

# **5100HD Zone 1 – X-Purge Tunable Diode Laser Spectrometer**

## **User Manual**



9000-168-VE, Rev C



---

**Process Instruments**

150 Freeport Road  
Pittsburgh, PA 15238

## Offices

### SALES, SERVICE AND MANUFACTURING

---

**USA - Pennsylvania**

150 Freeport Road  
Pittsburgh PA 15238  
Tel: +1 412 828 9040  
Fax: +1 412 826 0399

**Canada - Alberta**

2876 Sunridge Way NE  
Calgary AB T1Y 7H9  
Tel: +1 403 235 8400  
Fax: +1 403 248 3550

**USA - Delaware**

455 Corporate Blvd.  
Newark DE 19702  
Tel: +1 302 456 4400  
Fax: +1 302 456 4444

### WORLDWIDE SALES AND SERVICE LOCATIONS

---

**USA**

Tel: +1 713 466 4900  
Fax: +1 713 849 1924

**Brazil**

Tel: +55 19 2107 4100

**France**

Tel: +33 1 30 68 89 20  
Fax: +33 1 30 68 89 99

**Germany**

Tel: +49 2159 9136 0  
Fax: +49 2159 9136 39

**India**

Tel: +91 80 6782 3200  
Fax: +91 80 6780 3232

**Singapore**

Tel: +65 6484 2388  
Fax: +65 6481 6588

**China**

Beijing  
Tel: +86 10 8526 2111  
Fax: +86 10 8526 2141  
Chengdu  
Tel: +86 28 8675 8111  
Fax: +86 28 8675 8141  
Shanghai  
Tel: +86 21 5868 5111  
Fax: +86 21 5866 0969

© 2013 AMETEK

This manual is a guide for the use of the 5100HD Zone 1 – X-Purge Version Analyzer. Data herein has been verified and validated and is believed adequate for the intended use of this instrument. If the instrument or procedures are used for purposes over and above the capabilities specified herein, confirmation of their validity and suitability should be obtained; otherwise, AMETEK does not guarantee results and assumes no obligation or liability. This publication is not a license to operate under, or a recommendation to infringe upon, any process patents.

# Table of Contents

|                                                            |            |
|------------------------------------------------------------|------------|
| Offices .....                                              | ii         |
| Safety Notes .....                                         | vi         |
| Electrical Safety .....                                    | vi         |
| Grounding .....                                            | vi         |
| Sample Gas .....                                           | vi         |
| Warning Labels .....                                       | vii        |
| Environmental Information (WEEE) .....                     | vii        |
| SPECIAL WARNINGS AND INFORMATION .....                     | viii       |
| Equipment Used in Zone 1 Hazardous Locations .....         | viii       |
| Electromagnetic Compatibility (EMC) .....                  | ix         |
| WARRANTY AND CLAIMS .....                                  | x          |
| <br><b>5100HD Gas Analyzer .....</b>                       | <b>1-1</b> |
| Tunable Diode Laser Spectroscopy Theory .....              | 1-2        |
| Components .....                                           | 1-3        |
| Electronics Enclosure .....                                | 1-3        |
| User Interface .....                                       | 1-4        |
| Customer Connection Box .....                              | 1-4        |
| Sampling System .....                                      | 1-5        |
| Sample Cell .....                                          | 1-5        |
| Detector .....                                             | 1-6        |
| GRIN Lens .....                                            | 1-6        |
| Sample Gas Flow .....                                      | 1-6        |
| Laser Configuration .....                                  | 1-6        |
| Measurement .....                                          | 1-6        |
| Laser Line Locking and Built-in Verification .....         | 1-7        |
| Laser Line Locking .....                                   | 1-7        |
| Built-in verification .....                                | 1-7        |
| Measurement .....                                          | 1-7        |
| Options .....                                              | 1-9        |
| Herriott Sample Cell Option .....                          | 1-9        |
| High Temperature Sample Cell Option .....                  | 1-10       |
| Space-Coupled Option .....                                 | 1-10       |
| <br><b>Specifications .....</b>                            | <b>2-1</b> |
| <br><b>Installation and Start-Up .....</b>                 | <b>3-1</b> |
| Analyzer Requirements .....                                | 3-2        |
| Location .....                                             | 3-2        |
| Mounting Requirements .....                                | 3-2        |
| Dimensions .....                                           | 3-3        |
| Wiring .....                                               | 3-4        |
| General Wiring and Conduit Requirements .....              | 3-4        |
| <i>EMC Grounding, Shielding and Noise Protection</i> ..... | 3-4        |

|                                                                            |            |
|----------------------------------------------------------------------------|------------|
| Analyzer Installation.....                                                 | 3-7        |
| User-Supplied Items.....                                                   | 3-7        |
| Sample Pressure Requirements.....                                          | 3-7        |
| Gas Connections.....                                                       | 3-8        |
| I/O, Communication, and Alarm Relay Connections.....                       | 3-10       |
| I/O Signals.....                                                           | 3-11       |
| Current Loop Output Connection.....                                        | 3-12       |
| Analog Input – Voltage/Current .....                                       | 3-13       |
| RS-485 Communication Connection.....                                       | 3-14       |
| Relay Alarms.....                                                          | 3-15       |
| Ethernet Cable Connections .....                                           | 3-16       |
| User Interface.....                                                        | 3-17       |
| Overview of Keypad.....                                                    | 3-17       |
| Navigation Keys .....                                                      | 3-17       |
| Overview of Display.....                                                   | 3-18       |
| Initial Start-Up .....                                                     | 3-19       |
| <b>User Interface.....</b>                                                 | <b>4-1</b> |
| 5100HD Analyzer Menu Map .....                                             | 4-2        |
| Alarm Menu .....                                                           | 4-5        |
| Analog Range Menu .....                                                    | 4-7        |
| Test Config Menu .....                                                     | 4-8        |
| Modbus .....                                                               | 4-8        |
| Clock.....                                                                 | 4-9        |
| Press Display Units.....                                                   | 4-10       |
| Temp Display Units .....                                                   | 4-10       |
| System Test.....                                                           | 4-11       |
| Network .....                                                              | 4-12       |
| Background Gas.....                                                        | 4-13       |
| Units.....                                                                 | 4-13       |
| ZERO and SPAN Check Menu and Functions.....                                | 4-14       |
| Modbus Registers.....                                                      | 4-20       |
| Alarm Messages.....                                                        | 4-25       |
| <b>Maintenance.....</b>                                                    | <b>5-1</b> |
| Cleaning.....                                                              | 5-2        |
| Replacing the MCU Battery.....                                             | 5-2        |
| Changing Out Replaceable Parts.....                                        | 5-4        |
| Cleaning and Replacing Parts in the Standard Cell.....                     | 5-5        |
| Cleaning and Replacing Parts in the Particulate Filter (if Equipped) ..... | 5-13       |
| Spare Parts for the 5100HD Analyzer.....                                   | 5-16       |
| Sample System Leak Check.....                                              | 5-17       |

|                                                                            |            |
|----------------------------------------------------------------------------|------------|
| <b>X-Purge.....</b>                                                        | <b>A-1</b> |
| Purge Startup Procedure.....                                               | A-1        |
| X-Purge Startup.....                                                       | A-1        |
| Electronic Power Control Unit (EPCU) Response.....                         | A-2        |
| X-Purge Operating Instructions.....                                        | A-4        |
| Set-up procedures for the 6000 series system .....                         | A-4        |
| <i>Operation of the 6000 series system (gas hazardous location):</i> ..... | A-5        |
| Bypass Instructions .....                                                  | A-6        |
| Hardware Details .....                                                     | A-7        |
| Type X-Purge .....                                                         | A-7        |
| 6000 Series control unit.....                                              | A-8        |
| 6000 Control unit .....                                                    | A-8        |
| EPV6000 Relief Vent .....                                                  | A-9        |

## Safety Notes

WARNINGS, CAUTIONS, and NOTES contained in this manual emphasize critical instructions as follows:



---

*An operating procedure which, if not strictly observed, may result in personal injury or environmental contamination.*

---



---

*An operating procedure which, if not strictly observed, may result in damage to the equipment.*

---



---

*Important information that should not be overlooked.*

---

## Electrical Safety

Hazardous voltages are present in the analyzer housings when power is applied to the system. Always shut down power source(s) before performing maintenance or troubleshooting. Only a qualified electrician should make electrical connections and ground checks.

Any use of the equipment in a manner not specified by the manufacturer may impair the safety protection originally provided by the equipment.

## Grounding

Instrument grounding is mandatory. Performance specifications and safety protection are void if instrument is operated from an improperly grounded power source.



---

*Verify ground continuity of all equipment before applying power.*

---

## Sample Gas



---

*Potential hazards of the sample gas should be taken into consideration before connecting the sample to the analyzer. Personal protective equipment and proper ventilation should be used if sample gas is toxic, flammable, or corrosive. Check the sample line and all connections for leaks before powering up. Consult plant safety personnel for appropriate exhaust venting guidelines for specific sample gas type.*

---

## Warning Labels

These symbols may appear on the instrument in order to alert you of existing conditions.



Protective Conductor Terminal  
(BORNIER DE L'ECRAN DE PROTECTION)  
Schutzerde



Caution – Risk of electric shock  
(ATTENTION – RISQUE DE DÉCHARGE ÉLECTRIQUE)  
Achtung – Hochspannung Lebensgefahr



Caution – (Refer to accompanying documents)  
(ATTENTION – SE RÉFÉRER AUX DOCUMENTS JOINTS)  
Achtung (Beachten Sie beiliegende Dokumente)



CAUTION – Hot Surface  
(ATTENTION – SURFACE CHAUDE)  
Achtung – Heiße Oberfläche

## Environmental Information (WEEE)

This AMETEK product contains materials that can be reclaimed and recycled. In some cases the product may contain materials known to be hazardous to the environment or human health. In order to prevent the release of harmful substances into the environment and to conserve our natural resources, AMETEK recommends that you arrange to recycle this product when it reached its “end of life”.

Waste Electrical and Electronic Equipment (WEEE) should never be disposed of in a municipal waste system (residential trash). The Wheelie Bin marking on this product is a reminder to dispose of the product properly after it has completed its useful life and been removed from service. Metals, plastics, and other components are recyclable and you can do your part by doing one of the following steps:



- When the equipment is ready to be disposed of, take it to your local or regional waste collection administration for recycling.
- If you need further assistance in recycling your AMETEK product, contact our office listed in the front of the instruction manual.

## SPECIAL WARNINGS AND INFORMATION

### Equipment Used in Zone 1 Hazardous Locations

*Refer to Chapter 2 – Specifications for details about the suitability of this equipment in hazardous areas.*



---

*Explosion Hazard – Substitution of components may impair suitability for hazardous locations.*

---

---

*Risque d'explosion – La substitution de composants peut rendre ce matériel inacceptable pour les emplacements sont designés dangereux.*

---



---

*Explosion Hazard – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.*

---

---

*Risque d'explosion – Avant de déconnecter l'équipement, coupez le courant où vous assurez que l'emplacement est designé non dangereux.*

---

All input and output wiring must be in accordance with Zone 1 wiring methods and in accordance with the authority having jurisdiction.

## Electromagnetic Compatibility (EMC)



---

*Read and follow the recommendations in this section to avoid performance variations or damage to the internal circuits of this equipment when installed in harsh electrical environments.*

---

The various configurations of the 5100/5100HD Analyzer should not produce, or fall victim to, electromagnetic disturbances as specified in the European Union's EMC Directive. Strict compliance to the EMC Directive requires that certain installation techniques and wiring practices are used to prevent or minimize erratic behavior of the Analyzer or its electronic neighbors. Below are examples of the techniques and wiring practices to be followed.

In meeting the EMC requirements, the various Analyzer configurations described in this manual rely heavily on the use of metallic shielded cables used to connect to the customer's equipment and power. Foil and braid shielded I/O and DC power cables are recommended for use in otherwise unprotected situations. In addition, hard conduit, flexible conduit, and armor around non-shielded wiring also provides excellent control of radio frequency disturbances. However, use of these shielding techniques is effective only when the shielding element is connected to the equipment chassis/earth ground at both ends of the cable run. This may cause ground loop problems in some cases. These should be treated on a case-by-case basis. Disconnecting one shield ground may not provide sufficient protection depending on the electronic environment. Connecting one shield ground via a 0.1 microfarad ceramic capacitor is a technique allowing high frequency shield bonding while avoiding the AC-ground metal connection. In the case of shielded cables the drain wire or braid connection must be kept short. A two-inch connection distance between the shield's end and the nearest grounded chassis point, ground bar or terminal is highly recommended. An even greater degree of shield performance can be achieved by using metallic glands for shielded cable entry into metal enclosures. Expose enough of the braid/foil/drain where it passes through the gland so that the shield materials can be wrapped backwards onto the cable jacket and captured inside the gland, and tightened up against the metal interior.

Inductive loads connected to the low voltage "Alarm Contacts" are not recommended. However, if this becomes a necessity, adhere to proper techniques and wiring practices. Install an appropriate transient voltage suppression device (low voltage MOV, "Transzorb," or R/C) as close as possible to the inductive device to reduce the generation of transients. Do not run this type of signal wiring along with other I/O or DC in the same shielded cable. Inductive load wiring must be separated from other circuits in conduit by using an additional cable shield on the offending cable.

In general, for optimum protection against high frequency transients and other disturbances, do not allow installation of this Analyzer where its unshielded I/O and DC circuits are physically mixed with AC mains or any other circuit that could induce transients into the Analyzer or the overall system. Examples of electrical events and devices known for the generation of harmful electromagnetic disturbances include motors, capacitor bank switching, storm related transients, RF welding equipment, static, and walkie-talkies.

## WARRANTY AND CLAIMS

We warrant that any equipment of our own manufacture or manufactured for us pursuant to our specifications which shall not be, at the time of shipment thereof by or for us, free from defects in material or workmanship under normal use and service will be repaired or replaced (at our option) by us free of charge, provided that written notice of such defect is received by us within twelve (12) months from date of shipment of portable analyzers or within eighteen (18) months from date of shipment or twelve (12) months from date of installation of permanent equipment, whichever period is shorter. All equipment requiring repair or replacement under the warranty shall be returned to us at our factory, or at such other location as we may designate, transportation prepaid. Such returned equipment shall be examined by us and if it is found to be defective as a result of defective materials or workmanship, it shall be repaired or replaced as aforesaid. Our obligation does not include the cost of furnishing any labor in connection with the installation of such repaired or replaced equipment or parts thereof, nor does it include the responsibility or cost of transportation. In addition, instead of repairing or replacing the equipment returned to us as aforesaid, we may, at our option, take back the defective equipment, and refund in full settlement the purchase price thereof paid by Buyer.

Process photometric analyzers, process moisture analyzers, and sampling systems are warranted to perform the intended measurement, only in the event that the customer has supplied, and AMETEK has accepted, valid sample stream composition data, process conditions, and electrical area classification prior to order acknowledgment. The photometric light sources are warranted for ninety (90) days from date of shipment. Resale items warranty is limited to the transferable portion of the original equipment manufacturer's warranty to AMETEK. If you are returning equipment from outside the United States, a statement should appear on the documentation accompanying the equipment being returned declaring that the goods being returned for repair are American goods, the name of the firm who purchased the goods, and the shipment date.

The warranty shall not apply to any equipment (or part thereof) which has been tampered with or altered after leaving our control or which has been replaced by anyone except us, or which has been subject to misuse, neglect, abuse or improper use. Misuse or abuse of the equipment, or any part thereof, shall be construed to include, but shall not be limited to, damage by negligence, accident, fire or force of the elements. Improper use or misapplications shall be construed to include improper or inadequate protection against shock, vibration, high or low temperature, overpressure, excess voltage and the like, or operating the equipment with or in a corrosive, explosive or combustible medium, unless the equipment is specifically designed for such service, or exposure to any other service or environment of greater severity than that for which the equipment was designed.

The warranty does not apply to used or secondhand equipment nor extend to anyone other than the original purchaser from us.

THIS WARRANTY IS GIVEN AND ACCEPTED IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION AND WARRANTIES OF FITNESS OR OF MERCHANTABILITY OTHER THAN AS EXPRESSLY SET FORTH HEREIN, AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON OUR PART. IN NO EVENT SHALL WE BE LIABLE UNDER THIS WARRANTY OR ANY OTHER PROVISION OF THIS AGREEMENT FOR ANY ANTICIPATED OR LOST PROFITS, INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, TIME CHANGES OR ANY OTHER LOSSES INCURRED BY THE ORIGINAL PURCHASER OR ANY THIRD PARTY IN CONNECTION WITH THE PURCHASE, INSTALLATION, REPAIR OR OPERATION OF EQUIPMENT, OR ANY PART THEREOF COVERED BY THIS WARRANTY OR OTHERWISE. WE MAKE NO WARRANTY, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF FITNESS OR OF MERCHANTABILITY, AS TO ANY OTHER MANUFACTURER'S EQUIPMENT, WHETHER SOLD SEPARATELY OR IN CONJUNCTION WITH EQUIPMENT OF OUR MANUFACTURE. WE DO NOT AUTHORIZE ANY REPRESENTATIVE OR OTHER PERSON TO ASSUME FOR US ANY LIABILITY IN CONNECTION WITH EQUIPMENT, OR ANY PART THEREOF, COVERED BY THIS WARRANTY.

# 5100HD GAS ANALYZER



## 5100HD Zone 1 – X-Purge

The AMETEK 5100HD TDLAS gas analyzer is an extractive system. It is a single laser analyzer. It is comprised of fully enclosed optics, electronics, sample handling and built-in verification. The unit is designed for outdoor installation and is certified for worldwide hazardous area locations. See specifications page for details.

## Tunable Diode Laser Spectroscopy Theory

Tunable Diode Laser Absorption Spectroscopy (TDLAS) is a spectroscopic technique that uses a diode laser as the light source. The technology is extremely selective. The laser line is very narrow in frequency so it can probe the analyte gas without interference from other gases. It works according to the fundamental principles of Beer's Law. The Law indicates that for a constant path length, the intensity of the incident light energy traversing an absorbing medium diminishes exponentially with concentration.

$$\ln [I^0/I] = S \cdot L \cdot N$$

Where:

- I is the measurement of beam intensity when tuned to the absorbing wavelength the analyte
- $I^0$  is the reference measurement or beam intensity when tuned away from the analyte absorbing wavelength
- S is the fundamental absorption line strength and is a fixed constant
- L is the path length of the beam through the sample and is a fixed constant
- N is the number of analyte molecules contained in the beam path passing through the sample

So, by measuring the intensity of the laser both before and after absorption by the analyte, the number of analyte molecules in the sample can be determined since all of the other terms in the equation are constant.

