cosa+xentaur
Innovative Measurement Solutions

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

COSA 9610™

GENERAL PURPOSE & EXPLOSION PROOF

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1. INTRODUCTION

1.1. INTRODUCTION

1.1.1. Purpose of the analyzer

The continuous COSA 9610™ analyzer determines online the Wobbe-index of a gas. The COSA 9610™ can be used both, as feed forward and feedback analyzer for gases mixing or as a feed forward analyzer for burning control. In order to achieve an optimal performance of the analyzer system it is necessary to read this manual thoroughly before installation and start-up.

For the combustion of gas, air is required. When supplying the right quantity of air, the gas will completely burn. This is the so-called stoichiometric air requirement of the gas. Because of this, the Wobbe-index can also be seen as a value for the need of air in gas. By burning the gas with a small excess of air, the flue gas will contain the remaining oxygen from the air, which has not taken part in the combustion. When the Wobbe-index of a gas changes, the stoichiometric air requirement and the percentage of the remaining oxygen in the flue gas will change simultaneously. By measuring the concentration of oxygen in the flue gas, after calibrating the instrument with two gasses with known Wobbe-index, the Wobbe index can be calculated.

1.2. THE COSA 9610™ ANALYZER

The COSA 9610™ features fast response time and high accuracy. These features make it unique over conventional Wobbe index analyzers. The oxygen concentration in the air is considered as constant, namely 20.95%. Functionally we can divide the analyzer-unit in 3 major parts:

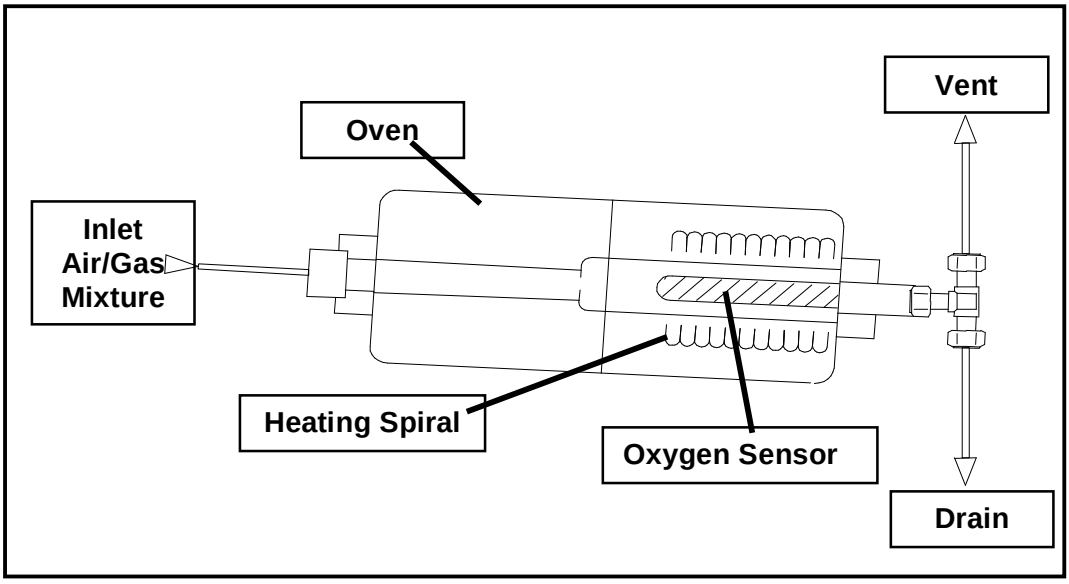
- Sample System
- Electronics compartment
- Oven compartment

Optionally the COSA 9610™ can be built in an explosion proof execution. In explosion proof execution, the analyzer is extended with a purge system.

WARNING - Potential Electrostatic Charging Hazard.
Due to the materials construction of the viewing port, there is a potential to build up an electrostatic charge across the surface. Suitable precautions should be taken to reduce this risk.

1.2.1. Oven with oxygen sensor

The gas/air mixture is burnt catalytically in an oven, which is kept at 812ºC with a burning spiral. The temperature is maintained with a temperature controller using a K-type thermocouple. The oxygen sensor in the oven is a zirconium oxide cell. This is mounted such, that one side is in contact with the outside air and the other side with the flue gasses. At high temperatures, (600ºC) O_2-ions in the ZrO_2 grating become mobile through vacancies herein. By fixing porous Pt-electrodes at both sides of the ZrO_2, O_2, gas molecules can through diffusion by and uptake of two electrons from the Pt electrode enter the ZrO_2 as O_2-ion, move to the other electrodes and be converted in gaseous O_2 again by release of the two electrons.



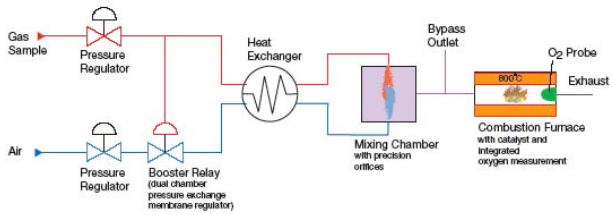
1.2.2. The sample system (SCS)

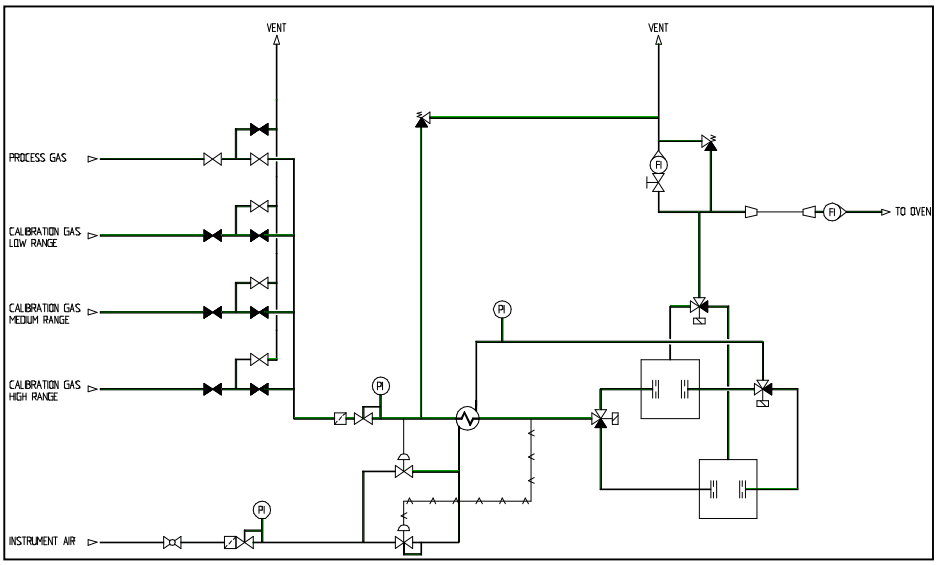
In the sample conditioning system (SCS), gas and air are mixed in a constant proportion, such that a small excess of air is present (± 2.5% oxygen) in the flue gas. The gas and air pressure, are equalized by a dome-loaded pressure reducer (or booster relay), where the gas pressure governs the air pressure.

The booster relay has a temperature reducing effect; the gas/air mixing proportion can therefore vary as consequence of variations in viscosity. Therefore, the temperature of the gas and the air are equalized in a heat exchanger. The gas and air temperature are still at surrounding temperatures, however, as long as gas and air fluctuate to the same extent this hardly influences the mixing proportion. In case of large surrounding temperature fluctuations, the calibration sequence has to be performed more often. Hereafter gas and air are mixed in the mixing chamber. The mixing chamber is equipped with orifices in the inlet nozzles. The gas and airflow are determined by a critical expansion over the orifices. The turbulence created provides a homogeneous mixture.

The diameter ratio of the orifices, together with the ratio between gas and air pressure, determine the mixing proportion.

After the mixing chamber, the mixture flow is divided into an excess flow to vent and a flow to oven. The flow to the burning oven will be approximately 30-50 Nl/hr. The vented stream is approximately 500 Nl/hr with a maximum 1000 Nl/hr.





1.3. CALIBRATION PROCEDURE

The analyzer can be calibrated in three different ways:

- Single point calibration
  Only one calibration gas is used. The value of the gas is chosen middle of the measuring range. This is only used to correct any offset error to the measurements.
- Two point calibration
  Two calibration gases are used. The low calibration gas is set at ± 20% of the measuring range. The high calibration gas is set at ± 80% of the measuring range. The advantage over a single point calibration is the increased accuracy over the entire span.
- Three point calibration
  This method uses three calibration gases and is mandatory for a dual range analyzer. The medium range calibration gas must be in the middle of the measuring range.

