NTRON
Gas Measurement

SIL O_2 Analyser

User Operation and Maintenance Manual

Manual Part No: 07-218

Iss.0.3 04/09/2019

EXCELLENCE
THROUGH DIVERSITY

Revision History

Iss. 0.1 11/12/2018
Iss. 0.2 26/07/2019
Iss. 0.3 04/09/2019 EN50104 amendments

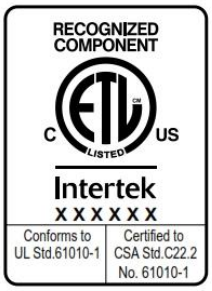
Approvals

CE mark

This product meets the specifications according to the EMC directive 2014/30/EU and standards EN 61326-3-2:2008 and EN55011:2009

ETL Mark for North America

This product meets the requirements for North America according to the certifying organisation below.



Labelling

SIL O2 Analyser Labelling

Power Supply Module Labelling

General Instructions and IMPORTANT INFORMATION

Please read this manual carefully prior to installation and commissioning.

WARNING

Flawless and safe operation of this device requires proper transport, proper storage, installation and assembly as well as careful operation and maintenance. The device may only be used for the purposes specified in this operating manual.

Note: Programming of all Alarm levels and other necessary functionality is not a user enabled function and is undertaken by Ntron prior to delivery of the device. Should any changes be necessary to the programming, please contact Ntron.

DISCLAIMER

All modifications to the device fall within the responsibility of the user unless expressly specified otherwise in the operating manual.

Qualified PERSONNEL

are persons who are familiar with installation, assembly, repair and operation of the product and have the qualifications necessary for their work, such as:

- Training, instruction and/or authorization to operate and maintain equipment/systems in accordance with the standards of safety technology for electrical circuits, high pressures and corrosive as well as hazardous media.
- In the case of equipment with explosion protection: training, instruction and/or authorization to perform work on electrical circuits for potentially explosive equipment.
- Training or instruction in accordance with the standards of safety technology regarding care and use of appropriate safety equipment.

CAUTION

- Potentially electrostatic components may be destroyed by voltage that is far below the limits of human perception. Such voltage occurs even when you touch a component or electrical connections of a component and are not electrostatically discharged. The damage that occurs to a component because of overvoltage usually cannot be detected immediately and does not become noticeable until after a longer operating period.

- No software development is possible. The required competence is limited to understanding and following the procedures documented in this manual..

Please Read Before Continuing

The following symbols should draw attention to important information and, where appropriate, may also appear on the instrument

The LT/LP Sensor reaches elevated temperatures during operation than can cause burns if it is handled incorrectly. Before attempting any manual intervention, turn off the power to the Analyser and Sensor and allow it to cool down.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by this equipment may be impaired!

Before turning on power to the SIL O2 Analyser and Sensor, ensure that the voltage is correct. See the specification section of this manual for details.

The SIL O2 Analyser module, Power Supply unit and Sensor operate with an Extra Low Voltage power source.(ELV) No special personnel protective measures are necessary but it must be ensured that the user connects a suitable power source to the SIL O2Analyser within the voltage range specified for this product. The user is to provide suitable isolation and protection for the power supply device used to power this Analyser and suitable interconnecting cabling between that power supply and the Analyser unit.

Instructions générales et UNE INFORMATION IMPORTANT!

Veuillez lire attentivement ce manuel avant l'installation et la mise en service.

ATTENTION

Un fonctionnement sans faille et sûr de cet appareil nécessite un transport, un stockage, une installation et un montage appropriés, ainsi qu'un fonctionnement et un entretien soigneux. L'appareil ne doit être utilisé qu'aux fins spécifiées dans ce manuel d'utilisation.

Remarque: La programmation de tous les niveaux d'alarme et des autres fonctionnalités nécessaires n'est pas une fonction activée par l'utilisateur. Elle est effectuée par Ntron avant la livraison du périphérique. Si des modifications sont nécessaires dans la programmation, veuillez contacter Ntron.

AVERTISSEMENT

Toutes les modifications apportées à l'appareil relèvent de la responsabilité de l'utilisateur, sauf indication contraire expresse dans le manuel d'utilisation.

Personnel qualifié

sont des personnes familiarisées avec l'installation, l'assemblage, la réparation et l'utilisation du produit et possédant les qualifications nécessaires pour leur travail, telles que:

• Formation, instruction et / ou autorisation d'exploitation et d'entretien des équipements / systèmes conformément aux normes des technologies de sécurité relatives aux circuits électriques, aux hautes pressions et aux fluides corrosifs et dangereux.

• Dans le cas d'équipements avec protection contre les explosions: formation, instruction et / ou autorisation d'effectuer des travaux sur les circuits électriques d'équipements potentiellement explosifs.

• Formation ou instruction conforme aux normes de la technologie de sécurité en ce qui concerne le soin et l'utilisation des équipements de sécurité appropriés.

MISE EN GARDE

• Les composants potentiellement électrostatiques peuvent être détruits par une tension bien en dessous des limites de la perception humaine. Une telle tension se produit même lorsque vous touchez un composant ou les connexions électriques d'un composant et que vous n'êtes pas déchargée de façon électrostatique. Les dommages causés à un composant par une surtension ne peuvent généralement pas être détectés immédiatement et ne

deviennent perceptibles qu'après une période de fonctionnement plus longue.

• Aucun développement logiciel n'est possible. La compétence requise se limite à comprendre et à suivre les procédures décrites dans ce manuel.

VEUILLEZ LIRE AVANT DE CONTINUER.

Les symboles suivants doivent attirer l'attention sur des informations importantes et, le cas échéant, peuvent également apparaître sur l'instrument.

Le capteur LT / LP atteint des températures élevées pendant le fonctionnement, car il peut provoquer des brûlures s'il est manipulé de manière incorrecte.
Avant d'essayer toute intervention manuelle, éteignez l'analyseur et le capteur et laissez-le refroidir.

Si cet équipement est utilisé d'une manière non spécifiée par le fabricant, la protection fournie par cet équipement peut être altérée!

Avant de mettre l'analyseur et le capteur sous tension, assurez-vous que la tension est correcte. Voir la section spécifications de ce manuel pour plus de détails.

Le module Microx Analyzer, le bloc d'alimentation et le capteur fonctionnent avec une source d'alimentation à très basse tension. Aucune mesure spéciale de protection du personnel n'est nécessaire, mais il faut s'assurer que l'utilisateur connecte une source d'alimentation appropriée à l'analyseur Microx dans la plage de tension spécifiée pour ce produit. L'utilisateur doit fournir une isolation et une protection adaptées au dispositif d'alimentation utilisé pour alimenter cet analyseur et le câblage d'interconnexion approprié entre ce bloc d'alimentation et l'analyseur.