## Components

The 5100HD consists of three distinct modular components:

- Electronics Enclosure/User Interface
- Customer Connection Box
- Sampling System

### Electronics Enclosure

The electronics enclosure houses the electronics, display, and moisture reference cell and is made of stainless steel and built to withstand harsh environments (IP65). Included in the electronic enclosure are:

- Customer Connection Board
- Interface Board
- MCU Board
- Power Supply
- AC Line Filter
- Solid State Relay for Sample Cell Heater
- Sample Cell Pressure Sensor
- Reference Cell
- Ethernet/LAN Connector
- Laser and associated optics

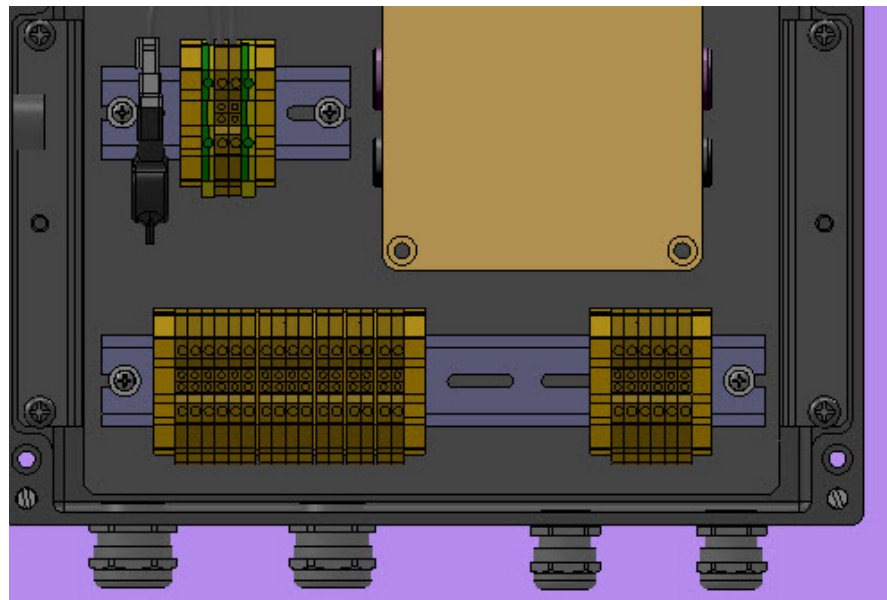
## User Interface



The user interface is a Vacuum Fluorescent Display (VFD) with 4 lines x 20 characters and alphanumeric keypad. It is part of the electronics enclosure.

## Customer Connection Box

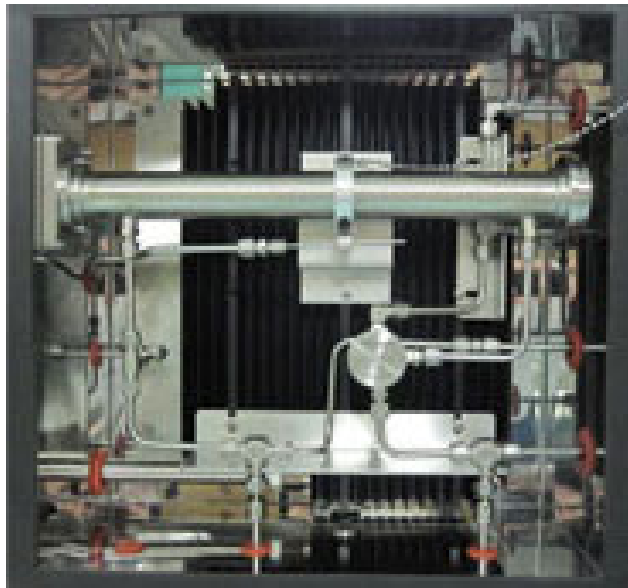
The customer connection box is a separate enclosure that houses the terminal strip which provides customer I/O, communication and relay alarm connectivity, the RJ45 Ethernet connector, and the power mains supply.



## Sampling System

The sampling system is housed in a stainless steel enclosure located on the right side. The sample system includes:

- Sample Cell
- Liquid Separator
- Cell Temperature Sensor
- Heater

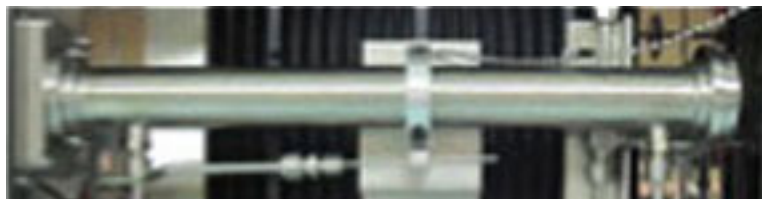


The sample inlet port, liquid filter drain and the exhaust port are located on the side for the model 5100HD.

## Sample Cell

The sample cell consists of :

- Sample tube
- Gold front-surfaced mirror
- InGaAs Detector
- GRIN lens



## Detector

Two light-sensitive detectors are typically used, one for the sample cell and one for the reference. The detectors output a voltage proportional to the intensity of the light striking the active area. The type of detectors used varies depending on the wavelength, which in turn depends on the analyte(s).

## GRIN Lens

GRIN is short for graded index or gradient index. One of the most important advantages of GRIN lenses compared to classical lenses is that the optical surfaces of GRIN lenses are flat. This is very important for creating a good quality joint between the lens and the fiber optics. The GRIN lens in the TDLAS focuses the laser/fiber optics package to detect the best signal.

## Sample Gas Flow

The sample flows from the inlet thru a Genie filter where any liquid condensate is removed. The liquid removed flows down the drain vent connection on the side of the 5100HD. The gas sample then flows thru the sample cell. Cell pressure and temperature are monitored using pressure and temperature sensors respectively. The cell is heated to a maximum of 150C.

## Laser Configuration

The laser output is coupled to a single mode fiber, which in turn is connected to a fiber optic splitter. The splitter is used to divide the optical power for use in the sample and reference measurements, respectively. The 'sample' output is coupled to the cell assembly by means of a fiber/Gradient Refractive INDEX (GRIN) lens combination. 'Reference' output is also similarly coupled to the reference cell. The GRIN lens helps collimate the output of the single mode fiber and direct the beam through the sample and reference cells. The beam is reflected by a mirror at the other end of the cell and is received by a light-sensitive detector at the originating end.

## Measurement

The detector converts the light energy received to an electrical signal and sends it for signal processing and the analyte concentration determination. WMS and signal processing are digital providing enhanced quality of analyzer response.

# Laser Line Locking and Built-in Verification

## Laser Line Locking

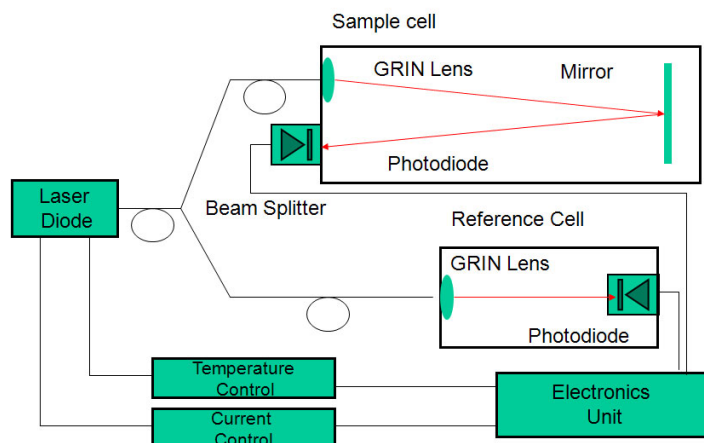
The reference cell is used to lock the output wavelength of the laser diode. The sealed reference cell contains a known concentration of the analyte in a host gas, which has no absorbance in the spectral range of interest. A block diagram of the wavelength-locking algorithm employed by the instrument is shown in the figure below. Two nested levels of temperature control are employed to maintain the operation of the DFB laser at the proper wavelength. The first level is a simple PID control loop, which maintains the laser at a target temperature. In the second level, the outer control loop, the spectra of the analyte samples in the reference cells are monitored. Minor shifts in the observed peak positions are used as a feedback signal for the temperature set point of the inner control loop. Thus, the outer control loop provides a fine adjustment for the inner control loop.

## Built-in verification

External calibration is time consuming, especially for polar species like water with long equilibration times. The 5100HD uses a sealed reference cell (containing moisture vapor in a buffer gas that does not absorb in the spectral range of interest) for quick analyzer verification. The analyzer response is compared to the value of the analyte concentration in the reference cell and the analyzer performance is verified continuously.

## Measurement

Fiber optics conduct the laser beam through the GRIN lens to the sample cell. When the beam reaches the mirror at the end of the cell, it is reflected so that it continues upward back through the cell until it enters the detector. The detector converts the information from the beam into an electrical signal that is transmitted to the microprocessor. The software then processes the signal and determines the analyte concentration.



## Controller Communications

All analyzer functions are controlled by microprocessors housed within the electronics enclosure. These include:

- (1) Isolated 4-20 mA analog output per laser diode (i.e. one output for single laser analyzer and (2) outputs for dual laser analyzer)
- (1) Relay Contact
- Moisture Reference Cell
- Piezo-Resistive Transducer Input
- Serial Port: RS-485
- 100 Mbs Ethernet
- MQX RTOS and Modbus capability

The 5100HD is configured, and the analyzer parameters are set, using the analyzer display and keypad. The 4-line x 20-character VFD provides moisture data, system operating parameters, system messages, and alarm conditions. The 20-button keypad on the front of the unit is used to set or change operating parameters and system values. There is a serial interface inside the main electronics enclosure, which is intended for service use only.

## Options

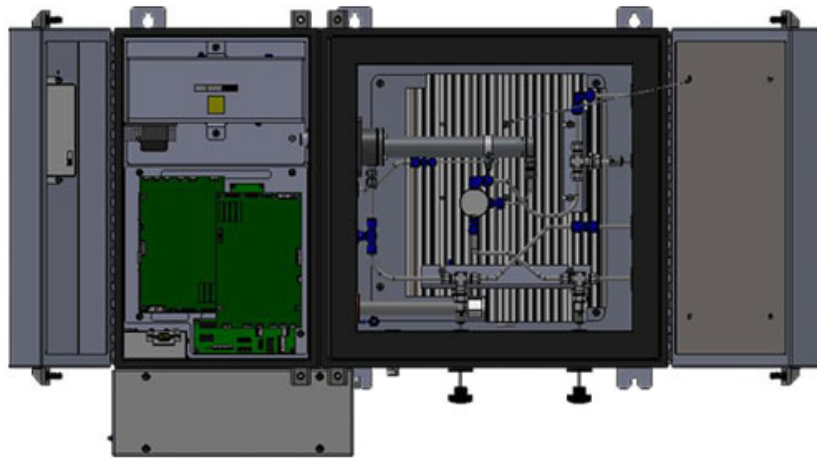
Several options are available

- Dual cell capability
- High temperature oven
- Multiple analytes
- High temperature sample cell
- Herriott (long path length) sample cell
- Space-coupled optics

### Herriott Sample Cell Option

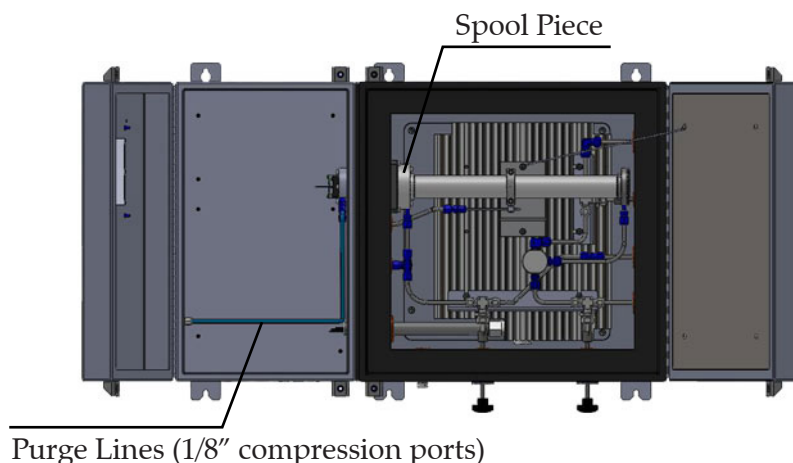
This option is recommended for applications that require enhanced performance at low analyte concentrations. For example, a moisture application requiring a range of 0-50 or 0-100 ppm, and a Limit Of Detection (LOD) lower than the standard 5 ppmV, would benefit from this option.

The Herriott sample cell is constructed with two mirrors, compared to the standard cell with one. The two mirrors are facing each other at both ends of the sample cell. The laser light is reflected back and forth between the mirrors many times, increasing the path length of the light through the sample gas. This increase in path length creates a proportional increase in sensitivity to the analyte. The rest of the analyzer remains the same as for a standard sample cell.



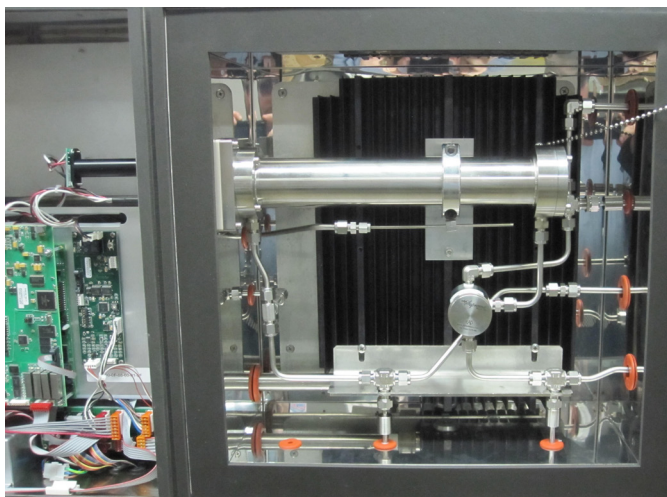
## High Temperature Sample Cell Option

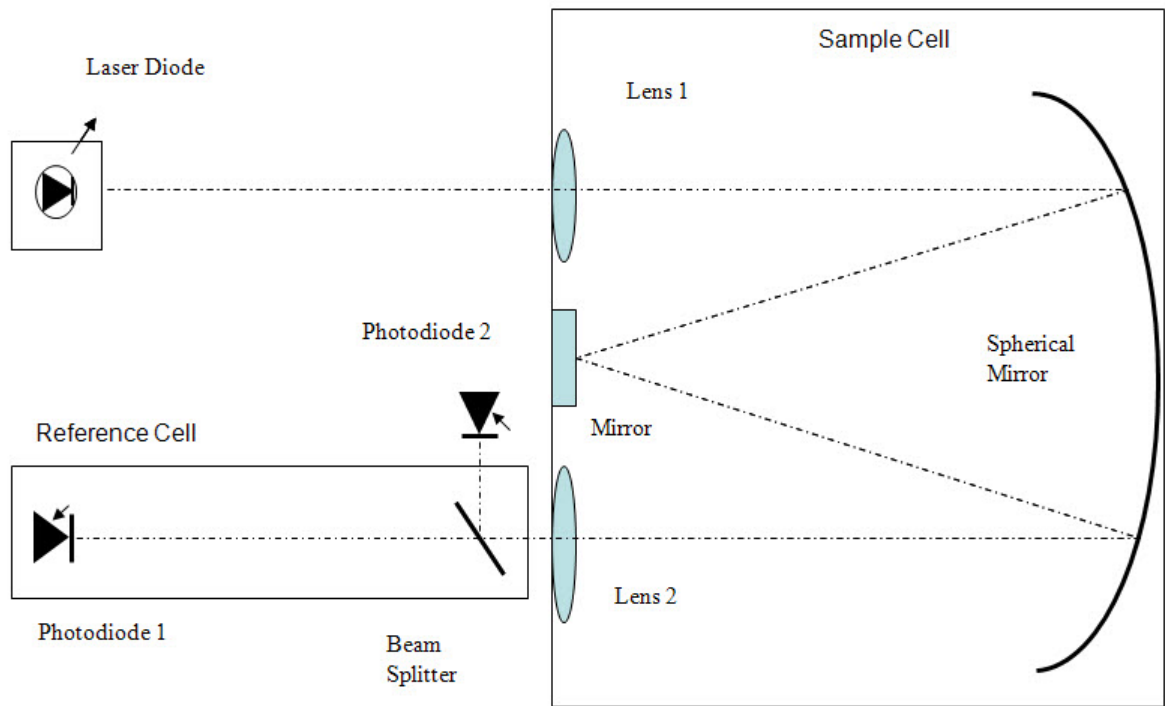
The 5100HD oven enclosure is capable of maintaining temperatures up to 150C. Some applications demand a high oven temperature to prevent condensation or plugging. For these situations, a special high temperature cell was designed. The main purpose of this sample cell is to thermally isolate the sensitive components (GRIN lens, detector) from these temperatures. This is accomplished through the use of a window and spool piece at the top of the sample cell. For some applications the spool piece may be purged with dry air or inert gas (e.g. to remove background moisture). The rest of the analyzer remains the same as for a standard sample cell.



## Space-Coupled Option

This option is used for certain application (e.g. O<sub>2</sub> measurement) where fiber optics are not the best approach. Instead of fibers, conventional optical components are used to direct the laser light through the sample cell. The reference cell is in series optically with the sample cell, creating a combined path. The reference cell absorption is then subtracted from the total to get the sample concentration. The sample system and electronics for this option are the same as for the standard analyzer.





**Space-Coupled Option Schematic**

This page intentionally left blank.