All three calibration methods can be performed both manually and automatically:

- Manually
  The operator navigates the procedure via on-screen menu to open the correct gas valves to the analyzer. The operator controls the timing.
- Automatically
  The analyzer itself controls the timing of the valves switching. When the measured values stay within the specified tolerances, the newly calculated calibration parameters will be accepted. Otherwise, the analyzer will keep the old value and generates a CAL ERROR on the display and switch the system fault contact and calibration fault contact.

The automatic calibration can be started as followed:

- Programmable time schedule (Timed calibration)
- Initiated manually via on-screen menu (Semi-automatic calibration)
- External host activates the calibration request contact (Remote calibration)

The one-point calibration/validation procedure will be executed as followed:

1. Analyzer activates calibration/validation contact.
2. The procedure pauses for the specified "Calibration Start Delay" time for the external host to prepare for calibration/validation.
3. Process gas is switched off and the calibration gas is switch on.
4. The analyzer waits for the readings to stabilize up to the "Switch Time".
5. Calibration gas is switched off and the process gas is switched on.
6. Analyzer deactivates calibration/validation contact.

The two-point calibration/validation procedure will be executed as followed:

1. Analyzer activates calibration/validation contact.
2. The procedure pauses for the specified "Calibration Start Delay" time for the external host to prepare for calibration/validation.
3. Process gas is switched off and the low calibration gas is switch on.
4. The analyzer waits for the readings to stabilize up to the "Switch Time".
5. Low calibration gas is switched off and the high calibration gas is switched on.
6. The analyzer waits for the readings to stabilize up to the "Switch Time".
7. High calibration gas is switched off and the process gas is switched on.
8. Analyzer deactivates calibration/validation contact.

The three-point calibration/validation procedure will be executed as followed:

1. Analyzer activates calibration/validation contact.
2. The procedure pauses for the specified "Calibration Start Delay" time for the external host to prepare for calibration/validation.
3. Process gas is switched off and the low calibration gas is switch on.
4. The analyzer waits for the readings to stabilize up to the "Switch Time".
5. Low calibration gas is switched off and the medium calibration gas is switched on.
6. The analyzer waits for the readings to stabilize up to the "Switch Time".
7. The analyzer switched the gas stream to the high range mixing chamber.
8. The analyzer waits for the readings to stabilize up to the "Switch Time".
9. Medium calibration gas is switched off and the high calibration gas is switched on.
10. The analyzer waits for the readings to stabilize up to the "Switch Time".
11. High calibration gas is switched off and the process gas is switched on.
12. Analyzer deactivates calibration/validation contact.

Between each step of the calibration process a switch time is programmed enabling the analyzer to stabilize. After the switch time the new value is used in the calibration algorithm. The calibration gas switch time is user programmable. By default, it is set at 120 seconds. Depending on the distance to the calibration gases it may be necessary to change to a longer or shorter delay.

1.4. EXTENDED (DUAL) RANGE OPTION

1.4.1. Operation

When the measuring range of the analyzer is larger than 1150BTU/SCF, an extended range option is available which covers a Wobbe index of 3000.BTU/SCF. This is accomplished by adding a second gas-mixing orifice and selection valves to make changeover possible.
The dilution ratios of each mixing orifice are chosen such that the measuring ranges overlap.
Via the software it is possible to create a 4/20mA current loop signal that covers the whole range.
It is necessary to establish a switch over point that must be calibrated.
For this reason the calibration system is expanded with an extra solenoid valve.

1.5. SPECIFICATIONS COSA 9610™ WOBBE INDEX ANALYZER

1.5.1. Analyzer performance

Make	Cosa Instrument Corporation
Service	Natural gas, fuel-gas, biogas, etc.
Ranges	Wobbe index 0-3000 BTU/scf (0-95 MJ/Nm$^{3)}$, span 0-1150 BTU/scf (40 MJ/Nm$^{3)}$ (selectable CARI 0-20, span 0-10)
Accuracy	± 0.4% of measuring value natural gas
Repeatability	±0.7 BTU/scf (±0.03 MJ/Nm^3)
Drift	±0.4 BTU/scf (±0.01 MJ/Nm^3), 24 hours
Response time	T90<5 seconds†
Output	2 isolated 4-20 mA outputs, 4 outputs total optional
	Span and service selectable
	Display & Optional Digital Output
	8 User-programmable contact relays
Safety	General area or Explosion proof

† Wobbe w/o density cell or with streaming S.G. option

1.5.2. Utilities

Power supply	110 VAC, 50/60 Hz or 230 VAC/50 Hz
Power consumption	430 VA maximum
Instrument air	0.353 SCF/min (analyzer) at 3 barG (43psig) 0.706 SCF/min (purge system) at 5.5 barG (80psig)
Sample	0.035 SCF/min at 2 barG (29psig)

1.5.3. Installation

Mounting	Freestanding Frame.
Dimensions	39 x 39 x 16 inches (1000 x 1000 x 400 mm)
Weight	± 330 lbs (150 kg)
Ambient temperature	40-113º F (+5 to 45 °C) Allow ambient temperature variation: ±45ºF (7 °C) per 24 hours
Humidity	0-90%

2. INSTALLATION

2.1. GENERAL

Upon receipt and unpacking of the COSA 9610™ a visual inspection must be carried out to check for any visual damage, caused by transport. Any damage must be reported immediately to:

COSA INSTRUMENT CORPORATION

New Jersey Office:
55 Oak Street
Norwood, NJ 07648
Tel: 201-767-6600
Fax: 201-767-6804

Texas Office:
7125 North Loop East
Houston, TX 77028
Tel: 713-947-9591
Fax: 713-947-7549

New York Office:
84G Horseblock Rd.
Yaphank, NY 11980
Tel: 631-345-3434
Fax: 631-345-5349

E-mail:
cosa@cosaic.com

We kindly ask you to submit photographs of the damage.

If the COSA 9610™ is supplied by the COSA INSTRUMENT CORPORATION, as part of a complete package and built into a shelter or house, installation may differ from hereunder described.

2.2. STORAGE

The COSA 9610™ must be stored frost-free and at a maximum temperature of 122ºF (50°C), preferably in it's original packing, and protected against direct sunlight and (rain) water.

2.3. PLACEMENT

2.3.1. General

The COSA 9610™ can operate under ambient conditions between +41º F (5°C) and +113ºF (45°C) and a maximum humidity of 90%.

2.3.2. COSA 9610™ in general purpose execution (Type 01 & 02)

The COSA 9610™ is to be mounted against an even wall or structural steel construction. Fixing lugs are located on each corner of the cabinet. Fixings used must be suitable for the weight of the COSA 9610™ (±331 lbs/150kg).

The COSA 9610™ must be mounted on such a level above the floor or underneath located obstacles that the oven drain can be connected to a drain header or a condense bottle.

The COSA 9610™ can optionally be supplied on a 304SS freestanding frame. This frame is to be placed on a flat surface (i.e. concrete slab). Two holes in the base of the frame enable the COSA 9610™ to be fixed to the floor .

2.3.3. COSA 9610™ in explosion proof execution (Type 01-Ex & 02-Ex)

The COSA 9610™ is supplied on a 304SS freestanding frame. This frame is to be placed on a flat surface (i.e. concrete slab). Two holes in the base of the frame enable the COSA 9610™ to be fixed to the floor.

2.4. MECHANICAL CONNECTIONS

2.4.1. General

- Location and amount of connections may vary depending on type and execution of the analyzer. See the project specific drawings of your order.
- Tubing connections on the COSA 9610™ are Swagelok double ferrule compression type fittings for imperial sizes. (Reducers to metric fittings or NPT thread are available)
- Only seamless and annealed imperial size instrument tubing according ASTM A-249 at a maximum permissible hardness of Rockwell B-90 may be used.
- Tubing must be cut off straight and de-burred thoroughly. (Inside <u>and</u> outside of tubing cutting edge)
- The outside surface of the tube ends entering the fittings must be clean and free from scratches.
- Nuts and ferrules do not have to and must not be removed to avoid mixing up of the nuts and or ferrules
- Tubing must be pushed into the fitting onto the seat
- Hand-tighten the nut and mark the nut against the fitting
- Use a correct size wrench to lock the body of the fitting and tighten the nut with another correct size wrench for 1- 1/4 turn for 1/4" fittings, 3/4 turn for 1/8" fittings. (Watch the marks)
- Before connecting the tubing to the analyzer they must be blown through with dry nitrogen or instrument air to remove all particles.
- All connections must be checked against leakage prior to putting the analyzer in operation or installing the tubing.
- Pressurise the lines with nitrogen or instrument air at 7bar maximum to perform leak test. Check each connection with soap. (e.g. snoop)
- Make sure before pressurizing for leak-test that the power to the analyzer is off (sample and calibration selection valves closed) and that the instrument air supply isolation valve in the analyzer is closed.
- Vent connections must not be pressure tested while connected to the analyzer. Disconnect and cap these tubes if leak test is required.
- Re-connection of the fittings is done by hand tightening the nut followed by wrench tightening for 1/4 turn.
- If a leak is detected, it might be fixed by tightening the fitting step by step a little more (up to a 1/4 turn) until it is tight. Then the fitting has to be inspected if it has not been over-tightened. This is done by disconnecting the fitting and to check if the ferrules can still be rotated in relation to each other and the pipe. (If the ferrules can also be moved in an axial direction the fitting is too loose) If the ferrules are stuck, the pipe has to be cut just after the nut and newly installed according above instructions using new ferrules. (The nut can be re-used)
- If this does not solve the problem, remove the fitting and inspect the fitting body for damage. If it is damaged the complete fitting must be replaced.

