SERVOMEX
ANALYZERS
HIGH-PERFORMANCE GAS ANALYSIS

SERVOTOUGH OxyExact 2223

INSTALLATION MANUAL

Part Number: **02223005A**
Revision: **13**
Language: **UK English**

SERVOMEX
a spectris company

This page intentionally blank.

IMPORTANT INFORMATION

Continued safe and reliable operation of this equipment is conditional on all installation, operation and maintenance procedures being carried out in accordance with the appropriate manuals, by personnel having appropriate qualifications, experience and training.

Failure to observe the requirements of the manual may result in the user being held responsible for the consequences and may invalidate any warranty.

Servomex will accept no liability for unauthorised modifications to Servomex supplied equipment.

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

In line with our continuous policy of research and development, we reserve the right to amend models and specifications without prior notice.

This handbook is accurate at the date of printing but will be superseded and should be disregarded if specifications or appearance are changed.

Servomex is a registered trademark of Servomex Group Limited. The use of all trademarks in this document is acknowledged.

This page intentionally blank.

Table of Contents

Table of Figures

This page intentionally blank.

About this manual

Safety information

The following icons are used throughout this manual to identify any potential hazards that could cause serious injury to people or damage to the equipment:

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

This symbol warns of specific hazards from laser radiation.

This symbol warns of specific hazards from high temperatures.

Other information provided by the manual

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

Note: *Notes give extra information about the equipment.*

Hint: *Hints give helpful tips.*

Scope of the manual

This manual is the Installation Manual of the SERVOTOUGH OxyExact 2223. It covers the installation and routine maintenance of the product.

Other documents for the SERVOTOUGH OxyExact 2223 are listed below:

Document	Description	Document number
Operator Manual	SERVOTOUGH OxyExact Control Unit Operator Manual	02210001A
Certification Supplement Manual	SERVOTOUGH OxyExact Series Certification Supplement Manual	02200008A

This page intentionally blank

1. Introduction

1.1 General Description

The SERVOTOUGH OxyExact Transmitter Unit is a paramagnetic oxygen transmitter specifically designed for high performance measurements in the process industry. It offers the following:

- Servomex oxygen specific, field proven paramagnetic technology
- Measurement of oxygen in potentially flammable sample gases
- Certification for hazardous areas, flammable dust and flammable gas atmospheres
- Simple transmitter operation or it may be used in conjunction with a SERVOTOUGH OxyExact Control Unit (by two-wire digital connection for ease of installation)

The transmitter is designed for use on process control applications such as the manufacture of ethylene oxide, propylene oxide, ethylene dichloride, vinyl acetate monomer acid and similar applications, where a high-performance oxygen measurement is required.

1.1.1 Standard Attributes

- The measurement is made using Servomex proven paramagnetic technology
- All internal pipework is metallic
- An intrinsically safe configurable mA output
- Three intrinsically safe 'NAMUR' (fault, maintenance required, in service) contact pairs
- Connections for an external pressure transducer
- Connections for an external cross interference signal
- Connections and drivers for two external flow sensors
- Connections for four digital logic inputs
- The integral software, coupled with a number of the above, will allow the transmitter to operate as a 'stand-alone' entity
- Simple connection, when required, to a control unit – two-wire, intrinsically safe, digital link

1.1.2 Optional Attributes

- Internal pressure transducer
- Stainless steel or Hastelloy pipework (latter usually with solvent resistant cell)
- Sample gas flow either 200ml/min or 1l/min nominal
- Internal filter (for cell protection purposes only)
- Internal flow alarm

1.2 Product Conformity

Please refer to the relevant EU or GB declaration of conformity or certificate within the Certification supplement manual 02200008A for details on applicable product conformity.

1.3 Hazardous Area Approval and Certification

Refer to Certification Supplement 02200008A

Copies of the Hazardous Area Certificates are held in the Certification Supplement (02200008A). In summary, the SERVOTOUGH OxyExact Transmitter Unit is certified for use in Zone 1/Division 1 areas (both gases and dusts) and is available with the following hazardous area approvals:

USA

FM Class I, Division 1, Groups A, B, C and D
FM Class II, Division 1, Groups E, F and G
FM Class III, Division 1
Type 4X, T4, ambient temperature 50°C maximum

Also, American Class I, Zone 1 approval, AEx d ia IIC T4 (Ta = 50°C).

Certificate number: FM22US0096X

Canada

CSA Class I, Division 1, Groups A, B, C and D
CSA Class II, Division 1, Groups E, F and G
CSA Class III, Division 1
Type 4X, T4, ambient temperature 50°C maximum

Also, Canadian Class I, Zone 1 approval, Ex d ia [ia] IIC T4 (Ta = 50°C).

Certificate number: 1193572

Europe

The transmitter unit is ATEX approved (both gases and dusts) with the following marking:

 II 2(1)GD
Ex db ia [ia Ga] IIC T4 Gb
Ex tb IIIC T70°C Db
IP66 (-20°C < Ta < +50°C)
250V~ Max. 100VA

Certificate number: BAS01ATEX2289X

Great Britain

The transmitter unit is UKEX approved (both gases and dusts) with the following marking:

 II 2(1)GD
Ex db ia [ia Ga] IIC T4 Gb

Ex tb IIIC T70°C Db
IP66 (-20°C < Ta < +50°C)
250V~ Max. 100VA

Certificate number: BAS21UKEX0482X

International

The transmitter unit is IECEx approved flameproof, intrinsic safety and dust ingress protection.

Ex db ia [ia Ga] IIC T4 Gb
Ex tb IIIC T70°C Db
IP66 (-20°C ≤ Ta ≤ +50°C)

Certificate number: IECEx BAS 04.0027X

Japanese

The transmitter unit is CML approved flameproof, intrinsic safety and dust ingress protection.

Ex db ia [ia Ga] IIC T4 Gb
Ex tb IIIC T70°C Db
IP66 (-20°C ≤ Ta ≤ +50°C)

Certificate number: CML 20JPN2104X

In addition, the serial number and year of manufacture are marked on an external rating label with duplicate details within the unit.

This page intentionally blank.

2. INSTALLATION

WARNING
You must ensure that, when the analyser is in its installation location:

- To avoid propagating brush discharges, the unit is not to be installed in a high velocity dust laden atmosphere.
- The unit must only be cleaned with a damp cloth.

This section gives an overview of the installation and includes details of the signal outputs and inputs available in the SERVOTOUGH OxyExact Transmitter Unit. It also outlines conditions of use that should be considered prior to installation.

Installation will require only the use of standard hand tools.

Section 3 carries details of mechanical installation. See Section 4 for electrical installation.

Section 5 details sample gas conditioning requirements.

The installer is advised to read all parts of this manual before commencing installation.

2.1 Overview of the Installation

The SERVOTOUGH OxyExact system consists of a SERVOTOUGH OxyExact Control Unit and one or more transmitter units which contains the gas measuring device. The two units can be located up to 1km apart (total cable length).

