9800CXi Calorimeter™

Installation, Operation and Maintenance Manual

Engr doc template:		Author | Title: Samir Ajit Patil
		Email: support.HOU@process-insights.com
Doc Type: (Internal /Customer): Internal		CXC Location: Houston, TX
Date Created/Updated:	Doc:	Rev:
February 10, 2023	**CAL.01.D.9800CXi**	**A.9**

Process-Insights
Corporate Office: 4140 World Houston Parkway #180, Houston, TX 77032, Tel: 713-947-9591, Fax: 713-947-7549
www.Process-Insights.com

(Back to Top)

Process Insights
Texas Corporate Headquarters,
Sales & Service Offices:
4140 World Houston Parkway
Suite 180, Houston, TX 77032, USA
Tel: 713-947-9591
Fax: 713-947-7549

E-mail: sales.HOU@Process-Insights.com, support.HOU@Process-Insights.com
Website: http://www.Process-Insights.com

(Back to Top)

Table of Contents

(Back to Top)

Section 1 – General Information

Section 1.1 - Letter from Corporate

Dear Valued Customer,

During the past several years, we have experienced extraordinary growth and change at Process Insights, due to our continued commitment to teamwork, technology-focused product strategies and to our policy of placing the trust of our customers above all else. We have successfully reached key milestones, expanded research and development initiatives, achieved significant technological advancements, and initiated our position as a premier manufacturer and developer of analytical instrumentation. In the face of challenging economic conditions, we are finding new ways to provide solutions to an evolving industry landscape to ensure PROCESS INSIGHTS remains the brightest light on the marketplace.

The upcoming years will be exciting as we continue to broaden our business efforts and move from promise to product. We have set increasingly ambitious goals but possess the passionate vision and resources to achieve them. We have the knowledge, experience, and expertise to bring specialty products to this niche market, and we know the steps we need to take are simply an extension of what we have been doing successfully since our inception. Simultaneously, we plan to continue responding to market challenges and expand our line of analyzers with products incorporating enhanced features to engage a wider customer base.

One of our customers has described our success story as "more a marathon than a sprint." We take pride in this characterization and embrace it as the philosophy for our operations as a successful business is built on sustainable and reliable growth. In recent years, we've grown our business substantially, yet managed to never waver from our promise to deliver the very best products and service to our valued customers. PROCESS INSIGHTS is building the analyzer tools of tomorrow, hearing the markets' demands and we are ready to meet the challenges. Watch us closely; the next five years will be a defining notch in PROCESS INSIGHTS's timeline.

We credit each of our devoted employees for making these past years such a success in turbulent times. I would also like to extend my thanks to our customers and our suppliers for their unfailing sense of devotion, responsibility, guidance, and support, without which we would have surely not have come this far.

Thank you for the purchase of this PROCESS INSIGHTS product and please trust in our commitment to your complete satisfaction. Should you have any concerns, please do not hesitate to contact us for support.
Sincerely,

Process Insights

(Back to Top)

Section 1.2 - About This Manual

This multipart user's manual provides information regarding the proper installation, operation and service of the 9800CXi Calorimeter.

The manual is divided into the following eight sections.

- **Section 1** General Information about Service, Parts List, Cautions and Warnings, and Instructions for proper installation and use of equipment
- **Section 2** Principle of Operation, Specifications, and Drawings
- **Section 3** Software Operation – navigating menu options
- **Section 4** Calibration / Validation procedures
- **Section 5** MODBUS Digital Communications
- **Section 6** Basic Maintenance Guide
- **Section 7** Troubleshooting
- **Section 8** Devices

Warranty, compliance, and safety information concerning the analyzer provided immediately following this page.

The benefits, features and configurations of the analyzer are described in Section 2 along with basic theory and operations.

Installation and operation of the analyzer and most optional equipment are illustrated in Sections 3 and 4 of this manual. Future Information may be supplied in other manuals (i.e., options manuals) or addenda to this manual.

Maintenance and Troubleshooting sections provide step-by-step procedures on basic maintenance tasks along with information on most commonly encountered operational pitfalls and their corresponding fixes.

The contents of this document are subject to change without notice. All technical information in this document is for reference purposes only. System configurations and specifications in this document supersede all previous information received by the purchaser. Process Insights makes no representations that this document is complete, accurate or error-free and assumes no responsibility and will not be liable for any errors, omissions, damage or loss that might result from any use of this document, even if the information in the document is followed properly.

Some of the terms and labels used in the manual are abbreviated intuitively due to space constraints in tables, photos and illustrations.

For further explanation, contact Process Insights service department.

(Back to Top)

Section 1.3 - Conditions for Proper Use

The 9800CXi Calorimeter is designed to be installed, operated and maintained as specified in this manual. Failure to operate the analyzer as specified may produce erroneous data and possible equipment failure which may void the warranty. Some of the conditions for proper and improper use of the 9800CXi Calorimeter are provided as follows:

1. Read the manual carefully prior to using the analyzer.
2. Keep the manual near the analyzer for reference.
3. Improper usage of the analyzer may void the warranty.
4. The general codes for working with chemicals and electrical equipment must be observed while using the analyzer.
5. Use PPE (coveralls, protective gloves, goggles, and hard hat) as required when working on the analyzer.
6. If faults occur when the analyzer is running and the user cannot rectify it, then please contact your local partner or Process Insights Technical Support.
7. Electrical and electronic devices must be disposed according to the local regulations.
8. The packaging crate material can be recycled. Please dispose appropriately.
9. Bear in mind the potential hazards while using different hydrocarbon samples.
10. Process Insights does not carry out construction work. The installation of the analyzer and options will be provided by the end user.
11. The analyzer is shipped in a wooden crate. Use of a forklift or a lifting device is strongly recommended to unpack the analyzer from the crate. Use of PPE is strongly recommended during this process to prevent any injury.
12. The analyzer does not come installed with a power cord and must be provided by the end user. It should meet the power rating of the analyzer, the hazardous location code, and the local electric code.
13. The analyzer is supplied with conduit hubs for the power and communication cables. The end user will provide the conduit sealing fitting, sealing cement and filler. Conduit sealing fitting, sealing cement and filler must be properly installed and sealed as per the local hazardous location codes and the manufacturer's instruction. If a cable gland is used instead, then it must be installed and sealed as per the local hazardous location codes and the manufacturer's

instruction. Cable/conduit glands used for power and communications entry into the unit must be sealed to maintain overpressure in the enclosure. They must have a minimum IP rating of 65.

14. An earth connection point is provided inside and outside the pressurized enclosures. These connections must be used to join the instrument's metalwork to the earth-ground plane. The external earth wire must be protected so that it cannot become accidentally loosened or damaged by twisting. It must be sized in accordance with local rules for electrical installations and must not be smaller in area than 4 square millimeters (7894 circular mils). The purpose of these connections is to direct any electrical current, internally, or externally generated, into an external ground rod that will eliminate or minimize any damage to personnel and equipment. To achieve the redirection of current, the resistance between the earth-ground connection and the external earth-ground lug must be kept below 0.1 ohms. Use 1/4-20 nut and 1/4" external-tooth lock washer to fasten the earth wire to the analyzer.

15. A manual or automatic power disconnect that removes all power from the analyzer is required to be installed near the unit and should be easily reached. The disconnect must be rated for the hazardous location code. Disconnect must be rated for two times the rated current of the analyzer. It must be labeled as the disconnecting device for the intended analyzer. Wires connecting from the external circuits to the analyzer must be rated for the hazardous location code. Wires and it's insulation should be rated for 600V.

16. It is necessary to keep an appropriate distance between the analyzer sides and opposite walls, such that the analyzer doors can be swung open, and maintenance can be done. Note the wall to which the analyzer is to be mounted should have the strength of a concrete wall. For mounting the analyzer use four corrosion resistant, Grade 8 or better, 3/8-16 x 1-1/4" (min) long bolts and flat washers. Make sure the analyzer is oriented horizontally. Use of a forklift or a lifting device is strongly recommended. If the analyzer is mounted on the supplied frame, then anchor the frame to a leveled ground or foundation with four corrosion resistant, Grade 8 or better, 3/8-16 x 1-1/4" (min) long bolts and flat washers.

17. For systems that come installed with the Z-Purge, it is considered a system-critical Digital Input. The Purge is always monitored and the Analyzer will not power up the furnace and resume analysis unless the Purge Alarm clears. The Z-Purge has a GREEN indicator that turns ON when it detects a positive purge. If the Analyzer loses purge, the indicator on the Z-Purge turns OFF as well as it triggers a GLOBAL FAULT ALARM. The analyzer turns OFF power to the furnace, the analyses are halted and analyzer goes into a "holding" state. It is recommended that once the Analyzer enclosure is closed and a positive purge is achieved (Z-Purge GREEN indicator turns ON), the operator should wait for 10 minutes to verify that the Z-Purge GREEN indicator remains ON before resuming analysis. The analyzer should be installed such that the GREEN indicator is visible and monitored by the operator.

18. For safety reasons, the purge can only be bypassed by authorized personnel with the key. Those without authorization are not permitted to bypass the purge monitoring device.

19. Utility gases such as Sample, Calibration standards, zero grade air and instrument air will be provided and connected to the analyzer by the end user. Leak check and connection integrity will be performed by the end user per the Swagelok instruction. If another brand fittings are used, then follow the manufacture's instruction. All external tubing must be instrument grade, debris free, chemically cleaned, and passivated.

20. If the analyzer is not installed upon receipt, the analyzer must be stored in a dry and frost-free environment at a maximum temperature of 122°F (50°C), preferably in its original packing, and protected against direct sunlight and (rain) water. The storage period should not be more than six months.

21. The analyzer is designed to continuously analyze gaseous samples from a sample handling system and display the Calorific value of the sample. Operation for any use other than specified may damage the analyzer and/or cause personal injury to the operator. The results obtained from any other use cannot be guaranteed.

22. The standard configuration of the analyzer is not intended for extended use in corrosive environments.

23. The best accuracy and precision are obtained when the analyzer is in a temperature-controlled environment.

24. To ensure safe operation, the purge system should always be engaged during operation of the analyzer except after the area has been determined to be non-hazardous and repairs or tests must be performed that require the purge system to be bypassed. Manufacturer's documentation regarding the purge system operation is included in the Section 7 of this manual.

25. The sample to the analyzer must be filtered through a 2-micron (min) filter and delivered to the analyzer by an approved, leak-free sample handling system to ensure the sample being analyzed is representative of the current process.

26. The sample handling system should eliminate or minimize "dead volumes" and areas in the flow path where new sample can be mixed with old sample.

27. Air and other gas supplied to the analyzer must be filtered and meet specified requirements.

28. All cautions and warnings in this manual, on tags and in other publications pertaining to the installation, operation and maintenance of the analyzer must be read and observed. Failure to consider the warning and caution messages can lead to severe personal injury, equipment damage, void of the warranty and impair the protection provided by the equipment.

29. Instrument should be sheltered from direct sun and rain. If the instrument is to be used for measuring very low concentrations, it should be in a climate-controlled area. Ambient temperature should be between 0°C to +40°C.

30. The analyzer must be calibrated correctly before running samples.

(Back to Top)

Section 1.4 - Warnings and Cautions

This manual provides caution and warning messages as listed below. Failure to consider these messages can lead to severe personal injury, instrument damage and/or void of warranty.

1.WARNING: 	**VOLTAGE SPECIFIED ON THE SERIAL NUMBER PLATE OF THE ANALYZER MUST MATCH THAT OF THE END USER POWER SUPPLY.**
2. WARNING: 	**POWER TO ANALYZER MUST BE SUPPLIED FROM AN EXTERNAL POWER BREAKER.**
3. WARNING: 	**SEVERE ELECTRIC SHOCK HAZARD MAY EXIST WHEN POWER IS APPLIED WHILE SERVICING INTERNAL COMPONENTS. THE ANALYZER MUST BE SWITCHED OFF FROM THE MAIN BREAKER BEFORE WORKING ON LIVE PARTS.**
4. WARNING: 	**SEVERE ELECTRIC SHOCK HAZARD MAY EXISTS WHEN CONTACT IS MADE WITH THE AC VOLTAGE COMPONENTS. DO NOT ATTEMPT TO REPAIR OR TEST THE AC VOLTAGE SECTION WITHOUT USING THE APPROPRIATE TEST METER WITH INSULATED PROBES.**
5. WARNING: 	**A POOR GROUND CONNECTION MAY PRESENT A SEVERE SHOCK HAZARD. AN EARTH CONNECTION POINT IS PROVIDED IN THE MAIN ENCLOSURE. THIS CONNECTION MUST BE USED TO JOIN THE INSTRUMENT'S METALWORK TO THE EARTH-GROUND PLANE. IT MUST BE SIZED IN ACCORDANCE WITH LOCAL ELECTRIC CODE.**
6. WARNING: 	**WHEN IGNITABLE COMBUSTIBLE MATERIALS ARE PRESENT, THE ANALYZER ENCLOSURE MUST NOT BE OPENED UNTIL A COOLDOWN PERIOD OF 3 HOURS IS OBSERVED, OTHERWISE AN EXPLOSION DANGER EXISTS. THE ANALYZER IS EQUIPPED WITH A PURGE/PRESSURIZATION DEVICE THAT AUTOMATICALLY CONNECTS POWER AFTER 15 MINUTES (APPROX.) OF PURGE INTERVAL AND DISCONNECTS POWER UPON LOSS OF PRESSURIZATION.**

7. WARNING:	**HIGH-PRESSURE GASES SHOULD BE HANDLED WITH EXTREME CARE. ENSURE THAT ALL RELEVANT SAFETY PRECAUTIONS ARE CAREFULLY FOLLOWED FOR GAS LINES, REGULATORS, GAS PURIFIERS, ETC.**
8. WARNING: 	**AFTER CONNECTING THE TUBINGS AND BEFORE CONTINUING WITH INSTALLATION AND OPERATION. ENSURE THE SAMPLE AND ALL GAS FLOW (INSIDE AND OUTSIDE THE ANALYZER) IS LEAK FREE BY PERFORMING A LEAK TEST WITH HELIUM LEAK DETECTOR (RECOMMENDED) OR LIQUID SOLUTION.**
9. WARNING: 	**SEVERE BURNS CAN RESULT WHEN WORKING AROUND A HOT COMBUSTION CHAMBER. ALLOW THE COMBUSTION CHAMBER TO COOL DOWN SUFFICIENTLY BEFORE PERFORMING MAINTENANCE.**
10. WARNING: 	**SEVERE BURNS CAN RESULT WHEN WORKING AROUND A HOT FURNACE. ALLOW THE FURNACE TO COOL DOWN SUFFICIENTLY BEFORE PERFORMING MAINTENANCE.**
11. WARNING: 	**SEVERE BURNS CAN RESULT WHEN REPLACING THE THERMOCOUPLE. ALLOW THE FURNACE TO COOL DOWN SUFFICIENTLY BEFORE PERFORMING MAINTENANCE.**
12. WARNING: 	**SEVERE BURNS CAN RESULT WHEN REPLACING THE HEATERS. ALLOW THE HEATERS TO COOL DOWN SUFFICIENTLY BEFORE PERFORMING MAINTENANCE.**
13. WARNING: 	**THE OXYGEN SENSOR ASSEMBLY IS MAINTAINED AT 812°C. SEVERE BURNS CAN RESULT WHEN REPLACING THE OXYGEN SENSOR. ALLOW THE SENSOR TO COOL DOWN SUFFICIENTLY BEFORE PERFORMING MAINTENANCE.**
14. WARNING: 	**SEVERE BURNS CAN RESULT WHEN REPLACING THE SAMPLE VALVE AND SSO/ARV VALVE. ALLOW THE SAMPLE ENCLOSURE TO COOL DOWN SUFFICIENTLY BEFORE PERFORMING MAINTENANCE.**

15. WARNING:	**POTENTIAL ELECTROSTATIC CHARGING HAZARD. WHEN CLEANING THE EXTERIOR PAINTED SURFACE OF THE UNIT IN A HAZARDOUS AREA, USE A DAMP CLOTH TO AVOID POTENTIAL ELECTROSTATIC CHARGING.**
16. CAUTION: 	**BECOME FAMILIAR WITH THE LOCATION AND USE OF ALL CONTROLS, INDICATORS, CONNECTIONS AND ACCESSORIES AND CAREFULLY READ ALL INSTRUCTIONS AND WARNING LABELS PRIOR TO OPERATING ANY PORTION OF THE SYSTEM.**
17. CAUTION: 	**THE ANALYZER SHOULD BE SHELTERED FROM DIRECT SUNLIGHT AND PRECIPITATION EXPOSURE.**
18. CAUTION: 	**FOLLOW INSTALLATION DRAWINGS AND SCHEMATICS IN THIS MANUAL BEFORE STARTING THE ANALYZER.**
19. CAUTION: 	**SERIOUS INSTRUMENT DAMAGE CAN OCCUR IF THE OPERATOR IS NOT PROPERLY TRAINED.**
20. CAUTION: 	**DO NOT ATTEMPT TO OPERATE THE ANALYZER UNTIL ALL INSTALLATION AND SETUP PROCEDURES OUTLINED IN THE PREVIOUS LISTED SECTIONS OF THIS MANUAL HAVE BEEN SUCCESSFULLY COMPLETED.**
21. CAUTION: 	**FITTINGS SHOULD BE TIGHTENED ACCORDING TO THE STANDARD INDUSTRY PRACTICE.**
22. CAUTION: 	**DEPRESSURIZE THE SYSTEM BEFORE REMOVING ANY FITTING.**
23. CAUTION: 	**ALL FITTINGS ARE COVERED WITH TAPE WHEN SHIPPING. ENSURE ALL TAPES ARE REMOVED AND DISCARDED TO PREVENT TUBE CLOGGING**
24. CAUTION: 	**DO NOT EXCEED RECOMMENDED PRESSURES. IF HIGHER PRESSURES ARE USED, SEVERE AND IRREPARABLE DAMAGE MAY BE DONE TO COMPONENTS.**

25. CAUTION: 	**AS WITH ANY TOOL, IF NOT USED PROPERLY HAZARD OF PINCH, PUNCTURE AND SQUEZE CAN OCCUR.**
26. CAUTION: 	**ELECTRICAL COMPONENT DAMAGE MAY OCCUR WHEN USING A LIQUID LEAK DETECTOR. CARE SHOULD BE TAKEN NOT TO WET ANY ELECTRICAL OR ELECTRONIC COMPONENTS.**
27. CAUTION: 	**MOST LIQUID LEAK DETECTORS CONTAIN SULFUR COMPOUNDS THAT CAN CONTAMINATE THE GAS SUPPLY LINE AND INSTRUMENT FLOW PATH COMPONENTS. CARE SHOULD BE TAKEN NOT TO WET OR CONTAMINATE THE ANALYTICAL FLOW SYSTEM WHEN USING A LIQUID LEAK DETECTOR.**
28. CAUTION: 	**ONLY A QUALIFIED PERSON SHOULD PERFORM ANY MAINTENANCE WORK ON THE ANALYZER. THE PERSON SHOULD BE HAVE UNDERGONE COMPREHENSIVE TRAINING AND SHOULD BE VERY FAIMILAR WITH THE ANALYZER OPERATION. IDEALLY, ANY MAINTENANCE WORK SHOULD ONLY BE PREFORMED BY A PROCESS INSIGHTS SERVICE ENGINEER.**
29. PROHIBITED: 	**THE ANALYZER SHOULD NOT BE MODIFIED IN ANY WAY. ANY MODIFICATIONS TO THE ANALYZER HARDWARE, ESPECIALLY TO AND FROM THE FURNACE, CAN POTENTIALLY MAKE THE SYSTEM UNSTABLE. MODIFICATIONS TO THE FLOW PATH ARE PROHIBITED AS IT CAN COMPROMISE ANALYZER INTEGRITY AND POSSIBLY CAUSE CATASTROPHIC FAILURE.**

(Back to Top)

Warnings and Cautions Labels

Caution and warning labels placed on the analyzer are listed below. Failure to consider these messages can lead to severe personal injury, instrument damage and/or void of warranty.

	**HOT SURFACE HAZARD**
	**ELECTRIC SHOCK HAZARD**
	**CAUTION. REFER MANUAL BEFORE OPERATING**
	**PROHIBITED**

(Back to Top)

Section 1.5 - Installation

The analyzer installation is part of a separate document and requires additional Engineering that is not covered by the scope of this manual. This manual provides basic information about the analyzer requirements towards installation, and should not be used as guidelines to install, start up and commission the analyzer. It is strongly recommended that a PROCESS INSIGHTS Service Engineer should be present, if not should commission the analyzer. Failure to have a PROCESS INSIGHTS representative present for commissioning can void any warranty on the analyzer.

Section 1.5.1 - Installation Checklist

These are some of the basic requirements that need to be provided to be able to run the analyzer.

- Instrument air for valve actuation and purge – dry, oil-free, regulated to 70 PSI
- Instrument air for Purging Enclosure – dirt-free (Particles ≤ 5µ), oil-free (ISA grade Hydrocarbon free) and -40°C (-40°F) dew point
  - Set at 40 psig
  - If coupled with instrument air for valve actuation then 70 psig
  - Total average consumption is 2 CFM.
- Zero Air used as reference air – UHP, regulated to 40 PSI
- sample pressure should be regulated to 30 PSI
- Calibration Standards – specified per Engineering docs
- Sample return, vent lines tubes per Engineering docs
- 110VAC Power
- DCS and analyzer communication wiring

In the case where compressed gas is used

1) The compressor shall be in an unclassified location
2) The intake line is to be made on non-combustible material if passing through a classified location
3) Power source should either be:
   a) Supplied before any device capable of deenergizing the equipment
   b) Or supplied separately

In addition, it is also recommended that all concerned personnel be available if required during commissioning.