# SPECIFICATIONS



*All specifications subject to change without notice.*

| Parameter                      | Specification                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Number of analytes</b>      | 1 to 4, depending on configuration                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Number of sample points</b> | Typically 1 or 2, depending on configuration                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Speed of response</b>       | < 2 seconds (photometric);<br>< 50 seconds to T90 including sample system purge (At flow rate of 2 liters/minute)                                                                                                                                                                                                                                                                                                 |
| <b>Outputs</b>                 | 4 line x 20 character alphanumeric VF display<br>Fast Ethernet (IEEE802.3).<br>Modbus over TCP/IP RS485 serial port, isolated (supports Modicon Modbus RTU) (supports Modicon MODBUS RTU).<br>One Isolated 4–20 mA analog output per laser diode (i.e. one output for single laser analyzer and two outputs for dual laser analyzer).<br>One dry relay contact (contact rating 30 VAC, 60 VDC, 100 VA resistive). |
| <b>Electrical requirements</b> | 120 VAC (108-132V);<br>47–63 Hz or 240 VAC (216–264V);<br>47–63 Hz or 24 VDC (22–26 VDC)                                                                                                                                                                                                                                                                                                                          |
| <b>Power requirement</b>       | For AC powered configurations:<br>Single laser: 425 Watts<br>Dual laser: 445 Watts max.<br>For 24 VDC:<br>Single laser: 25 Watts<br>Dual laser: 45 Watts                                                                                                                                                                                                                                                          |

| Parameter                          | Specification                                                            |
|------------------------------------|--------------------------------------------------------------------------|
| <b>Pressurization Data (Purge)</b> | Minimum Purging Flow Rate 140 l/min                                      |
|                                    | Minimum Purge Time 5 Minutes                                             |
|                                    | Protective Gas Air                                                       |
|                                    | Minimum Supply Pressure 1.4 bar                                          |
|                                    | Maximum Supply Pressure 8.3 bar                                          |
|                                    | Maximum Leakage Rate 20 l/min                                            |
|                                    | Minimum Overpressure 62.5 Pa                                             |
|                                    | Maximum Overpressure 1 000 Pa                                            |
| <b>Sample pressure</b>             | 70-170 kPa absolute (10 to 25 psia), typical                             |
| <b>Sample Temperature</b>          | -20C to +150C (-4 F to +302 F)<br>Gas-phase samples only                 |
| <b>Ambient temperature</b>         | -20° C to +50° C (-4° F to +122° F)                                      |
| <b>Storage temperature</b>         | -25 C to +80 C (-13 F to +176 F)                                         |
| <b>Ambient humidity</b>            | 0-90%, non-condensing                                                    |
| <b>Physical</b>                    | 1088 mm x 866 mm x 323 mm<br>(42.9" x 31.4" x 12.7")<br>73 kgs (160 lbs) |
| <b>Enclosure material</b>          | 300 series stainless steel                                               |
| <b>Maximum altitude</b>            | 2000 meters                                                              |
| <b>Pollution Degree</b>            | 2                                                                        |
| <b>Ingress protection (IP)</b>     | IP65 and NEMA Type 4X                                                    |
| <b>Sample flow rate</b>            | 1–10 lpm (2–20 SCFH)                                                     |
| <b>Sample wetted materials</b>     | Stainless steel, SiO2 glass, Gold, Teflon, EPDM rubber                   |

| Parameter                         | Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Electrical Classifications</b> | <p>This analyzer will be certified with regard to electrical safety for Pollution Degree 2 (normally non-conductive environmental pollution occurs with occasional condensation) and Installation Category II (local level transients, less than those found at power distribution levels). Mains supply voltage fluctuations are not to exceed 10 percent of the nominal supply voltage.</p> <p>Other approvals will include acceptance for use in:<br/> ATEX Zone 1 classified hazardous areas:<br/> Ex II 2 G Ex d e [op pr T4 Gb] px [ia] IIC T3<br/> Gb -20°C &lt; Ta &lt; +50°C</p> |
| <b>Regulatory Compliance</b>      | <p>ATEX Directive: 2014/34/EU<br/> EMC Directive: 2014/30/EU<br/> Low Voltage Directive: 2014/35/EU<br/> RoHS Directive: 2011/65/EU<br/> ATEX Certificate No.: Presafe 15 ATEX 7410X</p>                                                                                                                                                                                                                                                                                                                                                                                                  |

This page intentionally left blank.

# INSTALLATION AND START-UP



---

*Read this entire chapter before the installation of the 5100HD Analyzer. Failure to do so may impair protection against fire, electric shock and injury originally provided by this equipment. Do not use this analyzer in a manner not specified in this manual.*

---



---

*Please see the specifications table on the previous page for hazardous area information.*

---



---

*The operations in this chapter should be performed only by qualified service personnel experienced in electrical safety techniques. Never service the analyzer unless power has been removed.*

---

This chapter contains information on the installation and setup of the 5100HD Analyzer including:

- Analyzer Requirements:
  - Location
  - Mounting
  - Wiring
  - Sample Pressure Requirements
- Installation Connections:
  - User-Supplied Items
  - Gas Connections
  - Signal Connections
  - Communication Connections
  - Alarm Relay Connections
  - User Interface
  - Initial Startup

## Analyzer Requirements

### Location

The 5100HD Analyzer is wall-mounted; ensure that there is adequate clearance when mounting and select a readily accessible position for the analyzer to allow for routine maintenance. The location should be free from excessive vibration and the ambient temperature should be -20 °C to 50 °C (-4 °F to 122 °F) without external heating or cooling. Shade must be provided for the analyzer.

**Do not mount in direct sunlight. Shade from luminaires.**

- Allow a minimum of 8 inches (20.3 cm) on both sides and the bottom of the unit for space for system output cables and the AC mains supply conduit.
- Allow a minimum of 4 inches (10.2 cm) on the top of the unit to allow access to mounting hardware should the unit need to be removed from the wall.
- Provide adequate clearance at the bottom and sides of the unit for routing of gas supply line, vent lines and purge air supply.
- The access door(s) to the enclosures swing out when open. Be sure to allow space for door swing.

### Mounting Requirements



NOTE

---

*Avoid mounting the analyzer in extremely dirty environments or where it will be subject to large amounts of electromagnetic interference.*

---

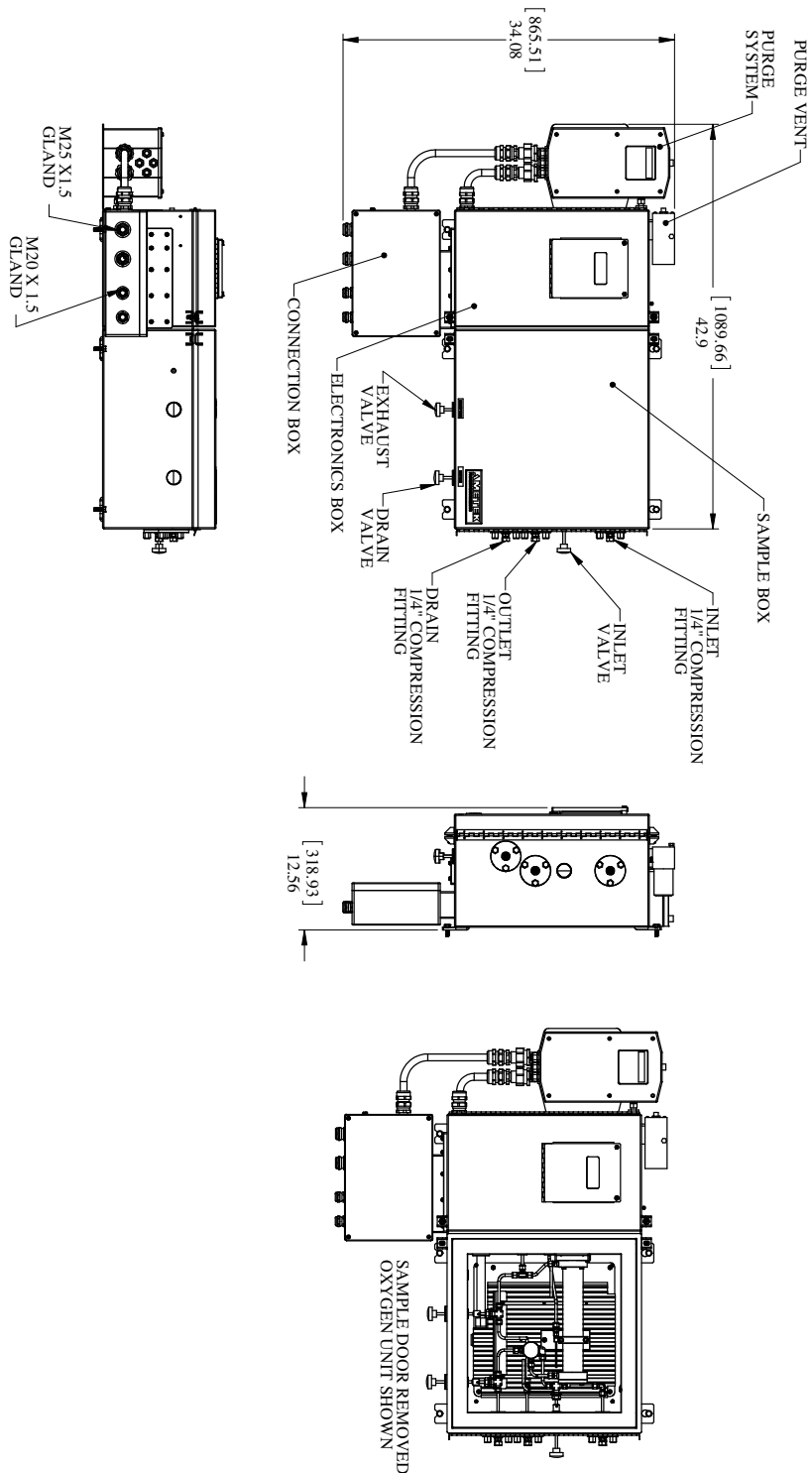
*Mounting Hardware: (6) 5/16" x L (M8 x 25 mm L) hex bolts*

## Dimensions

### 5100HD (Doors Closed):

26.5" High x 32.7" Wide x 11.9" Deep

57.3 cm High x 83.1 cm Wide x 30.2 cm deep



### General Wiring and Conduit Requirements

- All wiring conductor ratings should be for the minimum temperature required for the analyzer but not less than 50° C (122° F).
- Follow all applicable electrical codes for your location.
- Use only applicable NEMA-approved conduit fittings or cable fittings to maintain NEMA rating. If not using a conduit entry, leave the factory NEMA-approved plugs intact. Never leave any holes unplugged.
- Follow proper grounding, shielding, and noise protection practices.
- Use twisted-pair cable with an overall braided shield, or twisted-pair cable in rigid metal conduit for all communication wiring.
- For AC mains supply wiring, use between 12 and 14 American Wire Gauge (AWG) or equivalent metric between 3.3 mm<sup>2</sup> and 2.1 mm<sup>2</sup>.
- Do not add any additional conduit entry holes.
- The terminal blocks in the customer connection box are sized for 0.2–4.0 mm<sup>2</sup> (AWG 24–12) wire, 1 conductor per block, torque between 0.6 nm and 0.8 nm (85.1 to 113.5 in-oz).

### EMC Grounding, Shielding and Noise Protection



---

*For EMC purposes, do not leave cable shields disconnected at either or both ends of the cable under any circumstance.*

---



---

*Use twisted-pair cable in rigid metal conduit or twisted-pair cable with an overall braided shield. All cable shields or conduits connecting to the analyzer must be chassis-grounded.*

---

#### EMC grounding method

##### *Shield Ring Method*

Connect all shields for the conduit entry (other than power) to a supplied shield terminal ring. Place the shield ring under the conduit nut. Crimp the shields from all cables for the conduit entry to a female quick disconnect and then push it onto the tab that sticks out of the conduit shield ring. Keep shields as short as possible.

##### *Ground Stud Method*

Connect all cable shields for the conduit entry hole to the grounding stud closest to the conduit entry hole.

## Transient and RFI interference

Transient and noise protectors on I/O connections (communications, current outputs, etc.) are intended to act as a last line of defense against unwanted transient and RFI interference.

- Follow proper installation practices. Inductive loads connected to the analyzer must have transient suppressors installed at the inductive loads.
- For optimum noise protection, connect the analyzer mains supply wiring to a circuit separate from any that could introduce transients into the system.

## Connecting the 5100HD to Mains Power

There is no power switch or circuit breaker in 5100HD analyzer configured for AC power. The analyzer must be protected by installing it on a circuit-protected line, maximum 15 Amps, with a switch or circuit breaker close to the unit and within easy reach of an operator. Use the 1/2" conduit entry port in the customer connection box for the AC mains supply wiring. For the 24 VDC version, 4 amp fuse is provided.



NOTE

---

*Mark the switch or circuit breaker as the disconnecting device.*

---



NOTE

---

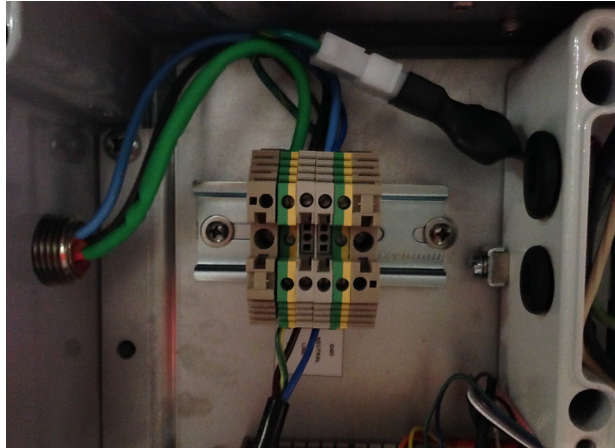
*The 5100HD analyzer supports 120 or 240 VAC, 50/60 Hz or 24 VDC.*

---

Connections to the 5100HD are made at the power entry terminal block. It is located in the customer connection box.

- Remove the cover of the customer connection box by removing the screws holding it in place and lifting the cover upward and away from the box.
- Locate the power entry terminal block to make connections to the AC power line.

- Thread the AC mains supply wiring through the conduit entry port on the customer connection box and connect as shown below.



*Mains supply connections to the terminal block are as follows:*

|                |   |                                 |
|----------------|---|---------------------------------|
| <i>Line</i>    | = | <i>Line connection</i>          |
| <i>Neutral</i> | = | <i>Neutral connection (USA)</i> |
| <i>Ground</i>  | = | <i>Ground connections</i>       |

The 5100HD must be ordered for either 120 VAC or 240 VAC since the oven heater is voltage-specific.

## Analyzer Installation



*Consult plant safety personnel for appropriate exhaust venting guidelines for specific sample gas type.*

### User-Supplied Items

#### *Interconnect Wiring*

The user must supply all wiring for serial communication, analog output (max cable resistance <900 Ohms), and alarm relays. Recommended wire is 22 gauge, twisted/shielded pair.

The terminal blocks in the customer connection box are sized for 02–4.0 mm<sup>2</sup> (AWG 24–12) wire, 1 conductor per block, torque between 0.6 nm and 0.8 nm (85.1 to 113.5 in-oz).

#### *External Sample Tubing*

Standard recommended sample gas input tubing is 1/4" stainless steel tubing (6mm for the OC6E metric connection fittings version), stainless steel. Sample input tubing length should be as short as possible.

#### *Secondary Process Seals*

Secondary process seals must be used on all conduit entry points at the customer connection box to prevent gas/liquids from venting to nonclassified locations.

### Sample Pressure Requirements

AMETEK recommends pressure settings between -4.5 and 10 PSIG.

|                         |           |             |             |
|-------------------------|-----------|-------------|-------------|
| Minimum input pressure: | -4.5 PSIG | (-31.3 kPa) | (10.2 PSIA) |
| Maximum pressure:       | 10 PSIG   | (68.7 kPa)  | (24.7 PSIA) |

A sample cell pressure sensor located in the electronics box is used to monitor inlet pressure (shown below).





NOTE

---

*Inlet pressure must be kept at less than 69 kPa (10 PSIG). If a regulator is necessary on the sample line to maintain required sample inlet pressure, it should be of a type suitable for use with the sample gas, and for the area classification. Heated regulators are recommended for large pressure drops with certain gasses.*

---



NOTE

---

*Check inlet pressure and flow rate on a weekly basis to ensure correct pressure.*

---

## Gas Connections

Locate the analyzer as close as possible to the sample source and install a main process shut-off valve at the sample tap. All connections to the 5100HD are made using 1/4" tubing (6mm for metric option) compression fittings. These fittings are located on the right side of the system enclosure. They include: sample inlet, liquid separator drain, and sample exhaust.



CAUTION

---

*When connecting the sample line, minimize the amount of time that the analyzer gas fittings are left open. Otherwise significant amounts of moisture may be introduced into the sample cell from the ambient air.*

---

1. Remove the fitting caps from the sample inlet fitting and exhaust fitting. Keep the fitting caps in case you have to ship the analyzer or if it has to be disconnected for an extended period of time.
2. Connect the sample input tube to the analyzer sample inlet valve.
3. Connect the exhaust tube to the analyzer exhaust. The exhaust must be vented to an appropriate vent system.



CAUTION

---

*All sample outlets should exhaust to atmospheric pressure, either outside or into a vent, not into the workplace. It is the customer's responsibility to ensure potentially hazardous samples are removed safely and to supply all necessary tubing to connect the exhaust to a suitable location. To prevent condensation in the exhaust draining back to the analyzer ensure a continuous downward gradient on the line, or fit a suitable trap to the line.*

---

4. The separator inside the sample section removes entrained liquids and particulates from the gas before it passes through the sample cell. For this reason, the bypass or drain valve is left OPEN to allow the residue to exit the analyzer. Ensure that the valve is turned slightly to the OPEN position.



NOTE

---

*If the bypass or drain valve is closed, water build-up can damage the separator.*

---



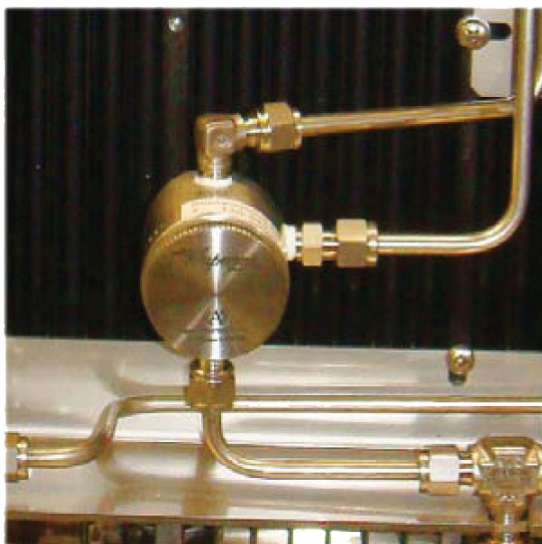
NOTE

---

*Check the filter on the liquid separator for contamination every two weeks and replace if necessary. Once you determine a pattern as to how long the filter can be used, you can adjust the time interval between replacements. Check and, if necessary, replace after any known process event.*

---

5. Check all sample input and exhaust fittings for leaks.



**5100HD Separator**

The following suggestions will help to minimize issues with the sampling system:

1. A pre-filter is recommended to prevent liquids and particulates from entering the analyzer. The 5100HD includes a membrane filter, but this should be considered the last resort protection for the sample cell. An upstream membrane filter should be installed if there is a chance of liquids and/or particulates being present in the sample gas.
2. Any condensate that drains from the membrane filters may contain hazardous and/or corrosive substances. Handle with caution and dispose of properly.
3. AMETEK offers sample system components such as heater pressure reducers, probes, and sample lines, which, together with a heated analyzer oven, minimize condensation issues that can cause down time. Consult the factory for information on these options. In general, the specifics of each sample stream must be considered when planning the installation to determine if any of these devices are needed.

## I/O, Communication, and Alarm Relay Connections

All end-user input/output signal, communication, and alarm relay contact connections are made through the customer connection box.