A single control unit can be connected to one or more transmitter units using a two- wire semi-duplex connection. The configurations possible are shown in Figure 2-1.

The transmitter unit contains the measuring cell in a temperature controlled enclosure and, as well as facilitating system configurations shown in Figure 2-1, provides the following intrinsically safe connections:

- One 0/4-20mA output signals for gas concentration
- Three relays for fault status according to NAMUR recommendation NA64
- Two 0/4-20mA inputs for external signals such as sample pressure or cross-sensitivity correction
- Four digital input signals for the status of associated external devices or initiating specific functions
- Two connection pairs for external flow alarm devices

The transmitter unit also requires connection to the electrical supply independent of a control unit.

Installation details in this manual do not include operation. See the Operator manual for this information.

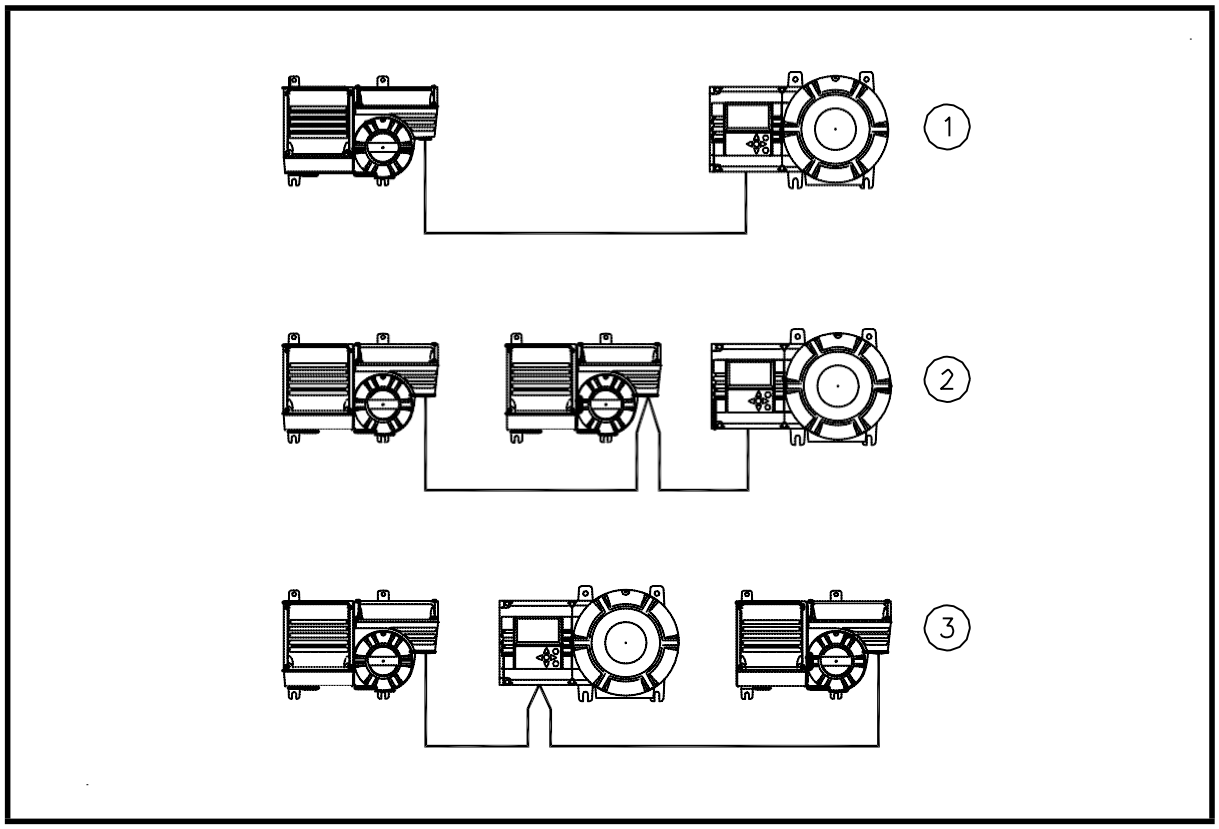

Figure 2-1: Analyser system configurations

Key to Figure 2-1

1. Control unit connected to a single transmitter unit
2. Multiple transmitter units with the control unit terminating the connecting cable
3. Multiple transmitter units with the transmitter units terminating the connecting cable

2.2 Installation Location

The equipment complies with EN 61010-1: 2001 2nd Edition (IEC 61010-1).

If the transmitter unit is to be installed in an area which may be hazardous due to the presence of flammable vapours, gases or dusts then any "Special Conditions for Safe Use" and/or "Schedules of Limitation", as detailed in the Safety Certification, must be followed.

The degree of protection of the enclosure is IP66 and NEMA 4X.

The SERVOTOUGH OxyExact Transmitter Unit may only be wall mounted. The site chosen should be protected from extreme weather conditions. Consideration should be given to the effect of sun, rain, snow or wind on the ambient temperature rating. It may be necessary to install the unit in a protective enclosure.

Ambient operating temperature range is -20°C to +50°C (-4°F to 122°F).

Ambient temperature fluctuations should be minimised. If low ambient temperatures are expected, then a heated enclosure may be required.

There should be adequate room for installation and subsequently servicing the unit.

The location should be reasonably vibration-free. Vibration of the transmitter unit may degrade the measurement precision. In applications where excessive vibration may be present, for example, on ships near large motors, consideration should be given to using anti-vibration mounts.

Relative humidity <95%, non-condensing.

The SERVOTOUGH OxyExact Transmitter Unit is rated in accordance with IEC 664 for "Pollution Degree 2".

Note: *Where the installation is such that the enclosure ingress protection is maintained to IP66 (NEMA 4X) and covers remain securely fitted, the apparatus is suitable for use in locations where there may be significant deposits of dusts or fibres, (Pollution Degree 4) and/or where there may be drips, splashes of water or subjected to hose down.*

Note: *The covers may be removed during installation or servicing only if there is negligible risk of pollution or contamination of the electronic circuits contained within the enclosures and the covers are securely replaced immediately after the operation is completed.*

Altitude <3,000m (10,000ft)

2.3 Sample Gas Conditioning

The minimum requirement would be to control the sample gas pressure and flow rate. Depending on sample gas composition it may be necessary to remove condensate and particulate matter.

When operating with high pressure (greater than 18psia, 124kPa) additional sample gas conditioning is required (see Section 5).

It is envisaged that all sample conditioning requirements will have been considered prior to receipt of the unit, however, Section 5 of this manual includes information pertinent to the system design.

2.4 Electrical Supply Requirements

The supply must be switched and fused external to the transmitter unit.

The electrical installation must comply with the requirements for the hazardous zone of the location and any local or national regulations.

An electrical supply is required. The SERVOTOUGH OxyExact Transmitter Unit is rated in accordance with IEC 664 for "Installation Category II".

The SERVOTOUGH OxyExact Transmitter Unit is designed for use with a "grounded neutral" supply and must also be connected to an external protective earthing system.