(Back to Top)

Section 1.6 – Customer Service and Technical Support

Contact Information

Address:

Process Insights
Texas Corporate Headquarters,

Sales & Service Offices:
4140 World Houston Parkway
Suite 180, Houston, TX 77032, USA

Phone and Email:

Tel: 713-947-9591
Fax: 713-947-7549

E-mail: sales@PROCESS INSIGHTSxentaur.com, service@PROCESS INSIGHTSxentaur.com
Website: http://www.PROCESS INSIGHTSxentaur.com

(Back to Top)

Section 1.7 - Spare Parts List

ITEM #	PART #	Description
1	10618-05002	Particulate and Coalescing Filter, 0.1 µm
2	11254-00001	Vent, Furnace Enclosure
3	11258-00001	Thermocouple, Sample Encl (Type K)
4	23135-00001	Z - Purge
5	60073-00200	1/16" tube
6	60097-00005	THERMOCOUPLE, SINGLE, S
7	CAL.24.E.0001	6A fuse
8	CAL.24.E.0071	3.15A fuse
9	CAL.24.E.0074	10A fuse
10	CAL.24.E.0075	5A fuse
11	CAL.70.M.0032	200W heater
12	CAL.98.E.0075	SS Relay Din Rail Mt 280Vac 32
13	CAL.98.E.10836	Compact Switch Module Siemens CSM 1277
14	CAL.98.E.10837	CM 1241, RS422/485, 9 PIN SUB D (FEMALE)
15	CAL.98.E.10838	Analog Input SM 1231, 65mA, 4ch
16	CAL.98.E.10839	Analog Input SM 1231 TC, 4 AI TC
17	CAL.98.E.10840	Analog Output SM 1232, 4ch
18	CAL.98.E.10841	AC-DC, 24V, 5A, 100-240V In, Din Rail Mount, Smart
19	CAL.98.E.10842	AC-DC, 1-Ph, 12V, 2A, 230VAC/120-240VDC, DIN Rail
20	CAL.98.E.10843	Frequency Transducer MINI ANALOG PRO Series
21	CAL.98.E.10844	SAFE BARRIER, MTL 7715+
22	CAL.98.E.10845	SAFE BARRIER, MTL 7710+
23	CAL.98.E.10846	Temperature Controller, 2-4 Channels
24	CAL.98.E.10847	CPU 1214C, DC/DC/Relay, 14DI/10DO/2AI
25	CAL.98.E.10852	7" HMI
26	CAL.98.M.0003	OVAL DENSITY CELL
27	CAL.98.M.0009	1/4" FILTER, 7µm
28	CAL.98.M.0010	Festo regulator & filter
29	CAL.98.M.0059	Reducer 3/4 x 1/2
30	CAL.98.M.0114	Regulator, porter
31	CAL.98.M.0315	Flow Indicator,100-1,000ccm, CO2, No Valve
32	CAL.98.M.10800	Flow Indicator 1-30 Slpm W/o Valve,
33	CAL.98.M.10801	Flow Indicator,100-1,000ccm, WITH VALVE
34	CAL.98.M.10849	Diaphragm Valve, 6-Port, 1/16” fitting,.75mm bore

35	CAL.98.M.10853	Three Stream Switching Valve w/ ARV
36	CAL.98.M.10855	Combustion Tube, 3/4" OD x 1/2" ID
37	CAL.98.M.10857	¾” Graphite Ferrules
38	CAL.98.M.10974	Furnace, Calorimeter, 9800CXi
39	CAL.S1.M.0002	Cooler Assembly
40	CAL.S1.M.10720-20	Thermal Fuse assembly
41	ESS.98.M.0300	PRESSURE GAUGE, 0-60PSIG
42	FJ19197	O2 sensor Detector Unit Assembly

(Back to Top)

Section 1.8 - Recommended Consumable Spare Parts List

ITEM #	PART #	Description
1	10618-05002	Particulate and Coalescing Filter, 0.1 µm
2	11258-00001	Thermocouple, Sample Encl (Type K)
3	60073-00200	1/16" tube
4	60097-00005	THERMOCOUPLE, SINGLE, S
5	CAL.24.E.0001	6A fuse
6	CAL.24.E.0071	3.15A fuse
7	CAL.24.E.0074	10A fuse
8	CAL.24.E.0075	5A fuse
9	CAL.98.E.0075	SS Relay Din Rail Mt 280Vac 32
10	CAL.98.M.0009	1/4" FILTER, 7µm
11	CAL.98.M.0010	Festo regulator & filter
12	CAL.98.M.0059	Reducer 3/4 x 1/2
13	CAL.98.M.10849	Diaphragm Valve, 6-Port, 1/16” fitting,.75mm bore
14	CAL.98.M.10855	Combustion Tube, 3/4" OD x 1/2" ID
15	CAL.98.M.10857	¾” Graphite Ferrules
16	CAL.98.M.10974	Furnace, Calorimeter, 9800CXi
17	CAL.S1.M.10720-20	Thermal Fuse assembly
18	FJ19197	O2 sensor Detector Unit Assembly

(Back to Top)

Section 1.9 - Preventive Maintenance Schedule

Recommended schedule for parts replacement *

1 years **

PART NUMBER	DESCRIPTION
CAL.98.M.10849	Diaphragm Valve, 6-Port, 1/16” fitting,.75mm bore
10618-05002	PARTICULATE AND COALESCING FILTER, 0.1 µM
CAL.98.M.0009	1/4" FILTER, 7µM

3 years **

PART NUMBER	DESCRIPTION
CAL.98.M.10974	FURNACE, CALORIMETER, 9800CXI
11258-00001	THERMOCOUPLE, SAMPLE ENCL (TYPE K)
CAL.98.M.10855	COMBUSTION CHAMBER, 3/4" OD X 1/2" ID
CAL.98.M.10857	¾” GRAPHITE FERRULES
FJ19197	O2 SENSOR DETECTOR UNIT ASSEMBLY

these are the minimum recommended replacement intervals and are based on customer provided data; customers are urged to use their discretion to choose schedule for parts replacement

****this only lists typical recommended parts, any other parts if needed, will be additional- please take this into account when planning for budgetary purposes***

(Back to Top)

Section 1.10 - Warranty

Process Insights warrants that all products supplied will be of merchantable quality and will comply with the specification agreed for them.

Process Insights offers warranty for a period of twelve months from installation of the product or fifteen months from delivery to the customer, whichever is the shorter, all Products and spare parts sold hereunder.

Process Insights will repair or replace defective and/or nonconforming parts without charge for material or labor service during the warranty period.

Products that have been repaired or replaced during the warranty period are themselves warranted only for the remaining portion of the original one (1) year.

Repairs, adjustments and service performed after the expiration of the one (1) year warranty period shall be charged to the owner/purchaser at the then current prices for parts, labor, and travel related expenses.

Exceptions to this warranty are:

- Defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, unauthorized modification, or the attachment of improper devices to the products.
- Installation, operation and maintenance of the products in a manner that does not meet Process Insights specifications will void this warranty.
- All requests for service or repair under this warranty must be received within the warranty period by Process Insights or its authorized representative.

The warranties contained in this agreement are in lieu of all other warranties, expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

Statements made by any persons, including representatives of Process Insights, which are inconsistent or in conflict with the terms of this warranty shall not be binding upon Process Insights unless reduced to writing and approved by an officer of the company.

Liability covered under this warranty is limited to the original cost of the Process Insights supplied equipment. Process Insights will not be liable for consequential damages including but not limited to loss of production, throughput or off specification product due to user or equipment error.

This warranty shall be governed by and construed in accordance with the laws of the State of Texas.

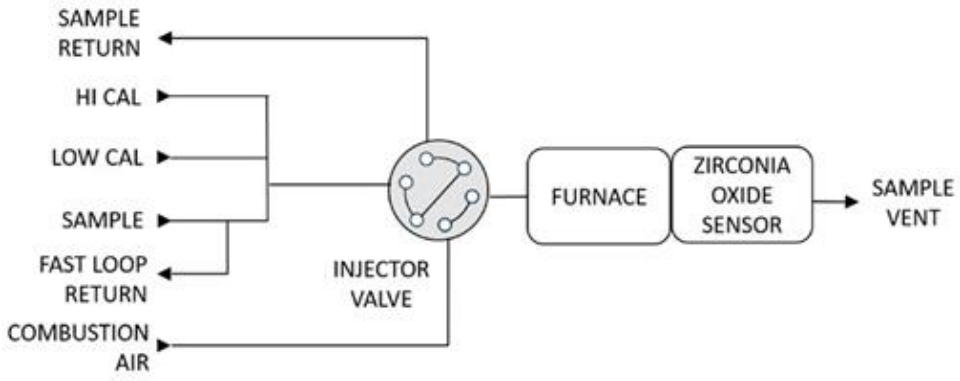
(Back to Top)

Section 2 – Principle of Operation, Specifications, and Drawings

Section 2.1 – Principle of Operation : Residual Oxygen Measurement

The PROCESS INSIGHTS 9800CXi™ Calorimeter uses the measuring principle based on the analysis of the residual oxygen content in fuel or flare gas after combustion of the sample. A small constant volume of sample gas is injected into a continuous flow of combustion air with each measurement cycle, providing a precisely maintained fuel/air ratio profile.

The fuel air mixture is oxidized in the combustion furnace at 1000°C, and the residual oxygen concentration of the combustion sample is measured by a zirconia oxide sensor. The residual oxygen provides an accurate method of measuring Heating Value with optional measurement of Wobbe Index correlated to Specific Gravity of the sample gas. Higher temperature reduces maintenance of the instrument; varying temperature up to 1000°C.



The majority of the sample gas will return to the process gas stream through the fast loop so there is no hazardous hydrocarbon emission. Only the small amount of sample gas and air mixture is completely burned in the combustion process resulting in extremely low, non-hazardous (CO2) emissions.

(Back to Top)

Section 2.2 - Features

Features

- Zero HC Emissions
- Fast Response Injection Style
- Direct Measurement of Calorific Heating Value
- BTU Measurement Range 0-3000 BTU/scfh
- Handles High Sulfur Concentrations
- H2 Measurement Option
- Industrial PLC System, Touchscreen HMI
- High Temperature Combustion
- Flameless / No Flameouts
- Built for Indoor, Outdoor, Dirty, and Corrosive Environment
- Precise Measurement of Air Fuel Ratio

Additional Features

- Compact, sturdy O2 Cell is designed to be cost-effective, and for ease of maintenance and service
- Internal sample system up to 50°C with options to 100°C or 150°C
- Full measurement range 0-3000 BTU/SCFH without the need of a specific gravity meter

(Back to Top)

Section 2.3 - Analyzer Construction

The 9800CXi Calorimeter is housed in a powder coated NEMA4x (IP65) cabinet suitable for outdoor installations without additional temperature-controlled shelter. For extreme climate conditions, the standard operating temperature range of the 9800CXi Calorimeter can be extended with the addition of a cabinet heater and/or vortex cooler. Enclosure is wall mounted with optional stand. The analyzer cabinet has three compartments: the gas mixing compartment, the combustion furnace compartment, and the electronics compartment.

The Sample Conditioning Enclosure contains sample conditioning and the gas mixing system. Components in this compartment are intrinsically safe. The gas mixing compartment is heated to avoid condensation of heavier gas constituents.

The Combustion Furnace Enclosure contains the combustion furnace with the zirconia oxide sensor. The electronics compartment and combustion furnace compartment can optionally be purged for Class 1 Div 2 applications.

The Electronics Enclosure contains the industrial PLC system and touchscreen HMI, which performs all instrument control functions and calculations. Results are available through digital and analog outputs and a touchscreen HMI, which displays Heating Values and Wobbe Index in BTU/SCF or MJ/Nm3, residual O2 in %, Cell voltage in mV, relative density (optional), and CARI (Combustion Air Requirement Index).

The 9800CXi Calorimeter maintenance requirements are low. It's easy to maintain. The higher furnace temperature provides complete oxidization of any molecular-bound sulfur compounds, virtually eliminating the typical accumulation of uncombusted sulfur products in the furnace vent further reducing instrument maintenance. Combined with use of proper sample conditioning, the 9800CXi can operate unattended for several months. All compartments are easily accessible through separate doors on the front side of the enclosure.

(Back to Top)

Section 2.4 - Specifications

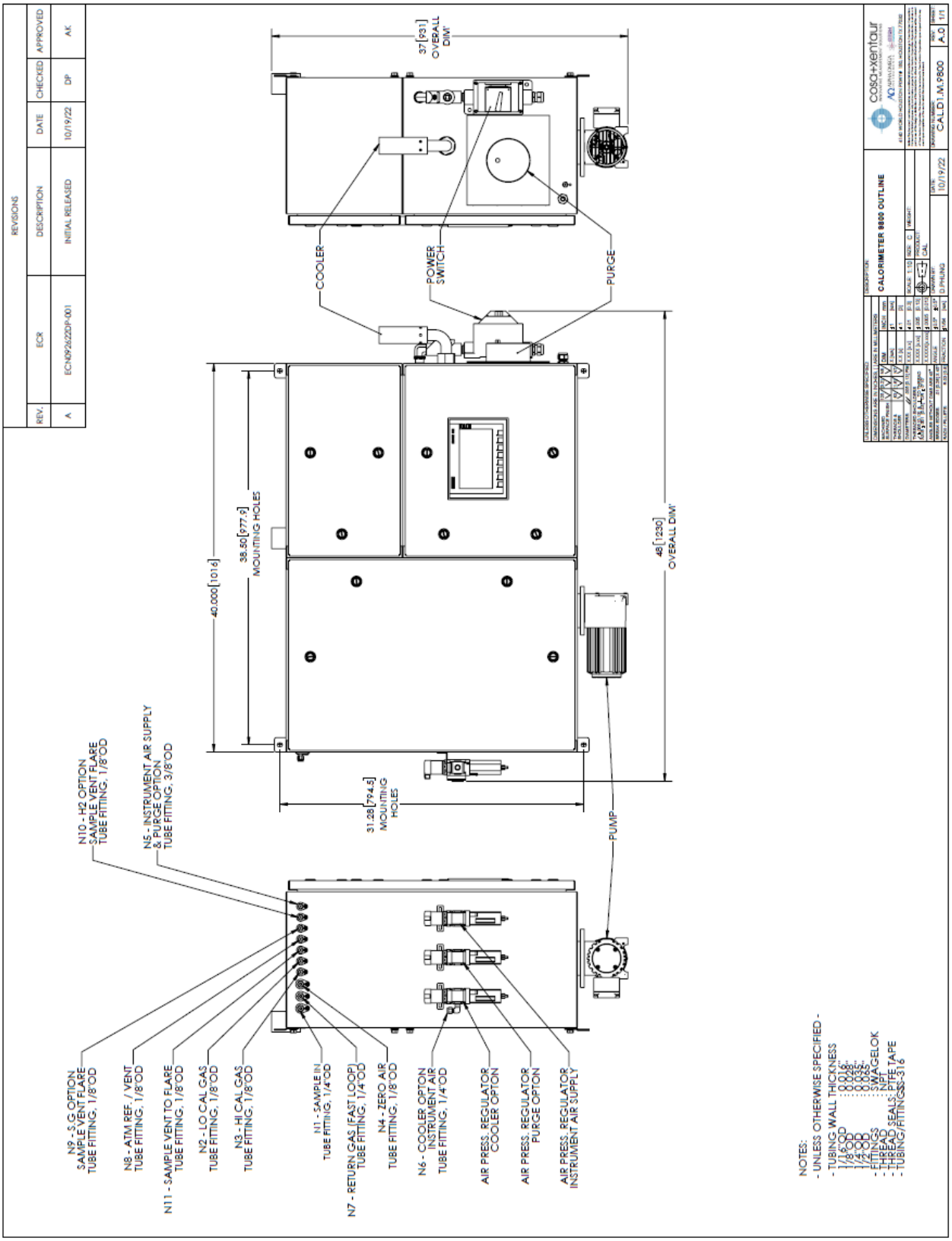
Model:	**9800CXi Calorimeter**
Sample Gas:	Natural gas, fuel gas, refinery gases, biogas, flare gas, etc.
Ranges:	
Heating Value:	**0-3000 BTU/SCF,**
Wobbe Index:	0-2750 BTU/SCF,
CARI Index:	0-20
Accuracy:	± 1% full scale
Repeatability:	**±0.5% BTU/SCF**
Response Time:	**< 30 sec**
Ambient Temperature:	Base: 5°C (41°F) to +40°C (104°F), -20°C (-4°F) to +55°C (104°F) (optional)
Outputs:	4 Analog Outputs, 4 Digital Outputs, 2 (optional)
Communication:	**Modbus over TCP/IP**
Specific Gravity (optional):	Range: 0.2-2.2 RD
Enclosure:	IP65 NEMA 4X
Furnace Temperature:	Up to 1000°C
Utilities	
Power Supply:	110/220 V AC, 50/60 HZ
Power Consumption:	2000 V A Base Analyzer
Air Consumption:	180 SCFH (Analyzer), 296 SCFH (with Purge) @ 80 psig
Sample:	Sample usage 100cc/min
Sample Pressure:	5-100 psig
Mounting:	Wall mount with optional stand or cart available
Weight:	200 lbs. (91k kg)
Dimensions:	**30" H x 40" W x 14" D** (762 mm x 1016 mm x 356 mm)

(Back to Top)

Section 2.5 - Drawings

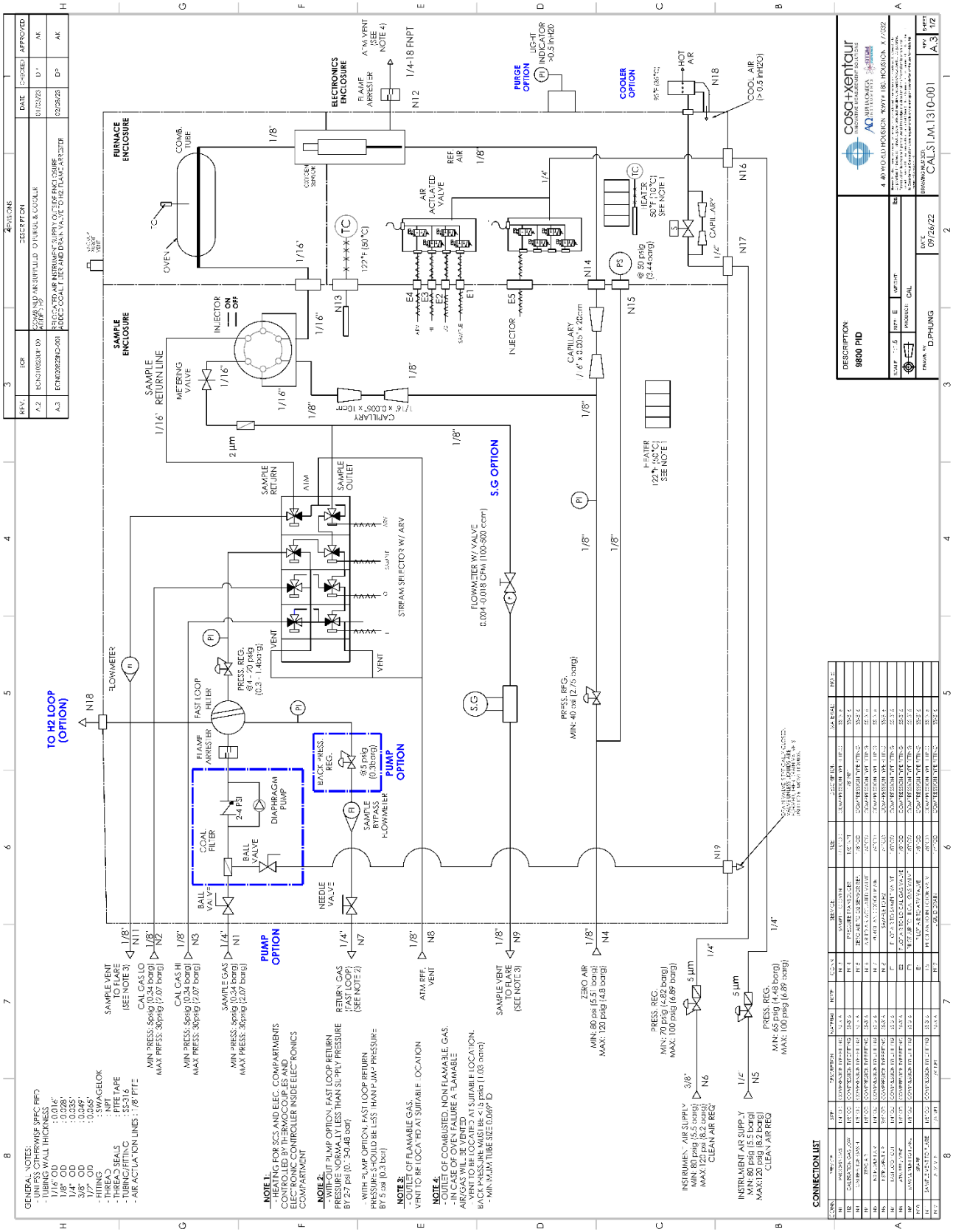
(Back to Top)

Section 2.5.1 – 9800CXi Calorimeter

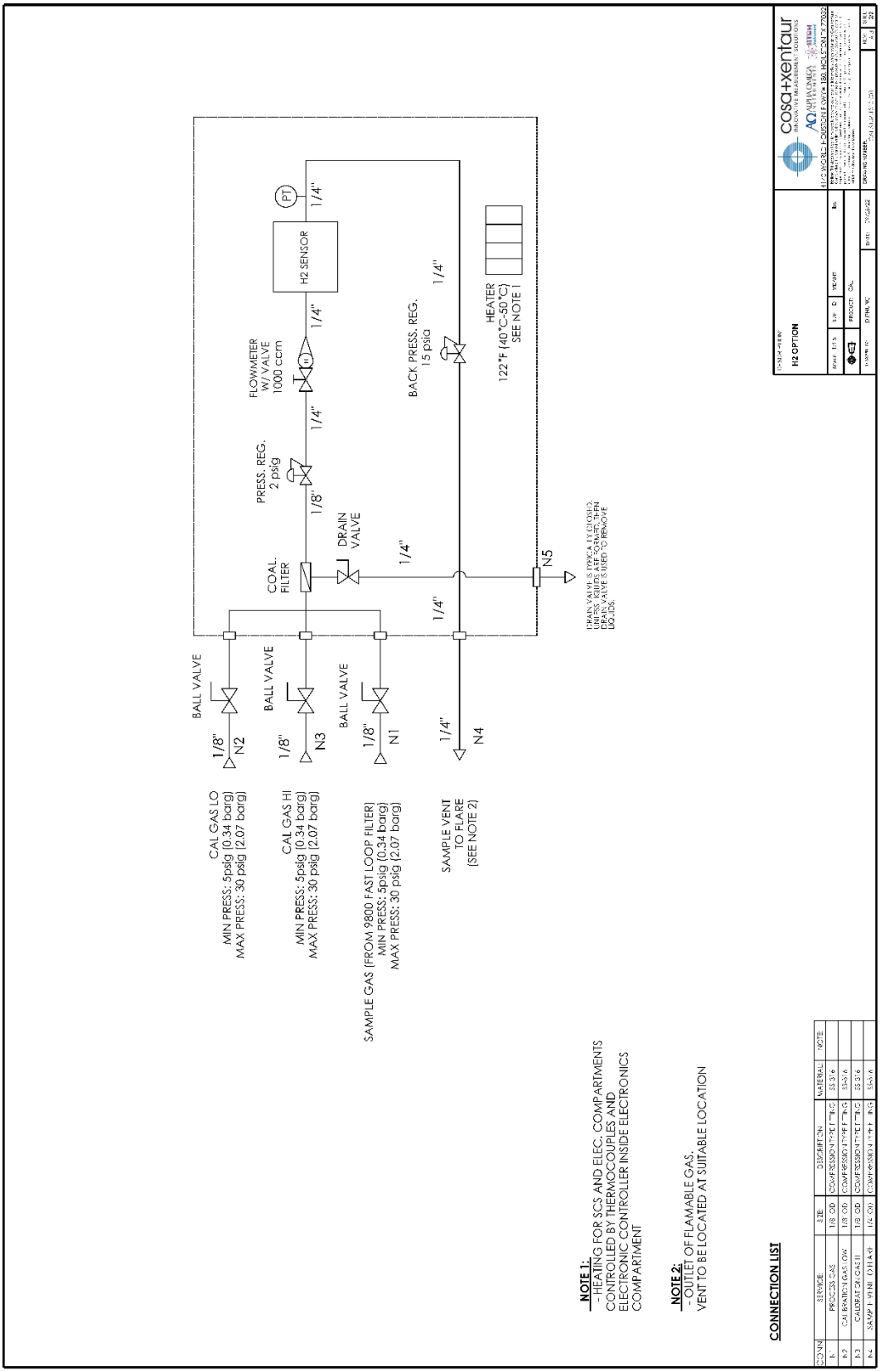


(Back to Top)