---

*Disconnect the power from the analyzer before wiring to the customer connection box. Open the cover on the customer connection box by removing the screws that hold the cover in place. Lift upward and pull away from the box.*

---

I/O Signals

|         |
|---------|
| GROUND  |
| NEUTRAL |
| LINE    |
| GROUND  |

|  |
|--|
|  |
|  |
|  |
|  |
|  |

SPARE

|         |
|---------|
| RLY NO  |
| RLY COM |
| LOOP -  |
| LOOP +  |
| ZW +    |
| ZW -    |
| TX +    |
| TX -    |
| RX +    |
| RX -    |

|  |
|--|
|  |
|  |
|  |
|  |
|  |

SPARE

## Current Loop Output Connection

There is one method that can be used to connect the output current loop to the I/O ports.

- **Connection using External Power Supply**  
Using the external power supply (VDC Output +), connect the LOOP+ terminal to the negative (-) side of the load. Connect the positive (+) side of the load to the positive (+) side of the power supply. Connect the negative (-) side of the power supply to the LOOP – terminal. See the following figure:

For a 5100HD with two analytes, the above connections are made for loop #2 (second analyte) by using the terminals marked LOOP2 +, LOOP2 -, VDC Output2 +, and VDC Output2 -. The connections are made in the same manner as for Loop #1.

## Analog Input – Voltage/Current

- **Current Input**

On the analog board find Header J2, place jumpers between Pins 3 and 5, and between Pins 4 and 6. See the following figure. Connect the positive (+) input to the Current Input + terminal, and the negative (-) input to the Current Input – terminal.

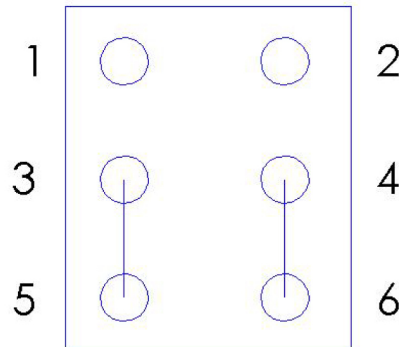


NOTE

---

*Current input range is 4-20 mA. Input resistance between Pins 4 and 5 is 100 Ohms.*

---



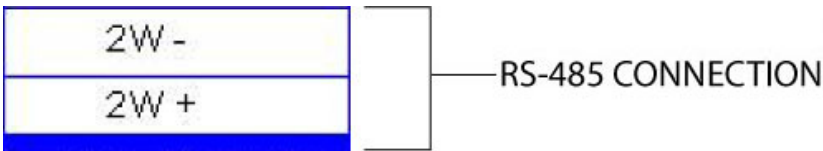
# RS-485 Communication Connection

The RS-485 communication port is used specifically with Modbus-RTU that is used to communicate with DSC or a Modbus master computer.

## 2-Wire Connection:

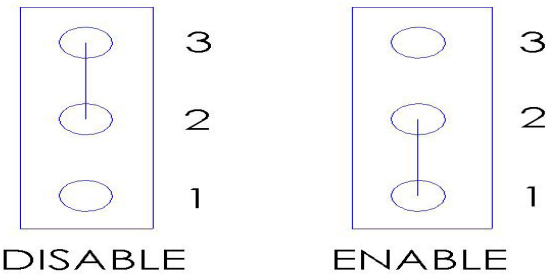
*The RS-485 uses a 2-wire connection:*

2W-  
W+



## 2-Wire Termination Resistor:

The 5100HD is equipped with a termination resistor that can be used for the last unit on the network. Jumper J7 on the MCU board allows you to place a 120-Ohm termination resistor into the RS-485 circuit. See the following figure.



## Relay Alarms

There is (1) relay alarm available for the 5100HD. The relay is configured in the software. The settings available for the alarms are: Disable, Concentration, Data Valid, System Alarm, and Normally Open/Normally Closed (NO/NC).

1. Disconnect the power from the analyzer and remove the cover on the customer connection box by removing the screws that hold the cover in place.
2. Thread the cable or conduit through the entry port on the side of the customer connection box near the relay connection terminals and connect the wiring to the relay terminals. See the following figure:



---

*Ratings for the Relay Alarms are as follows: Contact rating is 100 VA max, 1.0 A switching, 2.5 A max carry, 60 VDC/30 VAC max switching.*

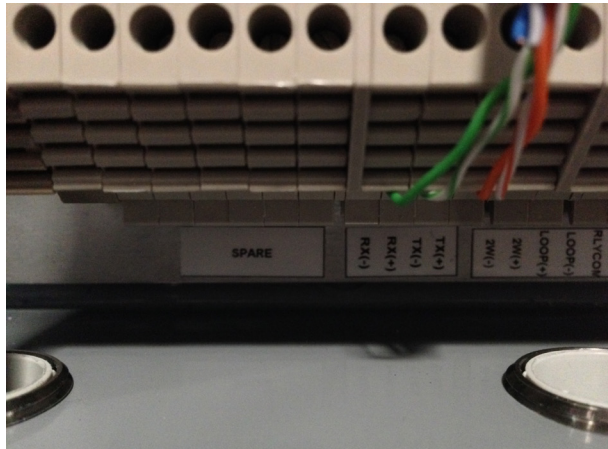
---

## Ethernet Cable Connections

When using the Ethernet interface on the 5100HD, the minimum requirement for the Ethernet cable is a CAT 5e (maximum 100 m) cable to connect the analyzer to the network. The maximum distance between the analyzer and the hub is 100 m. For outdoor analyzer installations, hazardous locations, and/or lengths greater than 100 m, special requirements may be necessary. Contact your network administrator for more information.

To install the Ethernet cable, follow the steps below:

1. Disconnect the power from the analyzer and remove the cover on the customer connection box.
2. Route the Ethernet cable through the cable entry port and into the box.
3. Standard Ethernet cable connections are as follows:



4. Route the cable to the network connection in the plant and connect it.

## User Interface

### Overview of Keypad



The Model 5100HD keypad is used to access menus, sub-menus and system values, and to set-up analyzer parameters.

Press **ENTER** to access the menus.

#### CALIB

Used to define on-demand calibration settings.

#### ALARM

Used to define alarm output settings.

#### ANALOG RANGE

Used to scale the 4–20 mA output in proportion to the moisture concentration.

#### TEST CONFIG

Used to define device and communication settings.

### Navigation Keys

#### BKSP

Used to reverse navigate.

#### ENTER

Used to select or to confirm an entry.

#### SPACE

Used to enter “-” (minus) for negative numbers.

#### Arrow Keys

Scroll up, down, left, and right through menu items and system value lists.

#### Number Keys (0 through 9)

Enter values. Use the period (.) to enter numbers that require a decimal point.

To select an item, use the arrow keys to scroll through the menu items until the small arrowheads point to your choice as shown below. When you come to the end of the selections under that menu item, the display will go back to the top of the list.



Once you access the menu you want, use the arrow keys to scroll through the menu until the desired item is between the arrowheads. Press **ENTER** to select the menu item. Depending on the selected menu item, either more menus will be displayed or you can enter data at that point. Follow the instructions on the display.

Except where otherwise noted:

- Press **ENTER**      Select a menu item and to confirm an entry.
- Press **BKSP**      To exit without saving or entering data.

(Any changes made will not be saved.)

To go back through previous levels, one level at a time, until the display returns to the normal operation screen, when browsing the menu list.

## Overview of Display

The default display has four lines:

|        | Single Analyte                                                     | Dual Analyte                                   |
|--------|--------------------------------------------------------------------|------------------------------------------------|
| Line 1 | Sample concentration                                               | Sample concentration for analyte 1 (or status) |
| Line 2 | Status message                                                     | Sample concentration for analyte 2 (or status) |
| Line 3 | Alarm message (if an alarm exists). Blank if no alarm              |                                                |
| Line 4 | Sample cell pressure and temperature (or alarm if an alarm exists) |                                                |

There is also a series of blips after the “status” message (Sampling . . .) that repeat to indicate the analyzer is functioning.

## Initial Start-Up

1. Open the main sample shutoff valve at the source.
2. AMETEK recommends you adjust the sample inlet pressure to between -4.5 PSIG and 10 PSIG.



---

*Maximum inlet pressure is 10 PSIG. Damage can occur if higher pressures are introduced into the analyzer.*

---

3. Turn on the power at the source. Boot-up information will appear on the analyzer display followed by the operation screen. Lines 3 and 4 of the display will flash various messages and alarm conditions at start-up.
4. When the sample flow starts, the analyzer will adjust to normal operating mode.
5. Adjust the inlet valve so that approximately 2000 ml/min of natural gas is flowing through the analyzer.
6. Set the flow rate of the flowmeter to about 1200 ml/min for air to correspond to the natural gas flow rate of about 2000 ml/min.
7. Use the software to set up your analyzer parameters (See Chapter 4 of this manual).

This page intentionally left blank.

# USER INTERFACE

The user interface consists of the display screen on the front of the 5100HD Analyzer and the keypad. Use the arrow keys, BKSP, ENTER, SPACE, numbers, and period to set the parameters for your analyzer.

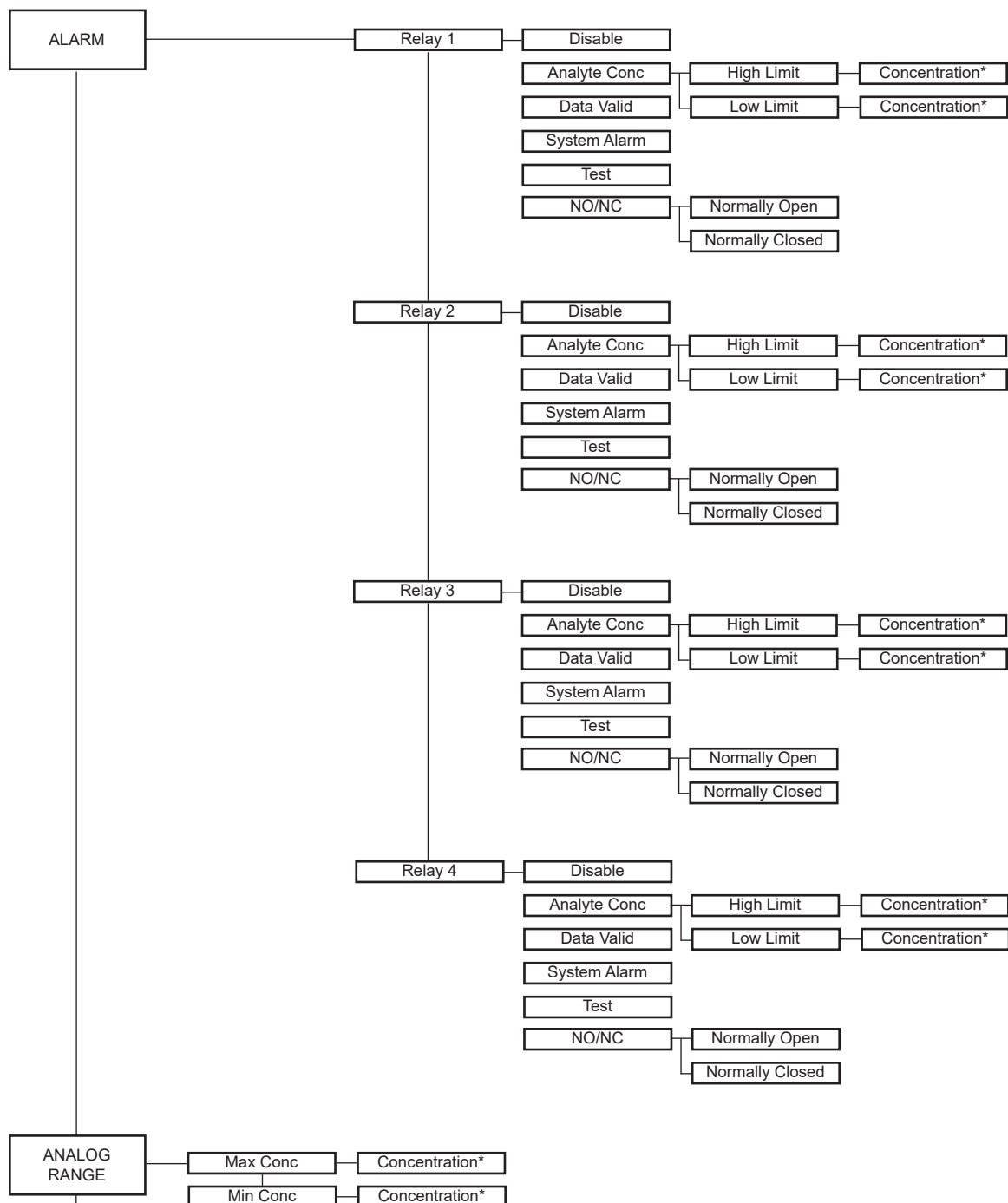


**Figure 4-1a.**  
Keypad and display for the 5100HD Analyzer.



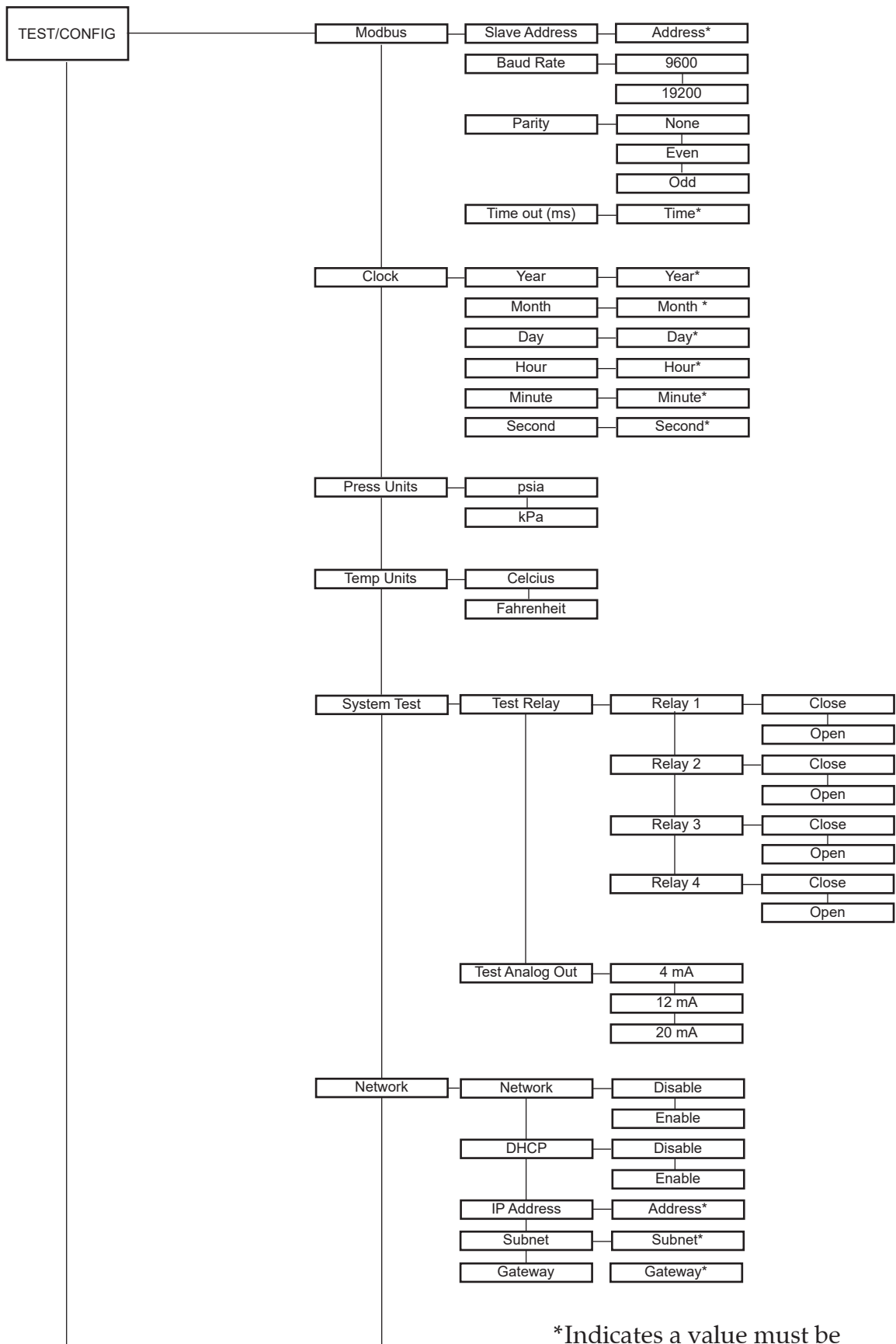
**Figure 4-1b.**  
Display for alarm condition.

## 5100HD Analyzer Menu Map

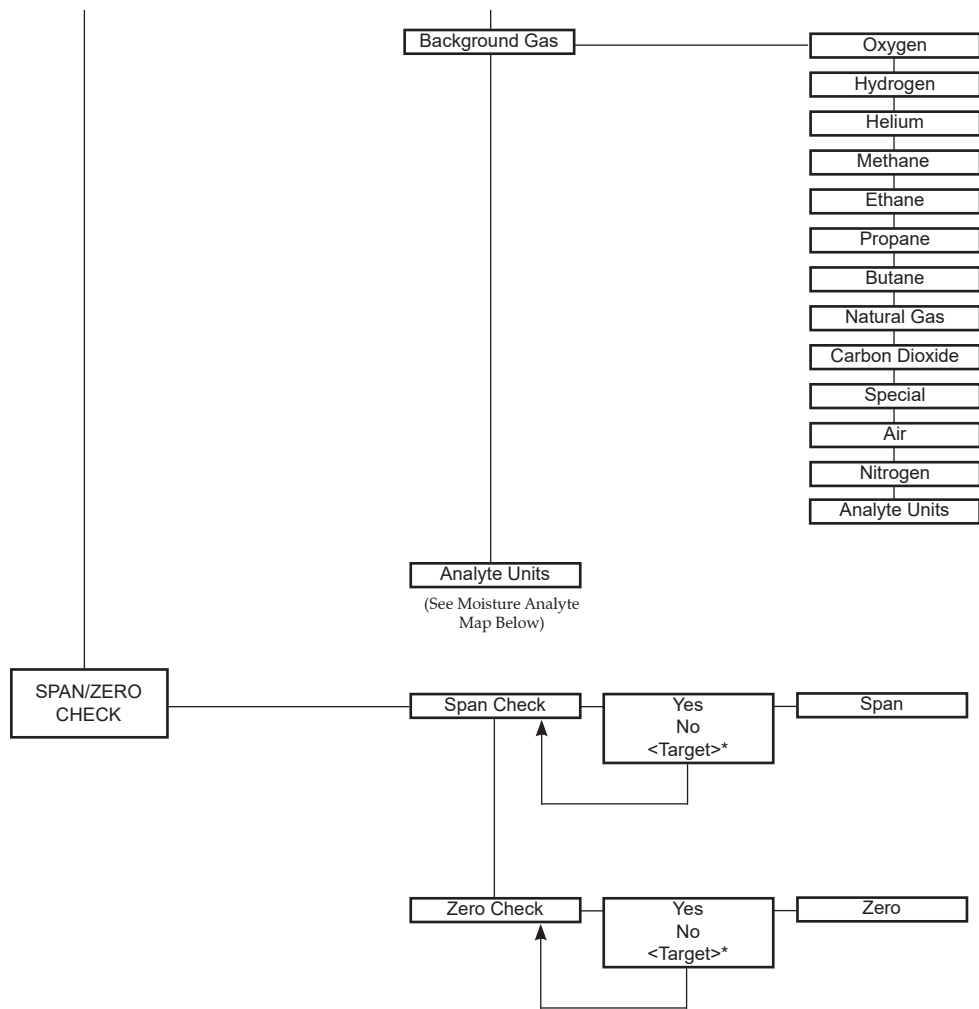


\*Indicates a value must be entered.