Rated voltage range:

The SERVOTOUGH OxyExact Transmitter Unit is factory configured to operate over the range:

100V ac to 120V ac, or
220V ac to 240V ac

The required range must be specified at time of order.

The transmitter unit includes an internal replaceable fuse, rated at F 1.6Amp HRC and power consumption is 100VA max. The supply installation should be rated accordingly.

2.5 Signal Outputs/inputs

All outputs and inputs are designed to form part of an intrinsically safe system. Configuration is changed via the digital communication port and any SERVOTOUGH OxyExact Control Unit may be used (refer to Operator manual).

2.5.1 Analog Output Board

The mA output is designed such that, whilst the hardware will limit maximum current to 21.5mA, under normal operation the output will not exceed 20.5mA.

Maximum load resistance – 600 ohms

500V minimum isolation voltage

According to NAMUR specification NE43

A number of features associated with the mA output may be configured:

1. The nominal output range may be set up to be 0 - 20 or 4 - 20mA and optionally reversed, i.e. 20 - 0 or 20 - 4mA.
2. The corresponding oxygen values at the nominal limits may be set to two decimal places within the range -25% to 150% oxygen (a minimum difference of 0.5% oxygen is recommended).
3. When a 4mA limit is selected, an absolute under range value may be set.
4. The output may be set to 'Jam' (either low; 0.00mA or high; 21.0mA) under transmitter fault conditions. The output will be 0.00mA when the transmitter is de-energised.
5. Under controlled calibration conditions (e.g. autocalibration), the output may be set to 'Freeze' (i.e. the output will 'not Follow' the gas concentrations during calibration).
6. The oxygen measurement may have additional filtering imposed – this affects both the mA output and any digitally transmitted oxygen signal to the control unit.

2.5.2 Status Outputs

Three contact pairs exist for status signals that can be interrogated by an external system to transmit the operational status of the transmitter unit (the signals are also available at the control unit).

CAUTION
Refer to Certification Supplement 02200008A
The rating of the contacts is dependent upon certification.

Status is defined in accordance with NAMUR recommendation NA64, i.e.:

NAMUR NAS4 terminology	Meaning	OxyExact 2200 system display
"Breakdown"	The measured signal is invalid due to a fault on the transmitter unit or its peripheral equipment	Fault
"Check request"	The measured signal is still valid but the "attrition reserves" will soon be used up.	Maintenance required
"In service"	Work is in progress on the transmitter unit	Service in progress

Table 2-1: NAMUR NAS4 vs System Display

The function of the status outputs may not be re-assigned.

The contacts will be open circuit when de-energised.

Whilst the following may be customised, factory settings are configured such that:

Transmitter status	Status output designation	Output condition
Transmitter unit fault exists	Fault	Open
No transmitter unit fault exists	Fault	Closed
Maintenance required	Maintenance	Open
Maintenance not required	Maintenance	Closed
Transmitter unit operational	Service	Closed
Transmitter unit in service mode	Service	Open

Table 2-2: Status outputs – factory settings

2.5.3 Analog inputs

Two 0/4-20 mA input channels, non-isolated, primarily intended for signals from an external pressure transmitter or a signal for cross interference correction. These inputs are freely configurable in software and may also be used for re-transmission of other, externally generated, analog signals to the control unit.

2.5.4 External flow alarm inputs

Two channel pairs, non-isolated, for inductive/proximity type flow detectors, intrinsically safe in accordance with BS EN 50227 (DIN 19234/NAMUR).

Voltage:	8Vdc
Current:	8mA (max)

Such sensors cannot be used with flowmeters using non-conductive floats, for example, ceramic.

2.5.5 Digital status inputs

External connections to four digital inputs, non-isolated, may be made. These may be configured to activate the SERVOTOUGH OxyExact Transmitter status functions, dependent upon an external event (e.g. alternative flow alarm) or assigned to specific transmitter action functions.

Transmitter status functions are:	Fault
	Maintenance Request
	Service in Progress
	Message

All of these signals are relayed back to any control unit fitted. The message status is only reflected at the control unit whilst the Fault, Maintenance and Service functions also cause the relevant status output signals to be generated by the transmitter (reference 2.5.2) as well as any action on the transmitter analog output (reference 2.5.1) to be taken.

Transmitter action functions are:	Calibrate zero point
	Calibrate span point

Whilst the following may be customised, as supplied, the following set-up is configured but not enabled. To activate the commands, the functions must be enabled within software and either momentary (between 0.5 and 1.5 seconds) or closed connections made:

Input 1:	Momentary Contact Calibrate Zero
Input 2:	Momentary Contact Calibrate Span
Input 3:	Closed Contact – set status to 'Service in Progress'"
Input 4:	Not Used

When used as the calibration interface, it is first necessary to configure low (zero) and high (span) calibration values to suit calibration gases, within the following parameters:

Concentration – percent oxygen	Permissible range	Recommended range	Default setting
Zero Gas Target	-10.00 to 99.00	0.00 to 5.00	0.00
Zero Gas Tolerance	0.10 to 10.00	0.50 to 5.00	2.00
Span Gas Target	0.00 to 125.00	10.00 to 100.00*	20.95
Span Gas Tolerance	1.00 to 50.00	2.50 to 25.00	5.00

Table 2-3: Calibration parameters

*It is strongly recommended that the span gas is at least 5% greater than the zero gas.

2.6 Tag Numbers

The transmitter unit enclosure must not be drilled or modified in any way. A tag number may be written on the unit identification label on the side of the unit. The system can also be configured to show a tag number on the control unit display.

3. MECHANICAL INSTALLATION

3.1 Unpacking and Inspection

WARNING
The transmitter unit weighs approximately 15Kg (33lbs). Care must be taken when handling it.

Remove the SERVOTOUGH OxyExact Transmitter Unit and accessories from their packing and inspect for any damage due to transit.

If damage has occurred, inform Servomex or its agent immediately. Retain all packing and shipping information.

Check that the supplied parts agree with the purchase specification. See also any Instrument Modification Sheets which may form part of this manual.

Supplied parts:

- One SERVOTOUGH OxyExact Transmitter Unit
- One accessories kit comprising:
  - Spare fuses
  - 2 x Allen key
  - 1 x Installation manual

(Other order specific items may also be included.)

3.2 Transmitter Unit Description

The SERVOTOUGH OxyExact Transmitter Unit is essentially an aluminium enclosure finished with a protective epoxy powder paint. All weatherproof seals are silicone rubber.

The unit comprises three separate compartments (see Figure 3-1);

Lower Right: An explosion proof enclosure for the power supply and intrinsic safety components that supply electrical power to the rest of the unit. Connection to the electrical power supply is made inside the enclosure.
Access to this enclosure is by releasing the locking screw in the explosion proof cover and unscrewing it anti(counter)-clockwise.

Upper Right: An enclosure for the signal processing electronics and all user connections. The electronics are intrinsically safe. Access to this enclosure is by removing the 4 screws securing the cover.