1. INTRODUCTION

The SIL O2 Zirconia Analyser is a SIL rated Oxygen Measurement system providing digital readout of Oxygen content and Analogue and Digital Oxygen level related outputs to user equipment. A safety trip Relay is included in the output configuration that is available for user interface into the user's safety circuit. The range of oxygen that can be measured is from 0% (99ppm) up to 25% volume.

1.1 INTENDED USE

Caution: For use in non-explosive atmospheres.
To measure a level of Oxygen content in a sample gas stream in a process pipeline or vessel or other gas generating equipment. The SIL O2 Zirconia Analyser can be used in High purity and process Oxygen measurement applications involving Inertization and ambient safe entry functions. The SIL O2 Zirconia Analyser can be integrated by the user into a SIS (Safety Instrumented System).

1.2 THIS MANUAL

This Manual is designed to provide the user with sufficient Safety, Operation and maintenance information to install and operate the SIL O2 Zirconia Analyser correctly.

This manual does not give instruction on the use of the configuration software and interface used to program the parameters and alarms within the The SIL O2 Zirconia Analyser. This information is available in the SilO2 Software manual.
This Manual also does not give the safety related data required for SIS (safety Instrumented System) design, application and Integration. This information is available in the SILO2 Safety manual.

2 FUNCTIONAL SPECIFICATION

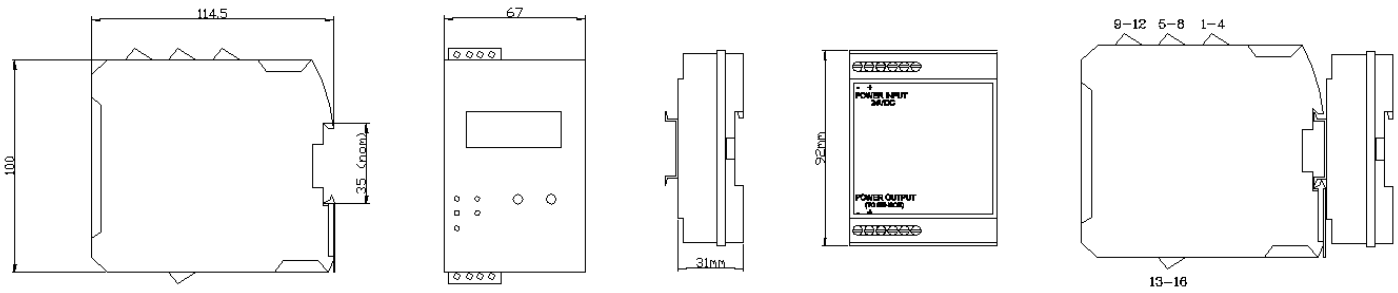
2.1 SYSTEM CONFIGURATION

2.2 Hardware

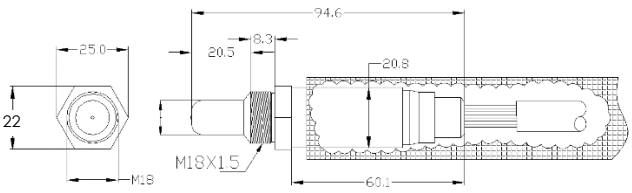
The complete SILO2 Analyser system comprises of the following components.

1. SILO2 ZR Analyser Part No.: 05-015
2. Power Supply Base Unit. Part No. 04-607
3. Zirconia Oxygen Sensor type 'LT' or 'LP' with electrical Junction with and connector and Extension cable to connect to SIL O2 Analyser.

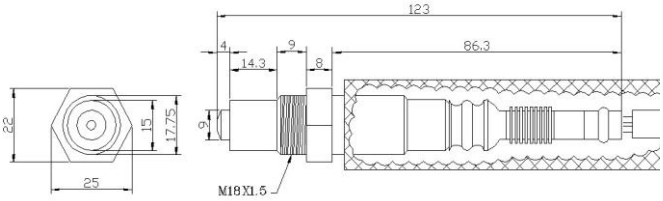
2.3 System Components Drawing



SILO2 ZR Analyser with Power Supply Base unit

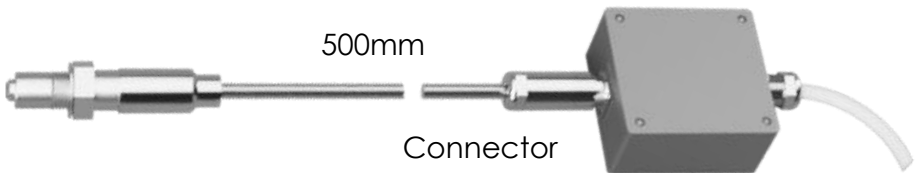


'LT' Model Sensor



'LP' Model Sensor

The Sensor is fitted with integral 500mm long flexible armoured cable and connector.
The Connector plugs into an EMC protective Junction Box



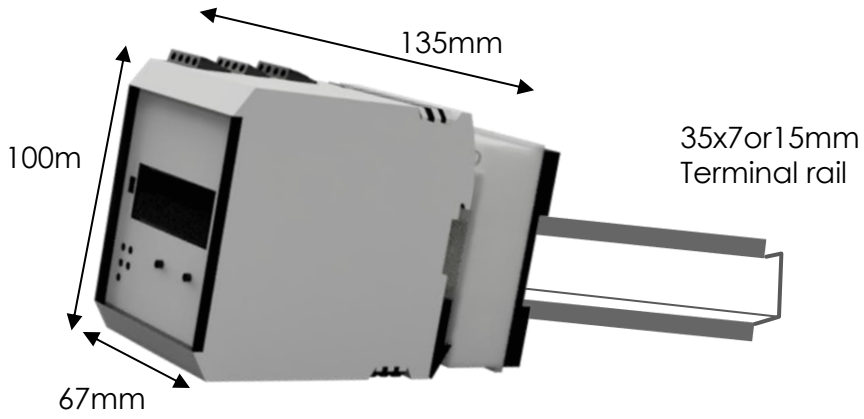
Junction Box

3 SYSTEM INSTALLATION

3.1 SIL O2 Analyser Installation

The assembly/disassembly, installation, operation, and maintenance may be only performed by qualified personnel observing regulatory requirements and the SIL O2 Oxygen Analyser manual.
Caution: During the installation, the technical data and the electrical values for the circuits must be observed.
When the SIL O2 Analyser is incorporated within another system, refer also to that system's manual for supplemental operational information.