- If the body is not damaged the pipe has to be cut just after the nut and newly installed according above instructions using new ferrules. (The nut can be re-used)
- Disconnected fittings can be re-installed by hand tightening the nut followed by wrench tightening for 1/4 turn. It is recommended to perform a leak test after re-installation.

2.4.2. Sample supply

The sample supply line must be heat-traced and/or insulated to keep the gas above dew point. Check your sample data for required temperature.

Sample inlet connection on the analyzer is identified with a tag-plate.

The sample connection on the analyzer is for 1/8"OD tubing. Tubing size to the process may require a different tube size, this should be determined taking into account process pressure, sample line length and acceptable lag time.

2.4.3. Calibration gasses

Calibration gas composition is depending on range and process gas. COSA INSTRUMENT can advise suitable compositions.

For a single range analyzer, 2 calibration gasses (low and high value) are recommended.

For a dual range analyzer, 3 calibration gasses (low/medium and high value) are mandatory.

The COSA 9610ª requires one power supply.

∞ Analyzer electronics (ATEX application).
The power has to be connected on the interference filter inside the electronics cabinet. The cable has to lead into the analyzer through a suitably certified cable gland.

∞ Analyzer electronics (NEC US application).
The power has to be connected on the interference filter inside the electronics cabinet. The cable has to lead into the analyzer through a suitable approved conduit and conduit addapters.

The COSA 9610ª has multiple input and output signals, which can be split in two groups, analog and digital signals. For both groups, a suitably certified cable gland for use with multi core cables are foreseen for ATEX use and suitable conduit and conduit addapters for North American instalation.

If more entries are required, only suitably certified cable glands or conduit addapters are allowed to be used and it has to be made sure that they are in good electrical contact with the white personated sink layer on the electronics enclosure surface (paint locally to be removed with a detergent).
For termination details see project specific drawings.

2.5.2. COSA 9610ª in explosion proof execution

Power supply cable

The COSA 9610ª requires only one power supply. The power is connected to the external certified power switch. Supplied power must not exceed 250Vrms or 250Vdc.

Signal cables

The COSA 9610™ has multiple input and output signals, which can be split in two groups, analog and digital signals. Both analog and digital signals are to be connected in the electronics enclosure. Please make sure that the cable glands used are suitably certified. For details see project specific drawings. Control equipment connected to barrier must not use or generate more than 250Vrms or 250Vdc.

Analog signals

The COSA 9610™ has two 4-20mA analog outputs (4 optional). The signals can be user-programmed to represent various measurement readings, such as Wobbe index and CARI index. The analog output signals are wired via isolating barriers. Please note that these barriers are to be connected to an intrinsic safe earth (I/S). When no intrinsic safe earth is available the barriers may be connected to a potential free earth (PE) with a resistance of less than 1 ohm. For details see project specific drawings.

Digital signals

The digital signals are divided in three, Digital outputs (alarm/status), digital input, and RS-485 serial signals. For details see project specific drawings.

3. IN OPERATION

3.1. START-UP SAMPLE CONDITIONING SYSTEM

The sample conditioning system is located in the left-hand compartment. This chapter describes how the components of the sample conditioning system should be set up, in correct order, so a perfect start-up of the total analyzer system can be achieved. The instructions hereunder should be performed step by step.

3.1.1. Inspection, visual and external connections

Perform a visual inspection of the system and close all shut-off valves in the system. Check the connecting fittings of the supply tubes to be correctly fitted and are not leaking. This can be checked quite simple by unscrewing the nut from the fitting and then check if "Front and Back ferrule" of the fitting are able to rotate but cannot be moved in an axial direction. If this is not the case, this tube must be renewed. Then turn the nut by hand and afterwards tighten it a 1/4 turn with a suitable spanner. The supply and drainage tube can now be connected.

Because the supply line is under pressure and has been closed off on the COSA 9610™ side, the connecting fittings can be squirted with soap in order to detect any possible leaks. When bubbles appear this indicates a leak and the tube concerned must immediately be closed off at the supply point. Inspect the fitting and tube, replace components when necessary.

3.1.2. Air orifice selection

Before the COSA 9610™ is set into operation, the range of measurement must be established. The air orifice is selected on the basis of the desired range of measurement.

The COSA 9610™ is standard equipped with the following orifices:

- Gas: .0079 in to .0118 in (0.2 mm and 0.3mm)
- Air: 0.55/0.60/0.65/0.70/0.75 for a dual range version extended with 0.80/0.85 and 0.90.

Relationship of pressure differential (gas/air) versus Wobbe-Index with different air orifices and a fixed residual oxygen concentration of 5% (theoretically determined).

It is therefore recommended that a residual oxygen concentration of 2.5% is chosen corresponding to the reference point. Possible fine-tuning of the reference point, (for the purpose of attaining the correct O_2 %); can be carried out by giving the booster relay a positive or negative offset.

3.1.3. Opening of shut-off valves

Open the shut-off valve with identification plate "instrument air supply".

3.1.4. Setting of gas pressure reducer

Turning the adjusting cap clockwise can raise the pressure of the gas pressure reducer. The set outlet pressure can be read immediately from the pressure indicator mounted on the reducer.
Set the output gas pressure to 30 PSIG.

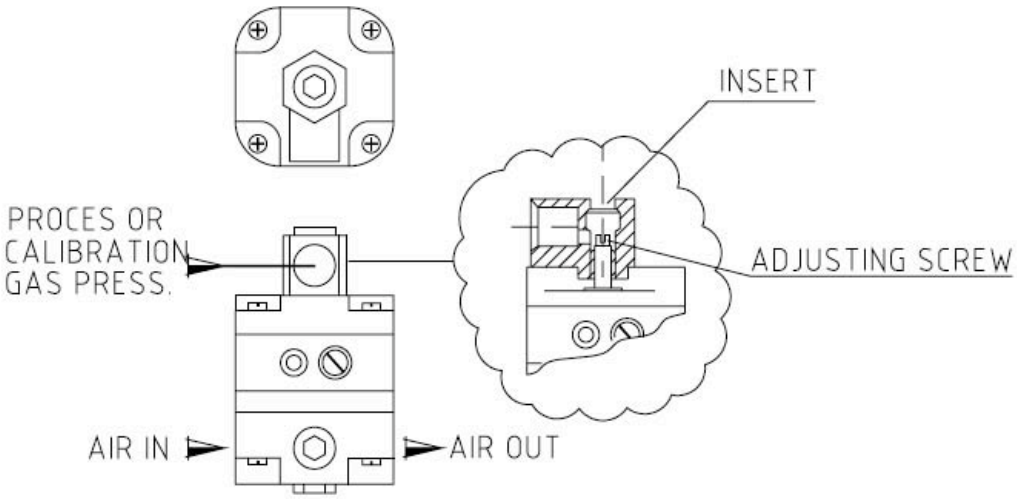
3.1.5. Adjusting flow with flow meters

Unscrew the needle valve of bypass flow regulator completely (turn counter clockwise). Use the "By-pass flow meter" needle valve; throttle back the flow so that the "Analyzer flow meter" shows a flow of 50Nl/hr.
After this throttle back the output of the analyzer flow to 40Nl/hr using the needle valve on flow meter tagged "Analyzer flow".

3.1.6. Adjusting booster relays

Set the chosen residual O_2 set point with help of the booster relay. With the booster relay it is possible to give a small negative (i.e. the gas pressure is higher than the air pressure) or positive offset of max 0.5 bar, as set point correction or as pressure drop compensation over the air- and gas tubes in the heat exchanger.