Left: A second enclosure containing the measuring cell and pressure transducer (option). Gas connections are made to this enclosure.

3.3 Fixing Centres

The transmitter unit must be mounted on a vertical surface (wall mounted). See Figure 3-1 for fixing centres and dimensions. Note that there should be sufficient space at the base and sides of the enclosure for routing cables, sample pipework and opening covers, etc.

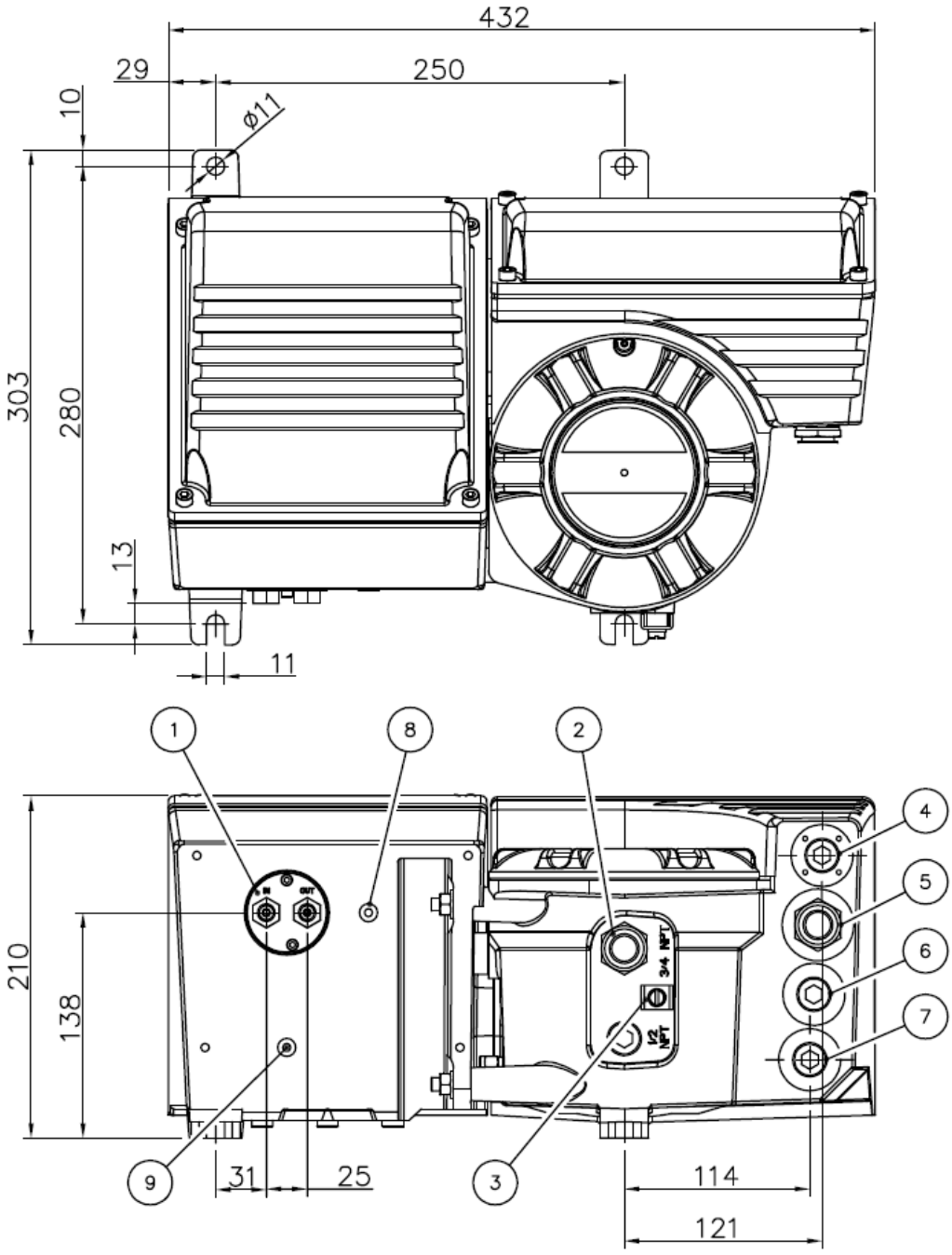

Figure 3-1: Mechanical arrangement

Key to Figure 3-1

1. Sample gas connections (leader line indicates gas inlet port position)
2. Power cable entry
3. Functional (EMC) earth/ground terminal
4. Signal cable entry
5. Signal cable entry
6. Signal cable entry
7. Signal cable entry
8. Corrosive purge gas outlet
9. Corrosive purge gas inlet

This page intentionally blank.

4. ELECTRICAL INSTALLATION

WARNING
The Intrinsically Safe circuits described as “isolated” (TB01/2-7, TB01/8&9 and TB03/7-10) are galvanically isolated for voltages up to 375V peak. The Intrinsically Safe circuits described as “isolated” (TB04/1-4, TB03/2-5 and TB02/2-9) are connected to the earth reference of the apparatus. This must be taken into account in any installation where the apparatus is used.

CAUTION

- It is a condition of certification that the unit must be installed following the appropriate national or international legislation or codes of practice. In particular, the correct glands must be fitted to cable entries and the weatherproofing of the enclosure must not be compromised.
- To retain certification the unit must not be modified, mechanically or electrically. Additional holes must not be drilled into any part of the unit's enclosure.
- Insulation testing: to prevent damage to the transmitter unit it is necessary to disconnect cables being tested from the unit.

WARNING
The installation must conform to relevant safety requirements, National Electrical Code and any local regulations. The installation must be safe for any extremes of operating conditions which may occur in the operating environment of the analyser system.

4.1 CE & UKCA Markings

The SERVOTOUGH OxyExact oxygen analyser system complies with the European Directives on CE Marking and Electromagnetic Compatibility. The SERVOTOUGH OxyExact oxygen analyser system complies with the UK Statuary Instruments on UKCA Marking and Electromagnetic Compatibility.

CAUTION

- To comply with EMC emissions and susceptibility standards the interconnecting cables used for all signal inputs and outputs must be screened/shielded or equivalent protection provided.
- To comply with EMC emissions and susceptibility standards the functional earth/ground must always be connected to a local EMC ground.

4.2 Glands and Cable Entries

WARNING
For gland entries to the flameproof enclosure, suitable Ex d equipment certified stopping plugs or gland fittings shall be used. Refer to applicable hazardous area certificate for conditions of use.

All cable entries must be fitted with appropriate glands or plugs to maintain the required weatherproofing of the enclosures. Whilst the SERVOTOUGH OxyExact has been tested to meet IP66 actual certification requirements are less onerous, however, as a minimum:

All entries to the enclosure must be sealed to meet IP20.

When used in a hazardous dust area, all entries to both enclosures must be sealed to meet IP6X.

Reminder: to maintain the full integrity of the transmitter unit all entries to both enclosures must be sealed to meet IP66.