The SIL O2 Analyser comprises of the Analyser module and Power supply base unit. They are typically assembled/fitted as one unit.



The installation must be in accordance with the local electrical codes and taking into account the details in the Specification section of this manual.
The SIL O2 Analyser is designed for DIN rail mounting and can be supplied mounted in an additional enclosure or provided without an additional enclosure for customer mounting in a system enclosure or control panel.
Unauthorised or inadvertent access to and adjustment of the SIL O2 Analyser must be prevented by the installation method chosen.

Mount the SIL O2 Analyser onto 35mm DIN rail as shown. Any Trunking/wireways above and below the Analyser when in situ, must be positioned so that there is a minimum of 30mm clearance between such trunking and the Analyser connection terminals.

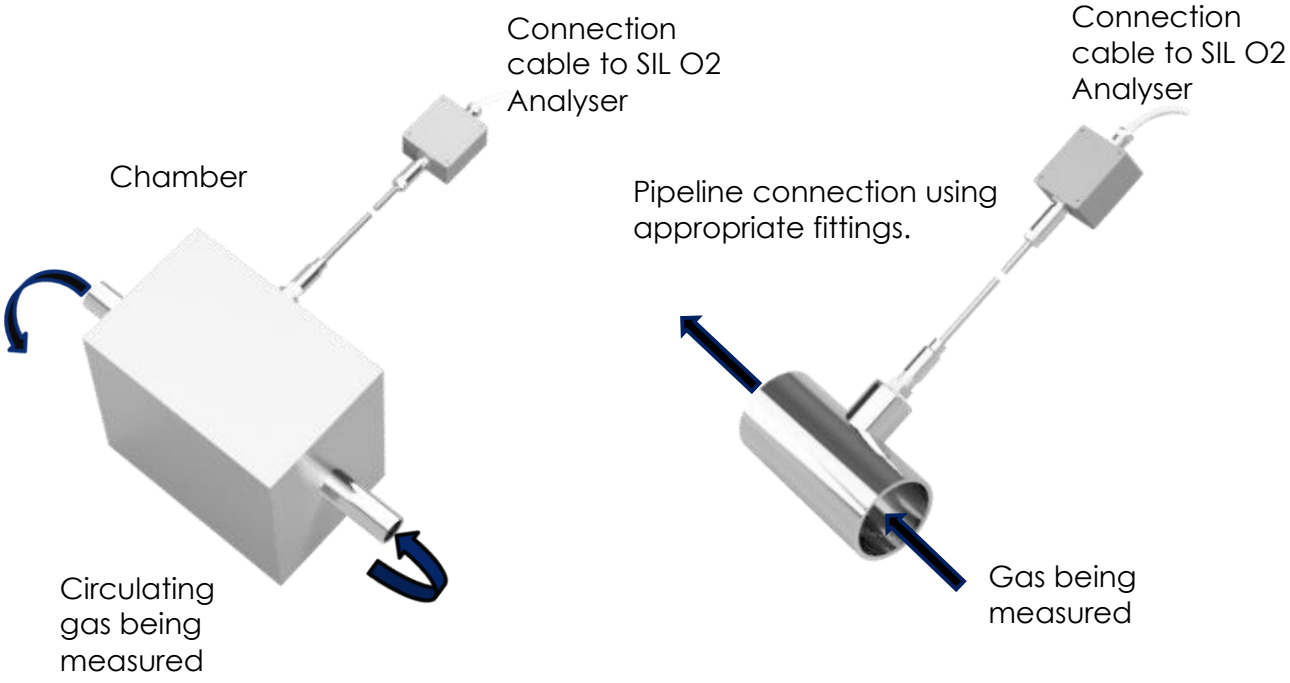
Orientation

The SIL O2 Analysers typically is mounted in the horizontal plane on a vertical backplate as shown above. It can be mounted Vertically facing upward on a Horizontal backplane or any angle in between. Orientation and location should provide easy access to the controls, display and wiring terminals. The

chosen location should not be close to heat sources or be susceptible to liquid or dust ingress.

3.2 Sensor Installation

A number of mounting options are available to the user, depending on the application. Two typical applications are shown below.
The Sensor assembly comprises of a flexible metal armoured cable With a 4-pole connector, Metal Junction Box and a flexible PVC Sheathed Cable for connection to the SIL O2 Analyser, the length of which can be specified by the user.



Location
Attention: Ensure the host process and process fitting is secure. Ensure the Sensor is secure and a gas tight joint is made. Ensure that the cable path for the Sensor signal cable and intermediate connector is free from obstruction and potential sources of heat, cutting or crushing.

Orientation
The Sensor is not position sensitive but inverted mounting should be avoided. Typically up to 90 degrees from the vertical position is the suggested range of orientation.