Section 2.5.2 - Process Flow Diagram

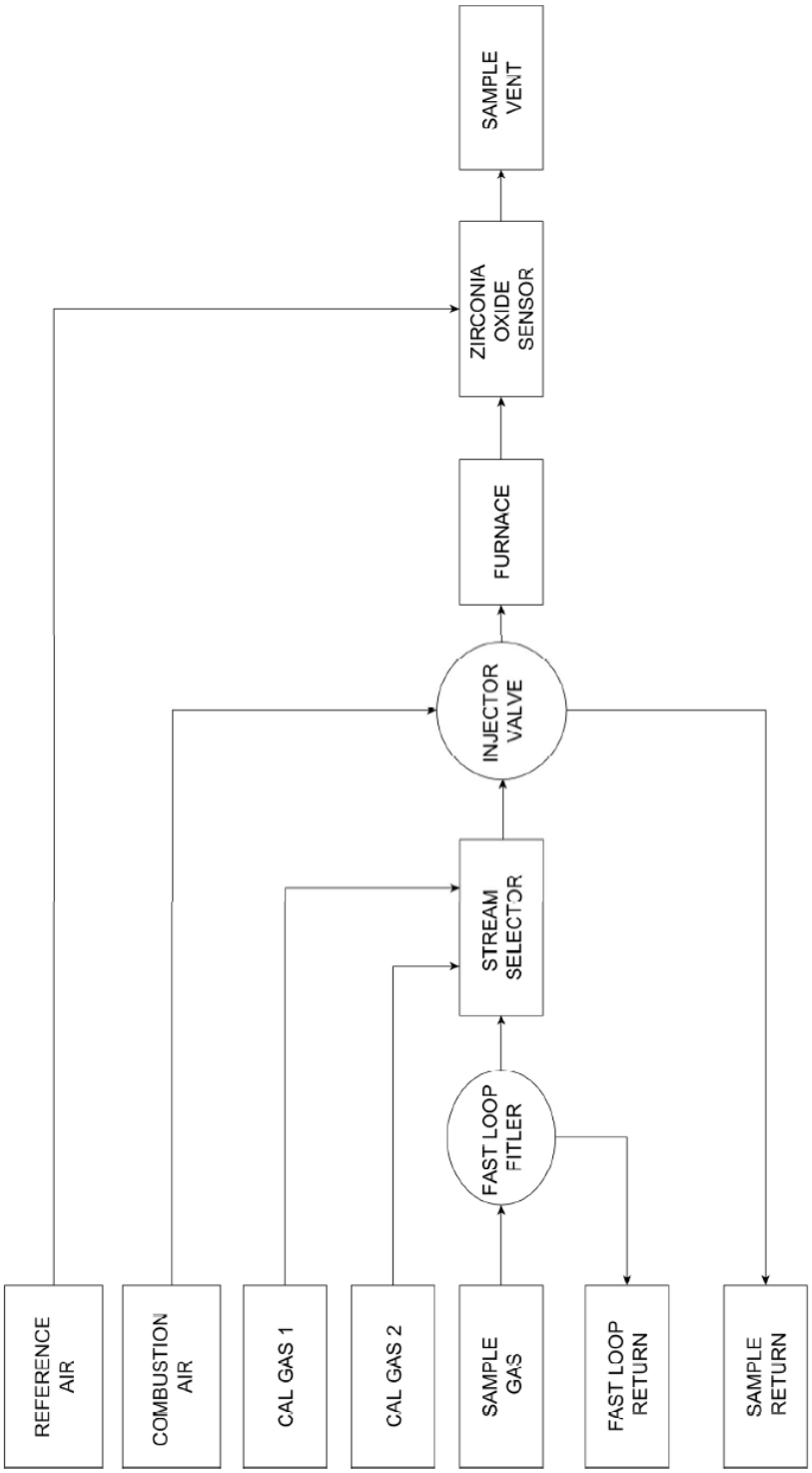


(Back to Top)


H2 OPTION
cosa+xentaur
BALL VALVE
1/8" N2
CAL GAS LO
MIN PRESS: 5psig (0.34 barg)
MAX PRESS: 30 psig (2.07 barg)
BALL VALVE
1/8" N3
CAL GAS HI
MIN PRESS: 5psig (0.34 barg)
MAX PRESS: 30 psig (2.07 barg)
BALL VALVE
1/8" N1
SAMPLE GAS (FROM 9800 FAST LOOP FILTER)
MIN PRESS: 5psig (0.34 barg)
MAX PRESS: 30 psig (2.07 barg)
1/4" N4
SAMPLE VENT
TO FLARE
(SEE NOTE 2)
COAL. FILTER
DRAIN VALVE
PRESS. REG. 2 psig
1/8"
1/4"
FLOWMETER W/ VALVE 1000 ccm
1/4"
H2 SENSOR
PT
1/4"
1/4"
BACK PRESS. REG. 15 psig
1/4"
HEATER 122°F (40°C-50°C) SEE NOTE 1
N5
NOTE 1:
- HEATING FOR SCS AND ELEC. COMPARTMENTS CONTROLLED BY THERMOCOUPLES AND ELECTRONIC CONTROLLER INSIDE ELECTRONICS COMPARTMENT
NOTE 2:
- OUTLET OF FLAMABLE GAS. VENT TO BE LOCATED AT SUITABLE LOCATION
CONNECTION LIST
CONN
SERVICE
SIZE
DESCRIPTION
MATERIAL
NOTE
PROCESS GAS
1/8" OD
COMPRESSION TYPE TUBE
SS 316
CALIBRATION GAS (CH4)
1/8" OD
COMPRESSION TYPE TUBE
SS 316
CALIBRATION GAS (H2)
1/8" OD
COMPRESSION TYPE TUBE
SS 316
SAMPLE VENT OUTLET
1/4" OD
COMPRESSION TYPE TUBE
SS 316

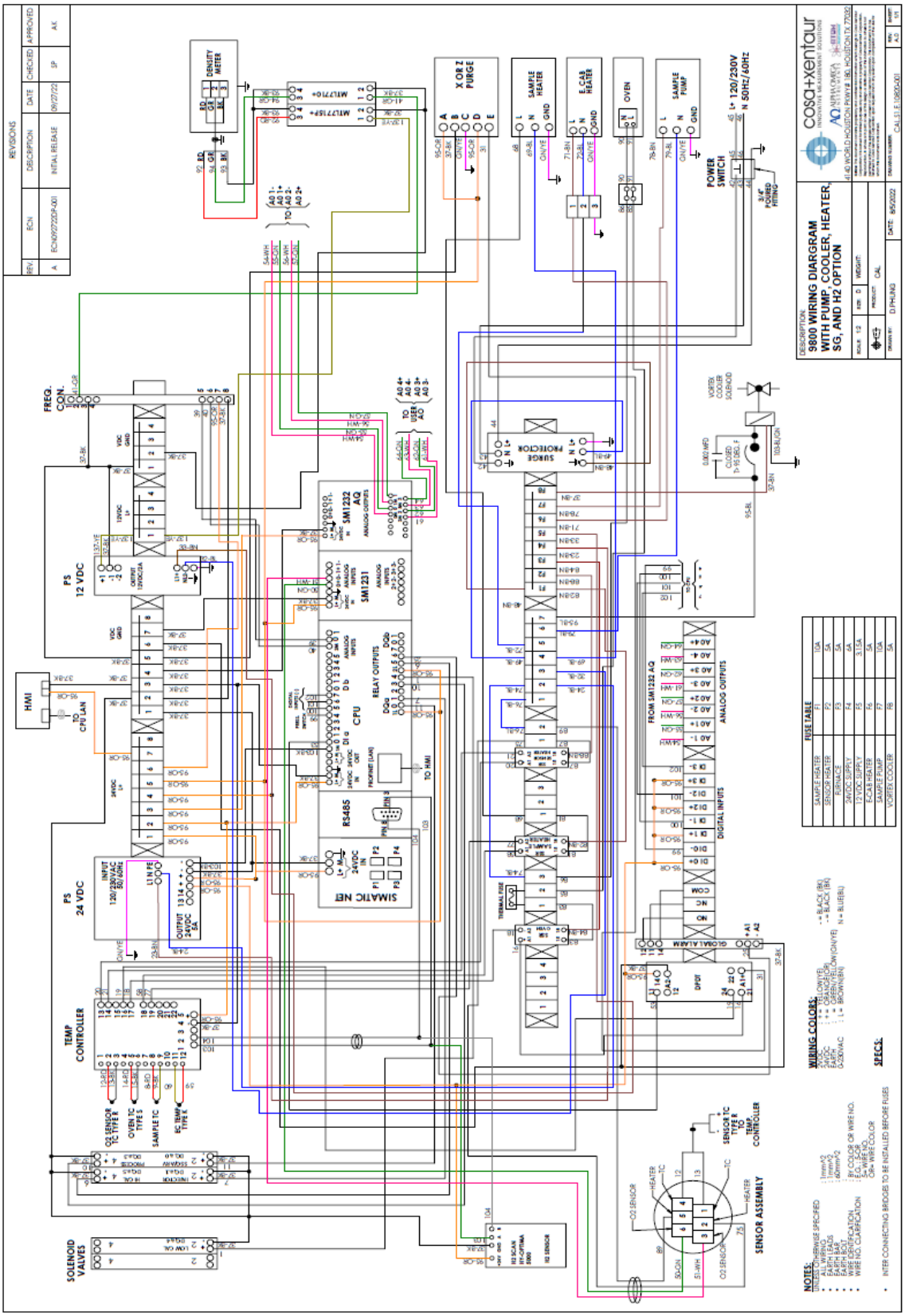
(Back to Top)

Section 2.5.3 - Process Flow Chart

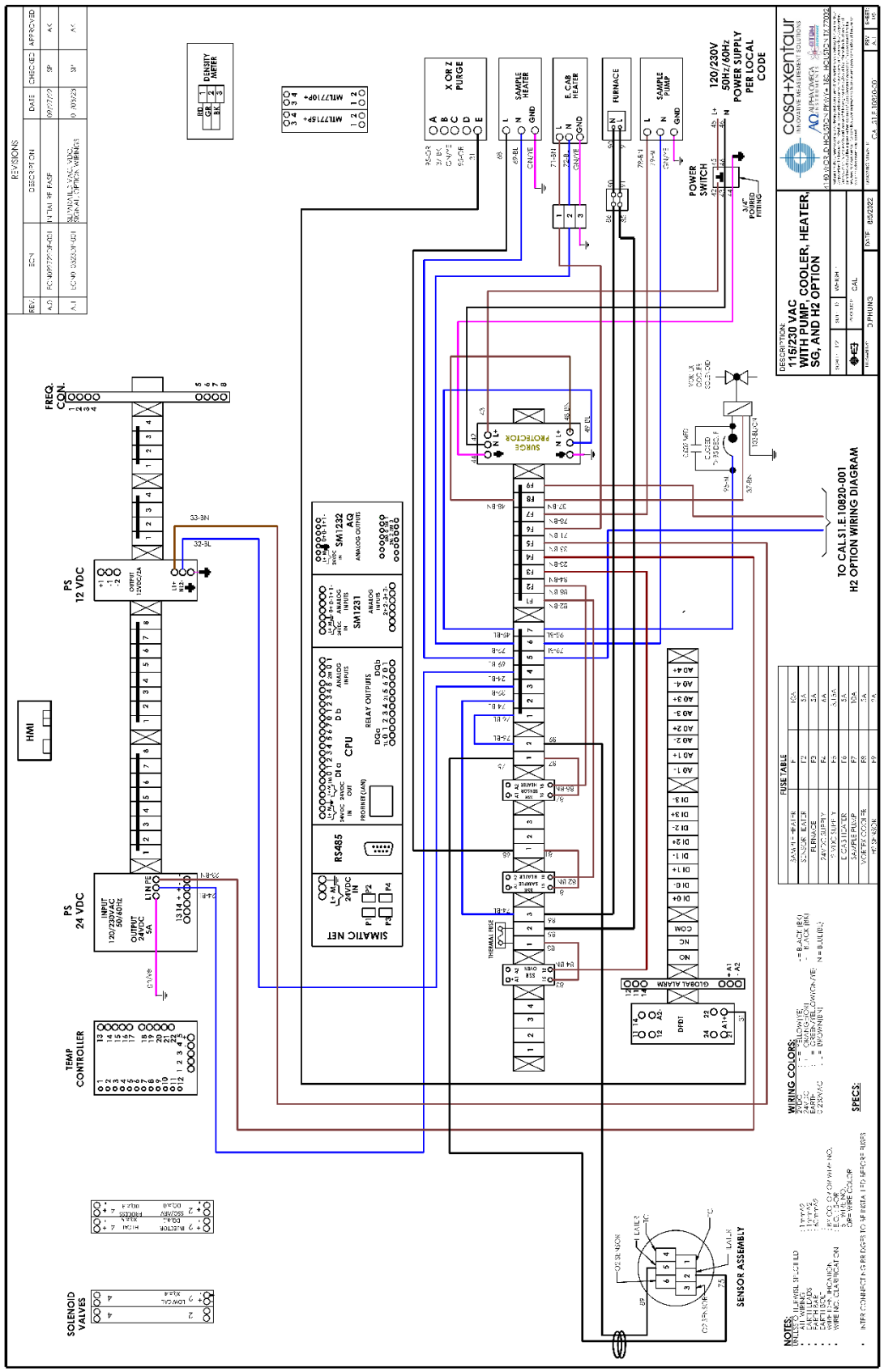


(Back to Top)

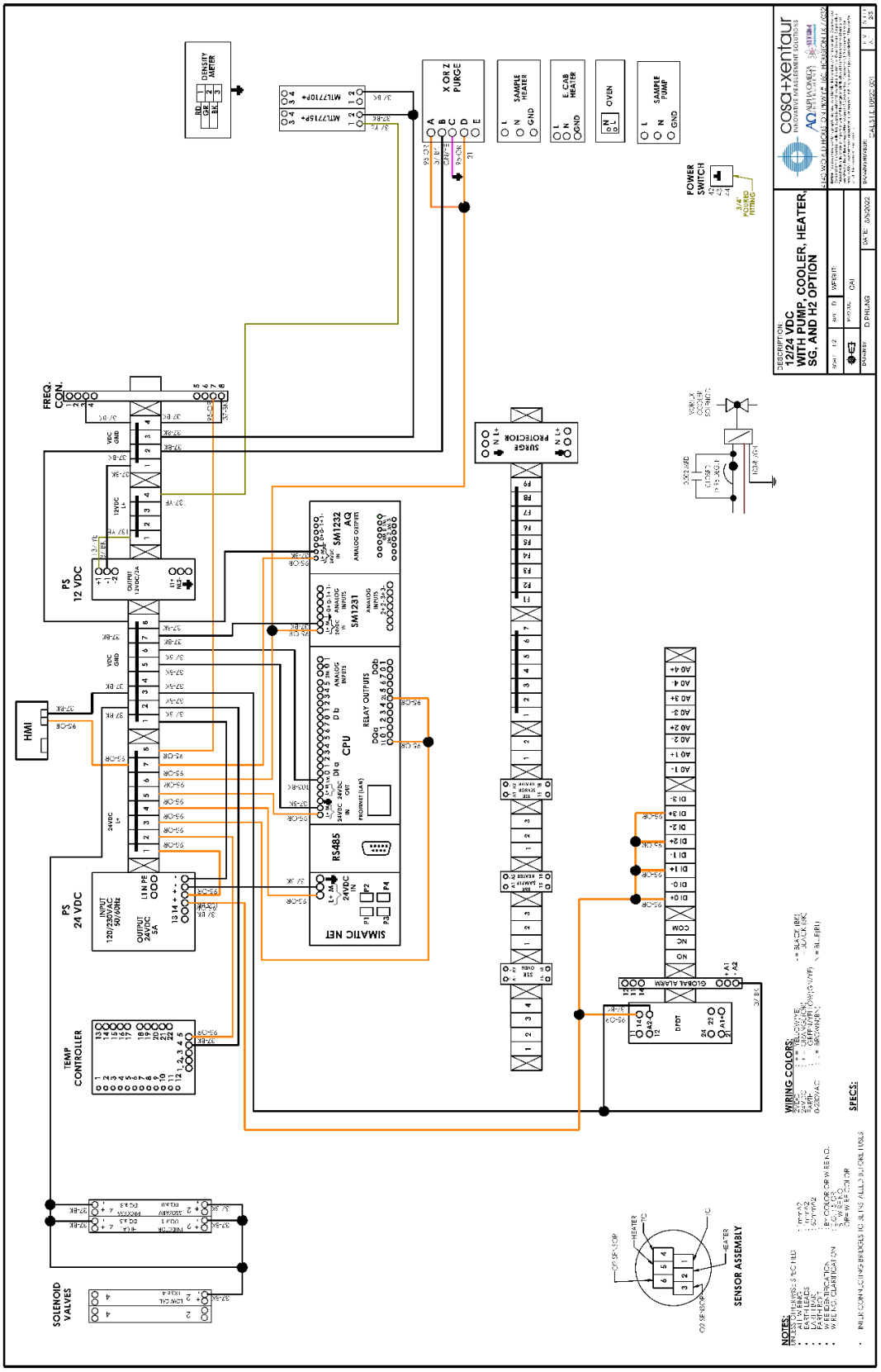
Section 2.5.3 - Total System Wiring



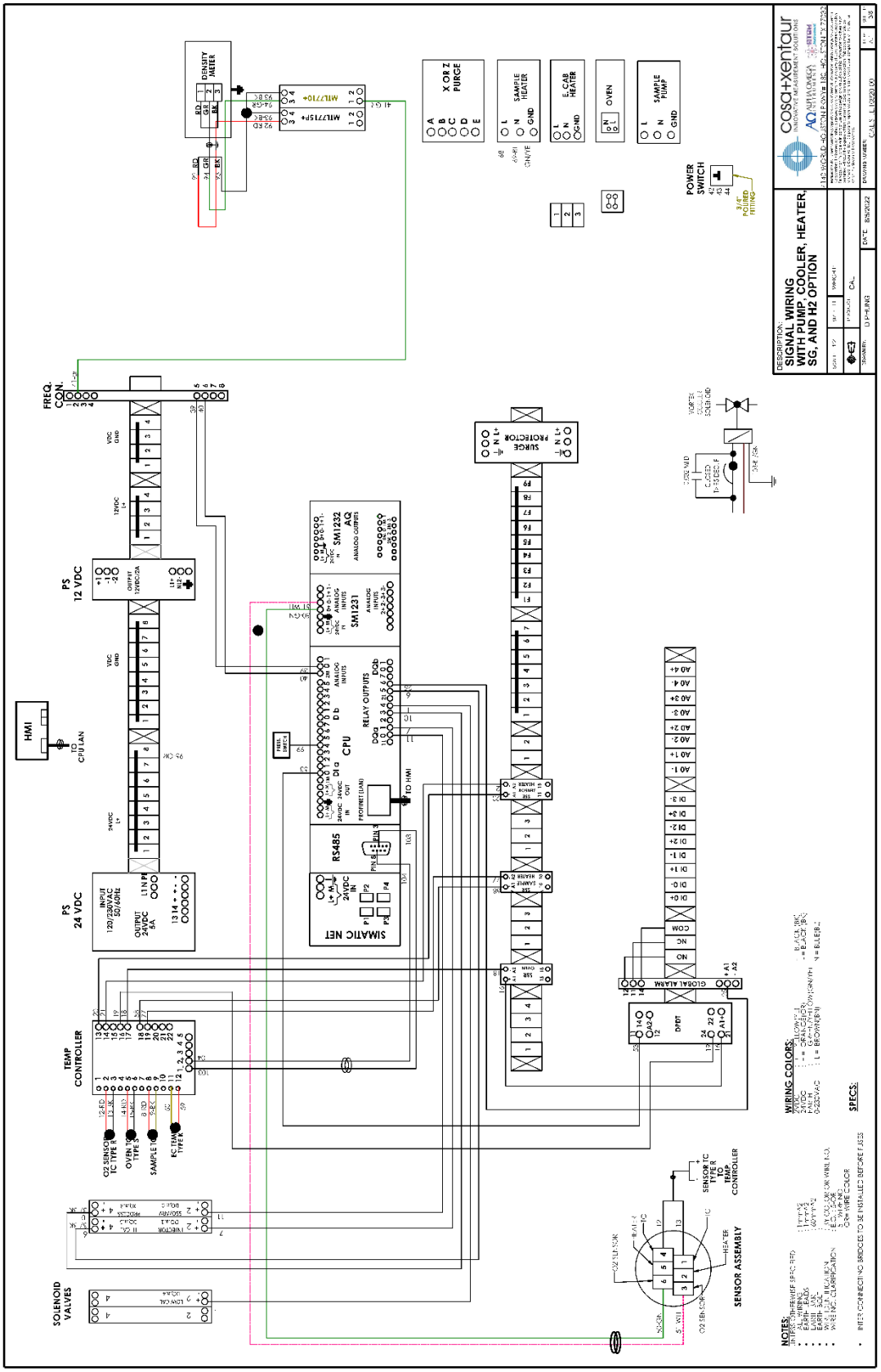
(Back to Top)


REVISIONS
DESCRIPTION
DATE
CHECKED
APPROVED
DESCRIPTION
115/230 VAC
WITH PUMP, COOLER, HEATER,
SG, AND H2 OPTION
DATE
8/5/2022
CAL
3 PHUMS
TO CAL.S1.E.10820-001
H2 OPTION WIRING DIAGRAM
FUSE TABLE
WIRING COLORS:
SPECS:
NOTES:
HMI
TEMP CONTROLLER
SOLENOID VALVES
SENSOR ASSEMBLY
SIMATIC NET
FREQ. CON.
PS 12 VDC
PS 24 VDC
DENSITY METER
X OR Z PURGE
SAMPLE HEATER
E-CAB HEATER
FURNACE
SAMPLE PUMP
120/230V 50HZ/60HZ POWER SUPPLY PER LOCAL CODE
POWER SWITCH
GLOBAL ALARM
THERMAL RIDGE