Power supply cable entry:	1 x 3/4" NPT
Signal cable entries:	1 x 3/4" NPT and 3 x ½” NPT

Accessories are available to convert to M20 or PG 13.5 and are supplied if ordered.

4.3 Identification and Location of Components

See Figure 4-1 for location of terminal blocks, etc.

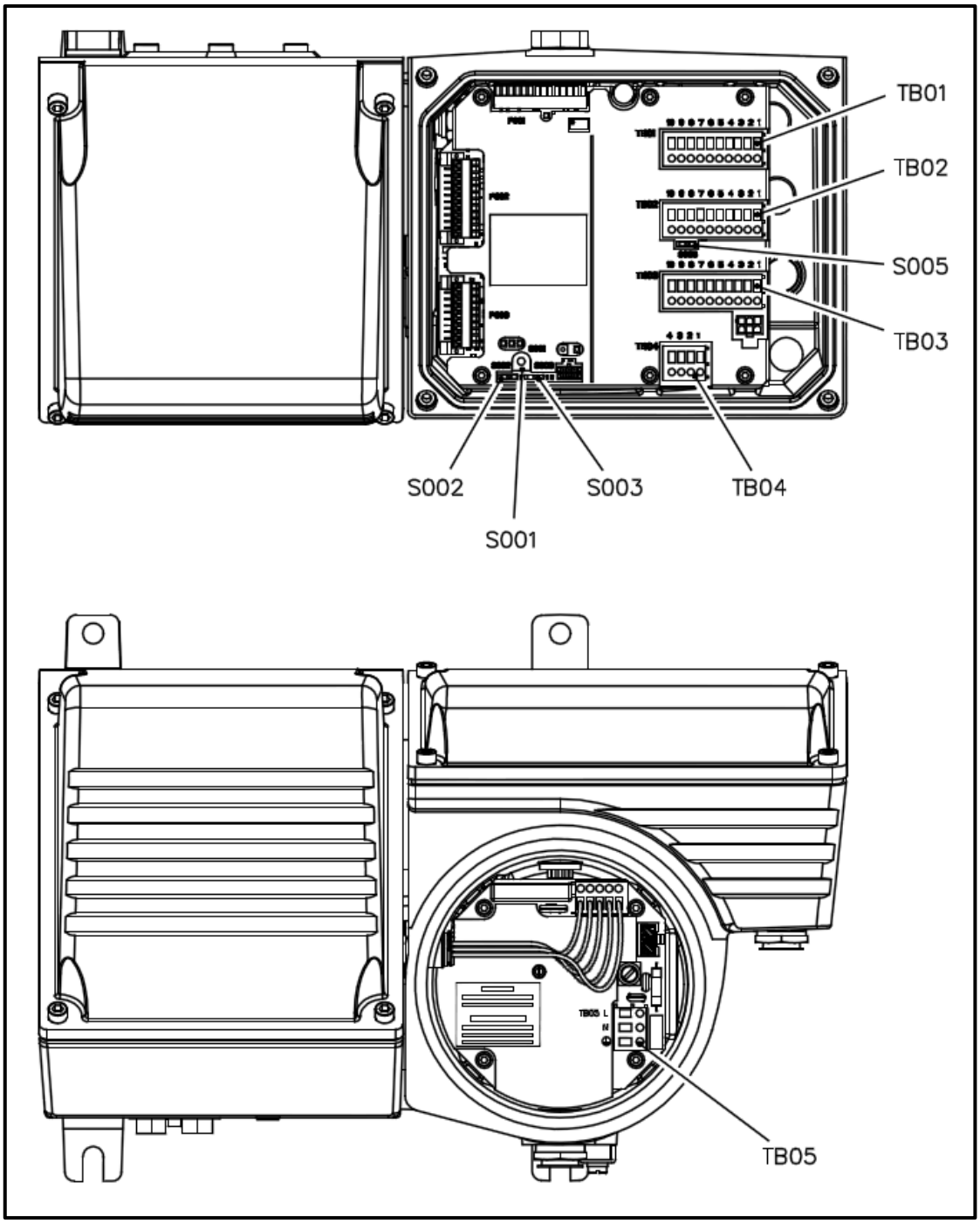

Figure 4-1: Electrical connections

4.4 Earth/ground Requirements

For compliance with EMC standards the external functional (EMC) earth/ground terminal located on the external base of the unit (see Figure 3-1) must always be connected to a local earth/ground.

The terminal is suitable for:

Flexible conductors	-	up to 10mm2
Solid conductors	-	up to 10mm2

WARNING
The transmitter unit contains intrinsically safe circuits. When the transmitter unit is installed in a hazardous area the safety earth/ground must comply with relevant national or international standards to ensure a safe installation, whether by the electrical supply or by a separate connection.

4.5 Electrical Power Supply Connection

WARNING
For gland entries to the flameproof enclosure, suitable Ex d equipment certified stopping plugs or gland fittings shall be used. Refer to applicable hazardous area certificate for conditions of use.

CAUTION

- The unit is factory configured to operate on either 100V ac to 120V ac or 220V ac to 240V ac. Refer to Section 2.4 for additional installation rating details.
- Specific voltage rating information is given on the label located on the right-hand side of the unit. Ensure that the unit is configured to operate on the correct supply voltage.
- The unit does not include an integral switch for disconnecting the electrical supply. The installer must include a means of isolating electrical power by a switch or circuit breaker located close to the transmitter unit. It must be marked as the disconnecting device for the equipment.
- The branch circuit supplying power to the transmitter unit should be installed with a suitable fuse rated not greater than 15A or a suitable over current protection device set not greater than 15A.

The electrical supply terminals are suitable for:

Flexible conductors	-	0.5 to 1.5mm2 (20 to 16 AWG)
Solid conductors	-	0.5 to 2.5 mm2 (20 to 14 AWG)

Cables should be suitable for temperatures of at least 70°C.

Connection is made to TB 05 located on the power supply unit (see Figure 4-1). Terminal order from the top is:

L	-	Live (AC)
N	-	Neutral (ACC)
⏚	-	Protective earth/ground

4.6 Transmitter Unit to Control Unit Connection

One or more transmitter units can be connected to a single control unit using a

two-wire, semi-duplex, bi-polar connection. The possible system configurations are shown in Figure 2-1 earlier in this manual. This connection does not require the use of additional intrinsically safe barriers or interface devices; however, no other equipment connections are permitted.

The maximum total cable length depends on cable parameters and certification conditions (refer to Certification Supplement 02200008A). However, typically, a single transmitter/control unit configuration may be separated by up to 1km of cable.

Cable is to be a screened/shielded, twisted pair with the screen/shield connected to the control unit ground. The screen/shield must not be connected directly to the transmitter unit ground.

The terminals are suitable for:

Flexible conductors	-	0.5 to 1.5mm2 (20 to 16 AWG)
Solid conductors	-	0.5 to 1.0mm2 (20 to 18 AWG)

Cables should be suitable for temperatures of at least 70°C.