Process Interface Fitting

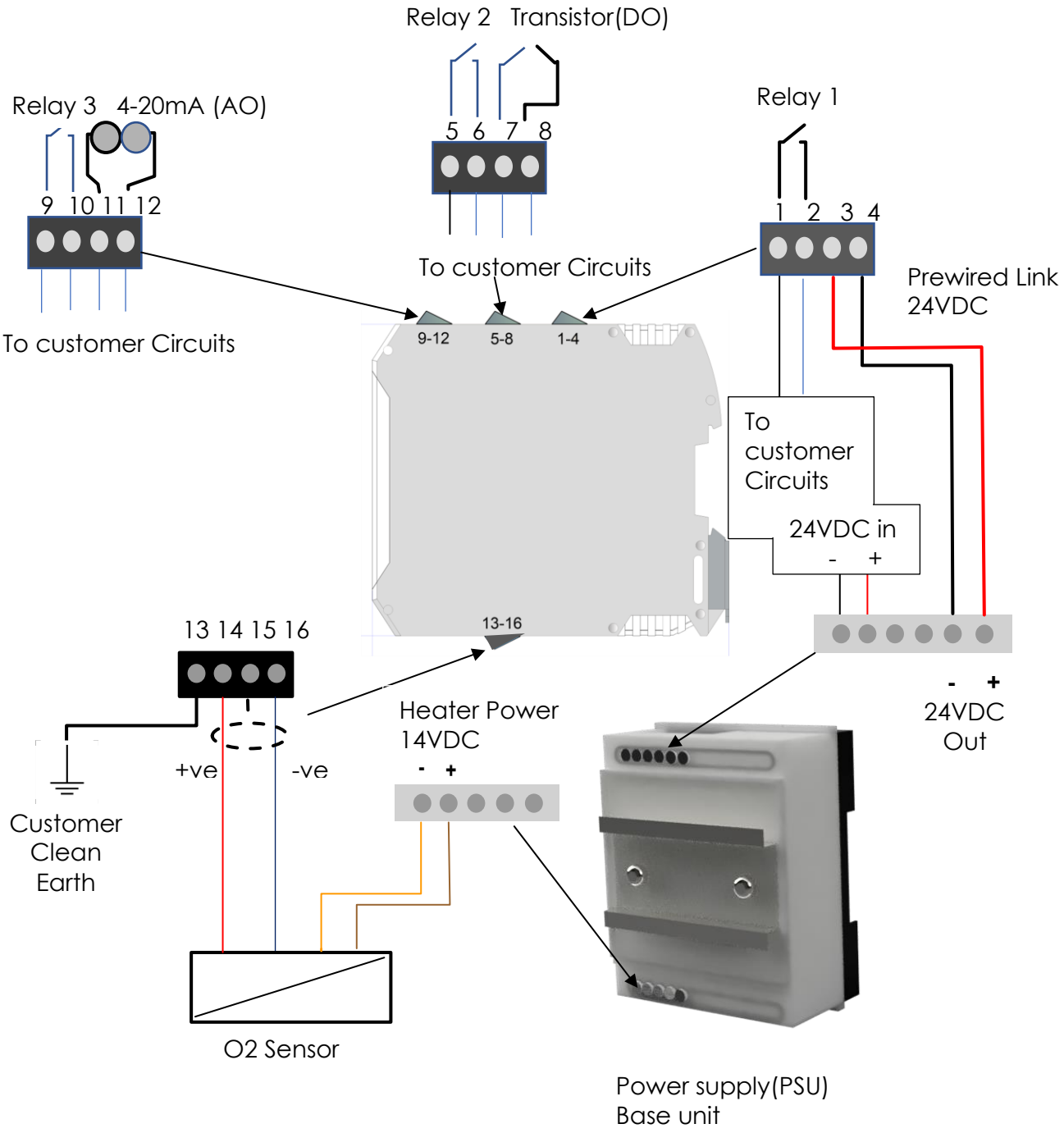
Caution. Avoid overtightening.
A variety of process fittings can be used with the LT/LP Sensor. The M18 threaded Sensor body allows for screw fitting into various process interfaces.
Care is required to ensure correct tightness and seal. Avoid overtightening.
The Method for fitting/removal of the Sensor is given below.

With the Sensor disconnected from the Junction Box, hand tighten the Sensor into the corresponding process fitting arrangement. Use a 22mm open spanner/wrench, turning clockwise to tighten fully. **Torque: 40-60Nm.**
Slide the heat resistant sleeve over the Sensor body including the hexagon body fitting.
Connect to the Junction Box via the connector.

4 ELECTRICAL CONNECTIONS AND WIRING

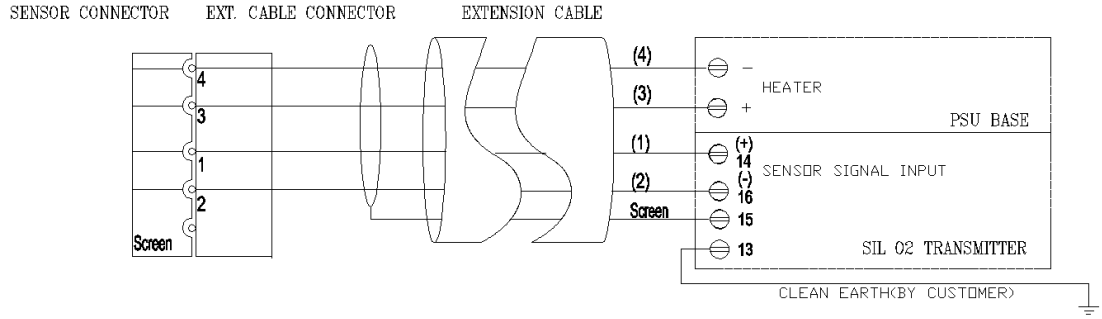
4.1 SIL O2 Analyser Connection options

For the safe operation a protective grounding connection at the terminal 13 or 15 must be made, in order to ensure a firm integration into the potential equalization.

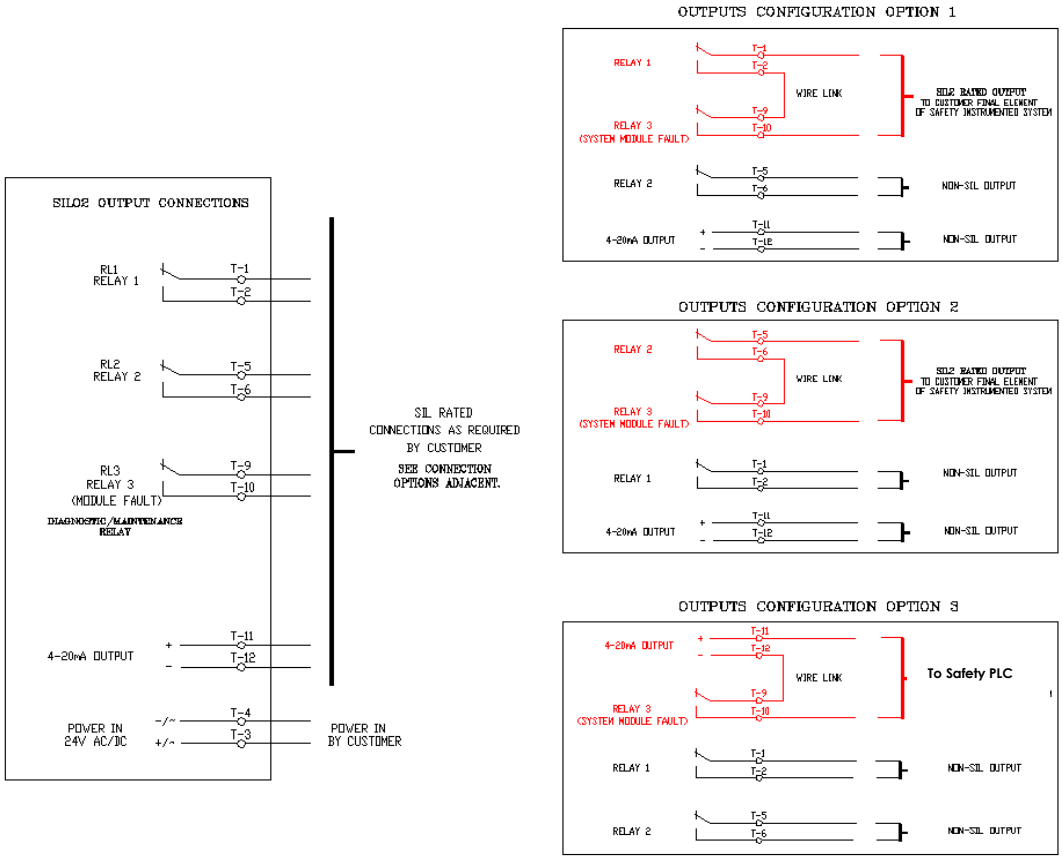


The use of stranded wire and wire end ferrules is recommended for all connections to the SIL O2 Analyser and power supply base.
See the Specifications section of this manual for the characteristics and construction of the required connecting cables.