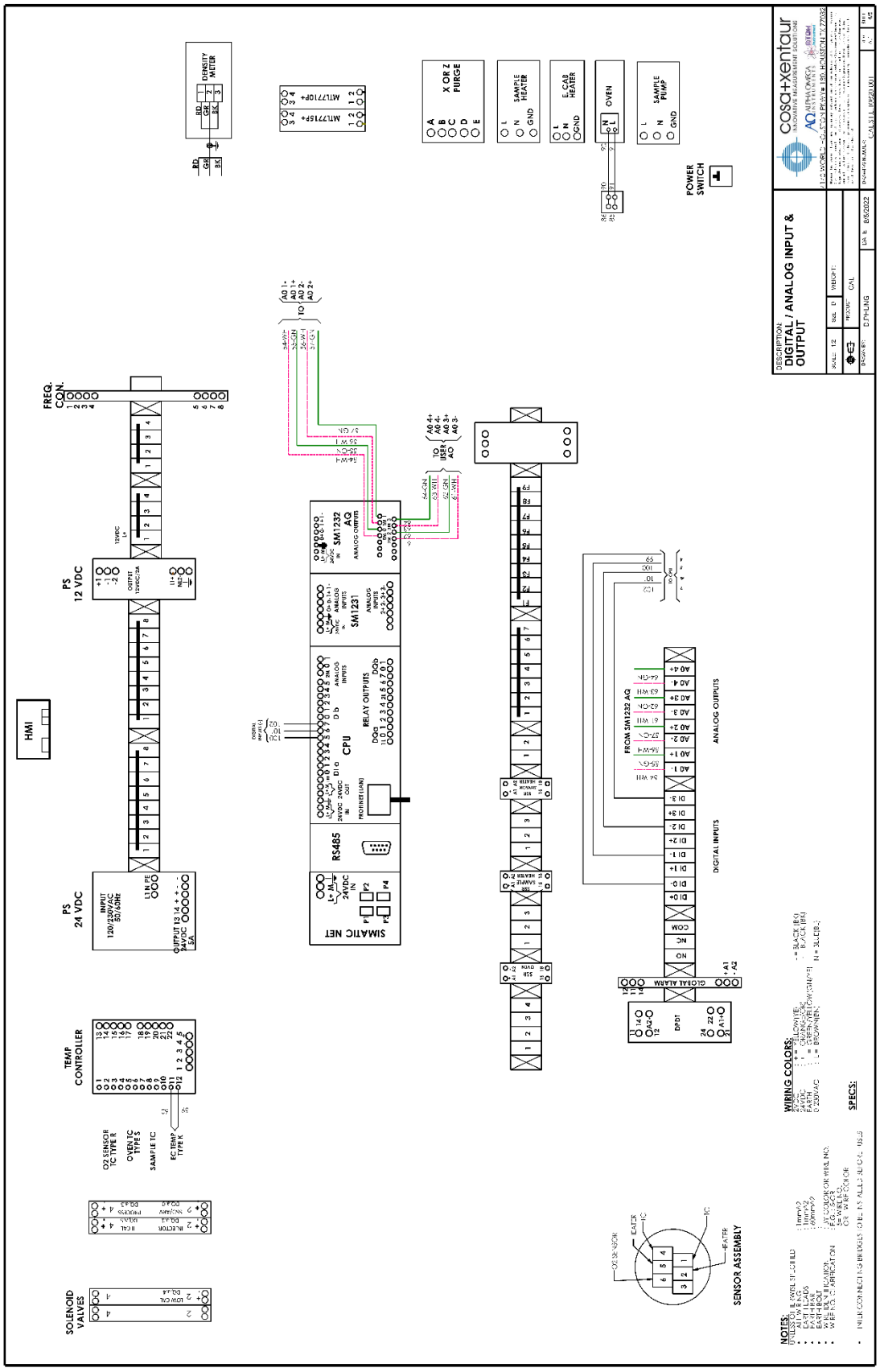
(Back to Top)


DESCRIPTION:
12/24 VDC
WITH PUMP, COOLER, HEATER,
SG, AND H2 OPTION
DENSITY METER
X OR Z PURGE
SAMPLE HEATER
E.C.B. HEATER
OVEN
SAMPLE PUMP
POWER SWITCH
FREQ. CON.
PS 12 VDC
PS 24 VDC
HMI
CPU
SM1232 AQ
SM1231
SIMATIC NET
RS485
TEMP CONTROLLER
SURGE PROTECTOR
GLOBAL ALARM
SOLENOID VALVES
SENSOR ASSEMBLY
WIRING COLORS:
NOTES:
SPECS:

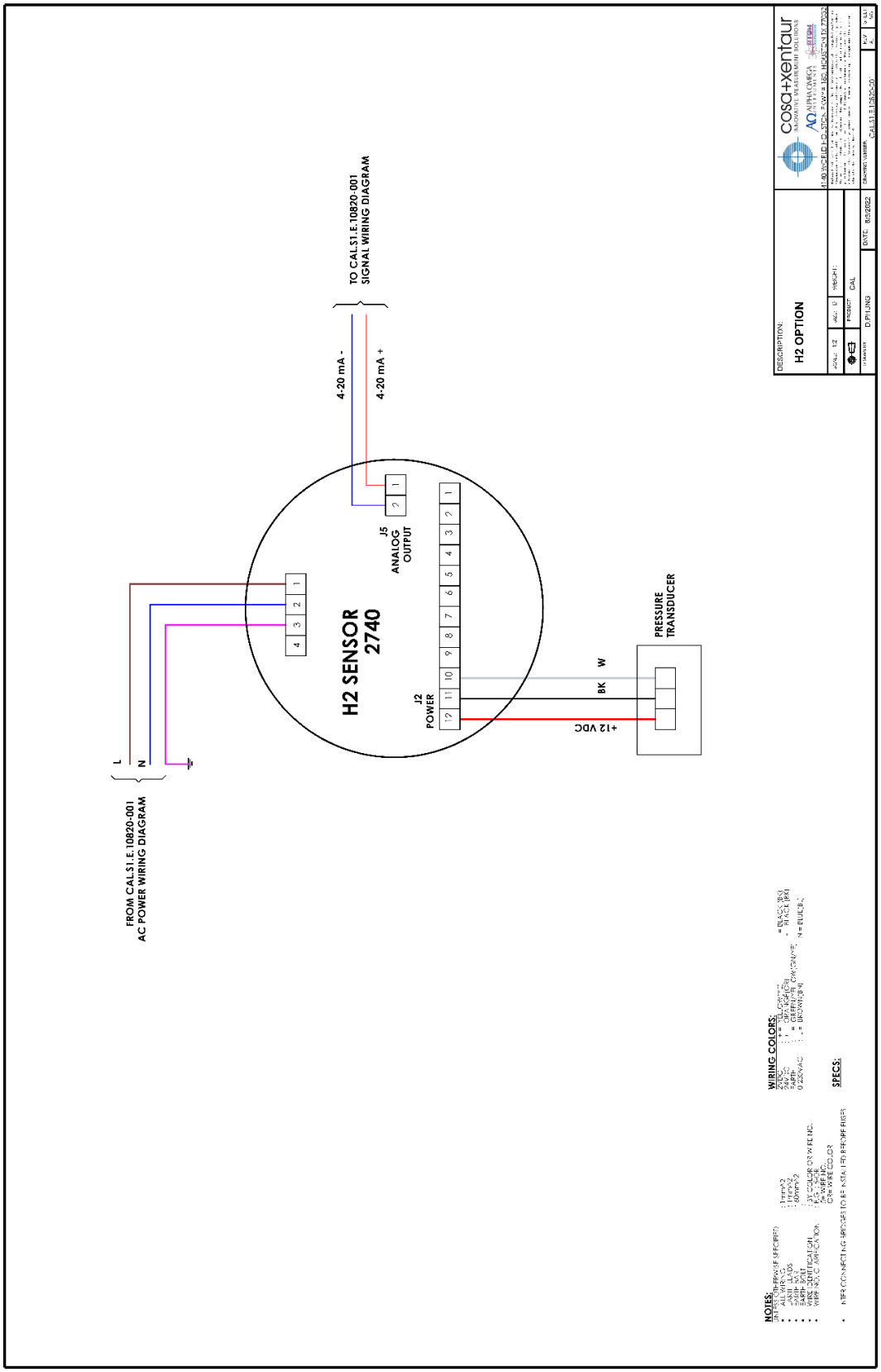
(Back to Top)


DESCRIPTION:
SIGNAL WIRING
WITH PUMP, COOLER, HEATER,
SG, AND H2 OPTION
DENSITY METER
X OR Z PURGE
SAMPLE HEATER
E CAB HEATER
OVEN
SAMPLE PUMP
POWER SWITCH
FREQ. CON.
PS 12 VDC
PS 24 VDC
HMI
CPU
SM1232 AQ
SM1231
SURGE PROTECTOR
SIMATIC NET
RS485
TEMP CONTROLLER
GLOBAL ALARM
SOLENOID VALVES
SENSOR ASSEMBLY
SENSOR TC TYPE R
HEATER
WIRING COLORS:
SPECS:
NOTES:

(Back to Top)

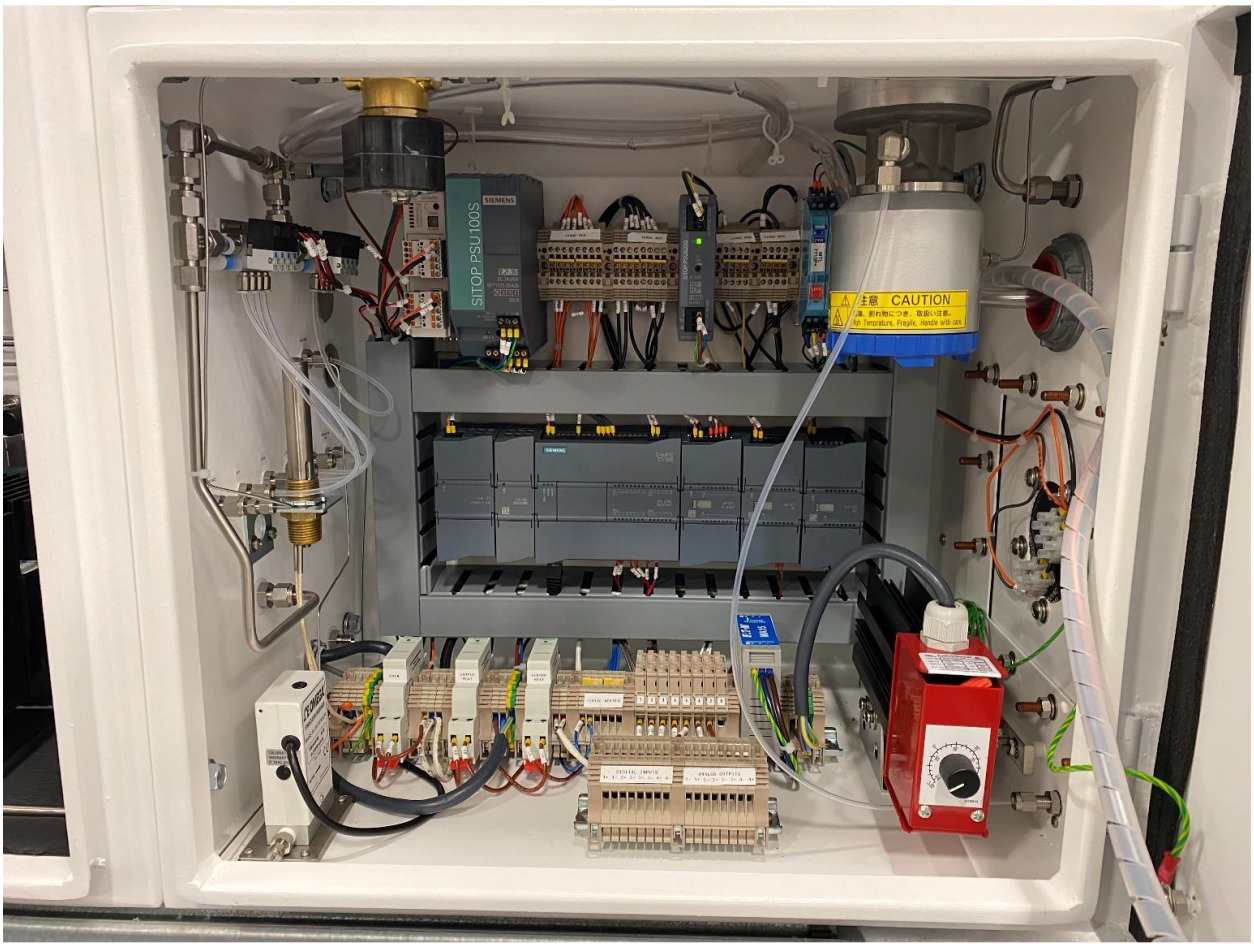

DESCRIPTION:
DIGITAL / ANALOG INPUT & OUTPUT
cosa+xentaur
FREQ. CON.
PS 12 VDC
PS 24 VDC
HMI
TEMP CONTROLLER
SOLENOID VALVES
SIMATIC NET
RS485
CPU
SM1232 AQ
SM1231
TO USER AO
FROM SM1232 AQ
ANALOG OUTPUTS
DIGITAL INPUTS
GLOBAL ALARM
DPDT
DENSITY METER
MT1771OP+
MT1771SP+
X OR Z PURGE
SAMPLE HEATER
E-CAB HEATER
OVEN
SAMPLE PUMP
POWER SWITCH
SENSOR ASSEMBLY
WIRING COLORS:
NOTES:
SPECS:

(Back to Top)


TO CAL.31.E.10820-001
SIGNAL WIRING DIAGRAM
4-20 mA -
4-20 mA +
J5
ANALOG
OUTPUT
H2 SENSOR
2740
J2
POWER
PRESSURE
TRANSDUCER
+12 VDC
BK
W
L
N
FROM CAL.31.E.10820-001
AC POWER WIRING DIAGRAM
H2 OPTION
cosa+xentaur
NOTES:
WIRING COLORS:
SPECS:

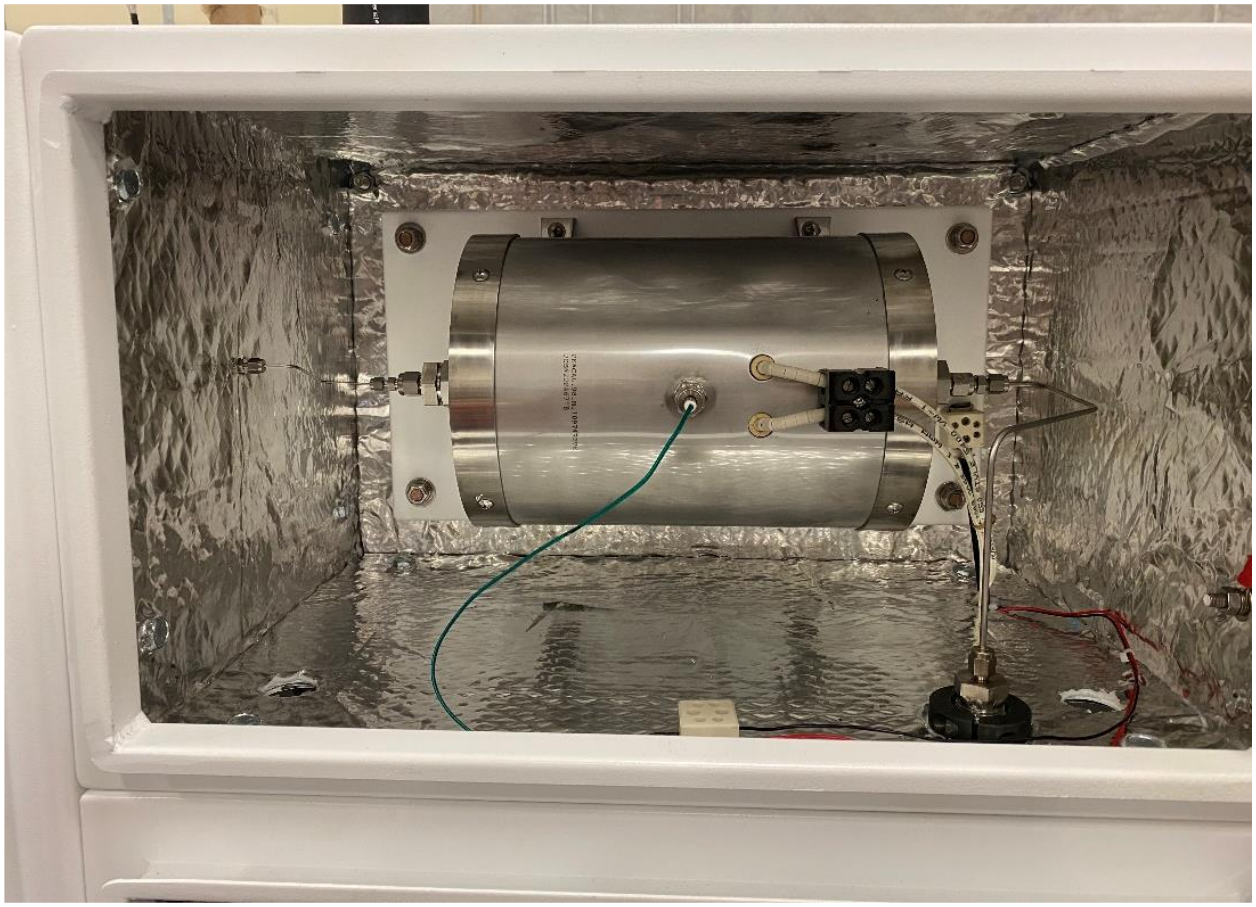
(Back to Top)

Section 2.5.4 - Electronics Enclosure



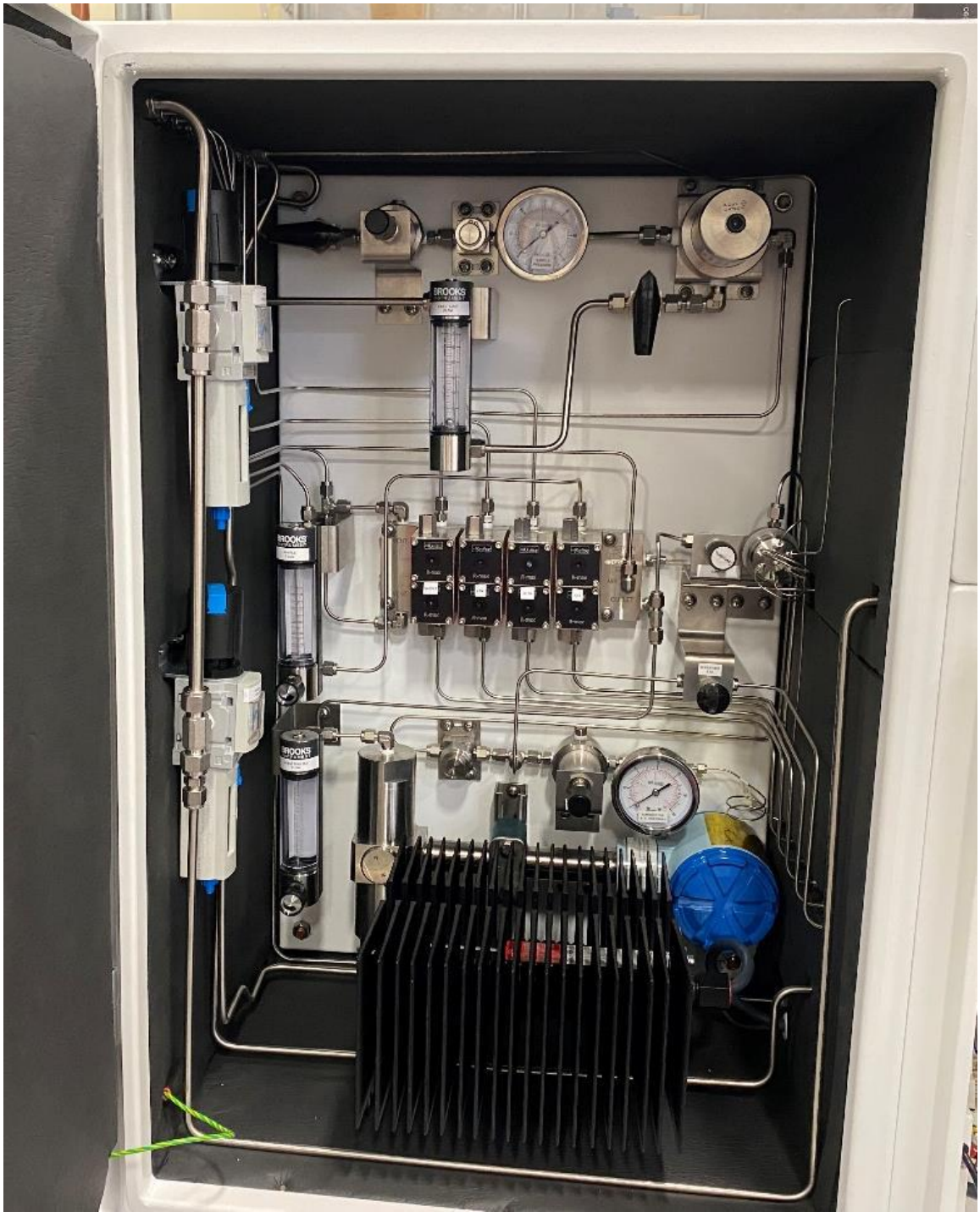
(Back to Top)

Section 2.5.5 - Furnace Enclosure



(Back to Top)

Section 2.5.6 - Sample Enclosure



(Back to Top)

Section 3 – Purges (If applicable)

Section 3.1 - Z-Purge

Section 3.1.1 – Description

Failure to maintain minimum overpressure within the protected enclosure shall be detected and communicated by an indicator and / or alarm. The purge cycle time is a manual operation and once the panel has been purged of explosive concentrations, only a minimum overpressure setting of 0.5 inch H2O (1.25 mbar) is required to be maintained within the enclosure and it is not necessary to remove power from the protected equipment upon the loss of minimum overpressure within the protected panel.

The CYCLOPS Z – Purge Indicator is used to provide safe monitoring of electrical equipment in Division 2, Zone 2 hazardous locations, which can be used to prevent the possibility of fire or explosion inside the panel of energized electrical equipment. A protective gas supply is used to purge potentially flammable materials to an acceptable level, creating a safe area for the electrical equipment within the pressurized enclosure. Maintaining a positive pressure prevents the ingress of potentially hazardous materials in the surrounding atmosphere from entering into the enclosure. After the enclosure is purged, power may be manually connected to the electrical equipment within the pressurized protected panel.

(Back to Top)

Section 3.1.2 – Purge and Pressurization System Installation

1) Make sure that area surrounding the Calorimeter to be monitored is known to be non-hazardous.

2) Make sure that all power is removed from the electrical equipment located in the enclosure where the CYCLOPS Z – Purge Indicator will be installed.

3) Before mounting the CYCLOPS Z – Purge Indicator install the o-ring provided into its appropriate groove. Next, line up CYCLOPS Z – Purge Indicator on the outside of enclosure, aligning the CYCLOPS Z – Purge Indicator to the mounting holes.

4) Using the five (5) each stainless steel, 1/4–20 UNC x 1/2 long screws, flat and split lock washers provided, mount the CYCLOPS Z – Purge Indicator to enclosure. Tighten bolts until the o-ring seal is completely compressed against the surface of the enclosure to a minimum torque setting of 5 Foot Pound (6.7 Meter Newton) using a #3 Phillips head tool.

NOTE: Refer Calorimeter wiring diagram for wire connecting to Z Purge

(Back to Top)

Section 3.1.3 – Back-Up Exhaust Vent Installation Procedures

1) Make sure that area surrounding the Calorimeter is known to be non-hazardous.

2) Make sure that all power is disconnected from the electrical equipment located in the panel that Back – Up Exhaust Vent will be installed.

3) **Back – Up Exhaust Vents are orientation sensitive and can only be mounted vertically on top of enclosure.**

4) Before mounting the Back – Up Exhaust Vent; install the O-ring provided into its appropriate mounting fitting groove. Next, insert the Back – Up Exhaust Vent into the mounting hole.

5) Use mounting fitting nut to mount the Back – Up Exhaust Vent to enclosure. Tighten mounting fitting nut until seals against the surface of the enclosure, which will be 25 – 30 in lbs. (2.8 – 3.4 Nm).

(Back to Top)

Section 3.1.4 - Startup Procedures

1) Make sure that area surrounding analyzer to be purged and pressurized is non-hazardous.

2) Power up the analyzer.

3) Close and latch enclosure door.

4) Increase the flow rate of the protective gas supplying until the Purge Indicator Green LED illuminates.

(Back to Top)

Section 3.2 - X-Purge

Section 3.2.1 – Description

The CYCLOPS X – Purge Controller, SM Version is used to provide safe control and monitoring of electrical equipment in Zone 1 hazardous areas. To prevent the possibility of fire or explosion inside the enclosure of energized electrical equipment, a protective gas supply is used to dilute potentially flammable materials to an acceptable level, creating a safe area for the electrical equipment within the enclosure. Positive pressure prevents the ingress of flammable materials in the surrounding atmosphere from entering into the enclosure, as long as positive pressure is maintained. After the electronics enclosure is purged, power may be automatically applied to the protected electrical equipment.

(Back to Top)

Section 3.2.2 – Start Up Procedures

1) With power applied to the CYCLOPS X – Purge Controller, SM Version, and the purge protective gas on the CYCLOPS X – Purge Controller, SM Version green light begins to blink.