In order to achieve the necessary offset pressure, the insert with internal hexagon at the top of the booster relay must be removed. By doing this, the slotted adjusting screw is accessible by means of a small rotation counter clockwise, a bigger negative offset is reached. In other words, the air pressure is lowered in comparison with the gas pressure. The correct choice of a negative rather than a positive offset needs to be used for proper analyzer operation. The chosen residual oxygen concentration, combined with the average of the chosen range of measurement, gives according to these curves the selection of the air nozzle and an indication for the booster offset.



Caution

The adjusting screw is located in the gas compartment of the relay. When the insert is released, gas will escape. Be prepared before the relay is going to be adjusted, e.g. have the right equipment readily available, so the gas compartment has to be open for only a minimum of time.

After this adjustment the insert must be fitted again and the offset can be checked. The offset adjustment can be checked by reading the air and gas pressure indicators. This operation must be repeated until the desired residual oxygen concentration is reached. After this the insert is fitted with sealing tape, assembled and then checked for leakage by means of either a gas leak detector or soap.

It is advisable; to carry out a check on the booster relay adjustment with high Wobbe-Index calibration gas, directly after setting up the booster set point. Using the on-screen menu, select 2 Points manual (Dual Range manual for dual range analyzer) validation. Proceed to the "Wait for cal gas 2 to stable" step ("Wait for cal gas 3 to stable" for dual range analyzer). When the signals become stable, the display will show the Residual O2 mV-value suitable to this calibration gas. The setting of the booster relay is right when the mV-value stays below 67 mV. If not, a positive offset should be set with help of the booster relay, so that relative more air will be added and the mV value will fall.

The required Residual O2 mV-signal should be around 65mV for the highest expected Wobbe value.

3.2. START-UP OF THE CONTROL UNIT

This chapter describes the procedure to start up the control unit. When a machine is being started up for the first time a gas calibration has to be done first.

3.2.1. Description

3.2.2. Programming the measurement parameters

Programming the COSA 9610™ is easy with the menu-controlled software. Menu can be navigated using the cursor keys. The key operations are:

Key	Menu navigation	Change setting value
→ or Enter	Select menu item	Accept value change
← or Esc	Go back to previous menu	Undo value change
↑	Go up one menu item	Go to previous item value
↓	Go down one menu item	Go to next item value

To enter the main menu screen, press → or the Esc. The screen now presents some functions that can be selected by the cursor keys or by typing the number associated to the menu item. To resume normal operation, press ← or Esc until the main screen to appear. To change a setting value on menu, select the item and enter the new value. For setting item with selection (e.g. On/Off), select the desired value using ↑ and ↓ keys.

3.2.3. Main screen

The main screen is divided into section, each representing data, status or charts as see in the figure below. Graphical chart trend data can be changed to any of the calorific, density or other values shown on the main screen.


4-10-2009 10:13
COSA 9610
Wobbe 454.44 BTU/scf
Calorific 345.56 BTU/scf
CARI 4.655
Spec Gravity 0.5782
Density 0.0466 lbs/cf
Residual O2 9.56 %
Residual O2 18.34 mV
Spec Gravity 1.83 V
Power Supply 23.4 V
Sample 49.0 °C
Oven 812.0 °C
Elec. Cabin 32.3 °C
Wobbe Index BTU/scf
3000
2400
1800
1200
600
0
Specific Gravity
3.00
2.40
1.80
1.20
0.60
0.00
cal gas 1
cal gas 2
cal gas 3
range 1
stream 1
stream 2
valid 1
valid 2
high alarm
low alarm
calibrate
validate
range 2
cal fault
in op
sys fault
watchdog
cal req
val req
stream sw
System OK

The lower right section displays the status of each digital input and output. The signal assignments are user-programmable.

Explanation outputs

cal gas 1	Digital output driving low value calibration gas air actuator
cal gas 2	Digital output driving medium value calibration gas air actuator
cal gas 3	Digital output driving high value calibration gas air actuator
range 1 (optional)	Extended range execution indicating second mixing chamber is selected for dual range option
stream 1 (Standard)	Indicating process stream 1 selected
stream 2 (optional)	Indicating process stream 2 selected
Stream sw	Status, switching streams
High alarm	High Calorific value
Low alarm	Low Calorific value
Calibrate	Calibration in progress
Validate	Validation in progress
Calibration fault	Calibration fault
Sys fault	Collective alarm
In op	Analyzer is in operation
System Ok	Status box, also displays access level and fault

Explanation inputs

Watchdog	Status watchdog for microprocessor on interface board and /or PC
Calibration req	External input to start calibration
Validation assignment	External input to start validation
Calibration gas pressure	Calibration gas pressure regulator (input)
Air pressure	Instrument air pressure regulator (input)
Sample pressure	Sample pressure regulator (input)
Flow alarm A (optional)	This digital input has no function at present
Flow alarm B (optional)	As above
Flow alarm C (optional)	As above
Flow alarm D (optional)	As above
Flow alarm E (optional)	As above

Menu Tree V2.3.0.0

- **Global Settings**
  - **1. Calibration**
    - **1. Start Calibration**
      - 1. Semi-automatic
      - 2. 1-point manual
      - 3. 2-point manual
      - 4. Dual range manual
    - **2. Start Validation**
      - 1. Semi-automatic
      - 2. 1-point manual
      - 3. 2-point manual
      - 4. Dual range manual
    - **3. Calibration gases**
      - 1. Gas 1 Wobbe
      - 2. Gas 1 CARI
      - 3. Gas 1 Specific Gravity
      - 4. Gas 2 Wobbe
      - 5. Gas 2 CARI
      - 6. Gas 2 Specific Gravity
      - 7. Gas 3 Wobbe
      - 8. Gas 3 CARI
    - **4. Settings**
      - 1. Semi-automatic
      - 2. Remote
      - 3. Timed
      - 4. Timed Method
      - 5. Start Delay
      - 6. Switch Time
      - 7. Error Detection
      - 8. Error Limit
    - **5. Schedule**
      - 1. Sunday
      - 2. Monday
      - 3. Tuesday
      - 4. Wednesday
      - 5. Thursday
      - 6. Friday
      - 7. Saturday
  - **2. Operation**
    - **1. General**
    - **2. Multi-Stream** *(warm up delay)*
    - **3. Dual Range**
  - **3. Measurement**
    - **1. Wobbe**
    - **2. Calorific Value**
    - **3. CARI**
    - **4. Specific Gravity**
    - **5. Density**
    - **6. Residual Oxygen**
    - **7. Temperature**
    - **8. Pressure**
      - 1. Sample System
      - 2. Instrument Air
      - 1. Oven
      - 2. Sample System
      - 3. Oven Inlet
      - 4. Oven Outlet

4. Output

(Analog & During Cal)
1. Channel A
2. Channel B
3. Channel C
4. Channel D

5. Communication

1. Modbus
2. Serial
3. Ethernet

6. System

1. About
2. Date & Time
3. Login

4. Password

(User Password 1234)
5. Logout

(Admin Password 9999)
6. Configuration
7. Test
8. Restart
9 Exit

1. Analog Output A
2. Analog Output B
3. Analog Output C
4. Analog Output D
5. Digital Output 1-8
6. Digital Output 9-16
7. Digital Input
8. Digital Out Polarity 1-8
9. Digital Output Polarity 9-16
0. Digital Input Polarity

7. Display

1. Chart 1
2. Chart 2
3. Color

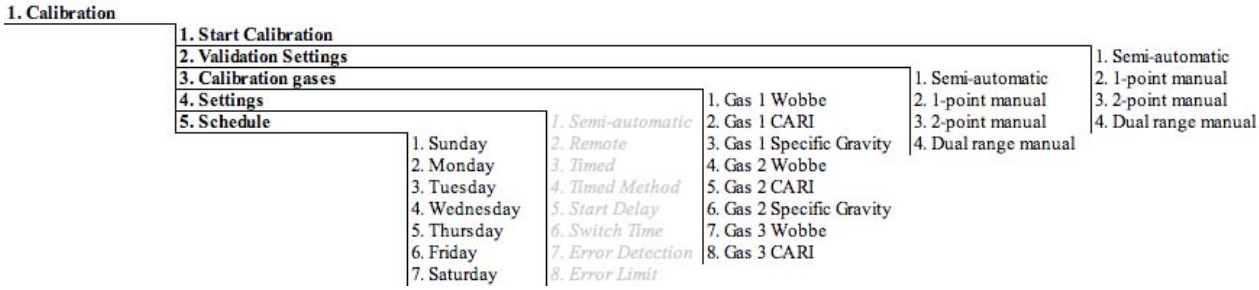
8. Reset Alarms

3.3. PROGRAMMING MENUS

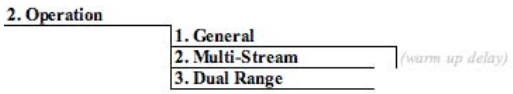
The paragraph numbers correspond with the key sequence from the 'menu tree'. In this way it is easy to see how a specific menu is reached. One exception is the measuring menu, this is reached from the main screen by either the [→] or [Enter] key.