4.2 System Electrical Schematic Drawings



Sensor to Analyser Internal Wiring



Analyser to user /customer External Wiring options

CONNECTION OF SIL OUTPUTS FROM NTRON SILO2 OXYGEN ANALYSER:

To comply with the second edition of IEC61508 Part 2 published in 2010, which supersedes the 1st edition of the standard published in 2001, as applied to the SIL O2 Analyser Internal Fault Relay RL3 (which indicates the internal status of the diagnostics of the Ntron SIL02):-
It is mandatory that both the signal from the Internal Fault Relay RL3 and the chosen output signal from either Level Alarm Relay RL1, Level Alarm Relay RL2 outputs are used to activate the Final Element of the Safety Instrumented System. For option 3, if only the Analogue output is used in connection with RL3, additional conditions apply. Any other configurations would have to be assessed on an individual basis by a suitably qualified person.

5 SYSTEM SOFTWARE AND SECURITY

5.1 SILO2 ZR Firmware

The SILO2 ZR Analyser has integral operational Firmware which contains variable settings to allow the configuration of specified to input and output elements meet the required application. Such settings have a bearing on the internal signal processing and hardware interfaces.
The variable settings can only be accessed and changed by means of a PC running dedicated interface software. Both the device Firmware and Interface software are revision controlled.

Current Version:
Firmware Version No.: 5.03

Interface Software

This Interface software is used for the factory configuration of each SILO2 ZR analyser but is also available to end users allowing onsite setting and adjustment of certain operational settings. This software allows configuration of both electronic and hardware input and output interface elements to the required application specific settings. Once a given configuration is downloaded to the SILO2 ZR Analyser, the interface software is disconnected from the Analyser and shut down.
Current Version:
Software Version No.: Version 8 Release 0.8

Interface Software Communications

The PC based interface software communicates with the SILO2 ZR Analyser by means of a dedicated RS232 connection cable assembly. See the Technical Data section of this manual for the RS232 communication settings.

Security

Without connection to the Interface Software and hardware, no configuration changes can be made to the SIL O2 ZR analyser.
The Interface software has two level password protection which can be set and changed by the user.
Password level 1: Allows access to all variable parameter settings except 'Calibration'.
Password level 2: Allows access to 'Calibration' only.

Note: The SILO2 Analyser is designed for mounting within Enclosures or control panels. Such Enclosures or control panels should have restricted user entry to specified key holders. This can prevent unauthorised calibration adjustment to the SILO2 ZR Analyser via the manual calibration buttons on the device.

Recommended System Configuration

The only configurable parameters that should be adjusted by the customer/user are those involving the operation of the user interface relay outputs. These are as follows.
1 Relay Alarm Levels; 2 Relay Hysteresis; 3 Relay operation delay time, 4 Rising or falling Oxygen level operation,5 Energised (fail safe) or de-energised state when healthy.
The foregoing settings values are typically determined by the customer/user and transmitted to Ntron for configuring during the production process.

Software development
The software element of the SILO2 analyser is a fixed program language (FPL) with no user access for coding development. User access is limited to entering data as instructed by operation and maintenance procedures.

Compatibility

- Backwards compatibility

The SILO2 ZR Firmware version 5.03 is backward compatible with Firmware version 5.02 models. This model is only suitable for use with Sensors with wire break functionality.

- Compatibility with other systems

The SILO2 ZR analyser System is a Standalone solution and no compatibility concerns with other systems are relevant.

Change control
Should any changes to the programming be necessary, please contact Ntron.

Factory defaults
No automatic device restore to a design safe state is supported. A Configuration Reload would be required.

User interface
User access is limited to entering data as instructed by operation and maintenance procedures.

6 SAFETY FUNCTIONS

6.1 All Relay contacts are non-Latching

De-energise alarm relay(s) R1 and R2 on detection of high oxygen level

The LT/LP Sensor generates a mV output that is proportional to the oxygen concentration in a process gas. The SILO2 interprets the mV input signal from the LT/LP Sensor and calculates the oxygen concentration using a calibration function. The analyser then compares the calculated oxygen concentration with a pre-determined threshold value that is defined by the user. When the calculated oxygen concentration exceeds the threshold value, the SILO2 de-energises two alarm relays (R1 and R2), which may be used either singly or together as part of a SIS to actuate the Final Element(s) and put the equipment under control into a safe state or maintain a safe state.

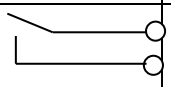
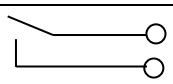
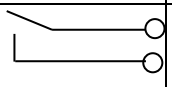
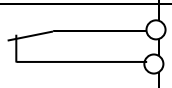
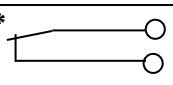
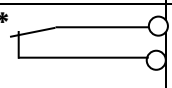
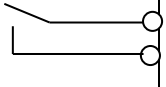
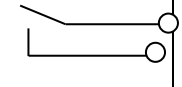
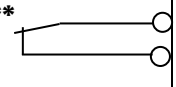
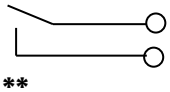
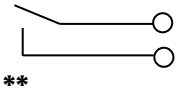
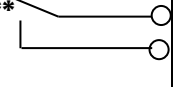
De-energise fault relay R3 on detection of fault by SILO2 internal diagnostics

The SILO2 has an automatic on-line diagnostic monitoring system that will de-energise a fault relay (R3) on detection of faults within the LT/LP Sensor, or SILO2, itself. It will also de-energise on a Sensor open or short circuit event.

Provide an analogue 4-20 mA output proportional to the measured oxygen concentration of the process gas

The SILO2 provides a 4-20 mA output that is proportional to the oxygen concentration derived from the mV input signal from the LT/LP Sensor. The 4-20 mA output signal may be used as part of a Safety Instrumented System.