2) With purge protective gas being supplied to electronics and furnace enclosure and CYCLOPS X – Purge Controller, SM Version's green indicator light blinking, the automatic dilution purge time cycle will start. **The automatic dilution time cycle must be set long enough to ensure that at least five (5) times the volume of free space in the enclosure of purge protective gas is exchanged before power can be automatically applied to the electrical equipment inside the purged enclosure by the CYCLOPS X – Purge Controller, SM Version.**

3) After the automatic dilution purge time cycle has elapsed and the following conditions are being met, the monitored enclosure pressure is being maintained above 0.50 inch H2O (1.25 mbar) for explosive gas hazardous areas, and enclosure exhaust port is registering adequate flow, the green indicator will stop blinking.

4) and go into a steady state. Power will then be automatically applied by the CYCLOPS X – Purge Controller, SM Version to the electrical equipment within the protected purged enclosure.

(Back to Top)

Section 4 – Software Operation

This section of the manual is intended to provide a complete overview of the 9800CXi software providing the user a fundamental understanding of analyzer operation.

The 9800CXi is a PLC-based system that is coupled with its own data acquisition system and HMI. The following section explains in detail the HMI screens layout and functionality of each screen.

(Back to Top)

Section 4.1 - Start Up

These is the analyzer power-up sequence.

Turn Power breaker “ON”.

Figure 3: Power switch

(Back to Top)

The PLC (mounted on the back wall inside the analyzer's electronics enclosure – *Figure 4*) and the HMI (Display – *Figure 5*) will start their power-up sequences which will take a few minutes. During this time, you may see the status lights on the PLC change between Red and Green, which is normal during power-up.

Figure 4: PLC module initializing

Figure 5: HMI initializing

(Back to Top)

When the Start menu pops up (*Figure 6*), you have the option to press the "Start" button to bring up the HMI, otherwise the HMI will automatically start up after a preset delay of 30 seconds.

Figure 6: HMI Start Up screen

Once the PLC and HMI have initialized, and as long as no alarms are triggered, the status of the analyzer will be "OK". The Analyzer will automatically start running analyses, and the graph and parameter values will be updated every second in the respective screens (*Figure 7*).

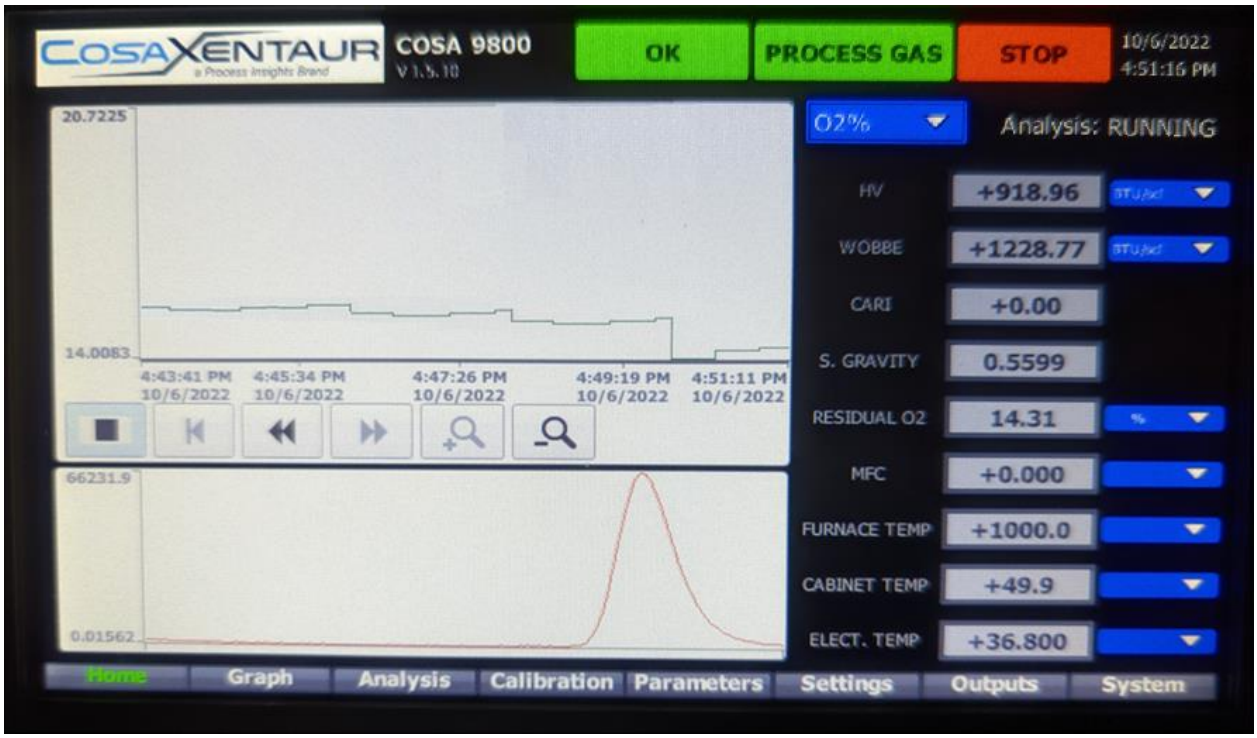


Figure 6: HMI Start Up screen

(Back to Top)

Section 4.2 - Status bar on HMI

This indicates the current status of the analyzer. This bar is visible on the very top of the HMI and is common to all the HMI screens.

Shows one of three states: OK, WARNING or ALARM.

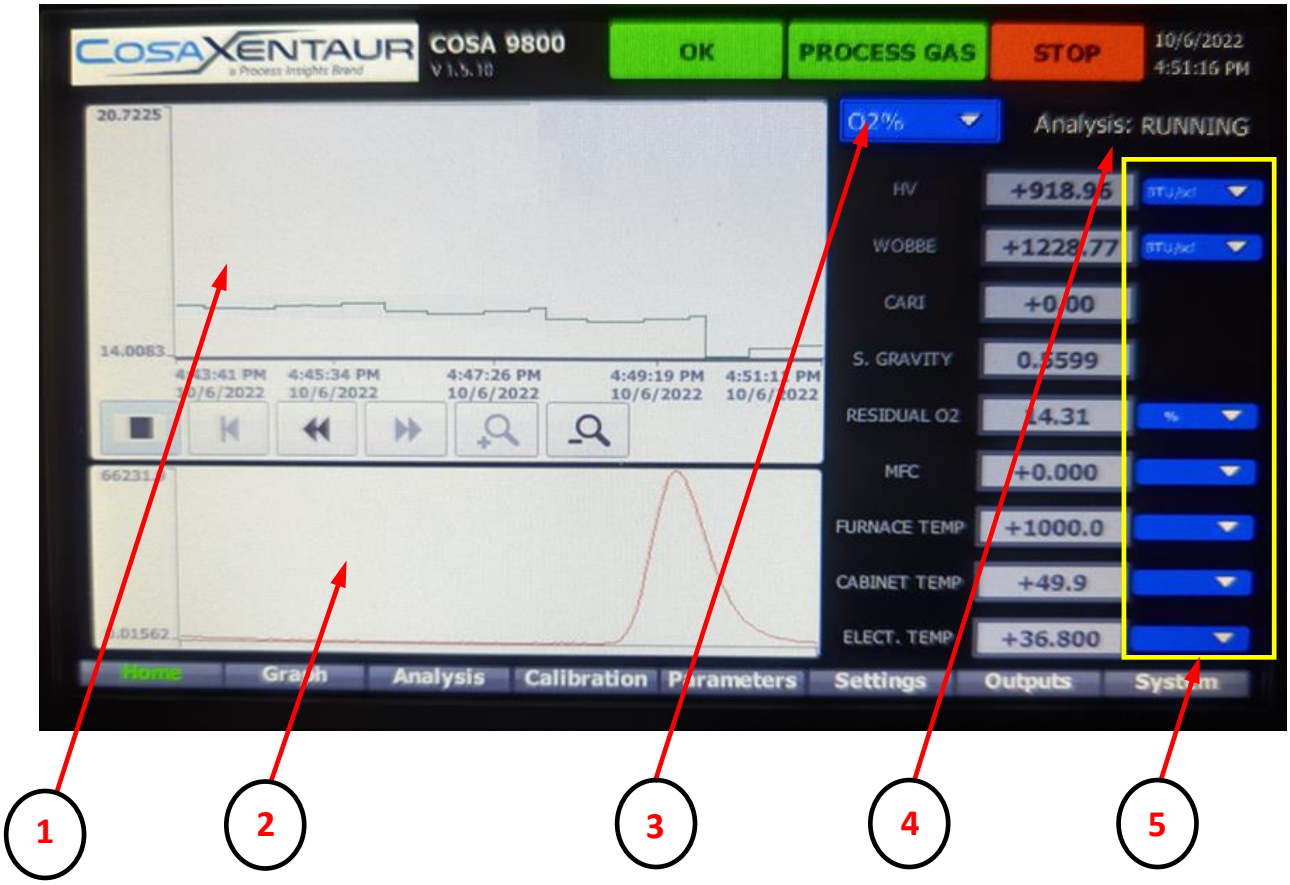
Shows whether current gas being analyzed is Process, Low Cal Gas, or High Cal Gas.

Button to START or STOP the analyses.

(Back to Top)

Section 4.3 - HOME Screen

This screen shows the latest results of the analysis cycle on the lower section of the screen, device parameters as well as the trend graph on the upper section of the screen.



The analysis values for HV (Heating Value), WOBBE, CARI, S. Gravity (Specific Gravity) and Residual O2 are updated at the end of every 30 second cycle. The temperature values are updated every second.

1. This displays a maximum of a 30 minute trend of the selected value.

2. This shows the current 30 second analysis cycle.

3. This drop-down list allows user to select one of the parameters (HV, WOBBE, SG, H2, O2) for the trend plot.

4. This is a status indicator that lets user know whether the analyzer is running/holding.

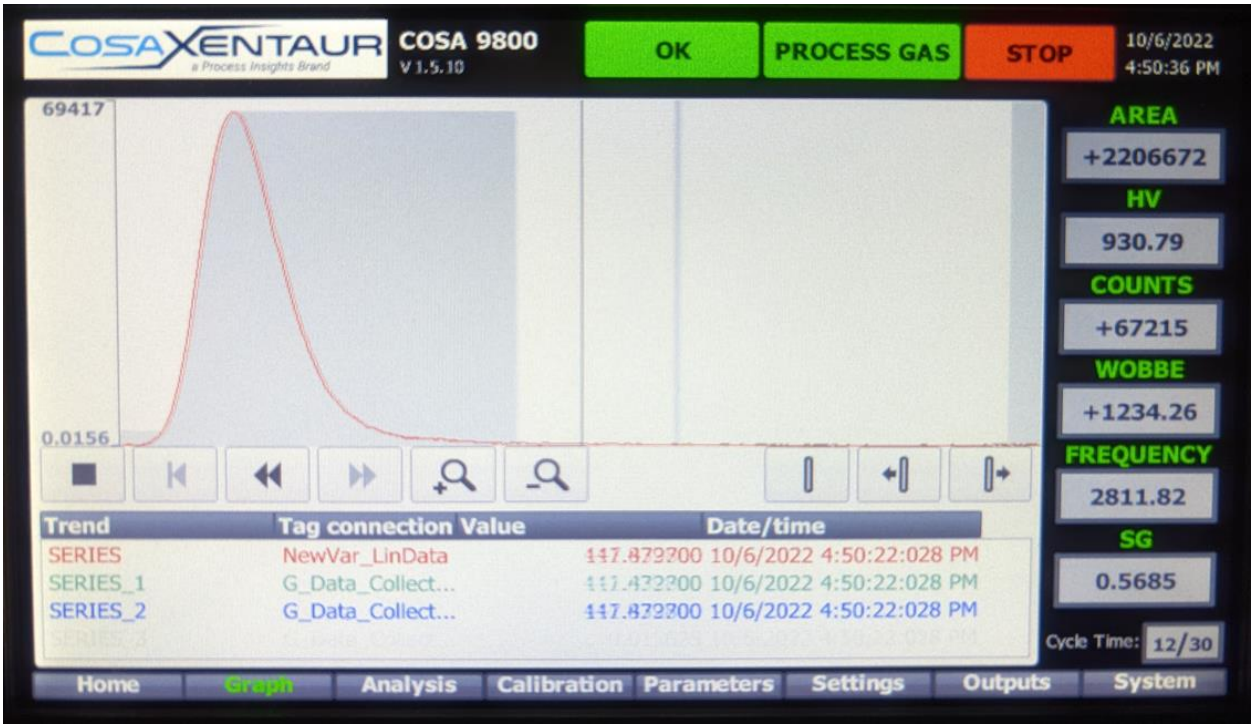
(Back to Top)

5 These are drop-down lists of units of measurement that can be selected for each individual parameters.

(Back to Top)

Section 4.4 - GRAPH Screen

This screen shows the magnified graph that is also shown on the bottom section of the HOME screen.

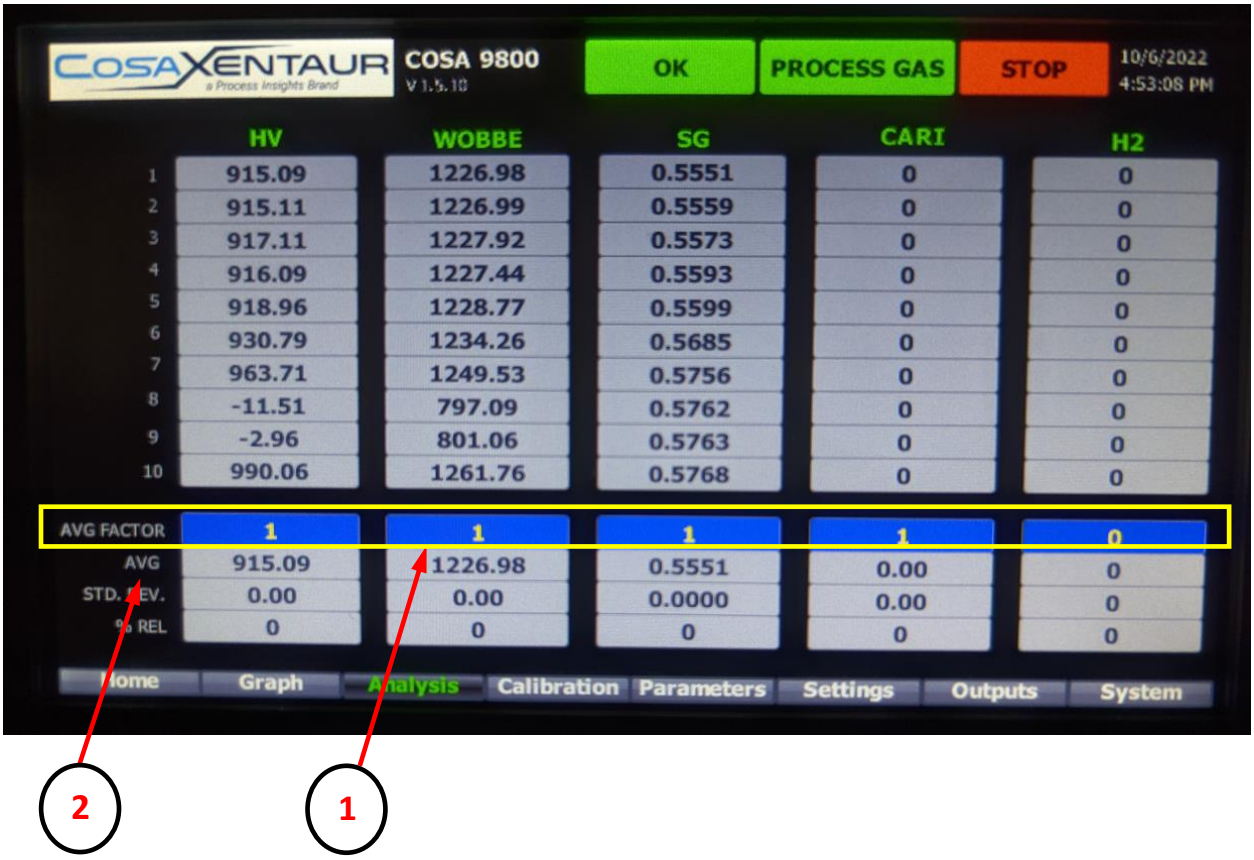


This graph displays the 3 latest analysis cycles with the “red” plot being the current cycle. This screen also provides the actual measured response in terms of COUNTS and FREQUENCY values that are used to calculate the HV, WOBBE, SG, etc. for the current gas being analyzed.

(Back to Top)

Section 4.5 - ANALYSIS Screen

The ANALYSIS screen shows the results of the 10 latest analysis cycles.



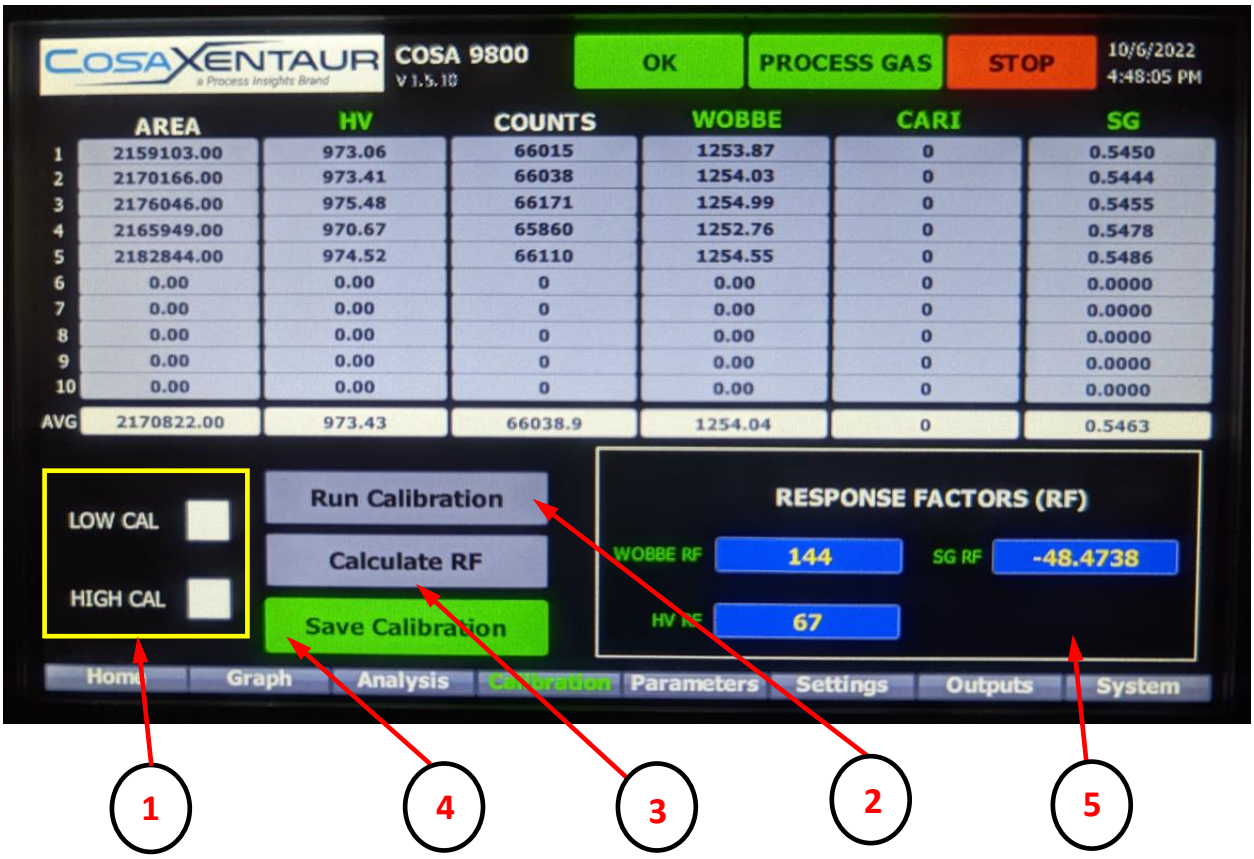
1 The user can enter an averaging factor value between 1 and 10 as show in above image. The analyzer then displays average of the selected number of values and displays them in the row labelled “AVG”.

2 For example, if “AVG FACTOR = 5”, then the value displayed in the “AVG” row will be an average of the 5 latest values in that particular column.

(Back to Top)

Section 4.6 - CALIBRATION Screen

This screen contains the manual calibration controls as well as information about the last run calibration and the response factors (RF).



The user can run up to a maximum of 10 calibration cycles. The average of the results of the set number of calibration cycles is then used to calculate the individual response factors used in the HV, WOBBE, CARI and SG values.

1. These check boxes are used to select the calibration gas that the user intends to run.

2. This button actuates the selected calibration gas and runs the set number of calibration cycles.

3. After the set number of calibration cycles have been run, clicking on this button will calculate the individual response factors for HV, WOBBE and SG.

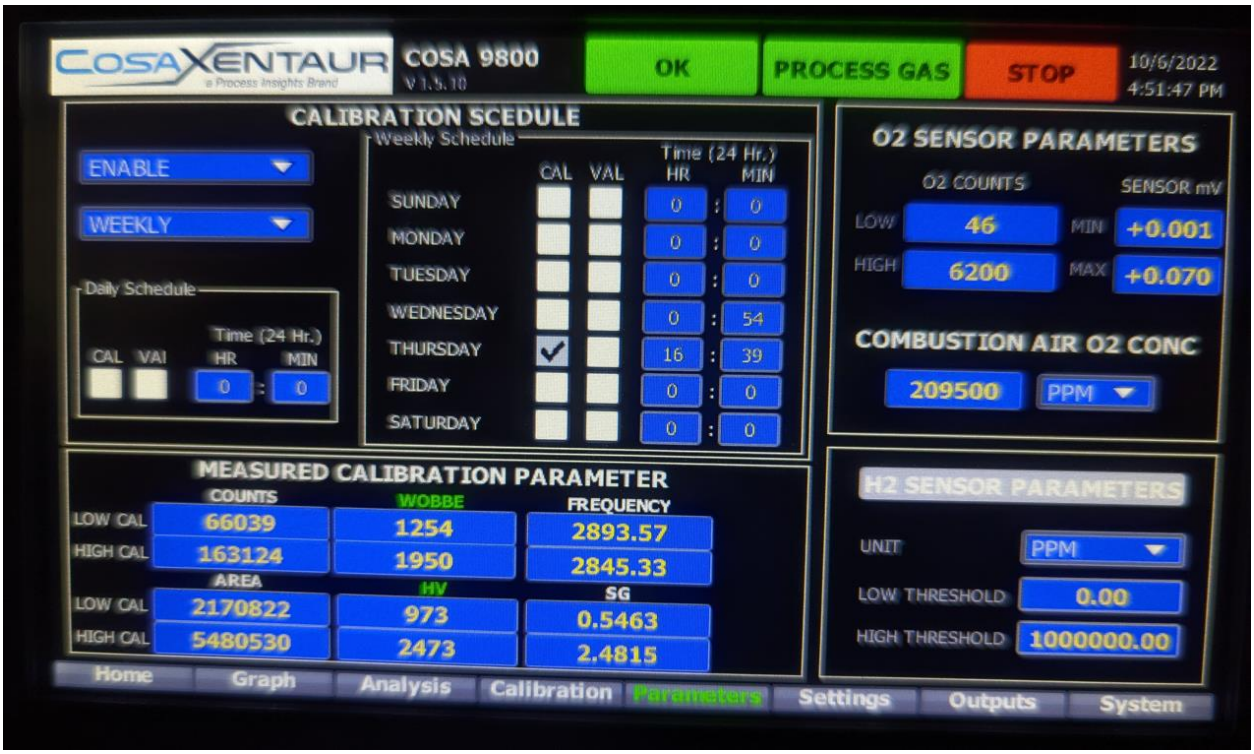
4 If the calibration is acceptable to the user, clicking on the “Save Calibration” button will accept this as a new calibration and all previous Response Factors will be overwritten.