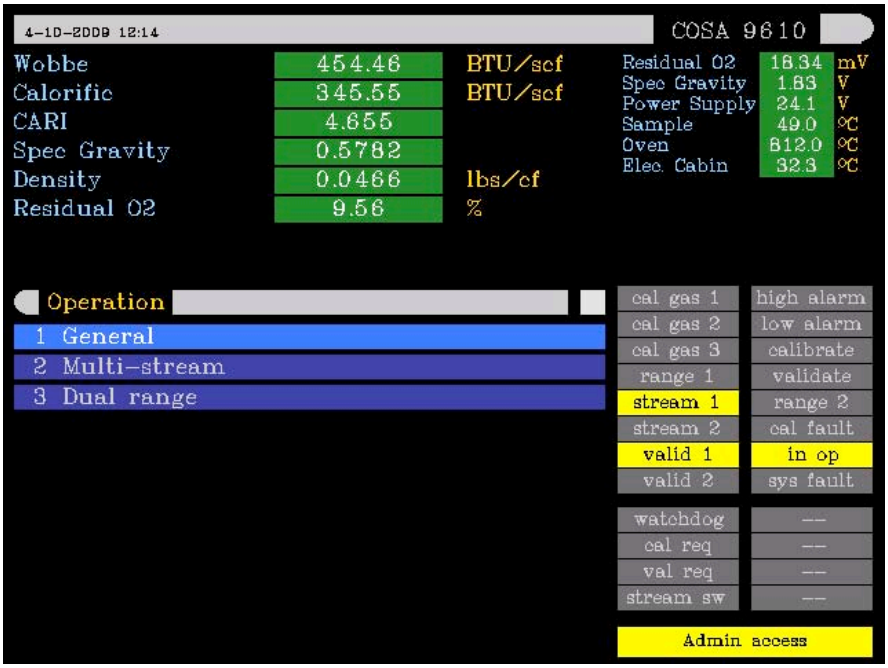
3.3.1. Calibration Menu

In the main menu the following sub-menus are available:

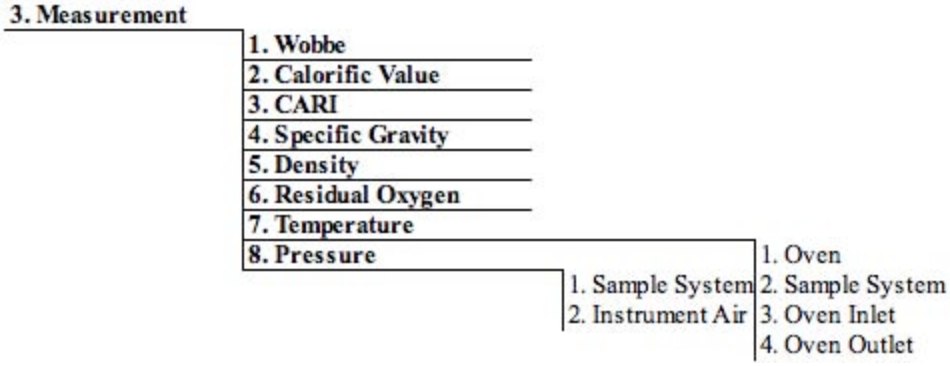


3.3.2. Operation Menu





3.3.3. Measurement Menu

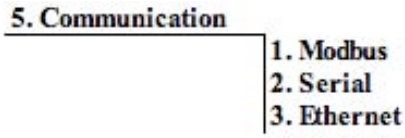


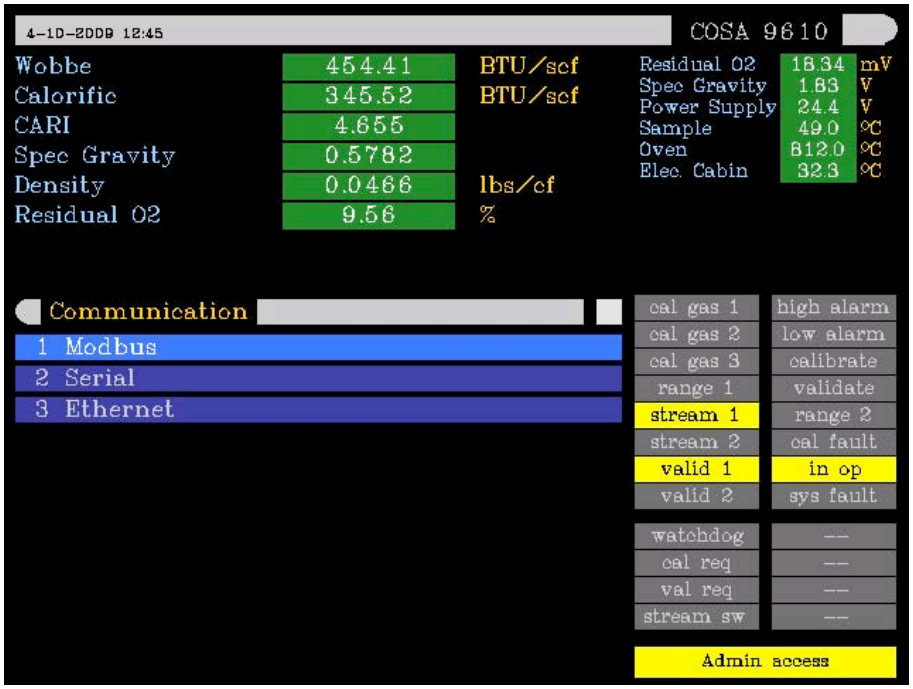
3.3.4. Output Menu

4. Output

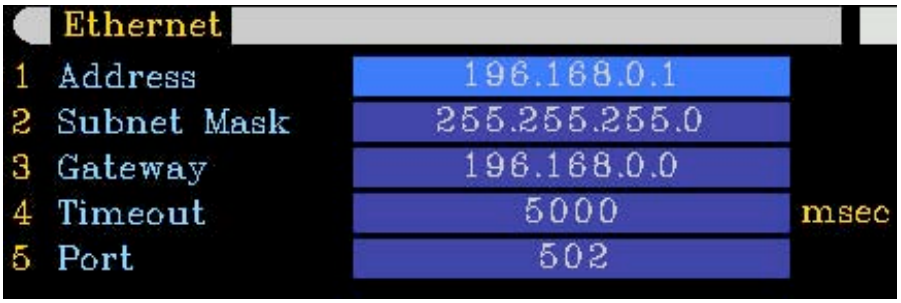
(Analog & During Cal)
1. Channel A
2. Channel B
3. Channel C
4. Channel D

3.3.5. Communications Menu

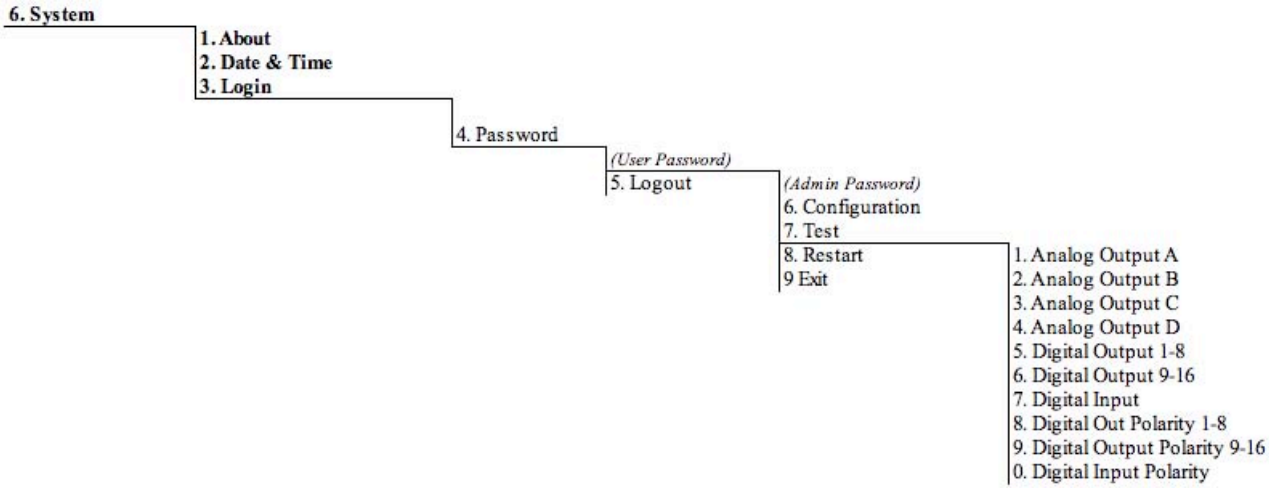




Submenus 1-3 with default communication settings:


Ethernet
1 Address
196.168.0.1
2 Subnet Mask
255.255.255.0
3 Gateway
196.168.0.0
4 Timeout
5000
msec
5 Port
502

3.3.6. System Menu



Passwords:

USER: 1234

ADMIN: 9999

Display Menu

3.3.7. Reset Alarms Menu

3.4. TEMPERATURE CONTROLLED OVEN

3.4.1. Furnace temperature control unit

The zirconia cell must operate at a temperature above 600ºC. For optimal performance, a set-point temperature of 812ºC was chosen. The oven that serves as the heating device for the zirconia cell is made of a metal wire-wound heating element. To minimize energy consumption, the heating element is encapsulated by glass-fibre insulating material. The driving voltage for the heater is 60VAC. The power is controlled by a separate microprocessor based temperature controller. This will prevent oven failures due to computer malfunctions, and at the same time releases computer-time for calculations and graphical tasks.

The temperature controller utilizes a PID algorithm to drive a solid-state relay, which on its turn controls the on/off ratio of the voltage to the heater element. To generate alarms, and to enable the system to compensate for temperature changes, the temperature controller has a retransmit output, which generates a voltage of 0-5V between 0-1000ºC.

The oven temperature controller is located inside the electronics compartment. It is the controller on the top left side. All settings are factory programmed and do not need to be changed. However, for servicing purposes it can be useful to change the temperature of the oven. The temperature controller has two displays. The top display shows the actual oven temperature. The bottom display shows the temperature set-point.

By pressing the up arrow key, one can increase the temperature set-point. By pressing the down arrow key one can decrease the temperature set-point. The oven needs about half an hour to heat up to 812ºC. Normal on/off-ratio is about 85%. This allows for a stable temperature control and long lifetime of the oven (typically 2 – 8 years).

Photo of temperature controllers located in electronics compartment

NOTE*: Set oven temp to 81 2ºC & sample system to 50ºC for standard units, 90ºC for mid-temp models*

3.4.2. Adjustment procedure temperature regulator

This procedure describes the setting of the temperature controller. The controller measures the temperature with the help of a K-type thermocouple. The heating is arranged by a pulsing 5VDC signal. The on/off relation decides the added capacity. The tuning program in the regulator will optimize the regulator algorithm. This program decides the most optimal settings for the PID regulation.

Procedure:

1: Check the connections according to drawing.
2: Turn on the voltage.

4. PREVENTIVE MAINTENANCE

4.1. WEEKLY / MONTHLY MAINTENANCE

4.1.1. Compressor (optional)

Checking for moisture. If the indicator on the drier has changed colour from light blue to lilac or pink, this indicates that the drier is saturated and is not working efficiently. If the indicator is discoloured, the supplier of the compressor should be contacted.

4.1.2. Filters

4.2. THREE (3) MONTH MAINTENANCE

4.2.1. Compressor (optional)

Replacement of both filter elements on the before- and after- filter

Disconnect mains voltage with the working switch and make the buffer vessel pressure-less using the de-aeration/dewatering valve. Both filter housings can now be loosened, after which the filter elements can be changed.

Replacement of the two intake filters

Disconnect mains supply and dismantle the upper half of the compressor housing, being careful that the ventilator cable plug does not come loose from the ventilator. Using a screwdriver, poke the filters out of their rubber seating, after which the new filters can be pressed into place.

Testing the automatic filter drying unit

Loosen the drainage tap on the underside the stabilisation chamber. If water comes out of here, the filter drier unit needs to be inspected by the supplier's service engineer.

Checking the safety valve

Draw the pin of the safety valve out a few times.

4.3. ANNUAL MAINTENANCE

- Check the calibration gas bottles for pressure.
- Check the sample system for correct pressure.
- Check the bypass flow meter for correct flow rate.
- Replace the instrument air filters as required.
- Replace optional sample gas filters as required.
- Replace optional pump diaphragms as required.

4.4. TROUBLESHOOTING

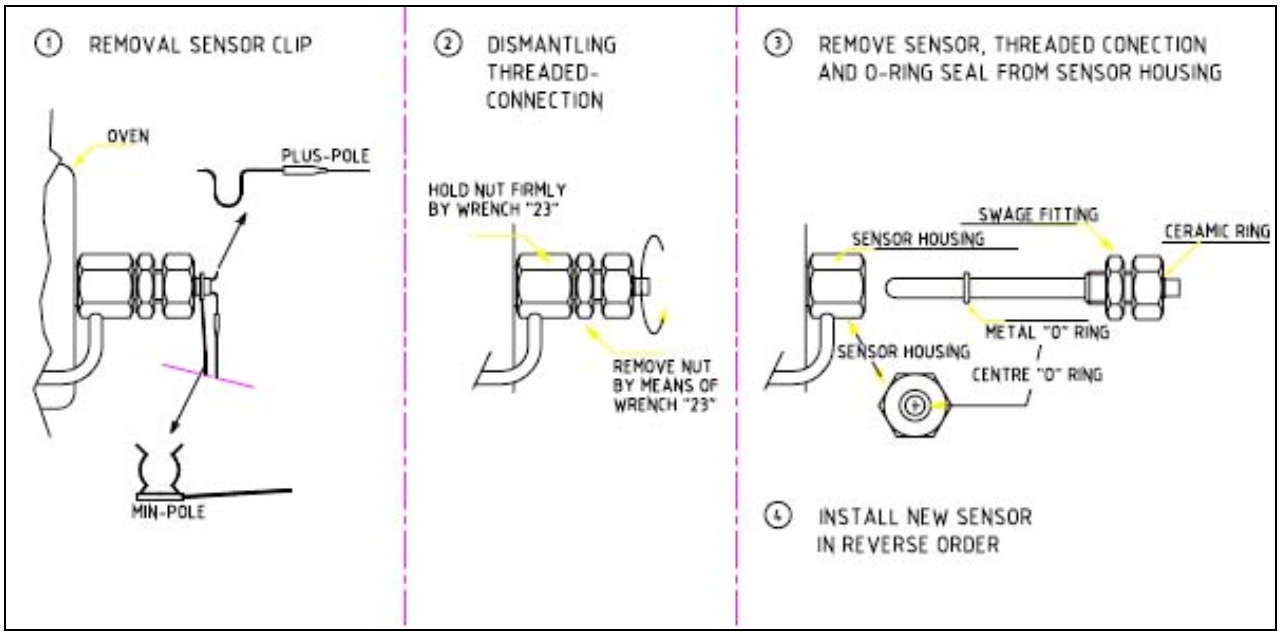
Breakdown -> fault report	**Test**	**Action**
No air pressure -> flow alarm	tube fracture	Replace tube
	Measuring pressure behind reducing valve	Open valve for reducing valve tagged "air supply"
		Increase output pressure
No gas pressure -> flow alarm	Tube fracture	Close main valve immediately and replace pipe
	Blockage in gas supply	Check/clean/replace tubing
Oven temperature below 750°C -> temp low alarm	Check set point on temp. Controller. Check fuse 1 in TB1 of regulated supply	Reset
	Check fuse 4 in TB4 of temp. controller (display is off)	Replace
	Check output voltage temp. controller (0-5 VDC) to Solid State Relay	Contact supplier
	Check pulsating voltage (0-60 VAC) to oven	Contact supplier
	Check oven resistance ± 13 Ω	Contact supplier
Analyzer becomes slow > 20 seconds response time	Check system flows and gas pressures	Clean system and/or adjust to correct values
	Check resistance of cell, when sample gas is "shut off" it should be lower than 1000 Ω	Replace Zirconia cell
No response from analyzer	Response to mV signal on cell input terminals	Electronic problem. Check interface board or computer
	No mV signal from cell	Replace Zirconia cell
	Leak in mixing system	Check for leaks
	Response to mV signal on cell input terminals	Clean systems and/or adjust to correct values
No mA output signal	Check or the test value is set to "NO"	Set test value to "NO"
	Simulate mA signal wiring. Check test value on 0%, 25%, 50%, 75% and 100%	Contact supplier