Relay Functional Truth Table

Power to the Analyser	Relay Contact 1	Relay Contact 2	Relay Contact 3	Comments
Power Off (All relay contacts in Fail Open condition)				**Relays De-energised**
Power on and system good/healthy	** 	** 	*** 	**All Relays Energised**
Power on and O2 alarm level(s) reached	* 	* 	*** 	**Relays 1 & 2 De-energised**
Power on and System fault	 **	 **	*** 	**All Relays De-energised**

* The opening points of relays1 and 2 will usually differ.
** Contact positions with standard Analyser configuration.
*** Relay 3 is the Fault Relay. Digital (Transistor) output is not considered in the above table.

7 ANALYSER OPERATION

Note: Check that the correct power source is connected to the Analyser.

Before applying power to the SIL O2 ZR Analyser for the first time or after disconnection of the Sensor for maintenance/replacement purposes, ensure that a working sensor is connected. Failure to do so will result in the SIL O2 ZR Analyser entering failure mode, with the Red Error indicator illuminating and Relay RL3 de-energising. As the fault circuit performs a cyclic check once every 30 seconds approx. when the Sensor is connected, resetting of the Red indicator and Relay 3 will occur automatically, but it is suggested that the system is powered down for disconnection/re-connection of the sensor under normal circumstances if possible.

7.1 Startup

Ensure correct installation and checks are performed as described previously in this manual prior to beginning operation.

Allow 30 minutes for power on for the sensor to reach operating temperature and the output signal from the Sensor to stabilise.
Caution: Do Not attempt any calibration during this warmup period! This will cause all important factory calibrated settings to be replaced with inaccurate values
The SILO2 ZR Analyser will begin to operate and provide a digital reading and Analogue output of measured oxygen content when power is applied.
When the prescribed time has elapsed, a stable reading of Oxygen content should be observed.
User intervention is only required for calibration or to investigate any fault outputs from the SIL O2.
If the SIL O2 and Sensor is being used as part of a safety integrated system, then other system diagnostics may alert to user to a fault condition.

8 MAINTENANCE

Periodic calibrations of the SIL O2 ZR analyser will be required during the life of the instrument. The need for calibration will be based on the performance of a Bump Check or partial proof test of the SIL O2 ZR analyser as part of any safety Instrumented System. The maximum period between such Bump Checks is given in the Bump Check procedure on the following page.

8.1 CALIBRATION PROCEDURE

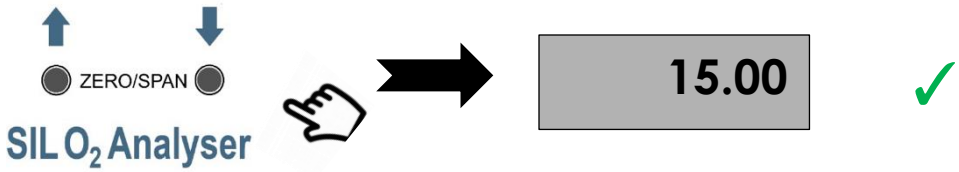
Note: The customer/user must obtain suitable certified calibration gases to the required tolerance levels prior to undertaking the calibration procedure.

The Sensor must be powered up and in its fully heated operational condition prior to calibration taking place.

15% First Point Calibration (Zero)

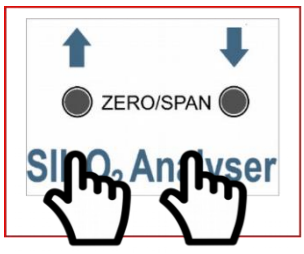
Gas Required: 15% 02
Flow rate: 250mLPM

1. Press both Buttons together at the same time. This places the Analyser into the First Point Calibration Mode. Lamp A3 will flash to indicate this.



2. Press the Up or Down arrow buttons (individually) as required until the analyser display reads 15%

3. Press both Buttons together at the same time again to exit First Point

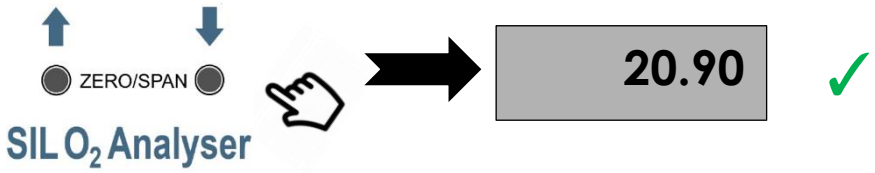


20.9% Second Point Calibration (Span)

Gas Required: 20.9% 02
Flow rate: 250mLPM

1. Ensure all the 15% gas is purged from the sample pipeline and that 20.9% O2 gas is flowing steadily at the rate given above.

2. Press the Up or Down Buttons Individually until a reading of 20.9% is attained on the Analyser display

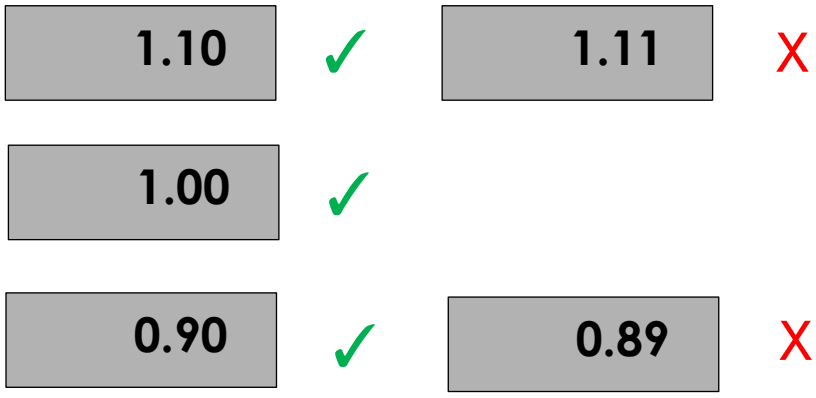


Check response with 15% Gas

3. 3. Flow the 15% 02 gas again and check to see if the reading is accurate (15%) If minor adjustment is necessary, repeat the 15% First Point calibration process (1.1 above) and then reconnect the 20.9% 02 gas and recheck the reading at 20.9%

Check Response with 1% Gas if available

4. Perform a response check using 1% 02.



If the response check returns an error of more than+/-10% of the measured (displayed) value, then the 1% gas standard being used should be verified for accuracy/tolerance, replaced if necessary and the response check repeated.

