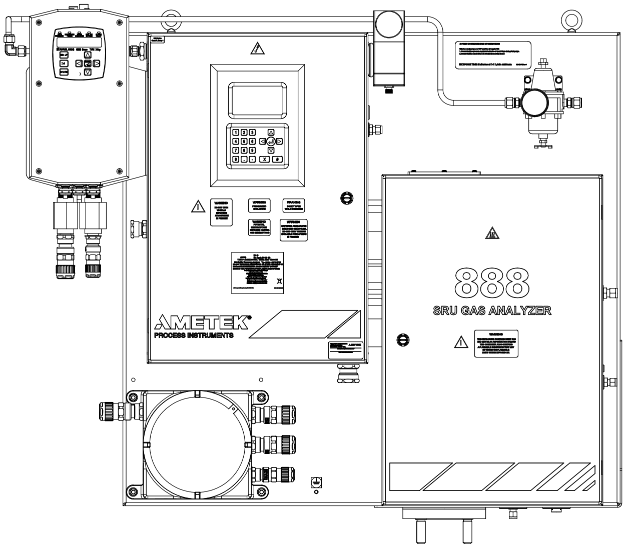
ESSENTIAL HEALTH and SAFETY

888 Tail Gas Analyzer
ATEX-IECEx



PN 883052901, Rev A

To obtain a PDF of this manual, visit our Products page at www.ametekpi.com.

Contents

Overview

About This Document

This document describes the essential health and safety requirements for the components that make up the 888 Tail Gas Analyzer intended for use in explosive atmosphere locations (Zone 1).

The procedures and information discussed in this document include only abbreviated steps to install, operate, and perform maintenance on the 888 Tail Gas Analyzer. They do, however, include all relevant safety warnings and cautions to ensure the safety of personnel and the analyzer in explosive atmosphere locations.

NOTE

AMETEK takes great effort to ensure that its translations of documents into foreign languages are accurate and complete. However, in the case of any discrepancies between the English version and the translated version, the original English version shall take precedence. AMETEK will not assume liability for any such discrepancies, or issues arising from them.

Important Safety Information

Warnings, Cautions, Notes

WARNINGS, CAUTIONS, and NOTES contained in this document emphasize critical instructions as follows.

Important information that should not be overlooked.

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.

Burn hazard. Hot surface. Do not touch, allow to cool before servicing.

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.

Personnel and Equipment Safety Information

Before working on the analyzer, read and understand the following Notes, Warnings, and Cautions, regarding safety and other required information.

Additional Notes, Warnings, and Cautions included in individual procedures in this document (and in the analyzer *User Manual*) indicate special conditions to consider during installation, before opening the analyzer covers or doors, and while working on the analyzer.

WARNING

High voltages are present in the analyzer housings. Always disconnect power and/or external power sources to the analyzer before opening any covers or doors on the analyzer to check or perform maintenance on any components within the enclosures.

WARNING

If it is necessary to open the analyzer's covers or doors while the circuits are live, first test the area for flammable gases and proceed only when the area is safe.

When the Electronics Enclosure and/or other enclosures are open, take appropriate precautions to avoid electrical shock. Hazardous voltages are present inside.

WARNING

All electrical connections, adjustments, or servicing of the analyzer should be performed only by properly trained and qualified personnel.

All electrical connections, materials, and methods (plus all safety standards and procedures) must be made in compliance with local wiring regulations and electrical code for the hazardous area, as specified by the Owner Company, local electrical-inspection authority, and National/EU regulations.

Follow appropriate regulatory and/or company procedures to lock out the analyzer while working on the analyzer electronics.

WARNING

Verify ground continuity of all equipment before applying power. For electrical shock protection, the analyzer must be operated from a grounded power source that has a securely connected protective ground contact.

WARNING

The glass Xenon Flash Lamp is under high internal pressure which could result in flying glass fragments if ruptured. Handle the tube with care to avoid dropping it, subjecting it to impacts, applying excessive force to it, or scratching it.

While handling a flash lamp, always wear protective devices (face mask, clothing) to prevent possible injury, especially to hand and face areas.

WARNING

Before working on the sample system, confirm that the system has been purged with zero fluid and is isolated (blocked in) from the process.

The analyzer oven enclosure and components inside the analyzer oven are hot; always wear protective devices to avoid burning yourself.

WARNING

Check the sample probe installation, sample connections at analyzer, and sample return for leaks before opening sample inlet ball valve and sample return valve.

WARNING

The sample gas contains highly toxic and corrosive substances. Proper personal protective equipment including fresh air breathing apparatus, eye protection, and skin protection MUST BE worn when installing the sample tap and/or opening the main oven chamber for inspection or maintenance.

The sample gas contains highly toxic and corrosive substances. Analyzed sample must be returned to the process or vented to a safe area.

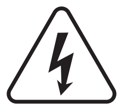
WARNING

THIS ENCLOSURE IS PROTECTED BY PURGING
Enclosure shall not be opened unless the area is known to be non-hazardous, or unless all devices within have been de-energized. Power shall not be restored after enclosure has been opened until the enclosure has been purged in accordance with the purge system start-up instructions.