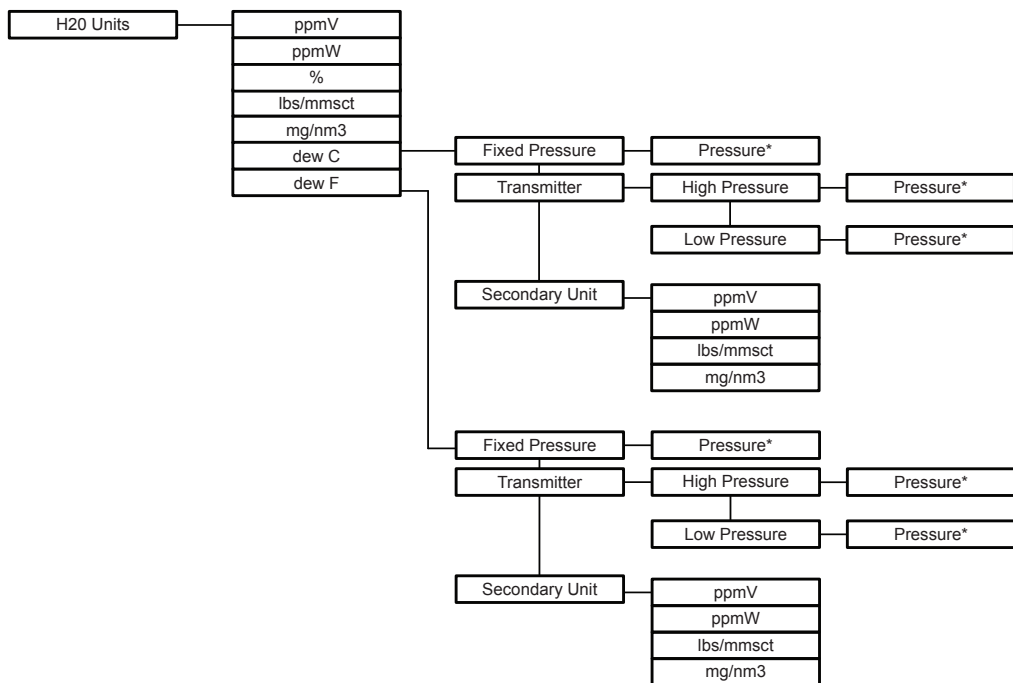
**Figure 4-2.**  
Menu map for the  
5100HD Analyzer.



\*Indicates a value must be entered.

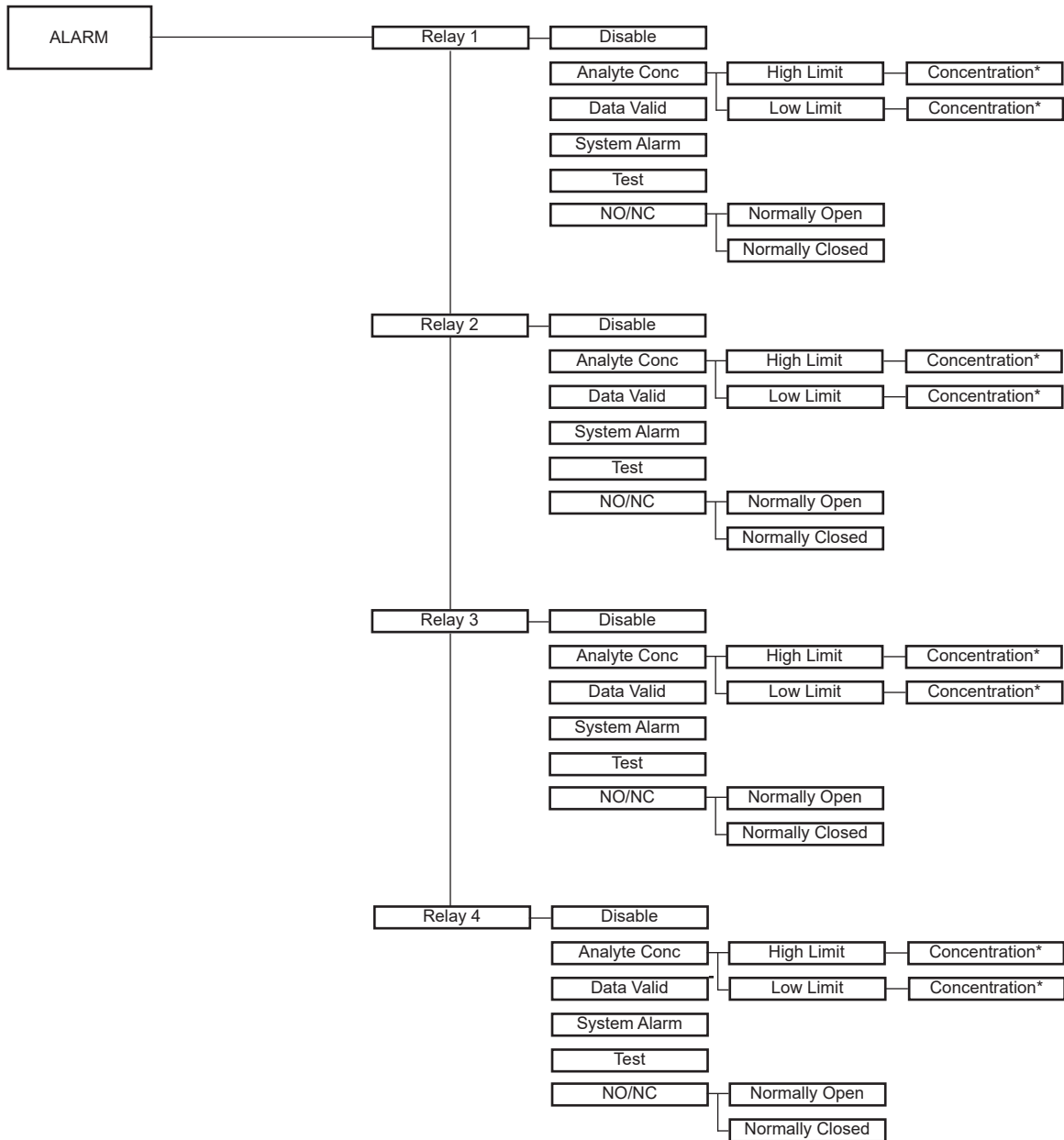


### Moisture Analyte Map



## Alarm Menu

*The Alarm Key defines alarm settings for each of the 4 relays available.*



### Disable

Select this alarm function to disable the alarm for the associated relay.

### **Concentration**

Select this alarm function to set the limits for the concentration.

- *High Limit*  
*Select and then enter the value for the **High Limit** for the Concentration alarm.*
- *Low Limit*  
*Select and then enter the value for the **Low Limit** for the Concentration alarm.*

### **Data Valid**

Select this alarm function to set the alarm to recognize corrupt data.

### **System Alarm**

Select this function to trigger an alarm when the system malfunctions.

### **Test**

Select this function to test the relay alarm settings.

### **NO/NC**

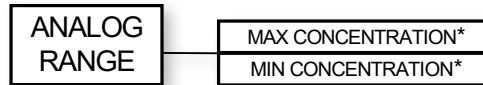
Select this function to define the default relay position.

*NC = Normally Closed*

*NO = Normally Open*

## Analog Range Menu

The **Analog Range** key defines your 4–20 mA output setting. Use this setting to scale the 4–20 mA output. The 4–20 mA output is proportional to the readings.



**Main menu for Analog Range key.**

### Max Concentration

Enter the reading equivalent to 20 mA.

### Min Concentration

Enter the reading equivalent to 4 mA.

### Example:

To scale the analog output to represent a 0 to 100 PPMV range enter the following settings:

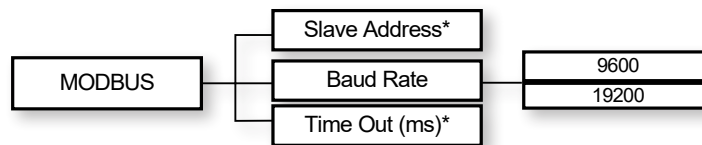
|                   |     |
|-------------------|-----|
| Max Concentration | 100 |
| Min Concentration | 0   |

## Test Config Menu

The **Test Config** key is used to define device and communication settings. See below for information on each section.

### Modbus

Selects the communication setup. The Modbus protocol transmission mode implemented is Remote Terminal Unit (RTU) with the analyzer operating as a slave device.



**Menu for Modbus key.**

#### Slave Address

Enter the **Slave Address**.

#### Baud Rate

Select the baud rate at which you transfer data (9600 or 19200). The default is 9600.

#### Time Out (ms)

Enter the time out in milliseconds.

Modbus interface parameters must be set up to establish communication. Use the Modbus registers to obtain specific input/output data.



NOTE

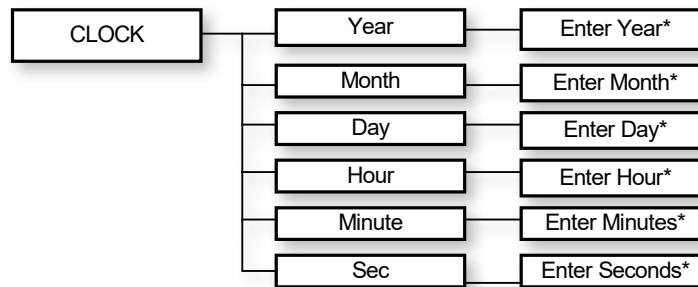
---

*Modbus Registers can be found at the end of this chapter.*

---

## Clock

Use the **Clock** function to set the clock on your analyzer.



**Menu for the Clock key.**

### Year

Select **Year** and enter the 4-digit value for the year.

### Month

Select **Month** and enter the numerical value for the month.

### Day

Select **Day** and enter the numerical value for the day.

### Hour

Select **Hour** and enter the numerical value for the hour using the 24-hour clock.

### Minute

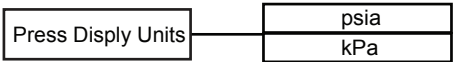
Select **Minute** and enter the numerical value using the 24-hour clock.

### Sec

Select **Sec** and enter the numerical value for the seconds.

## Press Display Units

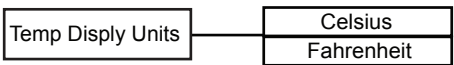
Use the **Press Disply Units** function to select the unit of pressure for the cell to display on the user interface LED when sampling. Select either psia or kPa.



**Menu for the Pressure Display Unit key.**

## Temp Display Units

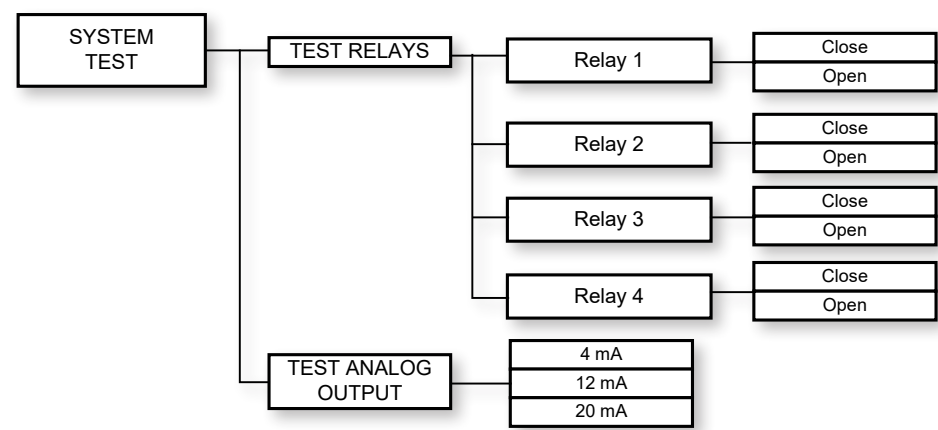
Use the **Temp Disply Units** function to select the unit of temperature for the cell to display on the user interface LED when sampling. Select either Celsius (°C) or Fahrenheit (°F).



**Menu for the Temperature Display Unit key.**

# System Test

Use the **System Test** Key to perform tests on various components of the analyzer.



## Menu for the System Test key.

### Test Relays

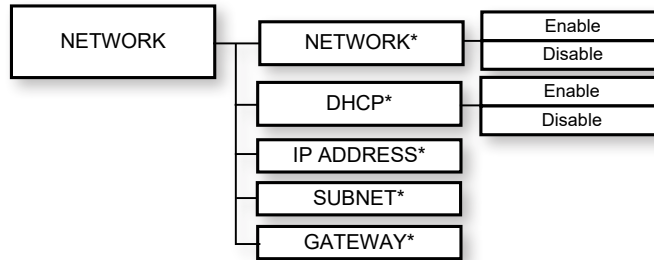
Tests the relay contacts by toggling them **Close / Open**.

### Test Analog Output

Tests the analog output by allowing the user to set outputs to 4, 12 or 20 mA.

## Network

The **Network** Key enables the 5100HD Analyzer to communicate over an Ethernet network to view data, diagnostics, or backing up/restoring the analyzer configuration.



**Menu for the Network key.**

### Network

Enables or disables the Ethernet network. Select Enable or Disable.

### DHCP

Dynamic Host Configuration Protocol (DHCP). Choose Enable to open the communication protocol or Close to disable it.

### IP Address

Defines the network of the analyzer and is a required parameter. Enter the IP address for your network.

### Subnet

Defines the subnet to which the analyzer belongs. Analyzers in the same subnet can communicate locally without going through a router (Gateway). Enter your network subnet.

### Gateway

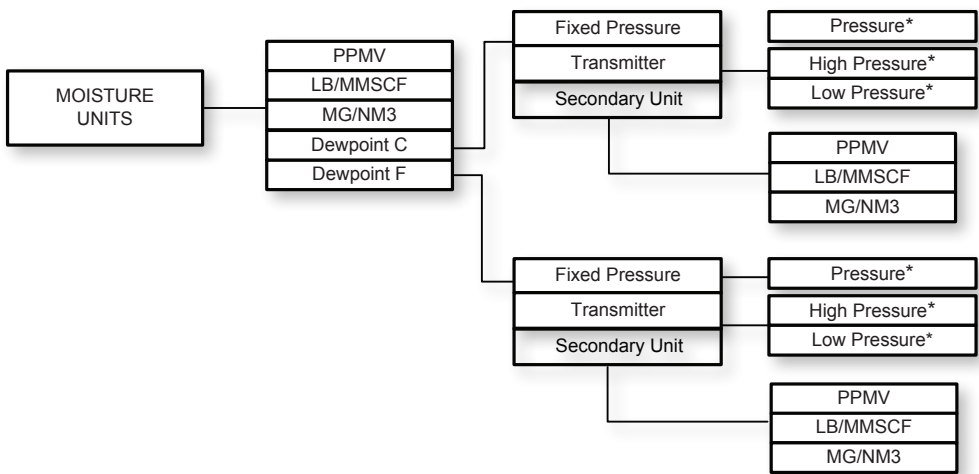
This function defines the Gateway IP address for the network to allow local network traffic to be sent to another network. Enter the Gateway address.

## Background Gas

This selection allows for the proper background gas to be set. It is critical that the background is chosen to represent the actual process gas as closely as possible. The background gas is typically chosen at the factory during calibration to ensure the best accuracy, based on the customer application data. However, it may be changed using this utility. Changing the background gas results in the application of a multiplication factor to the factory calibration curve

## Units

Use the **Unit** function to select the unit of measurement for the analyzer. (The map below is shown as an example using moisture.)



### Menu for the Unit key.

Select the unit for the readings from the list. Press **Enter**.

If you choose either **Dew Point C** (dewC) or **Dew Point F** (dewF), you must also select one of the following:

|                |                                                                      |
|----------------|----------------------------------------------------------------------|
| Fixed Pressure | Enter the value in units of kPa                                      |
| Transmitter    | Enter <b>High Pressure</b> and a <b>Low Pressure</b> in units of kPa |
| Secondary Unit | Choose moisture unit: ppmV, lb/mmscf, or mg/nm <sup>3</sup>          |



NOTE

*If you change the units, remember to make any necessary changes to the Alarm and Analog Range settings.*

## ZERO and SPAN Check Menu and Functions

The analyzer may be zeroed and/or spanned as necessary. This is accomplished by using the keypad.



*When zeroing it is important that the gas applied is known to represent a zero level (of the analyte), in the correct background. For span gas, the concentration of the analyte must be accurately known; and must also be in the correct background. For both cases the gas must be applied long enough to allow the instrument reading to stabilize before performing the zero or span.*

To begin, the analyzer should be in normal operating mode, and sampling. Press the ENTER key, and the main menu selections will appear on the display:



Scroll down to the “Span/Zero Check” menu selection using the down-arrow key:



Press ENTER to activate this selection.

The following screen will be displayed:



To perform a Span Check, scroll to that selection and press ENTER. The following screen will be displayed (for H2O in this example):



If you do not want to perform the span, press the NO key. To proceed with the span, press the YES key.

To change the target value to match the applied analyte concentration, press the enter key. The screen below will appear, prompting you for the new value.



The following screen is displayed:



The passcode is "123". It is not necessary to press ENTER after typing the passcode. The software will perform the span automatically once "123" is keyed. If the password is incorrect, the software will display the message "Incorrect Passcode".

After spanning, the analyzer will return to the "Span/Zero Check" screen.

To perform the Zero Check, the steps are the same, beginning with selecting "Zero Check".

The following screen appears:



Press "YES" to proceed as for the span.