Connection is made to TB 03 located on the signal processing board. To ensure that cables are dressed neatly it is recommended that a rearward gland hole is used.

For a transmitter unit at the ‘end’ of the data connection cable, connections are made to:

TB 03 – 6	-	screen/shield
TB 03 – 7	-	‘A’ from the cable
TB 03 – 8	-	‘B’ from the cable

For a transmitter unit located in the 'middle' of the data connection cable, connections are made to terminal numbers:

TB 03 – 6	-	screen/shield from both cables
TB 03 – 7	-	'A' from cable 1
TB 03 – 8	-	'B' from cable 1
TB 03 – 9	-	'A' from cable 2
TB 03 – 10	-	'B' from cable 2

In order to avoid ground loops, the screen/shield termination is connected via a capacitance. There is, therefore, no direct connection to ground for this cable within the transmitter.

The screen/shield will, however, be directly connected to ground at the control unit

4.6.1 Cable Termination Switch

A switch exists within the transmitter unit that configures the cable termination to either be a 'mid-point' or an 'end' (by definition an 'end' occurs when the second cable is not installed).

For example, reference Figure 2-1, the only 'mid-point' transmitter is the one in the centre of configuration 2. The switch is identified in Figure 4-1 as S005 and must be set as shown in Figure 4-2, below:

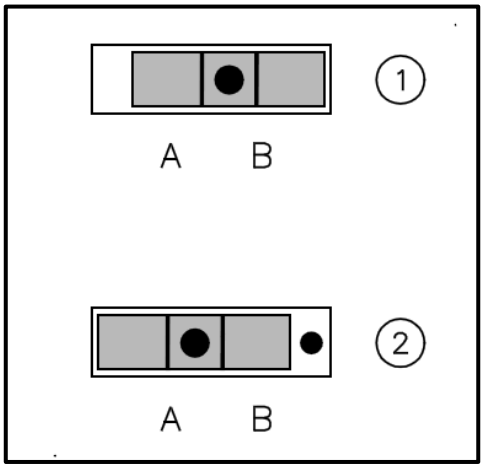

Figure 4-2: Cable Termination Switch [S005]

Key to Figure 4-2:

1. Setting for 'mid-point' – multiple unit connections
2. Setting for 'end' – single unit connection

4.6.2 Transmitter Unit Address Switch

The control unit 'recognises' a transmitter by a unique address. This must be set up as part of the transmitter installation. If only one transmitter unit is fitted, the factory default setting will suffice, and no further action is necessary.

If more than one transmitter unit is connected to a single control unit, a switch exists within the transmitter to configure a discrete address. This rotary switch is identified, in Figure 4-1, as S0001 and must be set as shown in Figure 4-3, below:

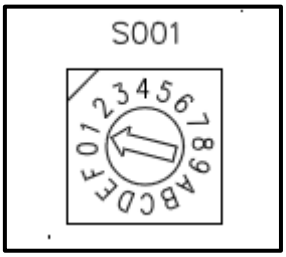

Figure 4-3: Transmitter unit address switch [S001]

Switch position	Function/Transmitter	Transmitter identity as the control unit
0	Not used	N/A
1	Factory default for 1 transmitter	T01
2	Set for transmitter no. 2 if fitted	T02
3	Set for transmitter no. 3 if fitted	T03
4	Set for transmitter no. 4 if fitted	T04
5	Set for transmitter no. 5 if fitted	T05
6	Set for transmitter no. 6 if fitted	T06
7 to F	Not used	N/A

4.7 Signal and Output/Input Connections

To comply with EMC standards, connections to signal outputs/inputs (with the exception of external flow alarm connections, reference Section 4.7.4) must use screened/shielded or shielded cable. This may be either separately screened/ shielded pairs or twisted pairs with an overall screen/shield.

All terminals are suitable for:

Flexible conductors	-	0.5 to 1.5mm2 (20 to 16 AWG)
Solid conductors	-	0.5 to 1.0mm2 (20 to 18 AWG)

Cables should be suitable for temperatures of at least 70°C.

WARNING
When the transmitter unit is installed in a hazardous area, these output/input signals must be connected to an intrinsically safe system.

4.7.1 Analog Output

Reference Section 2.5.1.

CAUTION
These connections are part of an intrinsically safe system and must only be connected to a suitable, intrinsically safe certified, interface device. Refer to the appropriate certification documents (see Certification Supplement 02200008A).

Connection is made to TB 01 on the signal processor board. To ensure that cables are dressed neatly it is recommended that a rearward gland hole is used.

TB 01 – 1	-	screen/shield
TB 01 – 8	-	+ve 0/4 – 20mA output
TB 01 – 9	-	-ve 0/4 – 20mA output

4.7.2 Status Outputs

Reference Section 2.5.2.

CAUTION
These connections are part of an intrinsically safe system and must only be connected to a suitable, intrinsically safe certified, interface device. Refer to the appropriate certification documents (see Certification Supplement 02200008A).

Connection is made to TB 01 on the signal processor board. To ensure that cables are dressed neatly it is recommended that a rearward gland hole is used.

TB 01 – 1	-	screen/shield
TB 01 – 2	-	+ve fault
TB 01 – 3	-	-ve fault

TB 01 – 4	-	+ve maintenance
TB 01 – 5	-	-ve maintenance
TB 01 – 6	-	+ve service
TB 01 – 7	-	-ve service

4.7.3 Analog Inputs

Reference Section 2.5.3.

CAUTION
These connections are part of an intrinsically safe system and must only be connected to a suitable, intrinsically safe certified, interface device. Refer to the appropriate certification documents (see Certification Supplement 02200008A).

Connection is made to TB 03 on the electronics board. To ensure that cables are dressed neatly it is recommended that a rearward gland hole is used.

TB 03 – 1	-	screen/shield
TB 03 – 2	-	+ve input 1
TB 03 – 3	-	-ve input 1 (connected to ground (earth))
TB 03 – 4	-	+ve input 2
TB 03 – 5	-	-ve input 2 (connected to ground (earth)

4.7.4 External Flow Alarm Inputs

Reference Section 2.5.4.

CAUTION
These connections are part of an intrinsically safe system and must only be connected to a suitable, intrinsically safe certified, interface device. Refer to the appropriate certification documents (see Certification Supplement 02200008A).

CAUTION
These cables do not require to be screened. To comply with EMC performance, these cables must not exceed 2 metres in length.

Connection is made to TB 04 on the signal processor board. To ensure that cables are dressed neatly it is recommended that a rearward gland hole is used.

TB 04 – 1	-	+ve status signal 2
TB 04 – 2	-	-ve status signal 2 (connected to ground/earth)
TB 04 – 3	-	+ve status signal 1
TB 04 – 4	-	-ve status signal 1 (connected to ground/earth)

4.7.5 Digital Status Inputs

Reference Section 2.5.5.

CAUTION
These connections are part of an intrinsically safe system and must only be connected to a suitable, intrinsically safe certified, ISOLATING interface device. Refer to the appropriate certification documents (see Certification Supplement 02200008A).