5 The Response Factors for HV, WOBBE and SG are saved in this section. These are the latest calculated Response Factors and are used for calculations until a new calibration is run and new Response Factors are calculated and saved.

(Back to Top)

Section 4.7 - PARAMETERS Screen

The PARAMETERS screen allows user to enter settings for auto-calibration/auto-validation as well as operating parameters for the Oxygen Sensor.



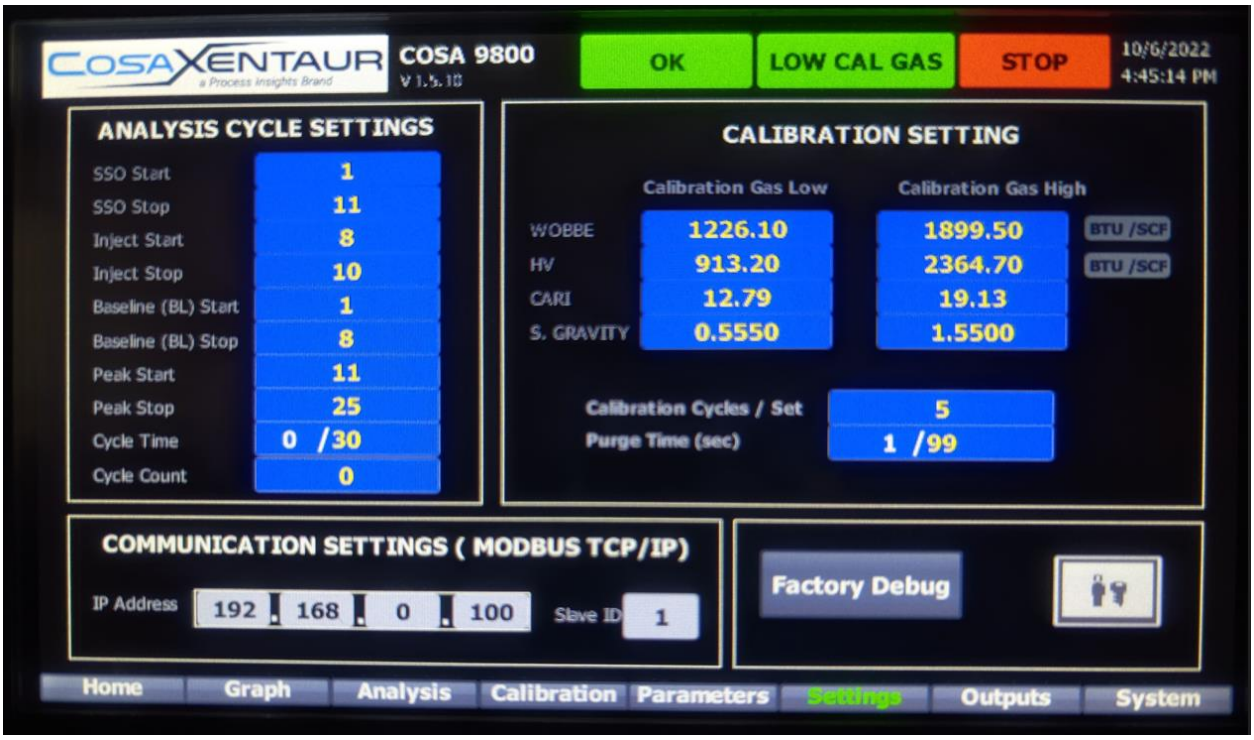
The O2 Sensor parameters are typically factory generated as they are required for calculation of residual oxygen that is in turn required to calculate the HV, WOBBE values. The accurate measurement of these values requires additional gases. Hence it is highly recommended that these values remain unchanged.

The Combustion Air O2 Concentration as the name suggests is the O2 concentration of the Reference air used. Typically the analyzer is run using UHP Zero Air and the typical O2 concentration is around 20.95%.

(Back to Top)

Section 4.8 - SETTINGS Screen

The SETTINGS screen contains information about the analysis cycle settings as well as settings for the calibration gases used.



Most of the analysis cycle settings are user-editable and can be modified to fine tune the analyses. However, the maximum cycle time value is capped at 30 seconds.

The calibration gas settings are derived from the actual composition of the calibration gases used which are typically blended based on the composition of the process gas. These values are used to generate the calibration curves (Response Factors) for HV, WOBBE, CARI and SG.

The user can enter a value from 1 to 10 for the set number of Calibration Cycles.

The Purge Time is the “wait” duration when the analyzer switches from one gas to another and allows the set time to purge out the previous gas to eliminate contamination.

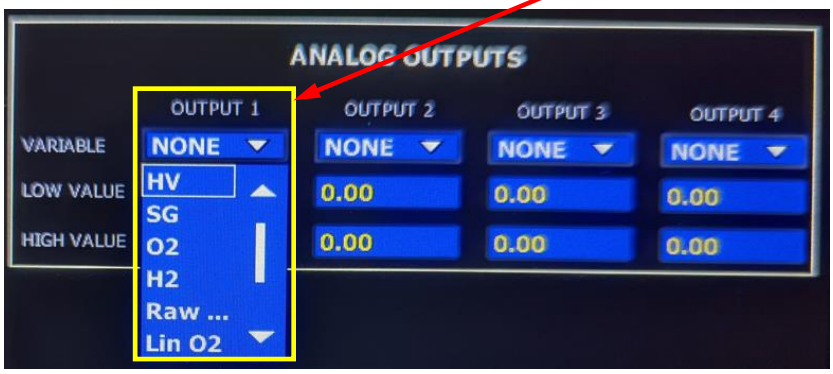
(Back to Top)

Section 4.9 - OUTPUTS Screen

The Outputs screen shows information about the Analog as well as the Digital Outputs of the analyzer.

The "Digital Outputs Status" section shows the current status of a Digital Output. These Digital Outputs control the analyzer manifold valves that select between process gas, calibration gas as well as the Atmospheric Reference valve. In addition, these Digital Outputs also control the Sample (Inject) valve. A "RED" status indicates that the output is ON, and a "RED" status indicates that the output is OFF.

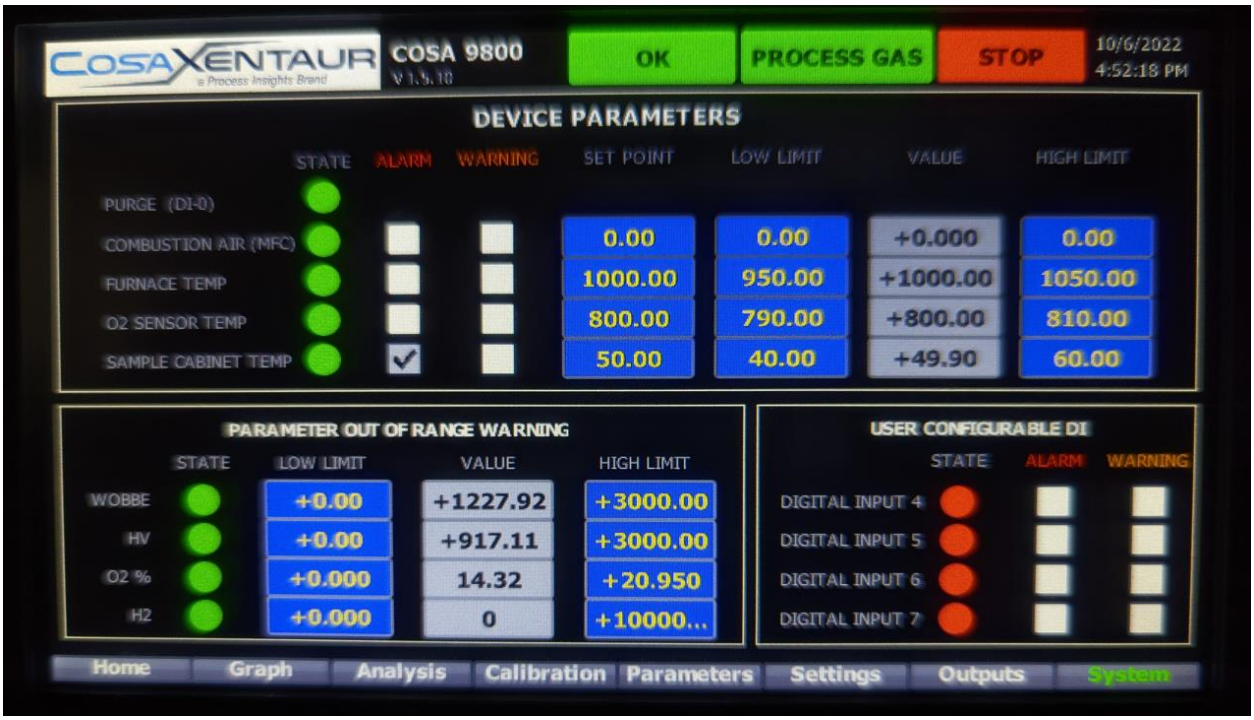
The analyzer has 4 Analog Output channels. Each channel provides a drop-down list of available parameters as shown below, that the user can select as an analog output.



(Back to Top)

Section 4.10 - SYSTEM Screen

The SYSTEM screen contains all the Alarm and Warning information of the analyzer. This provides the details about a particular Alarm/Warning generated during analyzer operation.



The Device Parameters screen provides the ability to monitor all the system temperatures as well as system-critical digital inputs.

The user has the ability to enter the alarm/warning limits. The checkboxes for “Alarm” and “Warning” dictate the logic on how the system responds when a parameter value is out of bounds.

For example, if the “Alarm” box is checked for the Furnace Temp parameter, and if the actual value falls out of either set limit, the analyzer status will change from “OK” to “ALARM”, and analyses will be stopped. However, if the “Warning” box is checked, the analyzer status will change from “OK” to “WARNING”, but analysis will not be suspended.

The Parameters Out Of Range Warning, as the name suggests, will change the analyzer status from “OK” to “WARNING”, if the value falls out of the lower or upper limit. The analysis will not be suspended.

The User Configurable DI are 4 digital inputs that the user can wire into the analyzer to be monitored. The analyzer can be programmed to either “Alarm” or just provide a “Warning”.

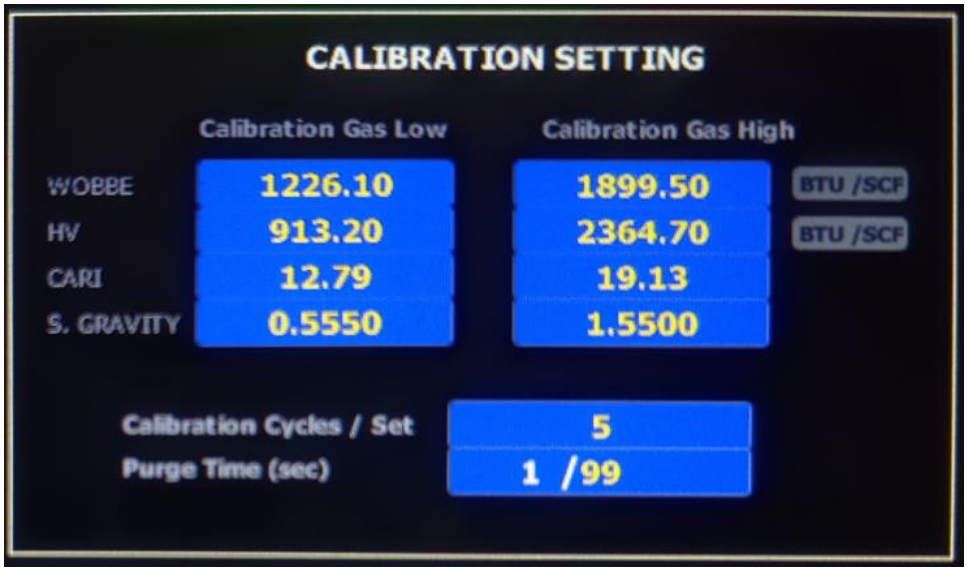
(Back to Top)

Section 5 – Calibration and Validation Procedures

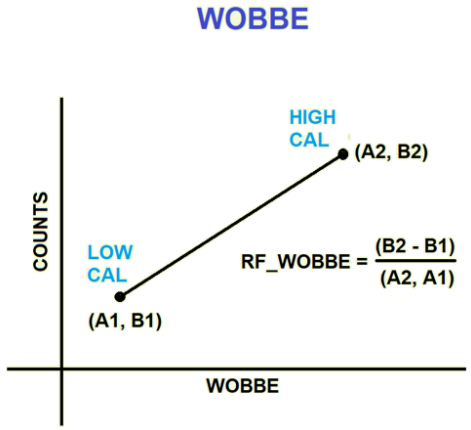
The analyzer requires two calibration gases, a low and high gas, to generate response factors used for calculating HV, WOBBE, CARI and SG values.

The calibration or validation can be run either manually, or automatically. Both these methods will be described in detail in the next sub-sections.

The calibration settings (located in the SETTINGS screen) provide information about the parameters for the low and high calibration gases. These known parameters are used to generate the calibration curve.



The calibration curve is actually a linear regression. As an example, the Response Factor calculation for WOBBE is as shown below.



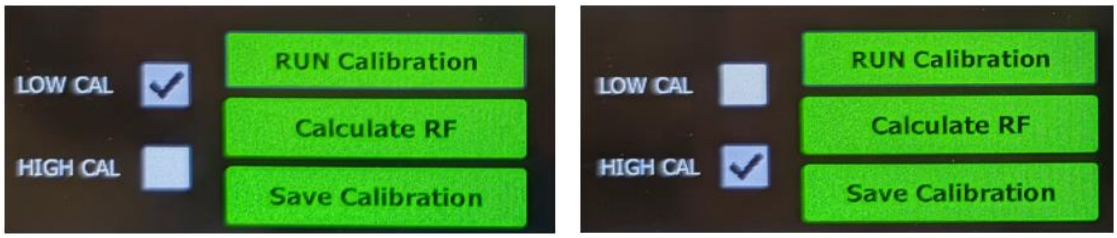
(Back to Top)

Section 5.1 - Manual Calibration/Validation

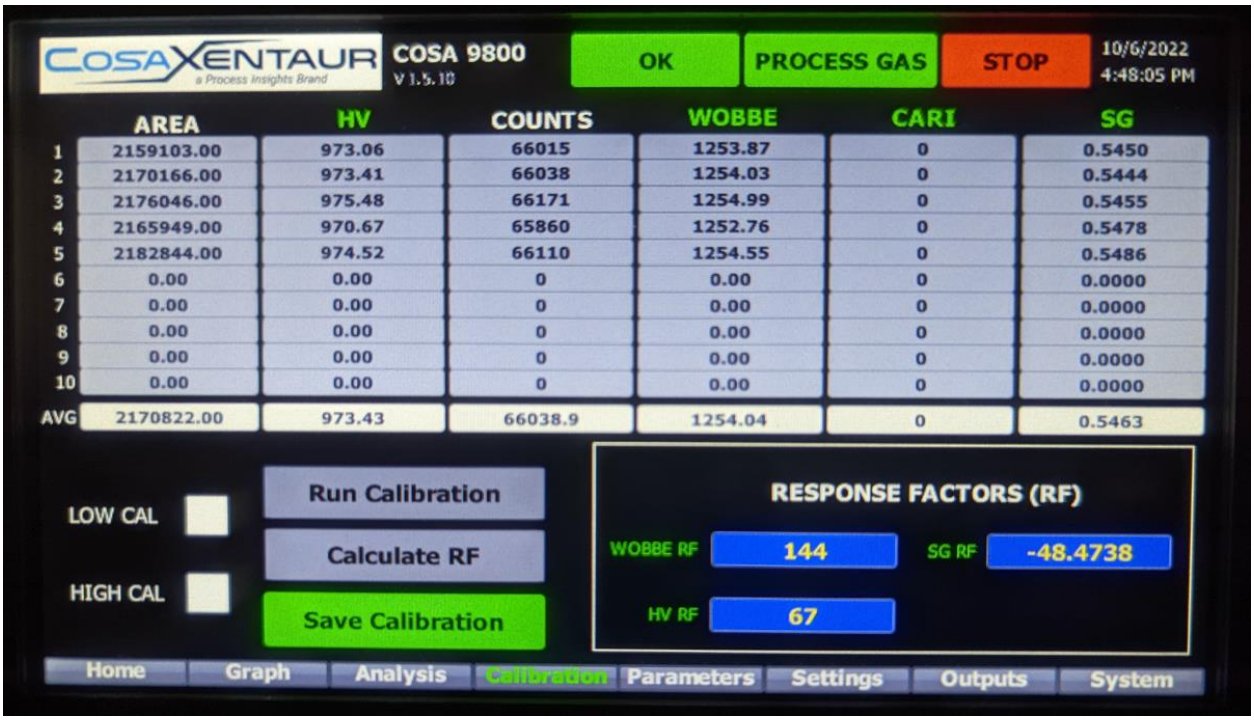
The manual calibration controls are located on the CALIBRATION screen. Before starting a calibration cycle, verify that the calibration settings for the calibration standards in the SETTINGS screen are set correctly.

Also, in the SETTINGS screen, enter the number of calibration cycles you wish to run (Calibration Cycles / Set), as well as the "Purge Time (sec)", which is the duration for which the analyzer will purge the system off the previous gas sample before beginning analyzing the new gas sample.

Then navigate to the CALIBRATION screen, select the checkbox for "LOW CAL" and then click on "Run Calibration". The analyzer will switch to the low calibration standard and purge for the set amount of purge time before running the preset number of calibration cycles.



The results of the analyses are updated in the table located on the CALIBRATION screen.



After the lower calibration is completed, follow the same procedure to run the high cal gas. The user can also select both checkboxes for “LOW CAL” and “HIGH CAL”. In that case, when “RUN CALIBRATION” is selected, the analyzer will run the high calibration standard first, and then the low calibration standard.

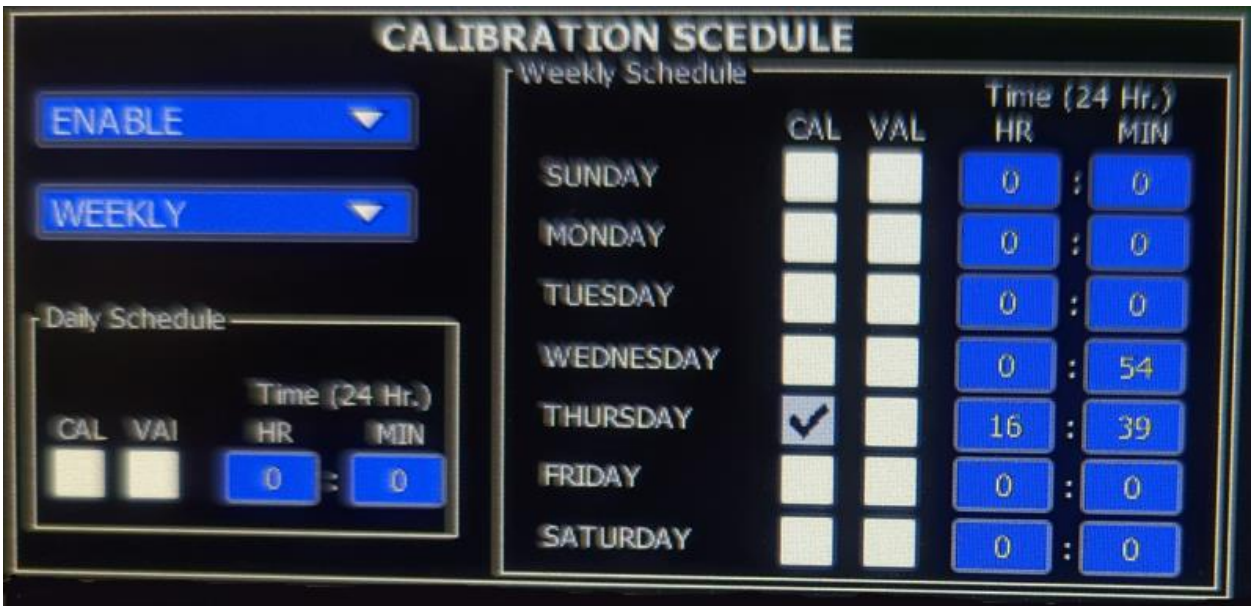
Once both calibration standard runs are completed, click on “Calculate RF”, which will generate new response factors for HV, WOBBE and SG. Click on “Save Calibration” to accept the new calibration. The new RF values will now be used to calculate the HV, WOBBE and SG for the process stream.

(Back to Top)

Section 5.2 - Calibration/Validation Schedules

The calibration / validation can also be set to run automatically on a preset schedule. The analyzer allows users to select either a Daily, or a Weekly schedule.

CAUTION: When using the Auto-Calibration option it should be noted that the new calibration is accepted irrespective of the response. This can potentially save incorrect Response Factors thereby reporting erroneous results that can adversely affect process.



In order to activate the scheduled calibration / validation, the “Calibration Schedule” has to be “Enabled”. Then select either the “Daily” or “Weekly” schedule.

(Back to Top)

Section 5.2.1 - Daily Calibration/Validation Schedules

For the Daily schedule, select the appropriate checkbox for “Cal” or “Val”, and enter the calibration / validation time in hours and minutes (24-hour format).

The analyzer will then run the calibration / validation as selected at the pre-set time every day. If the Calibration box is checked, the analyzer will run both the low and high calibration gases, then calculate the new RF values and automatically save and start using the new Response Factors.

If the Validation box is checked, the analyzer will run both the low and high calibration gases, however the new RF values will not be automatically calculated and saved. The measured calibration parameters will be updated in the PARAMETERS screen, and the user will have the option to calculate the new RF values and save them.

(Back to Top)

Section 5.2.2 - Weekly Calibration/Validation Schedules

The weekly schedule is flexible, and the user has the freedom to set either auto-calibration or auto-validation as well as choose a different start time for each day.

The user can also choose to run both, the calibration and validation one after the other.

To activate this schedule, “Enable” the Calibration Schedule, select the “Weekly” option. Select the appropriate checkboxes for Cal or Val for each day, and enter the time (24-hour clock) in hours and minutes.

The analyzer will run the set number of calibration and/or validation cycles at the set day and time and either calculate and save the RF values for calibration, or just report the end results of the validation runs.

(Back to Top)

Section 6 – 9800CXi Digital Communications

The 9800CXi Calorimeter is a PLC-based system and can be programmed for modbus TCP/IP communication. The detailed modbus map is available in the next section.

The MODBUS data is typically a near continuous stream of data packets from the Client. The 9800CXi software is self-aligning regardless of where it starts listening to packets. This is accomplished by starting with an index of zero. The byte read must equal the Station ID if the index is zero. If not, the alignment procedure begins again without incrementing the index. Alignment is achieved within 8 characters of a packet for the 9800CXi. When a character read does equal the ID, the index is advanced from 0 to 1. The next character read must equal an allowable function code (1-6). If there is no match the index is reset to 0. Under this scenario, the reception of packets will self-synchronize. If we have a match on the first and second byte, read the next 6 bytes. At this point we have 8 bytes in a receive register. Perform a CRC on the first six characters and compare with the 7th and 8th characters. There must be a CRC match to process the received packet. If there is no match, the index is again reset to 0 and the process of data capture and qualification repeats. Upon detection of a complete and valid packet the received 8-byte packet is transferred to private processing area. The “Save Packet” function is called which executes a function (1-6) as defined by the function code byte in the 2nd byte of the saved packet. The 9800CXi software creates a reply message for the Client and transmits it back to the client. A message stream resembles the image below showing the command on the left and the response on the right.