## Modbus Registers

| Data Type | Description                                                                                                                                                       | MB Starting Regs | MB Reg Size |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------|
|           |                                                                                                                                                                   |                  |             |
| uint      | IP Address                                                                                                                                                        | 13               | 2           |
| uint      | IB Subnet Mask                                                                                                                                                    | 15               | 2           |
| uint      | Gateway                                                                                                                                                           | 17               | 2           |
| uint16    | DHCP Enable: 1=disabled, 2=enabled                                                                                                                                | 21               | 1           |
| uint16    | TCP Enable: 0=disabled, 1=enabled                                                                                                                                 | 22               | 1           |
| char[20]  | Software Version                                                                                                                                                  | 26               | 10          |
| char[20]  | Model Name                                                                                                                                                        | 36               | 10          |
| uint      | Internal UART1 Baud Rate (Modbus)                                                                                                                                 | 46               | 2           |
| uint      | Internal UART2 Baud Rate (Display)                                                                                                                                | 48               | 2           |
| uint      | External UART1 Baud Rate (RS232)                                                                                                                                  | 50               | 2           |
| uint      | External UART2 Baud Rate                                                                                                                                          | 52               | 2           |
| int16     | Parity: 0=none, 1=even, 2=odd                                                                                                                                     | 56               | 1           |
| int16     | Stop Bits: 1=1 stop bit, 2=2 stop bits                                                                                                                            | 57               | 1           |
| uint16    | Modbus Address                                                                                                                                                    | 58               | 1           |
| uint16    | Modbus Port: 0=disable, 1=enable                                                                                                                                  | 59               | 1           |
| uint      | Modbus Timeout (ms)                                                                                                                                               | 60               | 2           |
| char[20]  | System Time                                                                                                                                                       | 62               | 10          |
| char[20]  | System Date                                                                                                                                                       | 72               | 10          |
| int16     | Parameter used to request a state machine change:<br>1=not ready, 2=measure, 3=zero, 4=span,<br>5=zero hold, 6=span hold, 7=idle                                  | 82               | 1           |
| char[20]  | Concentration Unit of Measure for Analyte 1                                                                                                                       | 83               | 10          |
| int16     | Float Format Index:<br>0=comma as decimal, 1=period as decimal                                                                                                    | 93               | 1           |
| uint16    | 0=MM\DD\YYYY, 1=MM-DD-YYYY                                                                                                                                        | 94               | 1           |
| char[10]  | Pressure Unit of Measure (case sensitive)<br>Valid strings include: psi, psia, in H2O, inHg,<br>bar, cmH2O, kg/cm2, kPa, mbar, micron,<br>mmHg, oz/in2, torr, atm | 95               | 5           |
| char[10]  | Temp Unit of Measure (case sensitive)<br>Valid strings include: degreeC, degreeF,<br>degreeK                                                                      | 100              | 5           |
| uint      | Data Valid: 0=not valid, 1=valid                                                                                                                                  | 105              | 2           |
| int16     | 0=line-lock mode, 1=sample, 2=calib                                                                                                                               | 107              | 1           |
| int16     | Pressure and Temp Compensation:<br>0=none, 1=pressure, 2=temperature, 3=both                                                                                      | 108              | 1           |
| uint      | Bit-Mapped System Alarms                                                                                                                                          | 109              | 2           |
| uint      | Bit-Mapped System Alarms                                                                                                                                          | 111              | 2           |
| uint      | Bit-Mapped System Alarms                                                                                                                                          | 113              | 2           |
| uint      | Bit-Mapped Concentration Alarms                                                                                                                                   | 115              | 2           |
| int16     | System Status:<br>0=everything OK, Not 0=something wrong                                                                                                          | 117              | 1           |

| Data Type | Description                                                                  | MB Starting Regs | MB Reg Size |
|-----------|------------------------------------------------------------------------------|------------------|-------------|
|           |                                                                              |                  |             |
| char[20]  | Analyte 1 Name                                                               | 170              | 10          |
| float     | Analyte1 Concentration                                                       | 180              | 2           |
| float     | Analyte 1 Band High-Limit Band 1                                             | 182              | 2           |
| float     | Analyte 1 Band Low-Limit Band 1                                              | 184              | 2           |
| float     | Analyte 1 Band High-Limit Band 2                                             | 186              | 2           |
| float     | Analyte 1 Band Low-Limit Band 2                                              | 188              | 2           |
| float     | Analyte 1 Band High-Limit Band 3                                             | 190              | 2           |
| float     | Analyte 1 Band Low-Limit Band 3                                              | 192              | 2           |
| float     | Analyte 1 Band High-Limit Band 4                                             | 194              | 2           |
| float     | Analyte 1 Band Low-Limit Band 4                                              | 196              | 2           |
| char[20]  | Analyte 2 Name                                                               | 198              | 10          |
| float     | TEC Temperature Value                                                        | 210              | 2           |
| float     | Cell RTD 1 Filtered Value                                                    | 231              | 2           |
| float     | Cell Set Point                                                               | 233              | 2           |
| float     | Calibration Temperature<br>for Concentration Compensation                    | 237              | 2           |
| float     | Calibration Pressure<br>for Concentration Compensation                       | 239              | 2           |
| uint      | Decimal Places to use for displaying Analyte 1                               | 252              | 2           |
| boolean   | Normally Closed indicator for Relay 1:<br>1=normally closed, 0=normally open | 256              | 1           |
| boolean   | Normally Closed indicator for Relay 2:<br>1=normally closed, 0=normally open | 257              | 1           |
| boolean   | Normally Closed indicator for Relay 3:<br>1=normally closed, 0=normally open | 258              | 1           |
| boolean   | Normally Closed indicator for Relay 4:<br>1=normally closed, 0=normally open | 259              | 1           |
| uint      | Temporary Cache to mirror warnings in<br>SYSALARM1                           | 262              | 2           |
| uint      | Temporary Cache to mirror warnings in<br>SYSALARM2                           | 264              | 2           |
| uint      | Temporary Cache to mirror warnings in<br>SYSALARM3                           | 266              | 2           |
| uint16    | Analog Output 1:<br>0=follow source during cal<br>1=hold output during cal   | 280              | 1           |
| uint16    | Analog Output 2:<br>0=follow source during cal<br>1=hold output during cal   | 281              | 1           |
| float     | Reference Laser Power (Power at Calib)                                       | 300              | 2           |
| float     | Laser Power                                                                  | 304              | 2           |
| float     | Reference Concentration of the reference cell<br>at                          | 306              | 2           |

| Data Type | Description                                                                                                                                                                                                                                                                 | MB Starting Regs | MB Reg Size |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------|
|           |                                                                                                                                                                                                                                                                             |                  |             |
| int16     | System State:<br>100=not ready, 201=measure run, 502=idle,<br>600=diag                                                                                                                                                                                                      | 118              | 1           |
| float     | External 4-20 mA Input 1                                                                                                                                                                                                                                                    | 123              | 2           |
| float     | Current Output 1                                                                                                                                                                                                                                                            | 125              | 2           |
| float     | Current Output 1 Offset                                                                                                                                                                                                                                                     | 127              | 2           |
| uint16    | Current output 1 Parameter                                                                                                                                                                                                                                                  | 129              | 1           |
| float     | Current Output 1 Span                                                                                                                                                                                                                                                       | 130              | 2           |
| int16     | Current Output 1 Output Type:<br>0=4-2 mode, 1=0-20 mode<br><i>If over-range enable (ANAOOUT1OR=1)</i><br>0=3.78 to 20.5; 1=0 to 20.5<br><i>High or Low values can also be set by fault value. See Fault option (ANAOOUT1F)</i>                                             | 132              | 1           |
| uint16    | Current Output 1 Over-Range Enable<br>0=disabled, 1=enabled                                                                                                                                                                                                                 | 133              | 1           |
| uint16    | Current Output 1 Fault Option<br>0=no fault, 1=low fault, 2=high fault<br>If High fault (2):<br>High End of Range becomes 22 mA;<br>Output Ratio becomes 1<br>If Low fault (1) AND in 4-20 mode<br>(ANAOOUT1T=0)<br>Low End of Range becomes 3 mA<br>Output Ratio becomes 0 | 134              | 1           |
| float     | Current Output 2                                                                                                                                                                                                                                                            | 135              | 2           |
| float     | Current Output 2 Offset                                                                                                                                                                                                                                                     | 137              | 2           |
| uint16    | Current Output 2 Parameter                                                                                                                                                                                                                                                  | 139              | 1           |
| float     | Current Output 2 Span                                                                                                                                                                                                                                                       | 140              | 2           |
| int16     | Current Output 2 Output Type:<br>0=4–20 mode, 1=0 to 20 mode<br><i>If over-range enable (ANAOOUT2OR=1)</i><br>0=3.78 to 20.5, 1=0 to 20.5<br><i>High or low values can also be set by fault value. See Fault option (ANAOOUT2F).</i>                                        | 142              | 1           |
| uint16    | Current Output 2 Over-Range Enable:<br>0=disabled, 1=enabled                                                                                                                                                                                                                | 143              | 1           |
| uint16    | Current Output 2 Fault Option<br>0=no fault, 1=low fault, 2=high fault<br>If High fault (2):<br>High End of Range becomes 22 mA;<br>Output Ratio becomes 1<br>If Low fault (1) AND in 4-20 mode<br>(ANAOOUT2T=0)<br>Low End of Range becomes 3 mA<br>Output Ratio becomes 0 | 144              | 1           |
| uint16    | Relay 1: 0=open, 1=closed                                                                                                                                                                                                                                                   | 145              | 1           |

| Data Type | Description                                                                        | MB Starting Regs | MB Reg Size |
|-----------|------------------------------------------------------------------------------------|------------------|-------------|
|           |                                                                                    |                  |             |
| uint16    | Relay 1 Delay<br>Holds the relay output for this set amount of time.               | 146              | 1           |
| uint16    | Relay 1 Function:<br>0=disabled, 1=concentration, 3=data valid,<br>4=system alarm  | 147              | 1           |
| uint16    | Relay 1 Source<br>The source parameter number used to evaluate the relay function. | 148              | 1           |
| float     | Relay 1 Value<br>The value used to evaluate the relay function.                    | 149              | 2           |
| uint16    | Relay 2: 0=open, 1=closed                                                          | 151              | 1           |
| uint16    | Relay 2 Delay<br>Holds the relay output for this set amount of time.               | 152              | 1           |
| uint16    | Relay 2 Function:<br>0=disabled, 1=concentration, 3=data valid,<br>4=system alarm  | 153              | 1           |
| uint16    | Relay 2 Source<br>The source parameter number used to evaluate the relay function. | 154              | 1           |
| float     | Relay 2 Value<br>The value used to evaluate the relay function.                    | 155              | 2           |
| uint16    | Relay 3: 0=open, 1=closed                                                          | 157              | 1           |
| uint16    | Relay 3 Delay<br>Holds the relay output for this set amount of time.               | 158              | 1           |
| uint16    | Relay 3 Function:<br>0=disabled, 1=concentration, 3=data valid,<br>4=system alarm  | 159              | 1           |
| uint16    | Relay 3 Source<br>The source parameter number used to evaluate the relay function. | 160              | 1           |
| float     | Relay 3 Value<br>The value used to evaluate the relay function.                    | 161              | 2           |
| uint16    | Relay 4: 0=open, 1=closed                                                          | 163              | 1           |
| uint16    | Relay 4 Delay<br>Holds the relay output for this set amount of time.               | 164              | 1           |
| uint16    | Relay 4 Function:<br>0=disabled, 1=concentration, 3=data valid,<br>4=system alarm  | 165              | 1           |
| uint16    | Relay 4 Source<br>The source parameter number used to evaluate the relay function. | 166              | 1           |
| float     | Relay 4 Value<br>The value used to evaluate the relay function.                    | 167              | 2           |
| boolean   | Master Enable for All Relays:<br>0=disabled, 1=enabled                             | 169              | 1           |

| Data Type | Description                               | MB Starting Regs | MB Reg Size |
|-----------|-------------------------------------------|------------------|-------------|
|           |                                           |                  |             |
| boolean   | if FALSE, use ANAIN1S, else use ANAIN1EU  | 308              | 1           |
| float     | Max Pressure allowed in PPMV to Dew Point | 309              | 2           |
| float     | Min Pressure allowed in PPMV to Dew Point | 311              | 2           |
| float     | Dew Point Coeff[0]                        | 314              | 2           |
| float     | Dew Point Coeff[1]                        | 316              | 2           |
| float     | Dew Point Coeff[2]                        | 318              | 2           |
| float     | Dew Point Coeff[3]                        | 320              | 2           |
| float     | Transmitter Pressure                      | 324              | 2           |
| float     | User Analog Input 1 Span                  | 326              | 2           |
| float     | User Analog Input 1 Offset                | 328              | 2           |
| float     | User Analog Input Fixed Substitute Value  | 332              | 2           |
| float     | RTD2 (Reference Cell Temperature)         | 336              | 2           |
| float     | PRESX1 Analog Input Filtered Value        | 344              | 2           |
| float     | Pressure Transducer 1 Scale               | 346              | 2           |
| float     | Pressure Transducer 1 Offset              | 348              | 2           |
| float     | Minimum Concentration                     | 379              | 2           |
| float     | Maximum Concentration                     | 381              | 2           |
| float     | Heater Set Point                          | 504              | 2           |

## Alarm Messages

| Condition                        | Alarm Message         | Causes                                                                                                                                                                            |
|----------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tec temperature high             | "TEC Hi Limit Alrm"   | Laser temperature is above the setpoint                                                                                                                                           |
| Tec temperature low              | "TEC Lo Limit Alrm"   | Laser temperature is below the setpoint                                                                                                                                           |
| Cell temperature high            | "Cell Hi Limit Alrm"  | Sample cell temperature is above the setpoint                                                                                                                                     |
| Cell temperature low             | "Cell Lo Limit Alrm"  | Sample cell temperature is below the setpoint                                                                                                                                     |
| Cell Pressure high               | "Pres Hi Limit Alrm"  | Sample cell pressure is above the setpoint                                                                                                                                        |
| Cell Pressure low                | "Pres Lo Limit Alrm"  | Sample cell pressure is below the setpoint                                                                                                                                        |
| Concentration Band 1 alarm       | "Conc. Band 1"        | Concentration is outside Band 1 (set in Relay1)                                                                                                                                   |
| Concentration Band 2 alarm       | "Conc. Band 2"        | Concentration is outside Band 2 (set in Relay2)                                                                                                                                   |
| Concentration Band 3 alarm       | "Conc. Band 3"        | Concentration is outside Band 3 (set in Relay3)                                                                                                                                   |
| Concentration Band 4 alarm       | "Conc. Band 4"        | Concentration is outside Band 4 (set in Relay4)                                                                                                                                   |
| Concentration out of range       | "Conc. Out of range"  | Concentration is outside of calibration range                                                                                                                                     |
| Concentration reading is invalid | "Data Invalid"        | <ul style="list-style-type: none"> <li>• In line-lock mode</li> <li>• Any of the system alarm</li> <li>• Low light intensity</li> <li>• Low moisture in reference cell</li> </ul> |
| Low light intensity              | "Low light intensity" |                                                                                                                                                                                   |
| Reference concentration          | "Ref conc. alarm"     | Calculated reference concentration is out of tolerance                                                                                                                            |
| Internal error                   | "Internal error"      | <ul style="list-style-type: none"> <li>• File system error</li> <li>• Memory error</li> <li>• I/O communication error</li> </ul>                                                  |

This page intentionally left blank.

# MAINTENANCE



---

## EXPOSURE TO SOME CHEMICALS MAY DEGRADE SEALED DEVICES:

*The relay RLY1 on the overtemp board is classified as a “sealed component” with regard to type n methods of flameproof protection. The case is made of PBT and LCP plastics and is sealed with a Bisphenol-A type epoxy resin. This combination provides excellent chemical resistance, but because this device cannot be considered hermetically sealed, brazed or welded construction, one must consider that certain chemicals or solvents in the area may be able to degrade the seal on this component. The user should periodically check the relay for any signs of cracking or corrosion of this component and replace this board if degradation is found.*

---



---

## SUBSTITUTION OF RLY1 MAY IMPAIR SUITABILITY FOR USE IN HAZARDOUS AREAS:

*Replace only with the same type – AMETEK part number 25869JE.*

---



---

## EXPLOSION HAZARD:

*Do not remove or replace components unless power has been disconnected or the area is known to be free of ignitable concentrations of flammable gases or vapors.*

---

## Cleaning

Cleaning the exterior of the analyzer is required occasionally to remove dust and other debris. Use a damp cloth to clean the analyzer's exterior, including the keypad and display.

## Replacing the MCU Battery

The battery on the MCU board powers the analyzer clock when the main analyzer AC power is not connected. The clock's primary function is to timestamp the **Alarm Log** entries. The AMETEK part number for one battery is 301-0382.

The battery's expected life-span is greater than five years; therefore, it is important to order and stock a battery when your analyzer is approaching five years from the original manufacture date.



NOTE

---

*It is possible that the battery can become damaged by a power spike, resulting in the need for a replacement.*

---

To replace the MCU battery:

1. Power down the analyzer.



---

### **Hazardous Locations**

*Before proceeding, test the area around the analyzer for flammable gases. If an explosive gas atmosphere is present, do not open the Electronics or Oven Enclosures, and do not power down the analyzer or any alternate power sources that supply power to the analyzer components. Proceed only when the area is found to be safe.*

---

2. While wearing a grounding wrist strap, use an appropriate tool to remove the battery from the MCU board. Insert the new battery.
3. Take all necessary precautions to safely power up the analyzer and prepare it for operation.



---

### **Hazardous Locations**

*If an external, flame-proof disconnect switch (breaker) has been installed, close the breaker.*

---



---

*When the analyzer doors are open, take appropriate precautions to avoid electrical shock. Hazardous voltages are present inside.*

---

4. Close the analyzer enclosure doors and secure them with their latches to allow the analyzer to warm up to operating temperature and stabilize.
5. Check the **System Time** and system **Date** (**System** screen, **SETUP** menu) and set them to the current time and date.

## Changing Out Replaceable Parts



---

*Maintenance procedures described in this document should be performed only by qualified personnel who have been properly trained by AMETEK.*

---



---

*AMETEK recommends reading the entire procedure before starting maintenance.*

---

Supplies and parts required for maintenance:

- Phillips head screwdriver
- 3 mm and 4.5 mm hex head wrenches, 9/16" wrench, adjustable wrench
- Methanol, or similar cleaning agent
- Clean lint-free cloth.
- Kimwipes® EX-L tissue (or an equivalent extra low-lint tissue)
- Compressed air (can)
- Reagent-grade acetone
- Pharmaceutical-grade distilled water
- Spare parts (see Sample Cell or Particulate Filter Spare Parts Lists in this chapter).

