTER'
I1 Oxygen AL1 LO 80.00% DISAB	konfigurácia každého zo štyroch alarmov (AL1 až AL4) sa zobrazí na dvoch obrazovkách, čo znamená, že celkovo budete prehliadať osem obrazoviek; použite šípku hore aby ste sa dostali k ďalšej obrazovke
I1 Oxygen AL1 LO HYST 0.1% FOL	
.....ATĎ.....	
I1 Oxygen AL4 LO HYST 0.1% FOL	toto je posledná z ôsmich obrazoviek, stlačte 'QUIT' (Ukončiť) aby ste zvolili iné meranie.

5.3 Zobrazenie konfigurácie výstupu

Relé

Chod'ťe cez SETUP/DISPLAY do RELAYS - stlačte ENTER	
Na displeji monitora	Operácia
DISPLAY RELAY 1.3 ASSIGNED <i>alebo</i> 1.3 UNASSIGNED	použite klávesy šípiek a zvolte požadované relé, potom stlačte 'ENTER'
1.3 I4 Oxygen AL4 LO 0.000 % <i>alebo</i> HI 98.00 % <i>alebo</i> FAILURE <i>atd'.</i>	zobrazí sa prvé priradenie k tomuto relé; ak existujú aj iné priradenia, zobrazí sa šípka, použite klávesy šípiek na prístup k nim stlačte 'QUIT' (Ukončiť) aby ste zvolili ďalšie relé

mA výstupy

Chod'ťe cez SETUP/DISPLAY do mA OUTPUT - stlačte ENTER	
Na displeji monitora	Operácia
DISPLAY mA OUTPUT 1.1 ASSIGNED <i>alebo</i> 1.1 UNASSIGNED	použite klávesy šípiek a zvolte požadovaný výstup, potom stlačte 'ENTER'
1.1 I1 Oxygen R1 L=99.000U=100.00	informácie na každom analógovom výstupe sú zobrazené na štyroch obrazovkách; použite šípku hore aby ste sa dostali k ďalšej obrazovke
1.1 I1 Oxygen R1 4-20mA FREEZE	
1.1 I1 Oxygen R2 L=99.000U=100.00	
1.1 I1 Oxygen R2 0-20mA FOLLOW	toto je posledná zo štyroch obrazoviek, stlačte 'QUIT' (Ukončiť) aby ste zvolili ďalší analógový výstup

5.4 Zobrazenie histórií analyzéra

Xentra uchováva zápisy do histórie (až do 40 na jednu 'časť') pre nasledujúce udalosti:

Alarmy: zápis sa vykoná zakaždým keď sa objaví alarm ('ON'), alebo keď je vymazaný ('OFF'), a to v nasledujúcom formáte:

[modul plynového senzora poloha číslo] [názov merania] [poradové číslo alarmu] [úroveň alarmu] [obsah alarmu]

napr. I2 O2 AL2
98.00 LOW

Chodíte cez ALARMS do ALARM HISTORY - stlačte ENTER	
Na displeji monitora	Operácia
Oxygen AL2 ON 12:13:20 12/06	použite šípku hore ak si chcete prehliadnuť ďalšiu obrazovku, stlačte 'MEASURE' (Meranie) aby ste sa vrátili do zobrazenia merania

Závady: zápis sa vykoná zakaždým keď sa objaví závada, alebo keď je vymazaná. Existujú dva súbory histórie, jeden sa týka ZLYHANÍ, druhý ÚDRŽBY.

Pozrite do manu menu. chodíte do FAULTS - stlačte ENTER	
Na displeji monitora	Operácia
FAILURE MAINTENANCE	zvoľte možnosť ktorú potrebujete, potom stlačte 'ENTER'
DISPLAY FAILURES FAILURE HISTORY ALEBO DISPLAY MAINT MAINT HISTORY	zvoľte požadovanú históriu, potom stlačte 'ENTER'
SELECT OBJECT I1,I2,I3,I4,E1,E2, CHASSIS or ALL.	zvoľte objekt, ktorého log si chcete prezrieť, potom stlačte 'ENTER'
I1 CELL TEMP LO 12:13:20 12/06	použite klávesy šípok ak si chcete pozrieť ďalšie zápisy

Kalibrácia: zápis sa vykoná zakaždým keď sa vykoná kalibrácia, alebo kalibračná kontrola, a to v nasledujúcom formáte:

[modul plynového senzora poloha číslo] [názov merania] [typ kalibrácie] [rozdiel]
[čas a dátum]

napr. I3 Oxygen CML 0.213
14:54:20 24/07

Typy kalibrácie: C alebo V C (kalibrácia) alebo (Validation) kontrola kalibrácie
M alebo A Manuálna alebo Automatická.
L alebo H Low (Nízka) alebo High (Vysoká)
MPO Odchýlka nameraného tlaku snímača *
SPO Odchýlka špecifického tlaku snímača *

Rozdiel: Rozdiel medzi nameranou a cieľovou koncentráciou, (aktuálna nameraná hodnota - cieľová hodnota kalibračnej vzorky, t.j. kladné číslo znamená kladnú tendenciu).

* Aplikovateľné len na paramagnetické moduly čistoty kyslíka.