Response time is approximately 10ms after the packet is decoded before a reply message is sent.

Example of reading a single unsigned 32-bit register

In the example below, registers pair R30169 and R30170 are the ppm value. Use function code 4 with an offset of 68 in the MODBUS message to read it.

Example MODBUS query: **02 04 00 44 00 02 31 ED**

Where:
02 = ID
04 = Function Code
00 44 = address offset = 68
00 02 = number of registers requested
31 ED = CRC

Example of MODBUS response, returns 4 bytes from offset 68: **02 04 04 00 07 B1 84 0D 76**

Where:
02 = ID
04 = Function Code
04 = Byte Count
00 07 B1 84 = 504,196 ppm
0D 76 = CRC

(Back to Top)

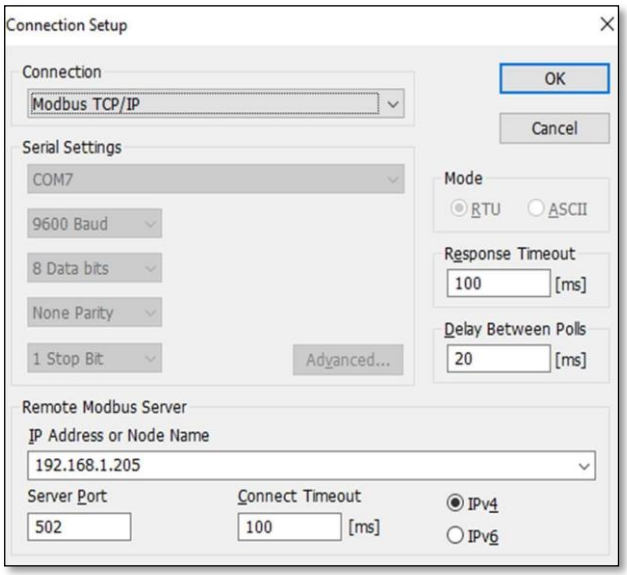
Section 6.1 - Communication Settings

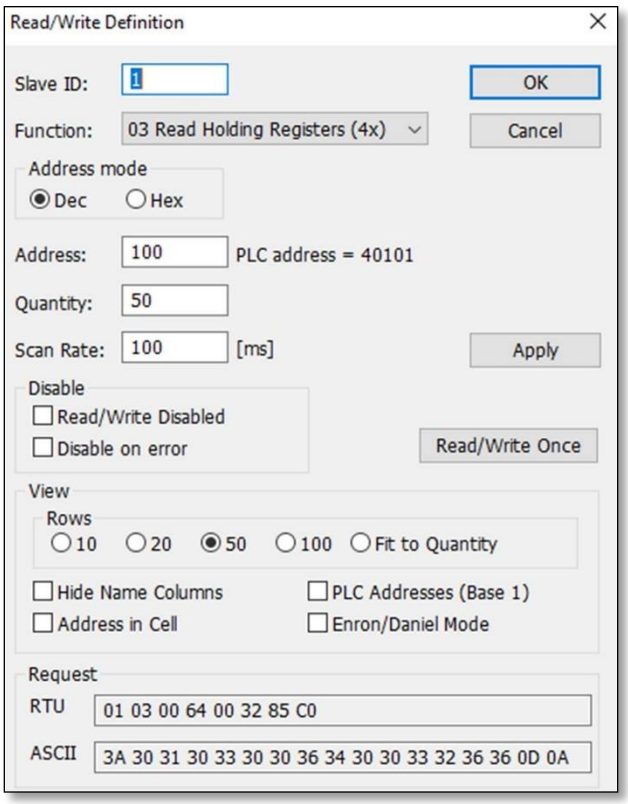
(Back to Top)

Section 6.2 - MODBUS Map

Address	Variable	Tag	Data Type	Updated every
40100	Cycle Counter	Process analysis cycle# every 30s	DINT	30s
40102	Peak	Max Counts during peak analysis	REAL	30 s
40104	Area	Area during peak analysis	REAL	30 s
40106	WOBBE	Calculated WOBBE	REAL	30 s
40108	HV	Calculated HV	REAL	30 s
40110	CARI	Calculated CARI	REAL	30 s
40112	ResidualO2	Calculated Residual O2	REAL	30 s
40114	Frequency	Measured Frequency from Densitometer	REAL	30s
40116	Specific Gravity	Calculated Specific Gravity	REAL	30s
40122	MFC	Calculated MFC	REAL	1 s
40124	FTemp	Furnace Temperature	REAL	1 s
40126	ECTemp	Electronics Cabinet Temperature	REAL	1 s
40128	SCTemp	Sample Cabinet Temperature	REAL	1 s
40130	O2Temp	Oxygen Sensor Temperature	REAL	1 s
40140	100ms Counter	Linearization sequence# every 100ms	UINT	100 ms
40142	Freq-100ms	Raw Freq – 100ms	REAL-4dp	100 ms
40144	Lin_Counts	Linearized Counts, updated 100ms	REAL-2dp	100 ms
40146	C_L	Low O2 Count	UNIT	100 ms
40148	C_H	High O2 Count	UINT	100 ms
40150	V_L	Low mV	REAL	100 ms
40152	V_H	High mV	REAL	100 ms
40154	S_CV	Count/ Voltage Ratio	REAL	100 ms

40156	#A	Residual O2%	REAL	100 ms
40158	C_BA	Baseline Average	REAL – 2dp	100ms
40160	RefO2	%Reference O2	REAL	HMI input
40164	Time msec	Time in msec	REAL	100 ms
40168	Cum mms	Cumulative msec from PLC reset	REAL	100 ms





(Back to Top)

Tx = 1825777: Err = 41326: ID = 1: F = 03: SR = 100ms

	Name	00100	Name	00120	Name	00140	Name	00160
0	Cycle Counter	19		--	100ms Counter	275	Ref O2	20.9499
1		--		--		--		--
2	Peak	209391	MFC	0	Raw_Counts	368		0
3		--		--		--		--
4	Area	1.242e+07	FTemp	24	Lin_Counts	-0.015625	Msec	792
5		--		--		--		--
6	WOBBE	865.188	ECTemp	0	C_L	10550		0
7		--		--		--		--
8	HV	36568.2	SCTemp	0	C_H	39100	Cumulative ms	797500
9		--		--		--		--
10	CARI	0	O2Temp	30.5	V_L	-0.001		
11		--		--		--		
12	ResidualO2	0.0108031		0	V_H	0.181		
13		--		--		--		
14	Freq	1		0	S_CV	156868		
15		--		--		--		
16	SG	0.819231		--	#A_Percentage	20.9499		
17		--		--		--		
18		0		0	Baseline Avg	10550		
19		--		--		--		

(Back to Top)

Section 7 – Basic Maintenance Guide

To ensure proper operation of your analyzer, it is recommended that user have regular visual checks using the guidelines listed below.

Wear PPE before performing any maintenance or inspection and follow the Warnings and Cautions stated in the manual.

The analyzer requires standard tools, the most common of which are listed below:

- Wrenches – 5/16, 1/4, 7/16, 1/2, 9/16
- Allen wrenches set - 1/16 - 3/8in
- #1 and #2 Flat head and Phillips head screw drivers
- 1" deep Socket wrench – 7 micron filter replacement
- small flat head screw driver set (electrical wiring)

Interval	Visual inspection	Actions
3 months	Leak check	Tighten or replace the fitting with new one
1 month	Plastic tubing	Replace if cracked, pinched, or degraded
1 month	Pressure regulator	Drain if water is collected in the filter bowl
6 months	Sample heater	Replace if not working
6 months	Main enclosure heater	Replace if not working
6 months	Pressure regulator	Replace if gauge is broken
6 months	Sample valve	Replace if it makes croaking sound
12 months	Wire & cables	Replace if cracked, pinched, or degraded
12 months	Purge monitor	Replace if Green/Red light is not working
12 months	Labels outside	Replace if worn out or illegible
12 months	Labels inside	Replace if worn out or illegible
12 months	Ground lugs nut	Tighten if loosened
12 months	Enclosures	If water and dust leakage found, then replace the seals
12 months	Mounting bolts	Tighten if loose and replace if corroded
12 months	Furnace vent	Replace if air flow is restricted

After performing any maintenance make sure following has been done:

1. Leak check.
2. Visual inspection of any loose wires that may have not been re-connected or accidentally pulled from the device.
3. Purge the instrument for minimum of 15 minutes.

(Back to Top)

Section 7.1 - Safe Service Instructions

This section covers some basic maintenance procedures that can be performed regularly to keep the instrumentation running efficiently.
However, it is important to follow safe work measures to avoid any personal injuries and/or loss of life and/or property.
Please follow the safety guidelines in this manual very carefully. The most common maintenance tasks and the associated hazards are identified in this section. However, this manual also includes detailed information about identified risks and safe operation of the analyzer and its peripheral modules.

WARNING: 	**A SEVERE TO POTENTIONALLY LETHAL ELECTRIC SHOCK HAZARD MAY EXIST ON 110-240 VAC LINE COMPONENTS WHILE POWER IS APPLIED TO INTERNAL COMPONENTS.** Ensure that power is disconnected from the power source before working on the instrument.
WARNING: 	**HIGH-PRESSURE GASES SHOULD BE HANDLED WITH EXTREME CARE.** Ensure that all gas lines, regulators, gas purifiers, etc. are specified for the intended use. Verify that all tubing is depressurized, and sample drained before beginning work on any of the modules. Verify that lines are properly purged before opening lines or disconnecting sample.
WARNING: 	**HIGH-PRESSURE GAS BOTTLES SHOULD BE HANDLED WITH EXTREME CARE.** Typically, most sample and gas bottles are under pressures in the hundreds or thousands of PSI. Ensure that the bottle regulators are closed OFF before disconnecting lines.
WARNING: 	**IMPROPER/INCORRECT TOOLS CAN CAUSE INJURY AND/OR PROPERTY DAMAGE.** Using incorrect tools can cause slippage leading to injury from loss of balance, or cuts or trauma.
WARNING: 	**SEVERE BURNS CAN RESULT WHEN WORKING AROUND A HOT FURNACE.** The combustion chamber is extremely hot (operating temperature of 1050 °C). Allow furnace to cool down for at least 4 hours before performing any maintenance on it.
CAUTION: 	Carefully ensure the analytical system is free from leaks. Failure to do so may cause inconsistent analytical performance and/or system component damage.

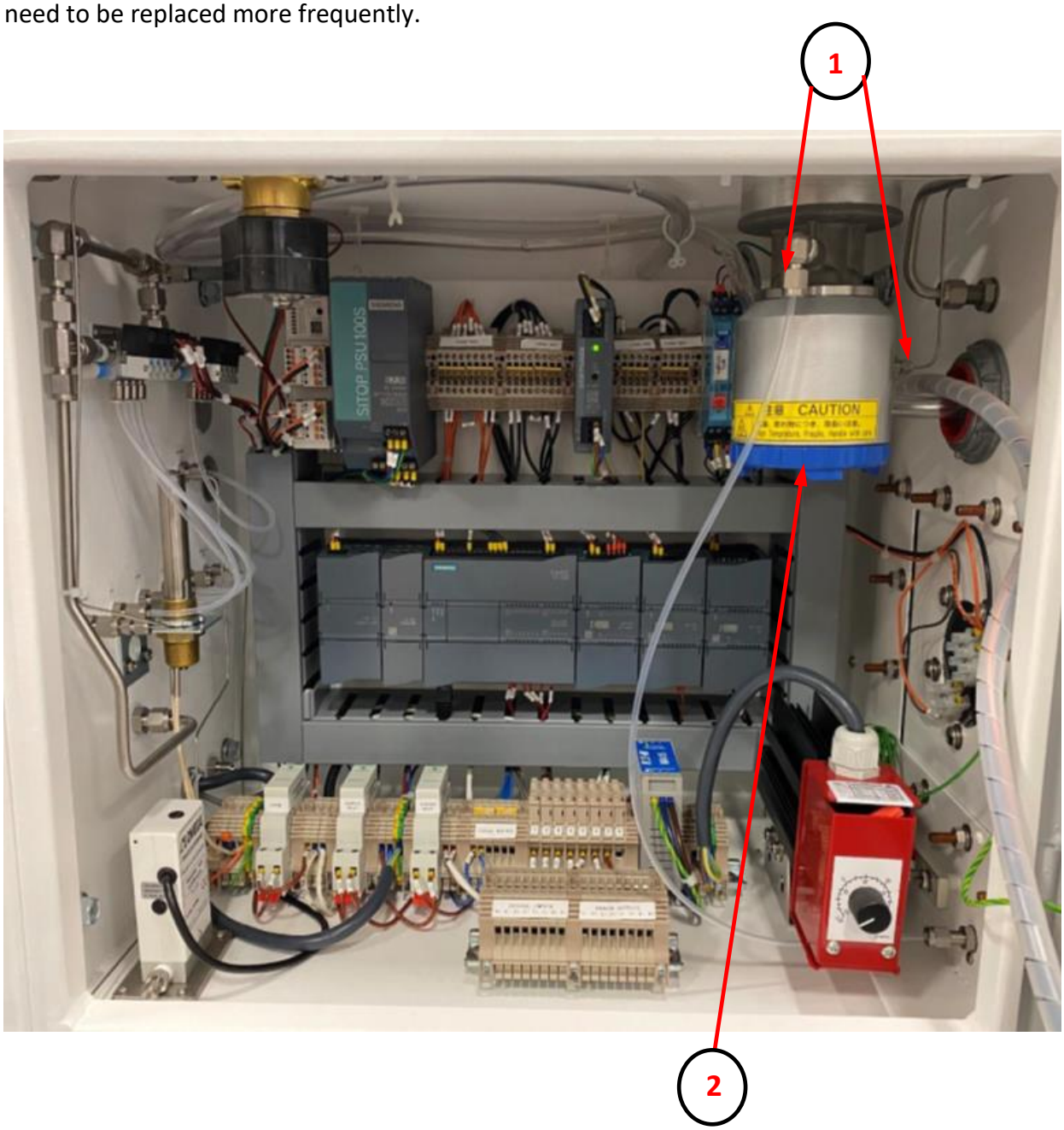
WARNING: 	**COMPONENT DAMAGE MAY OCCUR WHEN USING A LIQUID LEAK DETECTOR.** Even though the solution in an approved liquid leak detector "Snoop" solution is non-conductive, care should be taken not to wet any electrical or electronic components to avoid damage to sensitive equipment. Many liquid leak detectors contain sulfur compounds that can contaminate the gas supply line and instrument flow path components. Care should be taken not to wet or contaminate the analytical flow system when using a liquid leak detector.
CAUTION: 	**Do not over-tighten fittings.** Fittings should be tightened according to manufacturer's specified recommendations to prevent leaks.
CAUTION: 	**Ensure all inlet and outlet openings are kept clean and free from contaminants.** It is recommended that the inlet and outlet openings be plugged when not connected to lines.
CAUTION: 	**Potentially hot surfaces are identified using this warning label. Caution is required when touching hot surfaces to avoid burns and other injuries.**
PROHIBITED: 	THE ANALYZER SHOULD NOT BE MODIFIED IN ANY WAY. ANY MODIFICATIONS TO THE ANALYZER HARDWARE, ESPECIALLY TO AND FROM THE FURNACE, CAN POTENTIALLY MAKE THE SYSTEM UNSTABLE. MODIFICATIONS TO THE FLOW PATH ARE PROHIBITED AS IT CAN COMPROMISE ANALYZER INTEGRITY AND POSSIBLY CAUSE CATASTROPHIC FAILURE..

(Back to Top)

Section 7.2 - Oxygen Sensor replacement

The Oxygen Sensor assembly is mounted between the furnace and electronics enclosures such that it's electrical wiring section is accessible through the electronics enclosure. The sample delivery section of the sensor inlet is located in the furnace section so that the ambient heat inside the enclosure helps maintain the gas phase of the sample.

It is recommended that the sensor be replaced every three years. This replacement schedule is also dependent upon the kind of process environment and there may be some applications where the sensor may need to be replaced more frequently.



The sensor housing has a built-in heater that maintains the sensor at 800 °C which in turn heats up the sensor housing. Hence, before you begin replacing the sensor, turn **OFF** the power to the analyzer and wait until the sensor housing is cool enough to touch.

1. Turn OFF the zero/combustion/reference air to the analyzer and then undo both these fittings.
2. Unscrew this cap to access the sensor.
3. Remove the two screws holding the cover plate and take the plate off.
4. Next, remove the screws that attach the sensor to the housing and then pull the sensor out.
5. Replace the sensor and follow the steps in reverse to install the new sensor.
6. Re-connect the zero/combustion/reference air fittings.
7. Power ON the analyzer.

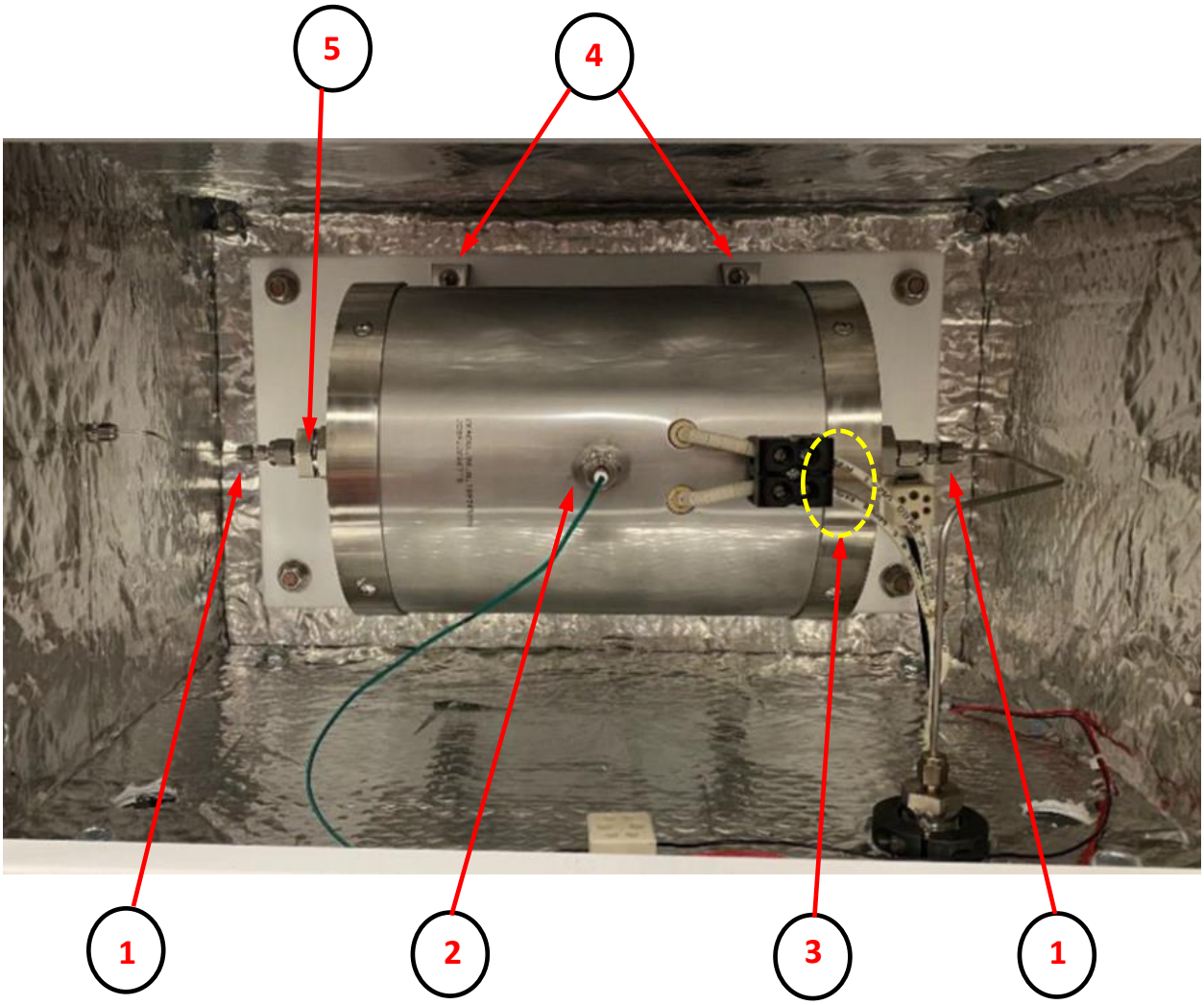
It takes a few minutes for the sensor temperature to reach its set point after which the analyzer will automatically start running analyses.

(Back to Top)

Section 7.3 - Furnace replacement

The 9800CXi furnace is set to work at a 1000 °C and is ON 24/7/365. The high temperature is required to get complete sample combustion encompassing varying process compositions. The extended high operating temperature and any power cycling can stress the furnace coils leading to furnace failure.

It is recommended that the furnace be replaced every three years as a part of Preventive Maintenance.



To replace the furnace, follow this procedure below.

Since the furnace operates at a 1000 °C, the exterior of the furnace can reach a temperature > 100 °C. Hence, before you begin replacing the furnace, turn **OFF** the power to the analyzer and wait until the furnace exterior is cool enough to touch. This can typically take up to 4 hours.

1 Undo both these ⅛" fittings.

2. Undo the ¼" fitting and remove the thermocouple from the furnace.

3. Remove the two AC power wires and cap them.

4. There are 4 screws that attach the furnace to the bracket. Two of the screws are shown here. Remove the 4 screws and detach the 1furnace from the bracket.