## Cleaning and Replacing Parts in the Standard Cell

This procedure discusses cleaning and replacing parts in the *standard* Dual-Pass Sample Cell, used on Single Laser 5100HD TDLAS Analyzers.

For other Sample Cells that can be used with this analyzer (listed below), refer to a separate *Manual Supplement* for instructions on how to clean and replace parts. Contact AMETEK Service for a *Manual Supplement* for the Sample Cell used with your system. Optional Sample Cells include:

- Multi-pass Herriott cell, using fibers
- Four-pass, space-coupled cell
- Mid-IR sample cell, 2-pass

Clean and replace parts in the Sample Cell:

- Any time a scheduled cleaning of the analyzer is performed.
- Following an operational upset, that may result in contaminants settling in the sample gas path

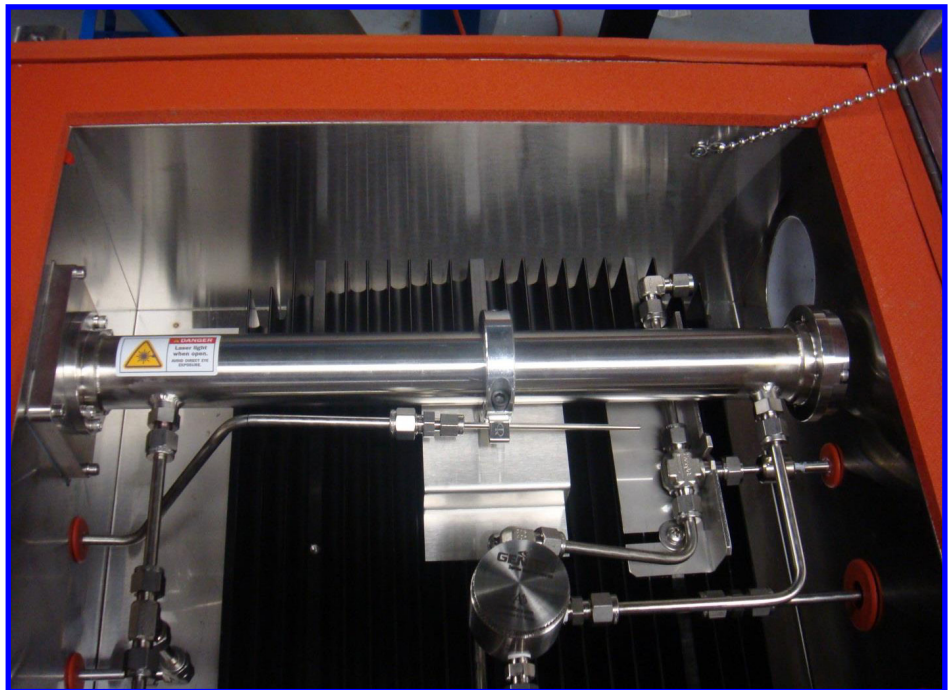


**Figure 1.**  
Standard Dual-Pass Sample Cell, shown mounted inside analyzer Oven Enclosure.



NOTE

---

*"PN" in this procedure refers to Part Number.*

---

To clean and replace parts in the Sample Cell:



---

***Hazardous Locations***

*Before proceeding, test the area around the analyzer for flammable gases. If an explosive gas atmosphere is present, do not open the Electronics or Oven Enclosures, and do not power down the analyzer or any alternate power sources that supply power to the analyzer components. Proceed only when the area is found to be safe.*

---

1. Close the Sample Inlet valve and the Sample Outlet valve. Close the Sample Drain valve (if applicable).
2. Take all necessary procedures to safely power down the analyzer and prepare it for maintenance, as described in this manual, and as specified by the end user/Owner Company.

After the analyzer has been powered down, open the Oven door and allow the Oven to cool down enough to ensure safe handling of its internal components.



---

*The Oven Enclosure and components within the Oven are hot; take precautions to avoid burning yourself.*

---

3. After the Oven has cooled down enough to work on, remove the Sample Cell from the Oven. To do this:
  - a. Disconnect the Sample Cell Inlet and Outlet tubing fittings on the Cell.
  - b. Remove the four (4) screws and four (4) lock washers that secure the Sample Cell assembly to the Oven wall.  
Remove the four (4) screws and four (4) lock washers that secure the Sample Cell to the Detector Block (Cell Mounting Plate) inside the Oven.



NOTE

---

*Do not remove or loosen the four (4) screws that secure the Cell Mounting Plate to the Oven wall (see Figure 2).*

---

- c. Remove the two (2) Cell Mounting Clamp screws and its bracket. The Cell RTD will disengage from the clamp, but remain in the Oven. While holding the Cell with one hand, carefully guide the Cell and its connected wires (from the Electronics Enclosure) out of the Oven.



---

*Before removing the Cell, note its orientation to ensure proper orientation when replacing it later.*

---

Slide the Cell to the right to disengage the alignment pins in the Cell Mounting Plate on the Oven wall. **Take care to ensure the pins are not bent while removing the Cell.** After the pins are free, carefully remove the Cell from the Oven Enclosure.

Figure 2 shows the Mounting Plate, after the Cell has been removed. Note that there are two (2) o-rings – one around the Detector and one around the Collimator (GRIN Lens). Remove these o-rings.

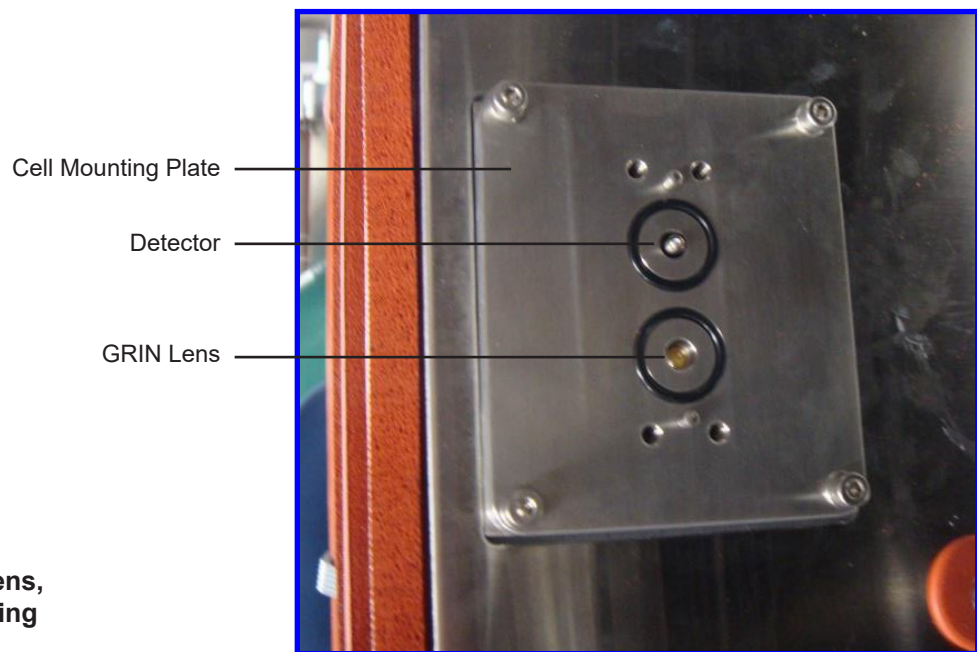


**Figure 2.**  
**Detector and GRIN Lens,**  
**shown on Cell Mounting**  
**Plate (Cell removed).**

- d. The Detector and GRIN Lens are made of glass. Inspect the glass for contamination, and gently clean with a mild solvent (alcohol or methanol). **Use only a soft, clean lint-free cloth if necessary – avoid scratching the glass.**

Using a cotton swab and reagent-grade acetone, clean the o-ring grooves and general area on the Mounting Plate.

4. Disassemble and clean and replace parts in the Sample Cell (Figures 3 and 4):
  - a. With the Sample Cell on a workbench or suitable work area, remove the four (4) screws and four (4) lock washers that secure the Bottom Cap to the Sample Cell.

Carefully remove the Bottom Cap from the Cell (Figure 4), **taking extreme care to ensure the Mirror does not drop out and to avoid losing the small spring when separating the parts.** Remove the Compression Spring from the Bottom Cap and set it aside to re-use it later.

- b. Carefully remove the Mirror by placing your hand with a soft, clean lint-free cloth over the Mirror, then turning the Sample Cell upside down to allow the Mirror to fall into the cloth. **Handle the Mirror only by its outer edge.**

Inspect the Mirror for scratches, chips, and cracks and discard if damaged. If it's not damaged, it can be cleaned with methanol and reused. **The mirror is gold-plated (see Figure 5), and the plating is susceptible to scratches. Take extra care when handling and cleaning the Mirror. Use only methanol to clean the Mirror. Do not use abrasives.** If additional cleaning is necessary, follow these steps:

- i. **Holding the Mirror by its outside edge**, stand it vertically and apply methanol to its reflective (gold) surface. Gently place a Kimwipes® EX-L tissue (or an equivalent extra low-lint tissue) on the reflective surface and allow it to absorb the methanol.
    - ii. Gently pull the Kimwipes tissue along the Mirror surface.
    - iii. Dry the Mirror with compressed air or allow to air dry. **Do not use a cloth, do not touch the mirror/reflective surface with your fingers, and do not scratch or rub the Mirror, or use water on a Mirror.**
  - c. Remove the o-ring from the Cell Body.
  - d. Inspect the interior of the Sample Cell for particulates or damage, and clean it and the o-ring groove with reagent-grade acetone followed by a rinse with pharmaceutical-grade distilled water.

Allow all components to dry thoroughly before reassembling.

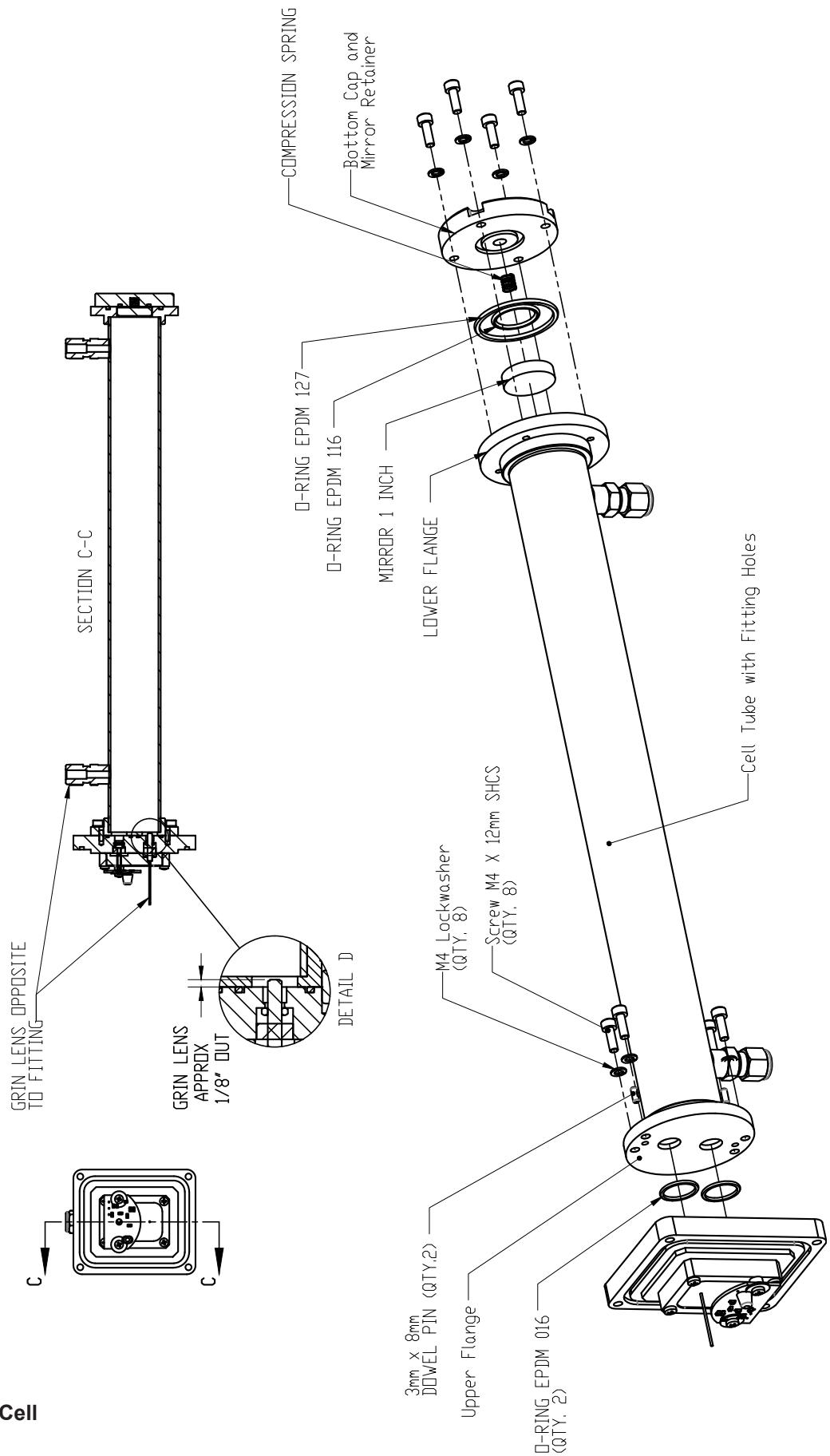


**Figure 3.**  
Standard Sample Cell  
assembly.



Bottom Cap – shown removed – with o-ring and Compression Spring.

**Figure 4.**  
Sample Cell, Bottom Cap upright (at left) and Bottom Cap removed, shown with o-ring and Compression Spring (at right).

5. Replace the parts in the Sample Cell:




---

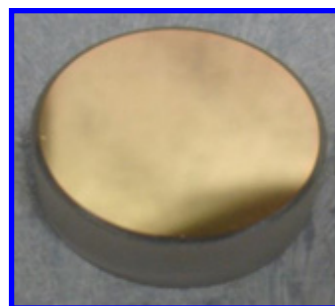
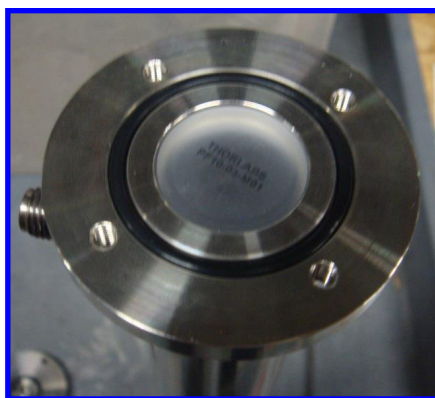
*It is critical to reassemble the Sample Cell in the exact orientation as it was assembled at the factory.*

---

*If the Mirror is found to be scratched, chipped, or cracked, replace it during reassembly. Do not operate the analyzer with faulty parts.*

---

- a. Install one (1) new 116 o-ring (PN 42828JE) and the Compression Spring (PN 31860JE) in the Bottom Cap (Figure 4).
- b. Install one (1) new 127 o-ring (PN 42827JE) in the Cell Body (Figure 5).



Mirror – gold-plated side shown.

**Figure 5.**  
Sample Cell, Mirror installed, gold-plated surface facing into Cell (with gold-plated side of Mirror shown at right).

**While holding the Mirror (PN 16052JE) by its outer edge**, install the Mirror (gold/mirrored surface facing inside) in the Cell.

Carefully replace the Bottom Cap (with Compression Spring installed) on the Cell Body, **taking extreme care to ensure the Mirror does not drop out and to avoid losing the Compression Spring when joining the parts.**

Replace the four (4) spring lock washers and four (4) M4 X 12 mm screws and tighten them evenly to secure the Bottom Cap to the Cell.

- c. Lightly wet a Kimwipes tissue with methanol and gently clean the Detector Block (Cell Mounting Plate) surface.

Install two (2) new 016 o-rings (PN 42826JE) in the grooves on the Cell Mounting Plate in the Oven.

6. Replace the Cell in the Oven:

- a. With the Cell oriented properly (see Figure 1), start by positioning the Cell toward the right side of the Oven then slowly move it toward the Cell Mounting Plate, using the alignment pins as a guide, until the Cell is in place against the Mounting Plate. **Take care to ensure the pins are not bent while replacing the Cell.**

Replace the Cell RTD in its original position in the bottom of the Cell Mounting Bracket.

Secure the Cell with the Cell Mounting Bracket and its two (2) screws but do not tighten it at this time.

- b. Secure the Sample Cell to the Cell Mounting Plate using the four (4) spring lock washers and four (4) screws and lock washers. Tighten the screws evenly.

Now, tighten the Cell Mounting Bracket.

- c. Connect the tubing to the Sample Inlet and Outlet ports on the Cell and tighten all fittings that were loosened or removed completely.

7. Perform a leak check on the sample system fittings that were disconnected and continue only after the leak check has passed. Refer to "Sample System Leak Check" in this chapter.

8. Take all necessary procedures to safely power up the analyzer as specified in this manual, and by the end user/Owner Company.



---

***Hazardous Locations***

*Before proceeding, test the area around the analyzer for flammable gases. If an explosive gas atmosphere is present, do not apply power to the analyzer or any alternate power sources that supply power to the analyzer components while the Electronics or Oven Enclosures are open. Proceed only when the area is found to be safe.*

---

After the analyzer has been powered up, close the Oven door and allow the system to warm up to normal operating temperature.

9. Perform a Zero Check on the analyzer, as described in the section “Zero and Span Check Functions” in Chapter 4 of this manual.
10. Open the Sample Drain valve (if applicable).  
Open the Sample Outlet valve.  
Open the Sample Inlet valve.
11. Adjust the flow and pressure rates for normal operation.

The procedure is complete.

## Cleaning and Replacing Parts in the Particulate Filter (if Equipped)

For systems that use the Particulate Filter, it is located in the Oven Enclosure. This filter helps protect the sample system (Cell, Pressure Sensor, etc.) from being contaminated by particulates and liquids in the sample stream.

Because the composition of sample streams can vary from site to site, or due to process upsets, there is no single service interval that applies to all applications and installations. However, if it has been determined that the Filter has become contaminated or plugged, the Filter will need to be cleaned or have its internal parts replaced. Therefore, AMETEK recommends inspecting the Filter frequently (e.g., weekly) for new installations, to determine how long it typically takes for the filter to become contaminated. Based on how long the Filter remains clean over a certain period of time, you can establish a more defined cleaning and Filter replacement schedule.



NOTE

---

*"PN" in this procedure refers to Part Number.*

---

To check, clean, and replace parts in the Particulate Filter:



---

### ***Hazardous Locations***

*Before proceeding, test the area around the analyzer for flammable gases. If an explosive gas atmosphere is present, do not open the Electronics or Oven Enclosures, and do not power down the analyzer or any alternate power sources that supply power to the analyzer components. Proceed only when the area is found to be safe.*

---

1. Close the Sample Inlet valve and the Sample Outlet valve. Close the Sample Drain valve (if applicable).
2. Take all necessary procedures to safely power down the analyzer and prepare it for maintenance, as described in this manual, and as specified by the end user/Owner Company.