Warning Labels

These symbols may appear on the instrument 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

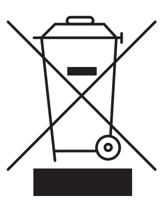
Caution – Refer to accompanying documents
(ATTENTION – SE RÉFERER AUX DOCUMENTS JOINTS)
Achtung – Beachten Sie beiliegende Dokumente

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.
- In some cases, your "end of life" product may be traded in for credit towards the purchase of new AMETEK instruments. Contact your dealer to see if this program is available in your area.
- If you need further assistance in recycling your AMETEK product, contact us through our Customer Support page at https://www.ametekpi.com/customersupport/request-support.

Classified, Hazardous Area Protection

Components and Functions

NOTE

For complete details about the operation of the purge system, refer to the analyzer User Manual.

The Zone 1 version of the 888 Tail Gas Analyzer is designed to be, and comply with requirements for, electrical equipment in Zone 1 classified hazardous areas. The methods of protection used include type "pxb" (purged/pressurized), and type "d" (flameproof enclosure). The purge system, redundant heater control, and enclosure designs assure that the system will not ignite surrounding gases. For this reason, any repairs must not bypass these safety considerations and must use only recommended components. The purge system consists of a supply of instrument air, the Electronics Enclosure, purge enclosure, and purge exhaust vent.

The purge controller monitors the enclosure pressure and interrupts mains power in the event pressure is lost. A disconnect assembly within a flameproof enclosure isolates all external signals should mains power be disconnected.

After the instrument air (or nitrogen) supply has been connected to the analyzer and turned on, the system is to be purged for approximately 20 minutes to ensure five (5) full exchanges of air within the purged enclosure. The flow is controlled by the purge controller through an exhaust vent. Once the controller senses that there have been five air exchanges within the enclosure, mains power is connected to the electronics.

When the Electronics Enclosure is opened or the pressurization gas supply is lost, the purge controller will disconnect mains power which, in turn, will disconnect all signal wiring. The analyzer should not be used without purge protection unless the area is known to be safe and is being continuously monitored (see Combustible Gas Detection protection techniques in NFPA70 article 500 and 505).

The analyzer must be installed and operated in accordance with this instruction manual.

Working with the purged enclosure in an open position is typically done only during installation, start-up (and verification), and certain troubleshooting and maintenance procedures. In these cases, appropriate safety conditions must have been met, per company policy.

WARNING

The analyzer may only be energized with permission of the works manager or his proxy. Permission may only be given when it has been determined that an explosive atmosphere is not present or when the necessary protective measures against explosion hazards have been taken ("hot permit") during the time that the system is energized.

The analyzer enclosure may not be opened when energized if an explosive atmosphere is present.

WARNING

For normal analyzer operation, the purge system must be on.

Purge Installation

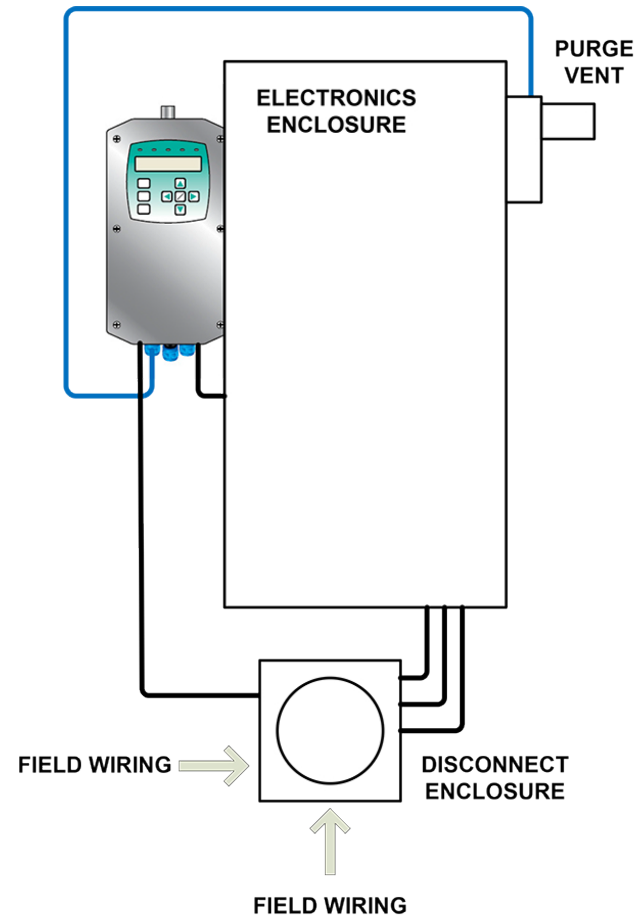


Figure 1.
X-Purge Installation.