Connection to external contact pairs is made to TB 02 on the electronics board. To ensure that cables are dressed neatly it is recommended that a rearward gland hole is used.

TB 02 – 1	-	screen/shield
TB 02 – 2	-	+ve status input 1
TB 02 – 3	-	-ve status input 1 (connected to ground (earth))
TB 02 – 4	-	+ve status input 2
TB 02 – 5	-	-ve status input 2 (connected to ground (earth))
TB 02 – 6	-	+ve status input 3
TB 02 – 7	-	-ve status input 3 (connected to ground (earth))
TB 02 – 8	-	+ve status input 4
TB 02 – 9	-	-ve status input 4 (connected to ground (earth))
TB 02 – 10	-	no connection

5. SAMPLE GAS CONDITIONING AND CONNECTION

A sample conditioning system is required to:

- Control the flow and pressure of the sample gas to the analyser
- Dry the gas to remove water and/or condensate
- Remove particulate matter
- Provide facilities for calibration gases for the analyser
- Protect the transmitter from abnormal sample conditions
- Incorporate solenoid valves for autocalibration (option)
- Incorporate a calibration facility for pressure compensation (option)

Correct conditioning and control of sample gases will greatly improve the accuracy and reliability of the analyser. Historically, most analyser faults are caused by inadequate sample conditioning.

It is recommended that the internal volume of the sample pipework and fittings (filters, etc.) is kept to a minimum to optimise response time.

Servomex or their agents can design and supply a suitable sample conditioning system.

WARNING
DANGER OF SAMPLE GASES
Sample and calibration gases may be flammable, toxic or asphyxiant. Gases must be vented to an area where they will not be a hazard to personnel.

5.1 Sample Wetted Materials

A full list of materials in contact with the sample will depend on options ordered. In all instances the sample gas must be compatible with the following materials:

- Borosilicate glass
- Nickel
- Platinum
- Platinum/iridium alloy
- 316 stainless steel

In addition

- If a standard 325 cell is fitted, internal seals will be Viton
- If the high pressure/solvent resistant cell is fitted, seals will be PTFE and Chemraz
- The internal pressure compensation option adds Hastelloy to the list.
- The internal flow alarm adds yttria stabilised zirconia to the list
- Solvent resistant pipework also adds Hastelloy to the list

CAUTION
If acid gases are being analysed the presence of moisture in the sample gas may lead to corrosion of the measuring system. The sample must be dried to a moisture

content below which such corrosion will not occur. It may be advisable to fit a moisture sensor to provide an alarm should this drying system fail.

5.2 Sample Gas Conditions

Flow Rate:

The transmitter unit offers two flow configurations, specified at time of order:

Low flow rate	-	100 to 250ml/minute
High flow rate	-	0.8 to 1.2litres/minute

Condition:

Free from liquid condensate
Particulates size <3 micron
Sample temperature <50°C
Sample dewpoint >5°C below ambient temperature

Pressure

0.3kPa (50mm wg) relative to outlet pressure

Maximum internal pressure:

Standard	18 psia (124kPaa)
High pressure option	45 psia (310kPaa)

The measuring cell flow rate and internal pressure must not exceed the above values otherwise damage to the measuring cell can occur.

Sample Vent

The oxygen signal is directly proportional to sample gas pressure in the measuring cell.

The sample gas exhaust connection to the transmitter unit should not be restricted and be of adequate diameter such that a back pressure is not created. Special consideration should be given if the exhaust is taken to a vent header and not vented directly to atmosphere.

5.3 Sample gas connection

Sample gas connections are made to the base of the transmitter unit. See Figure 3-1. The fittings are 1/8" NPT(F).

5.4 Calibration gas facilities

Two calibrating gases are required. Ideally calibration gases should be at the same pressure and flow as the sample gases.

The oxygen concentrations of the calibration gases may be application dependent. However, the following are recommended for use with the SERVOTOUGH OxyExact Transmitter:

Nitrogen, typically 0% oxygen (used as the 'low' oxygen gas)
Air, typically 20.95% oxygen (used as the 'high' oxygen gas)

See the Operator manual for further guidance on the correct choice of gases.

It is suggested a 'fast loop' is used to minimise response times and eliminate 'dead legs'. Gas selection valves should be placed as close to the transmitter unit as possible.

Calibration solenoid valves

The transmitter does not include electrical connections for solenoid valves. Autocalibration is available when used in conjunction with a Servomex Control Unit. All associated electrical connections are made to the control unit.

Internal Flow Alarm

If fitted, the internal flow alarm is usually calibrated at a known sample gas flowrate. Therefore, a means of monitoring the actual flow into the transmitter will be required.

5.5 Internal Pressure Compensation (Option)

If internal pressure compensation is installed, a calibration facility will be required to facilitate annual checking of this option. This consists of a means of putting a stable back pressure on the measuring cell when it is measuring the high oxygen content calibrating gas.

Figure 5-1 shows an example using a restriction that can be switched into the sample gas exhaust. This should be dimensioned such that the back pressure is increased by approximately 5 to 10%.