4.5. REPLACEMENT OF RESIDUAL OXYGEN SENSOR

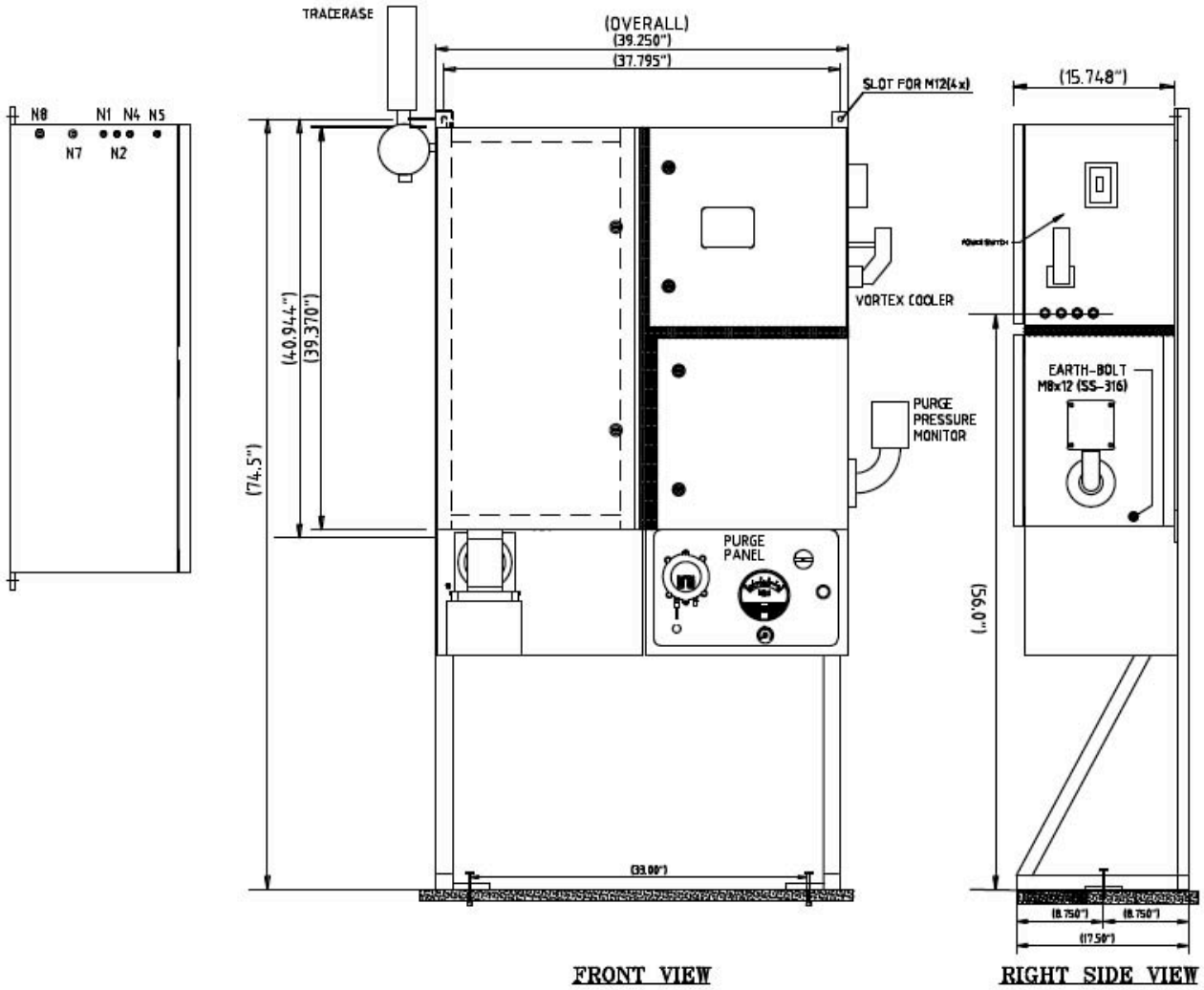
Before going any further make sure that the oven has been disconnected and cooled off so that no physical injury can occur caused by coming into contact with any parts which may still be hot.

1. Remove the connecting clips from the sensor and take care that the ceramic ring stays in place.
2. Unscrew the sensor from the cell holder.
3. Then draw the sensor out of its holder, taking care that the sensor does not come into contact with dirt, grease or oil.

The sensor is dismantled in the following order:



5. INSTALLATION DRAWING



TUBING CONNECTIONS LEGEND:

N5 - AIR SUPPLY: 3/8" TUBE BULKHEAD, ~ 100 PSIG.
(INSTRUMENT, PILOT, Z - PURGE, COOLER)
N6 - GAS SELECTION MANIFOLD BLEED OUTLET
(PROCESS AND/OR CALIBRATION GASES MAY BE PRESENT IN QUANTITIES EXPECTED FROM GAS LEAKS)
N1 - PROCESS GAS - CONSUMPTION = 2 SCFH
PRESSURE: MIN. 30 PSIG, MAX. 100 PSIG.
(UNLESS EQUIPPED WITH HIGH PRESS. REGULATOR)
N2 - LOW RANGE CALIBRATION GAS
PRESSURE: MIN. 30 PSIG, MAX. 100 PSIG.
N4 - HIGH RANGE CALIBRATION GAS
PRESSURE: MIN. 30 PSIG, MAX. 100 PSIG.
N7 - ATMOSPHERIC PRESSURE FAST LOOP VENT - GAS/AIR MIXTURE; NO BACKPRESSURE PERMITTED!
N8 - FURNACE EXHAUST VENT, MAY CONTAIN FLAMMABLE MIXTURE IN THE EVENT OF FURNACE FAILURE; NO BACKPRESSURE PERMITTED!
N12 - FURNACE DRAIN
N30 - FAST LOOP RETURN (DRAIN OF PROCESS GAS INLET FILTER)

REV
-

Standard drawing shown with optional equipment.

6. ORDERING OF SPARE PARTS

All spare parts may be ordered quoting number and specification from:
Installation and maintenance by trained personel only:

COSA INSTRUMENT CORPORATION

New Jersey Office:
55 Oak Street
Norwood, NJ 07648
Tel: 201-767-6600
Fax: 201-767-6804

New York Office:
84G Horseblock Rd.
Yaphank, NY 11980
Tel: 631-345-3434
Fax: 631-345-5349

Texas Office:
7125 North Loop East
Houston, TX 77028
Tel: 713-947-9591
Fax: 713-947-7549

E-mail:
cosa@cosaic.com

WARNING: Substitution of components may impair hazardous location safety.

COMPLETE PARTS LIST AS OF 6-2011

Item Number	Replacement	Item Description
CAL.00.M.1000		COSA MODEL 9610 WOBBE ANALYZER
CAL.00.M.2000		COSA MODEL 9610MT WOBBE ANALYZER
CAL.10.E.1045		DIGITAL I/O BOARD, PC
CAL.10.E.0006		ANALOG DIGITAL CONVERTER BOARD(ADC)
CAL.10.E.0009		CPU MODULE, ATHENA II
CAL.10.E.1057		INTERFACE BOARD
CAL.19.M.0004	1-Year	ORIFICE TUBE,1/8"OD X 0.2 MM,GAS
CAL.19.M.0005	1-Year	ORIFICE TUBE,1/8"OD X 0.3MM,GAS
CAL.19.M.0006	1-Year	ORIFICE TUBE, 1/4" ODx0.55mm, AIR
CAL.19.M.0007	1-Year	ORIFICE TUBE, 1/4"ODx0.60mm, AIR
CAL.19.M.0008	1-Year	ORIFICE TUBE, 1/4"ODx0.65mm, AIR
CAL.19.M.0009	1-Year	ORIFICE TUBE, 1/4" ODx0.70mm, AIR
CAL.19.M.0010	1-Year	ORIFICE TUBE, 1/4"ODx0.75mm, AIR
CAL.19.M.0011	1-Year	ORIFICE TUBE, 1/4" ODx 0.85 MM, AIR
CAL.19.M.0012	1-Year	ORIFICE TUBE 1/4"x0.80mm, AIR
CAL.19.M.0013	1-Year	ORIFICE TUBE 1/8"x0.15mm, GAS
CAL.25.E.0080		DISC ON CHIP f/CPU PCB
CAL.98.E.0024		TEMPERATURE CONTROLLER,OVEN
CAL.98.E.0059		DIN RAIL RELAY
CAL.98.E.0062		3" HEAT SHRINK ENTRY SEAL
CAL.98.M.0018		OVEN,60VAC,300W
CAL.98.M.0019	5-Year	AMETEK CELL 71174SE
CAL.98.M.0020	5-Year	AMETEK THERMOCOUPLE 71697KE
CAL.98.M.0024		EXP. PROOF PUMP, BELLOWS
CAL.98.M.0033		EMISSION ELIMINATOR - CSA APPROVED
CAL.98.M.0050	1-Year	TRACE ERASE HEATER ELEMENTS
CAL.S1.E.0101		DENSITY CELL OPTION ASSEMBLY
CAL.S1.E.0102		YOKOGAWA DENSITY CELL
CAL.S1.E.0103		DENSITY CELL - MID TEMP ASSEMBLY OPTION