Chodíte cez CALIBRATE/MANUAL CAL do HISTORY- stlačte ENTER	
Na displeji monitora	Operácia
LOW/HIGH P OFFSET HISTORY	zvoľte históriu, ktorú si chcete pozrieť, potom stlačte 'ENTER'
I1OxygenCML0.213 01:15:20 28/11	použite klávesy šípiek aby ste si pozreli ďalšie zápisy

5.5 Zobrazenie identity analyzéra a diagnostika

Identita

Chodíte cez SETUP/DISPLAY do ID - stlačte ENTER	
Na displeji monitora	Operácia
XENTRA 4100 REV 04000/651/0	použite šípku hore aby ste sa pozreli na nasledujúcu obrazovku
MODEL4104C1	použite šípku hore aby ste sa pozreli na nasledujúcu obrazovku
S NUM 1234 ORDER NUM 845123 TRANSDUCER I1 PARAMAGNETIC TRANSDUCER I2 ZIRCONIA etc	stlačte 'MEASURE' (Meranie) aby ste sa vrátili do zobrazenia merania

Signály merania z plynových senzorov môžu byť zobrazené pre diagnostickú informáciu, typické príklady sú uvedené nižšie:

Chodíte cez SETUP/DISPLAY do DIAGNOSTICS - stlačte ENTER	
Na displeji monitora	Operácia
I2 CELL EMF 0.234 Volts	použite šípku hore aby ste sa pozreli na nasledujúcu obrazovku
I2 CELL TEMP 35.5 °C	použite šípku hore aby ste sa pozreli na nasledujúcu obrazovku
I1 CO2 DIF SIG 0.003 Volts	použite šípku hore aby ste sa pozreli na nasledujúcu obrazovku
I1 CO2 GAS SIG 0.900 Volts	použite šípku hore aby ste sa pozreli na nasledujúcu obrazovku alebo stlačte 'MEASURE' (Meranie) ak sa chcete vrátiť do zobrazenia merania

Pre získanie podrobností súvisiacich s diagnostikou, prosím obráťte sa na Servisný manuál Xentra, časť číslo 04000002C.

Operation Manual for an Electrically Heated Tubular Furnace

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1 TECHNICAL DATA

type:	RDTM
size:	2/12 D
apparatus no.:	a17604
year of construction:	2004
rated temperature:	550° C
heating-up time:	approx. 0.06 h
rated connection power:	approx. 0.15 kW
rated connection voltage:	230 V, 1/N/PE, 50 Hz
admissible furnace atmosphere:	air
dimensions of the usable chamber:	Ø 20 mm, 125 mm deep

2 GENERAL INFORMATION

The following guidelines for the operation of the tubular furnace shall only give an overview on how to use it.

They do not release from careful handling and consideration of the general laboratory guidelines, the rules for the prevention of accidents and the safety-relevant guidelines for the operation of furnaces according to the standards of EN60519, IEC519 and EN746.

Liability is not accepted for damages which were caused by insufficient maintenance and incorrect operation.

When inserting the furnace into a switch cabinet sufficient ventilation has to be provided so that an ambient temperature of 40 °C is not exceeded.

No inflammable materials may be arranged above the furnace. If necessary, the customer has to provide additional thermal insulation measures.

Control on receipt:

On the basis of the accompanying documents the customer has to check the consignment concerning completeness and eventual transport damages.

Complaints have to be made immediately to the address of the responsible forwarder resp. of the supplier.

3 APPLICATION

The tubular furnace is suitable for the use of a customer's retort.

However, it has to be taken into consideration that the apparatus is not explosion-proof!

4 STRUCTURE

The furnace is constructed as tubular furnace in a 19" insertion enclosure with horizontal tube. A customer's retort can be inserted from the back side. A temperature regulator as well as an ON/OFF switch is built into the front part of the insertion enclosure. The fuses are inside the enclosure. The power supply is effected via a connection cord with earthing contact-type plug at the back side of the insert.

The temperature regulator is adjustable from 0 to 550 °C. The thermocouple type K is arranged under the heating wire winding in a ceramic tube.

Furthermore, the furnace is equipped with a safety temperature limiter, which consists of a safety regulator, a separate pair of thermocouples and a separate relay. The safety temperature limiter is factory-adjusted to a temperature of 570°C, which must not be in

(1

(2

increased by customer. If the temperatur limit if 570°C is exeeded, this results in a safety-related automatic switch-off of the farnace.

The chrome nickel heating coils are embedded and insulated against to high thermal losses by means of a temperature-specific fibre insulation.

5 INSTALLATION

For reasons of safety at the working place please consider the „**Guidelines for Laboratories**“, ZH 1/119“ when installing the furnace.

6 COMMISSIONING

After having installed the furnace under consideration of the afore mentioned safety prescriptions the furnace can be started.

- a) Connect the furnace to 230 V, 50 Hz, adjust the desired value at the temperature regulator to the desired working temperature.
- b) The furnace heats up to the adjusted desired temperature and regulates it automatically.
- c) Switching off is effected by resetting the desired value to "0".

7 DOCUMENTS DELIVERED

test report	R – QPP – 42 – 901, sheets 1 to 3
wiring diagram RDTM 2/12-D	Z 602 060 E, sheet 1
CE declaration of conformity (NSP, EMV, MSR)	K 920.03 / 09.08.2004
operation manual	compact microprocessor regulator JUMO iTRON B 70.2040 01.04/00359898 JUMO