After the analyzer has been powered down, open the Oven door and allow the Oven to cool down enough to ensure safe handling of its internal components.



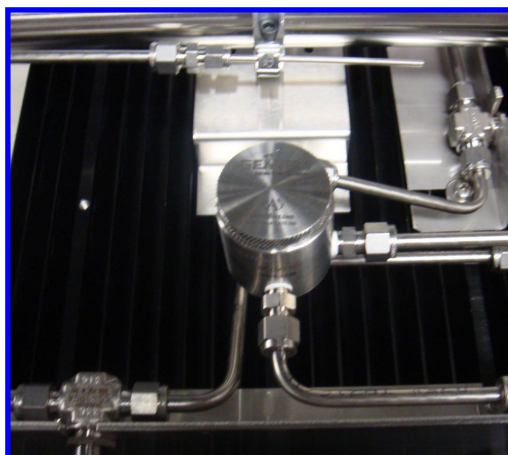
---

*The Oven Enclosure and components within the Oven are hot; take precautions to avoid burning yourself.*

---

3. After the Oven has cooled down enough to work on:
  - a. Remove the knurled cap – by hand – from the Particulate Filter (Figures 6 and 7). The cap should not require a wrench to unscrew it.

**Figure 6.**  
**Particulate Filter,**  
**inside analyzer Oven**  
**Enclosure.**



Filter cap—shown removed, at left—with o-ring and Membrane Filter installed in cap.

- b. The Membrane Filter is installed inside the cap (Figure 6). Inspect the filter for contamination or damage. Remove the o-ring that secures it inside the cap, then remove the Filter (Figure 7).



---

*If it is difficult to remove the o-ring and membrane, use an o-ring removal tool or a small tool with a blunt tip (e.g., a toothpick). Take care not to scratch the o-ring groove.*

---

**Figure 7.**  
**Membrane and Filter**  
**removed from cap.**



4. Inspect the interior of the Filter Body for foreign material and clean its interior using a non-abrasive agent such as reagent-grade acetone.

Inspect the Filter Cap and clean it and the o-ring groove with reagent-grade acetone followed by a rinse with pharmaceutical-grade distilled water.

Allow all components to dry thoroughly before reassembling.

5. Install the new Membrane Filter and o-ring:



---

*Some Membrane Replacement Kits include a new o-ring; but some do not. If your Membrane Replacement Kit does not include an o-ring, re-use the original one. In this case, clean the o-ring to remove any contaminants before replacing it.*

---



---

*The membrane is delicate; handle it with care.*

---

- a. Carefully install the Membrane Filter (PN 42891JE) in the Filter Cap then install the o-ring (PN 76152TE) on top of the Membrane by pushing it into the o-ring groove around the outer edge of the cap.
  - b. Replace the cap and hand-tighten it.
6. Perform a leak check on the sample system and continue only after the leak check has passed. Refer to “Sample System Leak Check” in this chapter.
  7. Take all necessary procedures to safely power up the analyzer as specified in this manual, and by the end user/Owner Company.



---

***Hazardous Locations***

*Before proceeding, test the area around the analyzer for flammable gases. If an explosive gas atmosphere is present, do not apply power to the analyzer or any alternate power sources that supply power to the analyzer components while the Electronics or Oven Enclosures are open. Proceed only when the area is found to be safe.*

---

After the analyzer has been powered up, close the Oven door and allow the system to warm up to normal operating temperature.

8. Perform a Zero Check on the analyzer, as described in the section “Zero and Span Check Functions” in Chapter 4 of this manual.
9. Open the Sample Drain valve (if applicable).  
Open the Sample Outlet valve.  
Open the Sample Inlet valve.
10. Adjust the flow and pressure rates for normal operation.

The procedure is complete.

## Spare Parts for the 5100HD Analyzer

Use the following AMETEK Part Numbers to order replacement Sample Cell or Particulate Filter parts for the 5100HD Analyzer.

### Sample Cell Spare Parts

| Part No. | Description                                                                                                                                                       |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16052JE  | Mirror, 1-inch Diameter                                                                                                                                           |
| 31860JE  | Compression Spring, SS                                                                                                                                            |
| 31869JE  | Spring Lock Washer, SS                                                                                                                                            |
| 31826JE  | M4 x 12 mm Socket Head Cap Screw, SS                                                                                                                              |
| 76152TE  | O-ring Accessory Kit<br>Kit Includes 116, 127, 016 o-rings:<br>O-ring, EPDM, 116 (PN 42828JE)<br>O-ring, EPDM, 127 (PN 42827JE)<br>O-ring, EPDM, 016 (PN 42826JE) |

### Particulate Filter Spare Parts

| Part No. | Description                             |
|----------|-----------------------------------------|
| 42891JE  | Membrane Filter Kit, Particulate Filter |
| 42892JE  | O-ring, Particulate Filter              |

### Miscellaneous Spare Parts

| Part No. | Description        |
|----------|--------------------|
| 301-0382 | Battery, MCU board |

## Sample System Leak Check



---

*Ensure that the pressure gauge, shut-off valve, and associated fittings and tubing are leak-tight prior to testing the analyzer.*

---



---

*Do not use a leak detection fluid on hot fittings. If the analyzer system is at operating temperature, cool down the heated zones before using a leak detection fluid on the fittings.*

---

Equipment and supplies required to perform the leak check:

- One calibrated pressure gauge capable of measuring at least 0–30 psig.
- One manual shut-off valve.
- 1/4" or 6 mm Swagelok plug fitting, as needed.
- Supply of clean, dry air or nitrogen with a minimum configurable pressure of 30 psig.
- Detergent-based leak detector (Snoop® or another suitable leak detection agent is permissible).

To leak check the sample system:

1. Fully open all valves on the analyzer (Inlet, Exhaust, and Drain – may vary, depending on configuration).
2. Install a plug on the analyzer's Drain port (if equipped).
3. Install the shut-off valve on the analyzer's Inlet port. Open the shut-off valve if necessary.
4. Install the pressure gauge on the analyzer's Exhaust port.
5. Connect a supply of compressed air or nitrogen to the shut-off valve on the Inlet port. Ensure the gas and associated tubing is clean and dry (AMETEK recommends using a compressed gas cylinder – do not use house air as it can contain high levels of moisture).

6. Gradually increase the Inlet gas pressure until the pressure gauge reads 30 psi.
7. Close the shut-off valve and start the stopwatch. The pressure reading on the gauge must not fall more than 0.1 psig in five (5) minutes for the leak check to pass.
8. If the analyzer fails the test, use a suitable leak detection fluid (such as Snoop<sup>®</sup>) on all fittings that were retightened, and repair the leak(s) as necessary.

Repeat the leak check and continue only after all leaks have been eliminated.

9. After all leaks have been eliminated, remove the plug from the analyzer's Drain port and replace the Drain tubing.

Slowly open all valves on the analyzer (Inlet, Exhaust, and Drain – if used).

10. Return the analyzer to its normal flow rate.

The procedure is complete.

# X-PURGE

## Purge Startup Procedure

The AMETEK 5100HD Zone 1 – X-Purge has an enclosure protection system that controls power to the analyzer (X-Purge). All enclosure protection systems have some alarm or indicator to alert the user upon loss of protective pressure. In either case, it is wise to make sure the purge system is functional before turning on power to the analyzer.

### X-Purge Startup

The Enclosure Protection Vent must be tested and the enclosure(s) must be sealed. Power can then be applied to the Electronic Power Control Unit (EPCU). If the EPCU is not programmed as desired, follow the instructions in the operation manual provided for the purge control unit. The purging start-up can be set up in 3 different modes, which are explained below:

- STD – Standard mode requires the operator to engage the manifold solenoid valve manually when purging and manually disengage when a successful purging is complete.
- SA – Semiautomatic mode requires the operator to engage the manifold solenoid valve manually when purging. The EPCU will automatically disengage when a successful purging is complete.
- FA – Fully-automatic mode will automatically engage the manifold solenoid valve when safe pressure is detected and will automatically disengage when a successful purging is complete.

Loss of safe enclosure pressure will cause the purge control unit to de-energize power to the protected enclosure(s) or activate the Shutdown Delay Timer.



---

*WARNING: Power shall not be restored after enclosure has been opened until enclosure has been purged for:*

*8 MINUTES at a flow rate of 5 cfm (141 lpm)*

*OR*

*4 MINUTES at a flow rate of 12 cfm (240 lpm)*

---

## Electronic Power Control Unit (EPCU) Response

When power is removed, the EPCU is at rest, the alarm relay and power relays are de-energized, the unit is in alarm state, and the LED's and LCD display are off. When power is applied, the EPCU performs a self-test of logic functions and briefly illuminates all the LED's. When the unit detects a minimum 0.25" (.63 mbar) safe pressure, the alarm relay will then energize and the alarm system will deactivate. Depending on the startup mode selected, the unit will wait for the user to press the START/SET key to start a purge cycle or it will start automatically. There is a 5 second delay before the rapid exchange solenoid valve is activated. After 1 minute, the unit must then detect a minimum 5 cfm (141 lpm) flow or 12 cfm (340 lpm) flow through the vent to start the timer for the purge cycle. The update of the timer is in increments of 1 minute in the Fixed Purge Time and % completed in the Dynamic Purge Time. The cycle must be completed, uninterrupted by the loss of safe pressure or rapid exchange flow. The enclosure power relays will then energize, and the unit will attain Normal Operating Status, wherein the Safe Enclosure Pressure, and Enclosure Power Engaged LED's will illuminate. Loss of safe enclosure pressure will cause the power relays to de-energize unless delayed or bypassed.

Model 6000 STATE definitions:

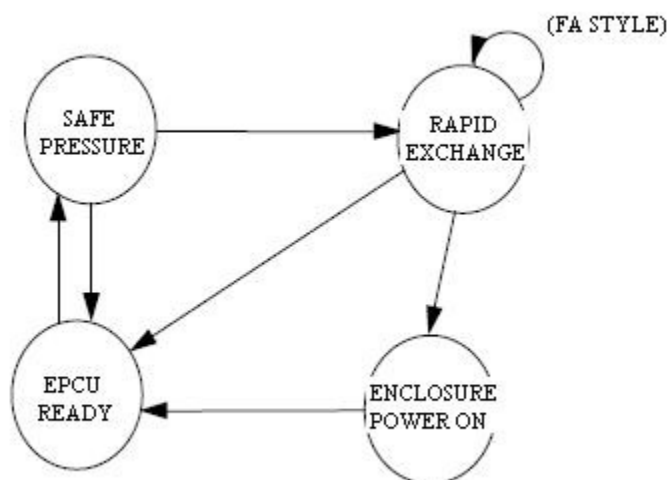
|        |                                                            |
|--------|------------------------------------------------------------|
| EPCU:  | Electronic Power Control Unit                              |
| SEP:   | Safe Enclosure Pressure (>.63 mbar)                        |
| REF:   | Rapid Exchange Flow                                        |
| RET:   | Rapid Exchange Time complete (4 or 8 minutes) <sup>1</sup> |
| EP ON: | Enclosure Power ON                                         |
| HEP:   | High Enclosure Pressure (>7 mbar)                          |
| ALARM: | EPCU relay engaged when no fault present                   |

| STATE                                 | EPCU ON | SEP | REF | RET | EP ON | HEP | ALARM |
|---------------------------------------|---------|-----|-----|-----|-------|-----|-------|
| Power Off                             | 0       | 0   | 0   | 0   | 0     | 0   | 0     |
| EPCU Warmed Up                        | 1       | 0   | 0   | 0   | 0     | 0   | 0     |
| Safe Pressure Set                     | 1       | 1   | 0   | 0   | 0     | 0   | 1     |
| Rapid Exchange Initiated <sup>2</sup> | 1       | 1   | 1   | 0   | 0     | 0   | 1     |
| Enclosure Power On                    | 1       | 1   | 0   | 1   | 1     | 0   | 1     |
| High Enclosure Pressure               | 1       | 0   | 0   | 0   | 0     | 1   | 0     |

<sup>1</sup>Rapid exchange time can be 4 minutes at 340 lpm or 8 minutes at 141 lpm depending on the selected mode.

<sup>2</sup>Rapid exchange can be initiated manually by pressing the START/SET key or automatically depending on the selected mode.

Each STATE of the system shown in the diagram below is unique. Transitions between states are only allowed along paths defined by the arrows and in the direction of the arrows.



## X-Purge Operating Instructions

The operating instructions for the Pepperl+Fuchs Model 6000 purge unit are included here. Please refer to the manufacturer's operation manual provided with the system for more details:

### Set-up procedures for the 6000 series system

1. Ensure that electrical, mechanical, and pneumatic connections and requirements are met to operate this system according to local and national standards. Refer to the manufacturer's manual and local and national standards for an explanation of the requirements.
2. Apply power to the 6000 series system.
3. Step 3 is for initial set-up of the system. This procedure can be skipped if the 6000 control unit has been programmed. Program the system using the user interface unit on the front of the 6000 series control unit.

Setup Password:



4. Verify that the "enclosure pressure control valve" stem is closed before applying pressure to the manifold.
5. Turn on the protective gas supply to the 6000 series system inlet on the manifold. Inlet pressure should be below 120 psig (8.2 bar).
6. Select the user interface display so that the enclosure pressure is showing. This should be reading less than 0.1" wc (.25 mbar). Seal the enclosure and slowly open the "enclosure pressure control valve" stem until you can feel air venting at the exhaust. Do not exceed 1.5" wc (3.75 mbar).
7. If air is not exhausting at the vent, check for any obstructions or improper installation.
8. The system is ready to operate.

### **Operation of the 6000 series system (gas hazardous location):**

- Follow the “Set-up procedures for the 6000 series system”.
- Seal the enclosure.
- Set the pressure to a value above a minimum of 0.25" wc (.625 mbar) or the set value from previous user input (cannot be below 0.25" wc).
- Start the purge according to the purge mode programmed into the system.
- When the purge has been successfully completed, the pressure in the enclosure should remain above 0.25" wc (.625 mbar) or any higher user set value. The enclosure is then considered safe and power to the enclosure can be energized.
- If the safe pressure drops below .25" wc (.625 mbar) or the minimum user set value, power to the enclosure will be disconnected unless a time delay for shutting off power is implemented.
- To energize the enclosure again, repeat the procedure.

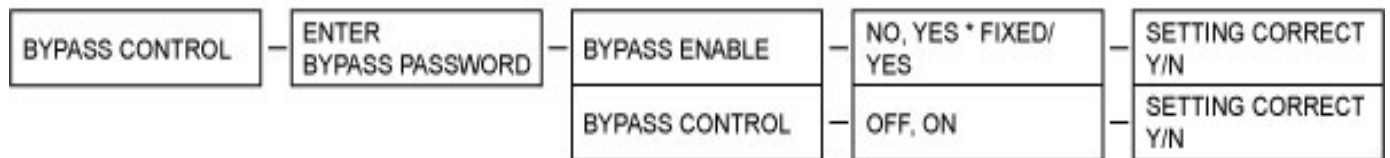
## Bypass Instructions

Bypass Password:



- Seal and purge the enclosure.
- Only when the enclosure is safely purged can the bypass control be activated.
- Using the 6000 Series controller follow the directions:

### BYPASS CONTROL



## Hardware Details

### Type X-Purge

If a Type X-Purge system is installed, the inlet for instrument purge air is located on the purge controller. Dry instrument air pressure should not exceed 8 kg/cm<sup>2</sup> (120 psi) and should be regulated between 4–5 kg/cm<sup>2</sup> (60–80 psig).



Initially a high flow of protective gas is passed through the enclosure. This flow is verified and performs the purging phase of the operation. When the purging phase is completed – i.e. the purge time has elapsed – the flow of protective gas is reduced via a leakage compensation valve so that it just compensates for any leakage from the pressurized enclosure in addition to maintaining its pressurization.

## 6000 Series control unit

Power requirement, AC Version: 100 to 250 VAC/ 50-60 Hz / 100 mA

Operating Temperature, 6000 Control unit:

-4 °F to +140 °F (-20 °C to +60 °C)

EPV6000 vent:

-4 °F to +140 °F (-20 °C to +60 °C)

Protective gas requirement:

Instrument grade air or inert gas

Pressure requirement:

20 to 120 psig  
(Filter + Regulator not provided)

Safe pressure minimum, Gas: 0.25" w.c. (6.4 mm w.c.)

Purging flow rate increment and enclosure pressures at flow rate:

- 5 SCFM @ 1.3" w.c. , (141 l/min @ 33 mm w.c.)
- 12 SCFM @ 2.5" w.c., (340 l/min @ 64 mm w.c.)
- 20 SCFM @ 3.1" w.c., (565 l/min @ 77 mm w.c.)
- 30 SCFM @ 3.4" w.c., (850 l/min @ 86 mm w.c.)

Flow rate (pressurization):

0.01 SCFM (0.30 l/min) and up  
(depends on enclosure seal)

Inlet fitting to Manifold:

3/8" NPT female to 3/8" tube fitting provided

Outlet fitting from Manifold:

3/8" bulkhead tube fitting provided

## 6000 Control unit

Protection class (all electronics): Type 4X, IP66

Weight:

25 lb

Power Connections:

3/4" NPT male pipe (explosion proof seals required)

I.S. Input connections:

Terminal connection inside 6000 series unit

### Materials

Enclosure:

316L (UNS31603) Stainless Steel

Manifold valve:

Anodized 6082 Aluminum

Fittings:

316L (UNS31603) Stainless Steel

## EPV6000 Relief Vent

|                                 |                                                                                                                                |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Flow rate measurement:          | Flow rate is measured in increments:<br>5, 12, 20, 30 SCFM (141 l/min, 340 l/min,<br>565 l/min, 850 l/min)                     |
| Protection Class:               | Mounting fitting Type 4X, IP66                                                                                                 |
| Weight:                         | 2 lb                                                                                                                           |
| Power connections:              | M12 (V1) pin connector (mating connector with cable comes with vent for connection to the control unit);<br>Intrinsically safe |
| Mounting:                       | Mounting can be any orientation to the enclosure<br>Not dependent on gravity                                                   |
| Mounting hole:                  | 1 1/2" NPT knockout hole, mounting with sealed nut                                                                             |
| <b>Material</b><br>EPV-6000-AA: | 6063 T6 Anodized Aluminum                                                                                                      |
| Spark arrestor assembly:        | Protected with 304 (UNS31603) Stainless Steel Screen<br>Movable so that opening can be positioned downwards                    |

This page intentionally left blank.