CAL.S1.E.0200		DIGITAL COMM. RS-485 MODBUS
CAL.S1.E.0520		4 ANALOG OUTPUT OPTION
CAL.S1.M.0001		HEATER OPTION
CAL.S1.M.0002		COOLER OPTION
CAL.98.M.0088		SAMPLE SYSTEM HEATER-400W 120Vac
CAL.S1.M.0005		PURGE OPTION
CAL.S1.M.0006		DUAL FILTER OPTION
CAL.S1.M.0007		AVENGER - MEMBRANE FILTER
CAL.S1.M.0022		DUAL STREAM OPTION
CAL.S1.M.0023		SINGLE STREAM OPTION
CAL.S1.M.0025		PUMP - SAMPLE OPTION
CAL.S1.M.0026		PUMP - RETURN OPTION
CAL.S1.M.0033		EMISSIONS ELIMINATOR OPTION
CAL.S1.M.1000		ORIFICES FOR 100-1000 BTU RANGE
CAL.S1.M.2000		ORIFICES FOR 500-1300 BTU RANGE
CAL.S2.M.0001		DUAL RANGE OPTION
ESS.37.M.0575		TAG - STAINLESS STEEL
CAL.98.M.0007		BOOSTER RELAY
XDO.98.M.5022		HEADLINE FILTER & HOUSING
XDO.98.M.5023	1-Year	FILTER ELEMENTS (BOX OF 10)
CHA.98.M.0008		SWIRLCLEAN BYPASS FILTER-MODEL I (SMALL)
CAL.98.M.0003		SPECIFIC GRAVITY CELL (OVAL)
CAL.98.E.0012		HEATER,110VAC,60HZ, 500W,EX,T3
CAL.18.E.0000		THERMOCOUPLE-PT-100,SCS.COMPARTMENT
CAL.60.E.0001		POWER SUPPLY,110VAC,12VDC & 5VDC
CAL.60.E.0002		POWER SUPPLY,110VAC,24VDC
CAL.98.M.0117		RELIEF VALVE,0.2-3.5BARG
CAL.98.M.0116		FLOWMETER w/VALVE (BYPASS) 250-1500 NI/h
CAL.98.M.0115		FLOWMETER (OVEN, DETECTOR) 6-50 NI/h
CAL.98.E.0068		SAMPLE SYSTEM HEATER-400W 220Vac.
CAL.S1.E.0005	1-Year	FUSE SET FOR ANALYZER
CAL.98.M.0009		TEE FILTER W/ELEMENT 7UM
CAL.98.M.0025	1-Year	FILTER ELEMENT W/GASKET
CAL.98.M.0114	1-Year	PRESSURE REGULATOR,0-4BARG(0-60PSI)
CAL.98.E.0003		KEYBOARD F/WIM 9600
CAL.98.M.0126	5-Year	VALVE ASSEMBLY - TT2B SERIES-4 MOD
CAL.98.M.0113	5-Year	VALVE ASSEMBLY-TT2B SERIES-3 MOD
CAL.98.M.0015		PUMP WITH EX-PROOF MOTOR
CAL.98.M.0224	1-Year	PUMP REPAIR KIT (ADI)
CAL.98.M.0048		DUAL HEAD FAST LOOP PUMP C1, D2, GRP.BCD

7. CERTIFICATION

1. ATEX CERTIFICATE
2. US/CANADIAN CERTIFICATE

This product has been examined against the following standards

1. ATEX:

EN 60079-0:2009

EN 60079-2:2007

EN 60079-11:2007

EN 60529 (+A1):2000

cosa+xentaur
84F HORSEBLOCK RD.
YAPHANK, NY 11980
U.S.A.
TEL: 001-631-345-3434

FM APPROVED

1725

TYPE/MODEL	: WIM 9610:
HAZARDOUS AREA PROTECTION DEGREE	Ex ib px IIC T3 Gb Ta=+5C to 45C, IP66.
CATEGORY	: II 2G
CERTIFICATE	: FM11ATEX0006X
SERIAL No.	: XXXX
POWER SUPPLY	: 115Vac, 60Hz, 12A /
	: 230Vac, 50Hz, 6A, +/-10%
Um:	: 250 Vrms / Vdc maximum
PURGED ENCLOSURE VOLUME	: 92.5 liter
MINIMUM PRE PURGE VOLUME	: 462.5 liter
MINIMUM PURGE DURATION	: (8 minutes)
MAXIUM ENCLOSURE LEAKAGE RATE	: 1 liter / second
MINIMUM PURGE SUPPLY PRESSURE	: 4 barG
MINIMUM PRE PURGE FLOW	: 2.8 liter / second
MINIMUM FLOW DURING OPERATION	: 0.5 liter / second
MIN. OVERPRESSURE DURING OPERATION	: 6 mbarG
MAX. OVERPRESSURE DURING OPERATION	: 10 mbarG
MAXIMUM PROCESS GAS FLOW	: 0.6 liter / minute
MAXIMUM PROCESS GAS PRESSURE	: 200 mbarG

c) a restriction that the flammable substance oxygen concentration must not exceed 2%.
d) a restriction that the flammable substance shall not have a UEL higher than 80%.

WARNING

- THIS ENCLOSURE NORMALLY CONTAINS INSTRUMENT AIR AND CAN RELEASE FLAMMABLE SUBSTANCES
- DO NOT OPEN THIS CABINET WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT
- DO NOT USE THE OVERRIDE SWITCH WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT
- TO PREVENT THE RISK OF ELECTROSTATIC SPARKING, THE VIEWING PORT SHALL BE CLEANED ONLY WITH A DAMP CLOTH

2. US/CANADA:

FM3600 1998
FM3610 2010
FM3810 2005
FM3620: 2000
ANSI/NEMA 250: 1991
ANSI/IEC 60529: 2004
ANSI/NFPA-496: 2003
CSA-C22.2 No. 0.4: 1999
CSA-C22.2 No. 157: 2006
CSA-C22.2 No. 1010.1: 2004
CSA-C22.2 No. 60529: 2005

cosa+xentaur
84F HORSEBLOCK RD.
YAPHANK, NY 11980
U.S.A.
TEL: 1-631-345-3434

FM APPROVED C US

TYPE/MODEL	: WIM 9610
HAZARDOUS AREA PROTECTION DEGREE	: CLASS I, DIV2, GROUPS B, C & D
CATEGORY	: TYPE Z - PURGE
CERTIFICATE	: T3C, TA = +5C TO +45C
	TYPE 4X (US), IP66
SERIAL No.	: XXXX
POWER SUPPLY	: 115Vac, 60Hz, 12A /
	: 230Vac, 50Hz, 6A, +/-10%
Um:	: 250 Vrms / Vdc maximum
PURGED ENCLOSURE VOLUME	: 92.5 liter
MINIMUM PRE PURGE VOLUME	: 462.5 liter
MINIMUM PURGE DURATION	: (8 minutes)
MAXIUM ENCLOSURE LEAKAGE RATE	: 1 liter / second
MINIMUM PURGE SUPPLY PRESSURE	: 4 barG
MINIMUM PRE PURGE FLOW	: 2.8 liter / second
MINIMUM FLOW DURING OPERATION	: 0.5 liter / second
MIN. OVERPRESSURE DURING OPERATION	: 6 mbarG
MAX. OVERPRESSURE DURING OPERATION	: 10 mbarG
MAXIMUM PROCESS GAS FLOW	: 0.6 liter / minute
MAXIMUM PROCESS GAS PRESSURE	: 200 mbarG

Flammable substance oxygen concentration must not exceed 2%.
Flammable substance shall not have a UEL higher than 80%.

WARNING

- THIS ENCLOSURE NORMALLY CONTAINS INSTRUMENT AIR AND CAN RELEASE FLAMMABLE SUBSTANCES
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