8.2 PROOF-TESTING

Attention: Periodic proof tests must be conducted at specified intervals to reveal undetected faults that would otherwise prevent the system operating in accordance with the user's Safety Requirement Specification. Different parts of the system may require different proof test intervals and the frequency of the proof test interval must be decided by the system PFDavg calculation. The entire system must be tested, including sensor(s), logic solver and final element(s), either end-to-end or in parts. Where the interval between scheduled process downtime is greater than the proof test interval, then on-line testing facilities must be provided.
The user must maintain records that certify that proof tests were completed as required. These records must include the following information as a minimum:

- a description of the tests
- dates that the tests were done
- name of the person(s) who performed the tests
- serial number or other unique identifier of the system tested
- results of the test

8.3 BUMP TEST PROCEDURE

A regular check of the SIL O2 Analyser operation is a requirement, to confirm the correct operation and safety related functionality of the Sensor. **The following partial proof-test procedure should be carried out at 6 monthly intervals or less.**

Note: This procedure should be arranged so as not create a Hazardous condition for personnel or equipment. (This procedure may be able to be carried out whilst the system and host equipment is in operational mode, or it may require putting the host equipment into an offline mode and in some applications this may require removing the Sensor from the equipment or process)

1. Apply a Bump Check Gas of 20.9% O2 to the Sensor. (Certified gas preferred for accuracy)
2. Observe the display on the SIL O2 Analyser. It should read 20.9% or be within a tolerance band of 19.5% O2 to 21%
3. If the display reads below 19.5% O2 then the sensor is demonstrating excessive drift and must be replaced or re-tested against a certified gas (if not done so already). If the sensor still reads below 19.5% when tested against a certified gas, it must be replaced.
4. Remove the Check gas and return the Analyser/Sensor and Host equipment to operational mode.

Warning! It is not possible to correct a failure that causes excessive drift by re-calibrating the sensor! A sensor that has failed a bump test within the specified calibration interval must be replaced.
A comprehensive Proof Test and Compliance Document SILO2-001 is available from Ntron.
The following elements should be included in any proof test procedure to be undertaken.

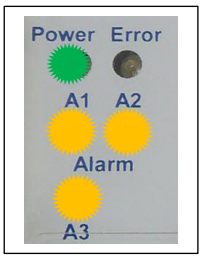
- Power Supply Output Voltage (See the Technical data section of this manual)
- Disconnect the Sensor from analyser to initiate a fault alarm. Main Trip/Diagnostic Relay de-activates. (Simulated wire-break) Analyser resets when Sensor is re-connected.
- Analyser measured oxygen concentration is within (X)% of a reference gas concentration (check for sensor drift). (See the Technical data section of this manual)
- Selected alarm relay goes into alarm state when supplied oxygen concentration rises above alarm set point (full functional check)

8.4 TROUBLESHOOTING

Possible Faults and their solutions

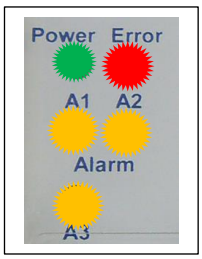
The following possible conditions are applicable to a system (Sil Analyser and Sensor) already installed and commissioned. Some conditions below may also be applied to new systems not yet commissioned.

- **Action: Performing a Zero calibration when the Oxygen Sensor is in ambient air.**



Problem: An incorrect Zero level input to the Analyser will result in an overrange fault. This can occur if a Zero calibration is performed when the Sensor is in ambient air. If this occurs, the Red fault LED will illuminate and the Analyser display and Analogue output will read an over-range value. The Alarm level LED's may also illuminate. This may also occur if a genuine overrange event takes place, with gas containing more than 25% O2 being applied. (25%O2 displayed)
Solution: re-calibrate with 15% O2 gas (Zero) and then re-calibrate at the Span point of 20.9%.

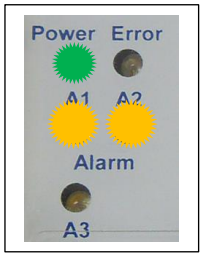
- **Action: Powering on the Analyser with no sensor connected.**



Problem: A calibrated Analyser Should give an apparent measured oxygen value of close to 15% if the sensor is disconnected. This would ordinarily cause relays R1 and R3 to de-energise. Analyser display and Analogue output will read a fault value. (28% O2 displayed and 22mA)

Solution: Check Sensor wiring and connect the sensor to the Analyser. After approximately 30 seconds, the Analyser will reset, and the Red LED should extinguish.

- **Action: Unable to perform a Span calibration.**



Problem: The Analyser cannot be adjusted to display 20.9% O2 during Span calibration.

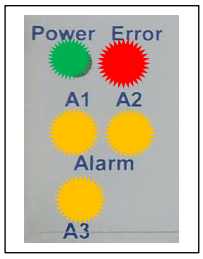
Solution: The Sensor may be approaching end of life or has been damaged and cannot generate sufficient output. Replace the sensor
Alarm level LED's may or may not be illuminated depending on configuration.

- **Action: Alarm Level LED's (Yellow) illuminated.**

Problem: Alarm level LED's illuminated.

Solution: Genuine Oxygen level alarm event.
Incorrect sample gas levels being applied to the Sensor or incorrect alarm level settings are configured within the Analyser. If this is not expected, then check sample gas with independent instrument gas/and/or re-configure Analyser Alarm setpoints. This will require interface with PC based software.

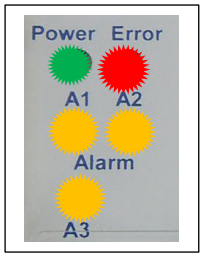
- **Action: Red Fault LED illuminated when none of the above conditions are present.**



Problem: Analyser in fault condition. Analyser display and Analogue output will read a fault value. (28% O2 displayed and 22mA)

Solution: Internal Analyser electronics or programming fault. Try Power On/Off cycle to reset.
If fault does not clear, then seek further assistance.

- **Action: No Display reading (Blank) on the SILO2 ZR Analyser**



Problem: Analyser not operating.

Solution: Check the 4-20mA Analogue output connection from the Analyser to the host control system. A break in this circuit will prevent the Analyser display from operating.

- **Action: Zero or very low Oxygen level display on the SIL O2 ZR Analyser**

Problem: Analyser not measuring correctly.

Solution: Check the Heater output voltage on the Power Supply Unit with a voltage measuring instrument. It should be around 14Volts DC.
Check also the correctness and security of the Sensor wiring to the Analyser including all the electrical connectors in the circuit.
If the above actions do not rectify the situation, then the Sensor could be faulty, damaged or at end of life and in need of replacement.
Alarm level LED's may or may not be illuminated depending on configuration.