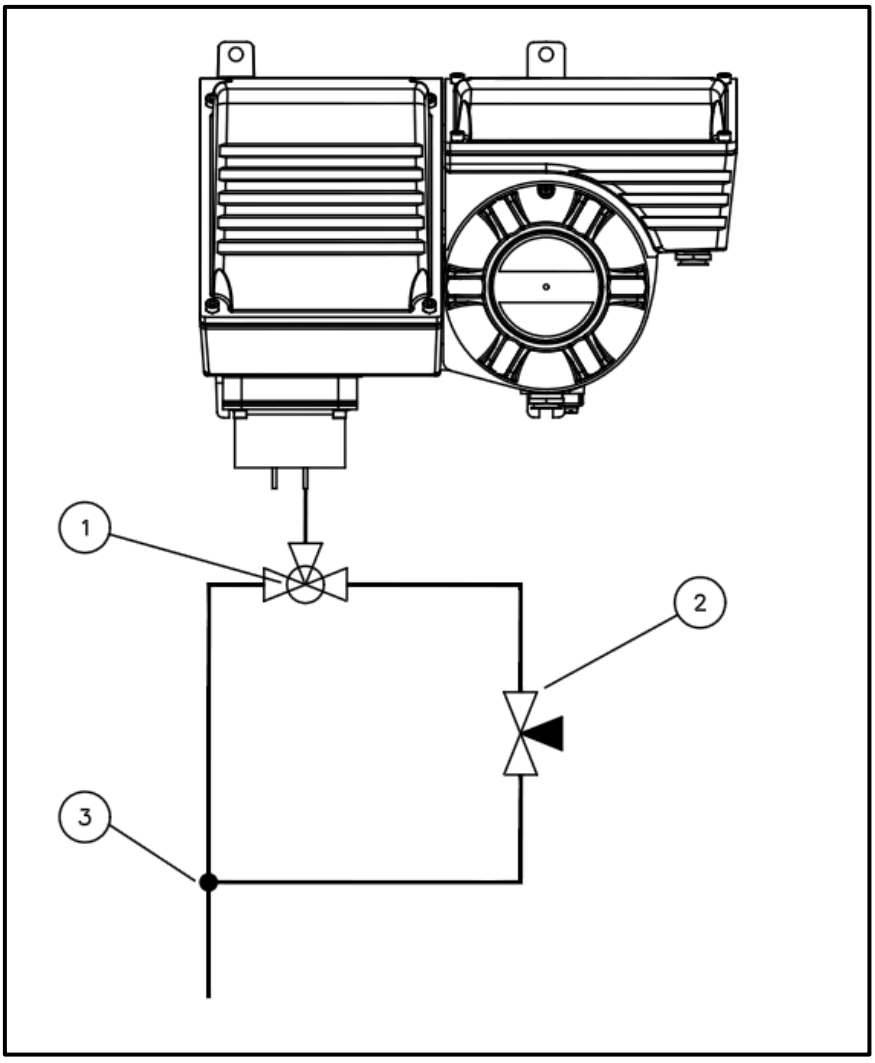

Figure 5-1: Back Pressure Arrangement

Key to Figure 5-1

1. Three-way valve
2. Adjustable restriction to create back pressure
3. ‘T’ connection

5.6 High Pressure Operation

WARNING

- The SERVOTOUGH OxyExact Transmitter may be used with sample gas pressures in excess of 18psia, however, this must be specified at the time of order.
- Such units will have a factory fitted vent or 'breather' underneath the left hand enclosure – reference Figure 3-1

Under no circumstances is the sample pressure allowed to exceed 45 psia (310 kPaa).

If the sample gas pressure exceeds 18psia (124kPaa), the following precautions must be taken:

1. A relief valve set to 45 psia (310 kPaa) must be sited at the inlet to the sample system.
2. A non-return valve must be sited in the system return to process line.
3. The sample gas flow should be limited such that, in the event of a leak, the flow rate to the analyser cannot exceed 2l/min.

5.7 Corrosive sample purge

If the sample is corrosive it is recommended that a dilution purge is fitted to the measuring cell compartment. This will reduce the possibility of damage should there be a leak of sample gas.

Gas connection is made to the base of the transmitter unit. See Figure 3-1. The fitting is 1/8" NPT (F).

Purge gas should be inert gas or clean, dry air. Maximum flow rate is 50 ml/min.

5.8 Leak test

Before commissioning it is recommended that the complete gas system is leak tested. When pressurising the system, ensure that the sample gas inlet and outlet are coupled together and raise the pressure slowly to prevent potential damage to the measuring cell.

This page intentionally blank.

6. INSTALLATION CHECK LIST

Following completion of the installation procedure check:

Item	Checked
Unit is firmly mounted	
Supply voltage agrees with unit supplied	
The unit is correctly earthed/grounded	
Connection is made to control unit	
Connection is made to analog outputs (as required)	
Connection is made to analog inputs (as required)	
Connection is made to alarm relays (as required)	
Connection is made to digital inputs (as required)	
Sockets are secured to their relevant boards	
All wiring terminations are tightened	
Screws in unused terminals are tightened	
Cable glands are secured and made weather-tight	
Cables are dressed neatly within the transmitter unit	
Inner door is secured (control unit)	
Hazardous area safety requirements are complied with	
External electrical connections are labelled	
Covers are secured and weatherproof	
Sample gas connections are labelled	
Sample gas system is leak free	

Table 6-1: Installation checklist

It is now possible to apply power to the unit.

See the Operator manual for commissioning and operating the unit.

This page intentionally blank.

7. ROUTINE MAINTENANCE

Aside from routine calibration (refer to Operator manual) the SERVOTOUGH OxyExact Transmitter Unit requires minimal routine maintenance.

WARNING
The unit must only be cleaned with a damp cloth.

In very dusty environments, it will be prudent to occasionally clean off the outer surfaces using a damp cloth.

Spares

The SERVOTOUGH OxyExact Transmitter Unit contains no parts that require routine service.

Refer to the Service manual for full service instructions.

This page intentionally blank.

Appendix A TECHNICAL SPECIFICATION

A.1 FUNCTIONAL

Power supply:	Either 100-120V ac 50/60Hz, -10% and +10%.
	Or 220-240V ac 50/60Hz, -15% and +10%.
Power required:	100VA
Physical:	Width: 432mm
	Height: 260mm (300mm including mounting)
	Depth: 209mm
Weight:	15kg

A.2 ENVIRONMENTAL

General:	Suitable for indoor and sheltered outdoor locations
Ingress protection:	IP66 and Type 4X (NEMA 250)
Operating temperature:	-20 to 50°C (-4°F to 122°F), in sheltered location
Storage temperature:	-20 to 70°C (-4°F to 158°F)
Relative humidity:	95% RH maximum, non-condensing
Atmospheric pressure:	76 to 112 kPaa (11 to 16.2 psia)
Altitude:	3000m (10,000 feet) maximum
Installation category:	II - in accordance with IEC 664
Pollution degree:	2 - in accordance with IEC 664
Warm up time:	Typically, 1 hour from cold start at 20°C

A.3 PERFORMANCE

Unit is targeted to measure oxygen in the range 0 to 21%.

Intrinsic error (accuracy):	<0.02% oxygen
Linearity:	<0.01% oxygen (inherently linear.)
Repeatability:	0.02% oxygen
Response time (T90):	Less than 4 s at 250ml/min (low flow range) Less than 4 s at 1 l/min (high flow range)
Zero drift[1]:	< 0.02% oxygen per week
Span drift:	< 0.05% oxygen per week

[1] Published specification attained after two weeks operation under Process Conditions

mA output:	
Resolution:	0.001% oxygen or 0.002% of output span, whichever is the greater
Noise:	0.01% oxygen peak to peak within any 5 minute period
Effect of ambient temp:	±0.02% oxygen ±0.2 % of reading per 10°C
Sample flow effect:	<0.1% oxygen change over the range 0-250ml/min (0.2-1.2 l/min for the high flow option)
Effect of barometric or sample pressure:	Output reading is directly proportional to the absolute pressure at the sample vent of the analyser. An 'internal' sample pressure sensor reduces these effects by a factor of 200 or ±0.02% oxygen, whichever represents the 'least' compensation.
Effect of supply voltage Variation:	A 10% change of the supply voltage within the specified range will cause the output to change by less than 0.01% oxygen or 0.1% of reading, whichever is greater.
Attitude sensitivity:	Less than 0.01% oxygen per degree of tilt
Vibration:	Tested in accordance with EN 50104
Internal Flow Alarm[2][3]:	
Reproducibility:	<5% of full scale
T90:	<20 seconds

[2] Not suitable for use with gas mixtures that contain Hydrogen and/or Helium at concentrations over 10% of the total mixture.
[3] The specification of the Flow Alarm is based upon a sample of Air at 20°C and normal atmospheric pressure of 101kPaa