5. Remove the combustion chamber from the old furnace and replace it in the new furnace.

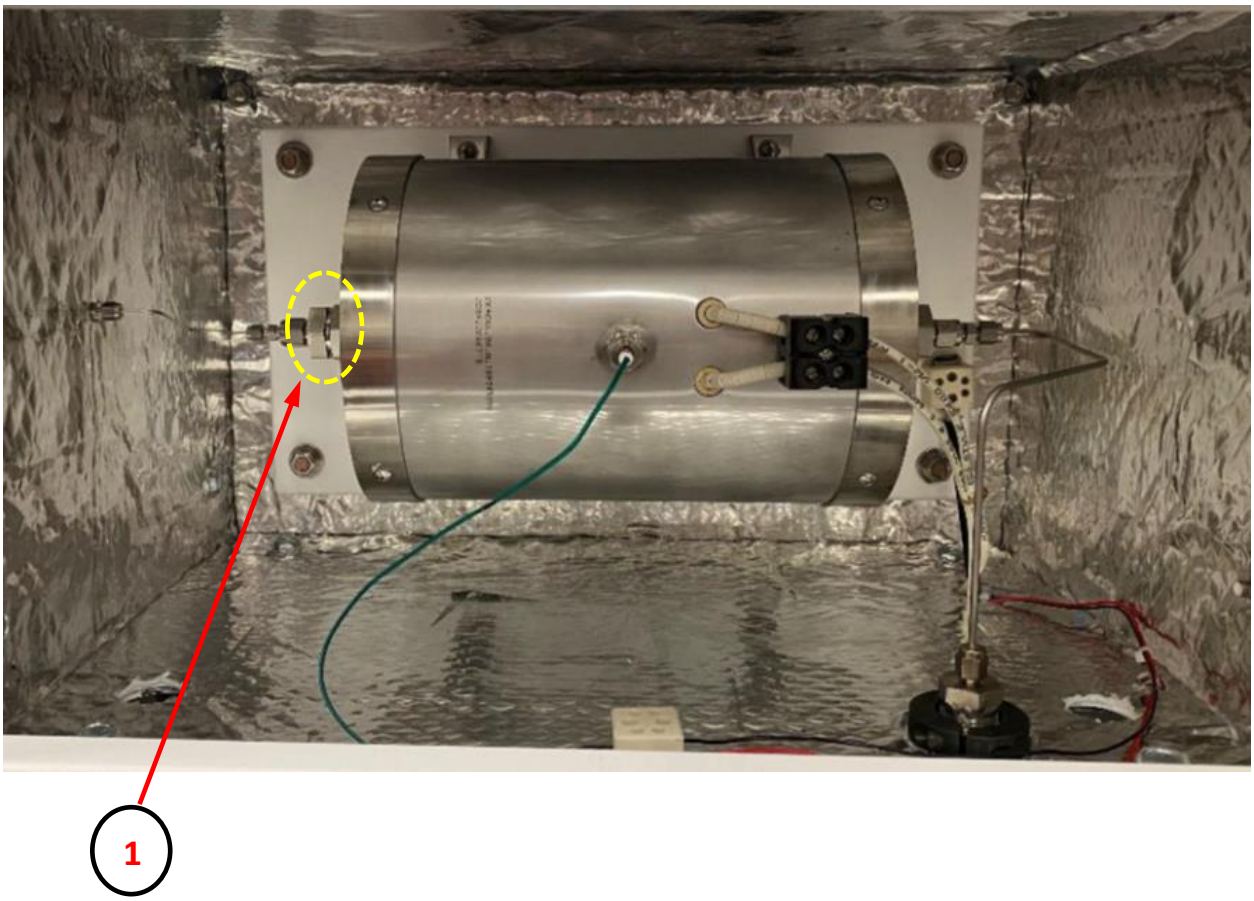
Follow the steps in reverse to install the new furnace.

Power ON the analyzer. It takes about 20-30 minutes for the 1furnace temperature to reach its set point after which the analyzer will automatically start running analyses.

(Back to Top)

Section 7.4 - Combustion chamber replacement

The recommended replacement schedule for replacing the combustion chamber is every three years. It is also more feasible to inspect and replace the chamber if required, during furnace replacement.



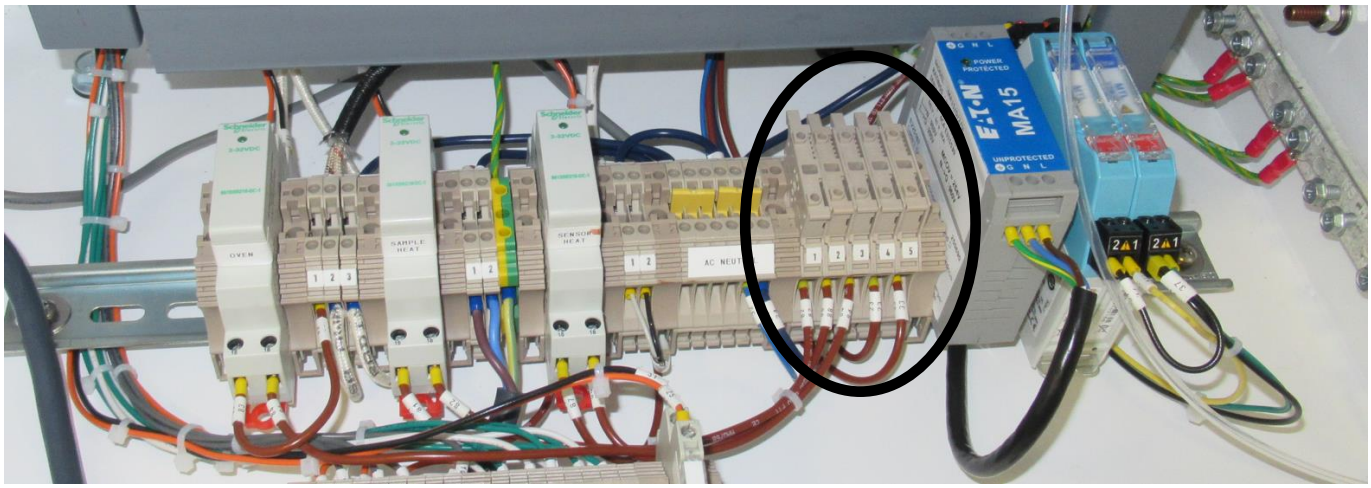
The procedure to replace the combustion chamber involves all the steps to take the furnace out as described in “Section 6.2 - Furnace replacement”.

1. Once the furnace has been removed, replace the combustion chamber as well as the graphite ferrules and follow the remainder of the procedure in Section 6.2.

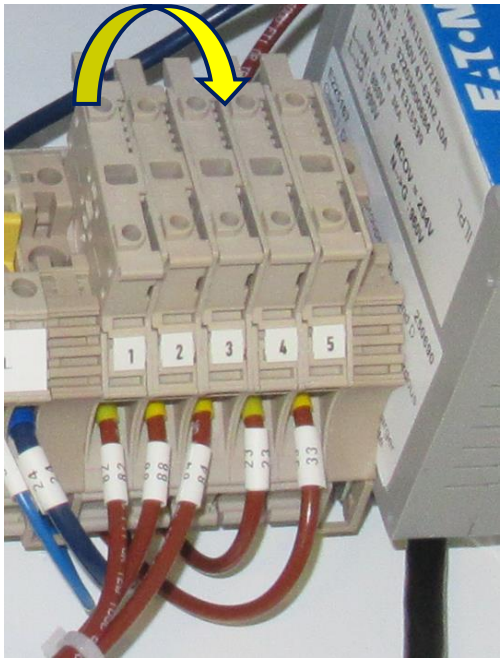
(Back to Top)

Section 7.5 - Replacing fuses

The fuses for the 9800CXi Calorimeter are located on the DIN rail mounted on the floor of the Electronics enclosure as shown below.



To replace a fuse, simply lift up the fuse holder from one end as shown to access and replace the fuse.



The correct ratings for all fuses can be found on the Electrical Wiring Diagram.

(Back to Top)

Section 7.6 - Updating Software

STEP 1: INITIAL SETUP

1. Stop the analysis/cycle (if running)

2. **Settings backup**: On the HMI program take screen-shots (or manually write down information) of all the screens except the Home and Graph screens. This data can be used to manually re-enter the original settings in the event the data gets erased during software installation.

STEP 2: SETUP

Follow the rest of procedure to install the new software.

(Back to Top)

Section 7.7 – Z-Purge Maintenance or Service Procedure (If applicable)

1) Properly disconnect power from all pressurized panel electronics, which requires maintenance or servicing.

2) Turn off the Protective Gas by turning the Pressure Regulator counterclockwise until the pressure reaches 0 psi.

3) Enclosure door may now be opened for maintenance or service can begin.

4) After maintenance or servicing is completed; properly close and seal enclosure door.

5) Supply purge gas to panel by turning the Protective Gas Inlet Kit manifold valve to the ON position. The Protective Gas Inlet Kit pressure regulator should remain the same to keep the purge gas CFM (LPM) flow rate the same as what was established during the initial Purge Cycle Time set up.

6) Power up the analyzer and the Green LED on the purge indicator should illuminate.

7) With Purge Indicator Green LED illuminated; let the purge run for at least 10 minutes.

8) After the manual Purge Cycle Time is completed and Green LED is still illuminated; this indicates that the enclosure is maintaining a minimum overpressure above 0.30 inch H2O (0.75 mbar) for gas hazardous locations.

NOTE: For more information, refer to CYCLOPS Z-Purge Indicator _ IOM Manual.

(Back to Top)

Section 7.8 – X-Purge Maintenance or Service Procedure (If applicable)

1) If maintenance or service must be performed with power applied to the electrical equipment mounted within the purged enclosure the CYCLOPS X – Purge Controller, SM Version is monitoring, first make sure that area-surrounding the electronics enclosure, which the CYCLOPS X – Purge Controller, SM Version is monitoring and controlling is known to be non-hazardous.

2) After it has been established that the area surrounding the electronics enclosure is non-hazardous, unscrew the cover over the CYCLOPS X – Purge Controller, SM Version's maintenance switch. Insert key and turn switch to the Maintenance position. **Maintenance switch key can only be removed from maintenance switch in Normal Operation position and cover cannot be screwed back on until key is removed from switch.** This means, that the maintenance switch key must remain in the switch while maintenance or service is being performed. When the CYCLOPS X – Purge Controller, SM Version is in maintenance mode the indicator light will begin blinking red and, if connected, a remote alarm will be sent.

3) With the CYCLOPS X – Purge Controller, SM Version in maintenance mode, turn off purge supply gas at the shut off valve on Continuous Dilution Purge Gas Inlet Kit manifold block. **Not at the Continuous Dilution Purge Gas Inlet Kit pressure regulator. The Continuous Dilution Purge Gas Inlet Kit pressure regulator setting should remain the same to keep the purge gas CFM (LPM) the same as what was established during the initial automatic dilution time set up.**

4) With protective gas supply off at the shut off valve, open electronics enclosure door.

5) With electronics enclosure door opened and the CYCLOPS X – Purge Controller, SM Version in maintenance mode applying power to the electronics, perform required maintenance or service.

6) After maintenance or service has been performed and completed, properly close and latch electronics enclosure door.

7) After enclosure door has been properly closed and latched, turn on purge supply gas at the shut off valve on Continuous Dilution Purge Gas Inlet Kit manifold block. **Not at the Continuous Dilution Purge Gas Inlet Kit pressure regulator. The Continuous Dilution Purge Gas Inlet Kit pressure regulator setting should remain the same to keep the purge gas CFM (LPM) the same as what was established during the initial automatic dilution time set up**

8) With electronics enclosure door latched and purge supply gas turned on at the shut off valve, return CYCLOPS X – Purge Controller, SM Version maintenance switch to the Normal Operation position. After the maintenance switch has been returned to the Normal Operations position and the following conditions are being met. The monitored enclosure pressure is being maintained

(Back to Top)

above 0.30 inch H2O (0.75 mbar) for explosive gas hazardous areas, 0.50 inch H2O (1.25 mbar) for combustible dust hazardous areas and enclosure exhaust port is registering proper flow, the CYCLOPS X – Purge Controller, SM Version will go from a light blinking red to a steady state of green and power will remain connected through the CYCLOPS X – Purge Controller, SM Version to the electrical equipment within the purged enclosure.

9) After CYCLOPS X – Purge Controller, SM Version's maintenance switch has been returned to Normal Operations position, remove key and screw maintenance switch cover back on as before.

NOTE: for more information, refer to CYCLOPS X-Purge Controller_ SM Version _ IOM Manual

(Back to Top)

Section 8 – Troubleshooting

Section 8.1 - Reported Calorific value is “zero”

1) Verify that sample is injected – check sample pressure and flow.

2) Verify that RF values are not “zero”.

3) If all these items check out and the issue is not resolved, please contact Process Insights Service department.

(Back to Top)

Section 8.2 – Furnace not at set temperature and will not heat up

The furnace in the 9800CXi Calorimeter is controlled by a temperature controller. The analyses will not begin unless the furnace heats up to the set point and the software will indicate a Furnace Temperature Alarm until then.

Follow these steps to troubleshoot are the Furnace Temperature Alarm:

1) Check the fuse for Furnace heater.

2) Verify that the Furnace Temperature set point is set correctly and not set at “zero”.

3) Verify that the Temperature Controller has power.

4) Check if the correct AC voltage can be measured on the furnace coils.

5) Measure the coil resistance and verify the coils are not open.

6) If all these items check out and the issue is not resolved, please contact Process Insights Service department.

(Back to Top)

Section 8.3 – Analyzer will not calibrate correctly

1) Verify that the calibration parameters, sensor parameters and calibration gas specifications have been entered correctly in the appropriate settings screens.

2) Verify that the sample pressure and flow are adequate and meet the minimum requirements of the analyzer.

3) Verify that the Reference Gas has correct flow.

4) Verify that the sample valve does actuate at the correct time and that sample does get injected.

5) Check the system for leaks or plugging.

6) If all these items check out and the issue is not resolved, please contact Process Insights Service department.

(Back to Top)

Section 9 – Devices

Section 9.1 - Autonics 4-Channel Temperature Controller

TM Series

Multi-channel(4 channel / 2 channel) modular type PID control

▣ Features

Line-up

- Multi-channel(4 channel/ 2 channel) simultaneous controlling possible
- High-speed sampling cycle(4 channel: 100ms, 2 channel: 50ms)
- **No communication and power supply for expansion modules required by using side connectors: Max. 31 units (124 channels / 62 channels)**
- Input channel isolated design(Dielectric strength 1,000 VAC)
- Heating/Cooling simultaneous controlling
- Allows parameter setting by USB port of PC
  : Free download the integrated device management program(DAQMaster)
  ※Communication converter, sold separately
  : SCM-WF48(Wi-Fi to RS485/USB communication converter(availabe soon), SCM-US(USB to Serial converter), SCM-38I(RS-232C to RS485 converter), SCM-US48I(USB to RS485 converter)
- Parameter setting by SCM-US without power/wiring
- Easy maintenance via connector type connection
  : Sensor input connector, control output connector, power/communication connector
- Multi input / Multi range
- Heater disconnection function(CT input) ※ CT, sold separately: CSTC-E80LN, CSTC-E200LN

⚠ Please read "Caution for your safety" in operation manual before using.

CE cULus

(Back to Top)

Section 9.1.1 - Device Specifications

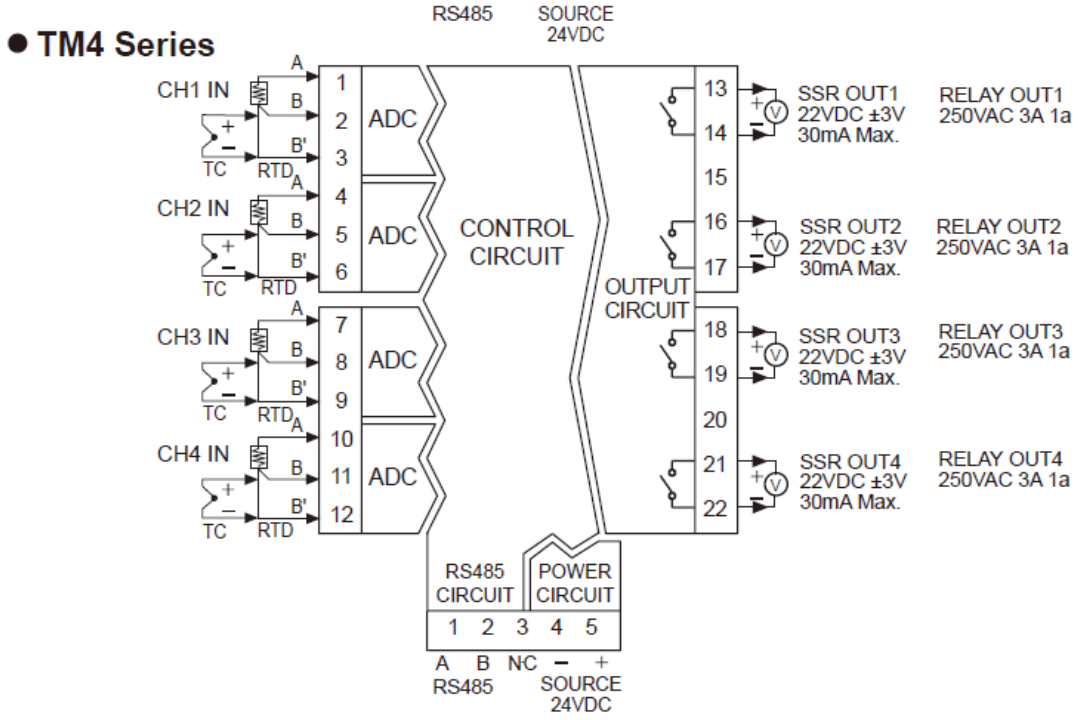
Multi-Channel Module type PID Control

▣ Specifications

Series		TM2-22RB	TM2-42RB	TM2-22RE	TM2-42RE	TM2-22CB	TM2-42CB	TM2-22CE	TM2-42CE	TM4-N2RB	TM4-N2RE	TM4-N2SB	TM4-N2SE
Channel		2 Channel (Each channel insulated-Dielectric strength 1,000VAC)								4 Channel (Each channel insulated-Dielectric strength 1,000VAC)			
Power Supply		24VDC											
Allowable voltage range		90 to 110% of rated voltage											
Power consumption		Max. 5W											
Display type		Non-display type Parameter setting & monitoring with external devices (PC or PLC)											
Input type	RTD	DPt100Ω, JPt100Ω 3 wire (allowable line resistance max. 5Ω per a wire)											
	Thermocouple	K, J, E, T, L, N, U, R, S, B, C, G, PLII (13types)											
Display accuracy	RTD	(PV ±0.5% or ±1℃, select the higher one) ±1digit Max.											
	Thermocouple※1												
	CT input	±5% F.S. ±1digit Max.								—			
	Current output	±1.5% F.S. ±1digit Max.								—			
Influence of temperature※2	RTD	(PV ±0.5% or ±2℃, select the higher one) ±1digit Max.(In case of thermocouple input, it is ±5℃ at -100℃ below.) • Thermocouples L, U, C, G, R, S, B: (PV ±0.5% or ±5℃, select the higher one) ±1digit Max.											
	Thermocouple												
Control output	Relay	250VAC 3A 1a				—				250VAC 3A 1a		—	
	SSR	—				12VDC ±3V 30mA Max.				—		22VDC ±3V30mA Max.	
	Current	—				DC 4-20mA or DC 0-20mA selectable(load 500Ω Max.)				—			
Option output	Relay	250VAC 3A 1a								—			
	Communication	RS485 Communication output (Modbus RTU)											
Option input	CT input	0.0-50.0A(Primary current meaurement range) ※CT ratio = 1/1000								—			
	Digital input	• Contact input: ON Max. 1kΩ, OFF Min. 100kΩ • Non-contact input: ON Max. 1.5V residual voltage, OFF Max. 0.1mA leakage current • Outflow current: Approx. 0.5mA								—			
Control method	Heating, cooling	ON/OFF control mode, P, PI, PD, PID control mode											
	Heating&cooling												
Hysteresis		1 to 100℃/℉ (0.1 to 100℃/℉) variable								1 to 100 digit			
Proportional band (P)		0.1 to 999.9℃/℉											
Integral time (I)		0 to 9999 sec.											
Derivative time (D)		0 to 9999 sec.											
Control period (T)		0.1 to 120.0 sec. (only relay output and SSR drive voltage output type)											
Manual reset value		0.0 to 100.0%											
Sampling period		50ms (2 channel synchronous sampling)								100ms (4 channel synchronous sampling)			
Dielectric strength		1,000VAC 50/60Hz for 1 min. (between power source terminal and input terminal)											
Vibration		0.75mm amplitude at frequency of 5 to 55Hz(for 1 min.) in each of X, Y, Z directions for 2 hours											
Relay life cycle	Mechanical	Min. 10,000,000 operations											
	Electrical	Min. 100,000 operations (250VAC 3A resistance load)											
Insulation resistance		100MΩ(at 500VDC megger)											
Noise resistance		±0.5kV the square wave noise (pulse width: 1us) by the noise simulator											
Environment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃											
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH											
Accessory		Expansion connector											
		Power / communication connector (※Basic module only)											
Insulation type		Double insulation or reinforced insulation (Mark: ⊡, Dielectric strength between the measuring input part and the power part: 1kV)											
Approval		CE cULus											
Unit weight		Approx. 144g	Approx. 152g	Approx. 135g	Approx. 143g	Approx. 139g	Approx. 148g	Approx. 130g	Approx. 139g	Approx. 174g	Approx. 166g	Approx. 160g	Approx. 152g

※1: In case of thermocouple K, T, N, J, E at -100℃ below and L, U, PlatinelII, it is ±2℃ ±1digit Max.
In case of thermocouple B, display accuracy cannot be ensured under 400℃.
In case of thermocouple R, S at 200℃ below and thermocouple C, G, it is 3℃ ±1digit Max.
※2: Applied when used out of range 23 ±5℃.
※Environment resistance is rated at no freezing or condensation.

Section 9.1.2 - Temperature Controller Wiring



(Back to Top)

Section 9.2 - Control circuit for X purge

Alarm Signal Installation:

NOTE: ***The CYCLOPS X – Purge Controller, SM Version provides dry alarm contact(s) for use by the customer. For hook-up and use the alarm contact(s) provided by the purge controller, consult the following Alarm Source Specifications, Alarm Connection table, and Wiring Diagram drawing numbers DO-50007-A, page 75 for 115VAC unit and DO-50008-A, page 76 for 230VAC unit.***

Alarm Source Specifications
Alarm Contact is rated for 265Volts AC/DC, 150mA max.
Use up to 20 AWG two conductor copper or tin-plated copper power wire rated for at least 300 V at the required length.

Alarm Connections	
ALARM TERMINAL	**TERMINAL NUMBER**
Loss of Purge Pressure: Open on Alarm (Standard). Closed on Alarm (Optional). Closed (Standard) Open (Optional) when pressure in enclosure being monitored is at or above 0.50 inch H2O (1.25 mbar) Standard, 0.30 inch H2O (0.75 mbar) Optional	Terminal Block – 2 Position –1
Return for position one	Terminal Block – 2 Position – 2
Loss of Exhaust Flow: Open on Alarm (Standard). Closed on Alarm (Optional). Closed (Standard) Open (Optional) when flow of exhaust for enclosure being monitored has fallen below a safe level.	Terminal Block – 2 Position – 3
Return for position three	Terminal Block – 2 Position – 4
Maintenance Alarm and By-Pass Mode: Open on Alarm (Standard). Closed on Alarm (Optional). Open (Standard) Closed (Optional) when maintenance switch or by-pass switch is operated.	Terminal Block – 2 Position – 5
Return for position five	Terminal Block – 2 Position – 6

(*Normal Operation Mode*) Alarm Matrix			
ALARM	**VISUAL INDICATION**	**REMOTE INDICATION**	**POWER DISCONNECTED**
Purge pressure goes below 0.50 inch H2O (1.25 mbar) Standard, 0.30 inch H2O (0.75 mbar) Optional	Steady State, Red LED	Yes, when installed	Yes
Exhaust vent flow drops below safe level	Steady State, Red LED	Yes, when installed	Yes
Maintenance Switch turned to Over-Ride	Blinking, Red LED	Yes, when installed	No
During Purge Dilution Cycle Time	Blinking, Green LED	No	Yes
Normal Operation	Steady State, Green LED	No	No

(*Power Disconnect By-Pass Switch Mode*) Alarm Matrix			
ALARM	**VISUAL INDICATION**	**REMOTE INDICATION**	**POWER DISCONNECTED**
Purge pressure goes below 0.50 inch H2O (1.25 mbar) Standard, 0.30 inch H2O (0.75 mbar) Optional	Steady State, Red LED	Yes, when installed	No
Exhaust vent flow drops below safe level	Steady State, Red LED	Yes, when installed	No
Maintenance Switch turned to Over-Ride	Blinking, Red LED	Yes, when installed	No
During Purge Dilution Cycle Time	Blinking, Green LED	No	Yes
Normal Operation	Steady State, Green and Blinking Red LED.	Yes, when installed	No

(Back to Top)