9 SPARES AND REPLACEMENTS

The only user serviceable replaceable parts in the SILO2 ZR Analyser system is the Oxygen Sensor and the extension cable.
The specific type of Sensor and Extension cable must be confirmed with Ntron prior to ordering.
On replacing any of the aforementioned components and following a successful calibration procedure, a proof test of the system must be undertaken prior to returning the SILO2 ZR Analyser system into service.

For Service, contact Ntron Ltd. at the address below.

Mullaghboy Industrial Estate, Navan, County Meath,
Ireland C15 XD61
info@ntron.com
www.ntron.com

9.1 Sensor Replacement

Caution: Heat hazard.

The procedure for replacing a Sensor follows the Sensor installation instructions given previously in this Manual.
Power down the Analyser and Sensor.

- Sufficient time for the Sensor to be replaced, to cool down, must be allowed.
- Slide off the heat resisting sleeve.
- Disconnect the Sensor at the cable connector. extension cable connector interface.
- Select a 22mm Spanner/Wrench
- If the process fitting is a Screwed Flow Base, apply to the Sensor hexagon body fitting and turn ant-clockwise to loosen the Sensor.
- If the process fitting is a KF Flange, loosen and remove the flange coupling clamp, supporting the Sensor as the clamp is removed.
- Remove the Sensor completely from the Flow Base or process KF flange fitting and seal or cover the open Flow Base orifice or process KF flange fitting.
- Replacement is the reverse of the above procedure. When tightening the Sensor into a threaded flow base, a Torque spanner should be used to achieve the required tightness.
- Slide down the heat resisting sleeve over the Sensor body, also covering the hexagon body fitting.
- Re-connect the Sensor to the extension cable.
- Power up the system and allow the warmup and stabilization time to elapse prior to operation of the Analyser.

10 SPECIFICATIONS

SIL O2 Analyser	Specifications-Electrical
Supply Voltage	19-28VDC
Supply Power	Total Analyser Module & Sensor PSU 50 Watt peak, 30 Watt normal.
Sensor Power Unit PSU	14VDC +/- 0.1VDC output@ 1A normal, 2A peak.
Analogue Output	4-20mA active source. 22mA Max output. Analogue Output load maximum resistance, 350 Ohms.
Communications	RS232/Com 9600bps
Measurement range	0 to 25% oxygen
Relay Contact outputs RL1/RL2/RL3	Um 125VAC/110VDC (Typically 30VDC)@ 1Amp. Min Current 10uA DC. Min. Voltage 10mVDC. Type
Transistor Output (Do)	Switching parameters: <28V @<50mA
Warm Up & stabilisation Time	Warm up- Immediate. Stabilisation time is Sensor dependant.
Response Time	Dependant on Sensor specification
Display Resolution	0.01 %
	Specifications-Mechanical
Terminal /Wire Size/Type	Screw clamp terminals/ capacity 2.5mm$^{2.}$ Stranded flexible wire 0.5-1.0mm$^{2.}$ PVC Insulated.
Mounting	35mmx 7mm/35mmx15mm Din rail
Housing Material	PBT Analyser, Lexan 940/Noryl Sensor power unit
Protection Class	IP20 overall
Combustibility Class	VO according to UL
Weight	420g
Environmental	Temperature: -20 to +60°C, 10-95% Humidity, no condensation @ 1013mb +/-10%
Dimensions	67 mm x 114.5 mm x 99 mm
Indications	4 Digit LCD Display, Green OK led, Red Fault LED, Amber Alarm LED. Green OK LED on Sensor power unit.

Certification/Standards	**CE,** Functional safety: SIL2 according to IEC 61508/61511 **ETL** UL 61010-1 Identified with the ETL Recognized Component Mark **EMC 2014/30/**EU EN 61326-3-2:2008; EN 61000-6-3: 2007 + A1: 2011 EN 61000-4-2:2009; EN 61000-4-3: 2006 + A1: 2008 + A2: 2010 EN 61000-4-4:2012 2006 + A1: 2008 + A2: 2010 EN 61000-4-5:2014 EN 61000-4-6:2014

Oxygen Sensor	Specifications-Electrical
Models	LT AND LP
Measurement Range	0…25% Oxygen
Pressure range	80 …115kPa
Signal Output	-2mV to -10mV in Air
Measurement Range	0 to 25% Oxygen
Technology/Lifespan	Zirconia Dioxide / 3-5+ Years application dependant. Storage Life 1 Year.
Warm Up time	30 Minutes
Stabilisation time	
Response Time T90	Following the Warmup & Stabilisation period: <10 Seconds
Connections	Circular or rectangular Connector with cable to standard or user specified length.
Extension cable	UL-LiyCY 4 core AWG 18 (0.82mm^2) Screened, Black outer sheath flame retardant PVC. Temp. amb. -20°C to +80°C; max. 250 Ohm/km OD 7.4mm. Minimum Bending Radius: • flexing 15x cable Ø• fixed installation 7,5x cable Ø
	Specifications-Mechanical
Dimensions LT Sensor	94.6mm Long (Body only) + 500mm cable. 25mm widest point (Across hexagon fixing)
Dimensions LP Sensor	123mm Long (Body only) + 500mm cable. 25mm widest point (Across hexagon fixing)
LT Sensor Operating temperature	Circa 130°C Main Body. (Protected by Heat Resistant Sleeve when in service)
LP Sensor Operating temperature	Circa 100°C Main Body. (Protected by Heat Resistant Sleeve when in service)
Process Media Temperature	LT & LP Up to 600°C maximum
Protection Class	LT & LP IP67 When inserted into process fitting with Connector fitted.
Process Connection	LT & LPM18x1.5 Thread (Right Hand) or KF25 Flange
Weight	LT & LP 170g
Environmental	LT & LP Ambient Temperature: -20 to +45-50°C, 0-95% Humidity, non-condensing.
Material	LT & LP Stainless Steel

10.1 Gas Mixtures and Adverse Effects

Caution: The following gases can cause serious damage to the LT and LP Sensor and should not be presented to the Sensor in whole or part. In addition to permanent or terminal damage, the performance and accuracy of the Sensor will be reduced.

Acidic gases such as Hydrogen Sulphide (H2S), Sulphur Dioxide (SOx) and Hydrogen Chloride (HCL) particularly when the Sensors is not powered(Un-heated)
Halogens such as F, Cl, Br.
Organic vapours and Water.

Note: Condensed liquids including Water, when allowed to settle on an un-heated Sensor element can cause temperature differential damage to occur to the Zirconia Element matrix as the Sensor is powered up and heated.

RELEASE NOTES

Initial Release 24/10/2018

ETL Certification UL 61010-1 included in this manual 26/07/2019