1. Maximum non-hazardous area voltage must not exceed 250 V.
2. Installation in accordance with Canadian Electrical Code (CEC), Part I for installation in Canada.
3. Install in accordance with the NEC (ANSI/NFPA 70) and (ANSI/ISA RP 12.6) for installation in the United States.
4. Install in accordance with the IEC60079-11 and IEC60079-14 for ATEX and IECEx installations.
5. Resistance between barrier ground and equipment ground must not exceed one (1) ohm.
6. Wiring for alarm circuit and supply circuit must be routed separately or each must be protected by a grounded shield cable.

888 Tail Gas Analyzer Specifications

For the purpose of this document, specifications listed here apply primarily to the utilities required for the 888 Tail Gas Analyzer. For complete specifications, refer to the 888 Tail Gas Analyzer ATEX-IECEx *User Manual* (PN 883056901).

Utility Requirements

Electrical	120/240, 50/60 Hz, 500 W single phase
Instrument Air	Instrument grade air or nitrogen Minimum/maximum pressure: 379–690 kPa (55–100 PSIG) Air Quality: As per ANSI/ISA-S7.0.01 (1996)
Purge Gas	Zone 1 units only. Regulated instrument air or nitrogen: 3–8.3 bar with flow capacity of 141–340 SLMP.
Steam	Steam Jacketed Ball Valve Option: 515–690 kPa (75–100 PSIG) Blowback: Option: 210–690 kPa (30–100 PSIG)
Loss of Purge Alarm	Rating: 2 Amp, 24 VDC resistive Alarm Connection: Loss of Purge Pressure; Form C Contact
Ambient Temperature Limit	-20 °C to +60 °C (-4 °F to +140 °F) The analyzer must be shaded from direct sunlight or light from luminaires. Sun shade is required.

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888 Tail Gas Analyzer Directives and Standards

EMC Directive 2004/108/EC	Using the following standards: EN 61000-6-2:2005 EN 61000-6-4:2007+ A1:2011 EN 61326-1:2013 FCC Title 47 Part 15 Subpart B, Class A Device ICES-003 Issue 5, August 2012 , Class A Device VCCI V-3/2013.04, V-4/2012.04, R1693 and C-1809 Class A ITE
EU General Safety LVD 2006/95/EC	Using the following standard: EN 61010-1:2010
US/CAN General Safety (Ordinary location)	Using the following standards: UL 61010-1, 3rd Edition CSA C22.2 No. 61010-1, 3rd Edition
US/CAN General Safety (Hazloc)	Using the following standards: ANSI 12.12.01-2010 CSA C22.2 No. 213
ATEX Directive 94/9/EC	Using the following standards: EN/IEC 60079-0:2012+A11:2013 EN 60079-0:2012+A11:2013 IEC 60079-0: 2011 Ed 6 EN 60079-2: 2014 IEC 60079-2: 2014 Ed 6 EN/IEC 60079-2:2007

888 Tail Gas Analyzer Rating Label

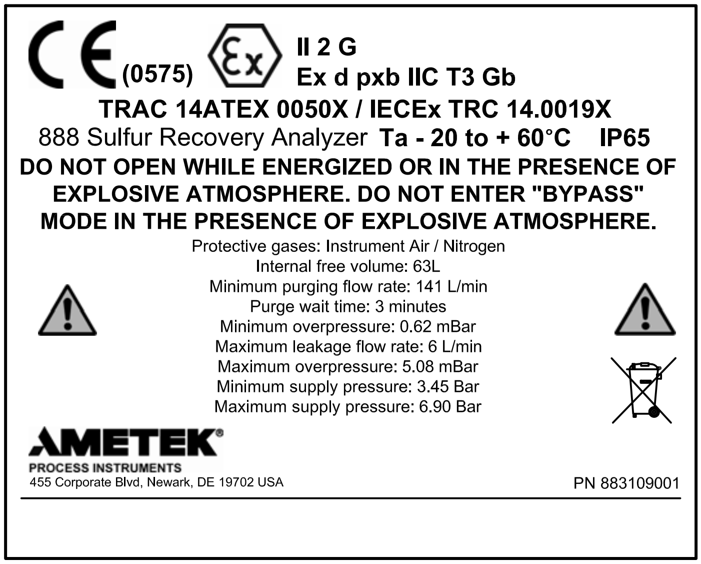


Figure 2.
888-ATEX Label.

Analyzer Markings

CE followed by a Notified body number for DNV (0575) II 2 G Ex pxb IIC T3 Gb IP 65 Tamb = -20 °C to 60 °C

Installation and Start-Up

Pre-Installation Requirements

CAUTION

Installation drawings found in this section are for typical installations. Customer Drawings supplied with the system supersede the drawings included here.

WARNING

The installation of the analyzer must be in accordance with all of the customer (end user) and local regulatory standards and procedures. There are no operator-serviceable components inside the analyzer. Refer service requirements to qualified personnel.

WARNING

Read this entire section before beginning installation of the 888 Analyzer. Failure to do so, and / or use of the analyzer in a manner not specified in this manual, may impair the protection against fire, electrical shock and personal injury originally provided by this equipment.

Personnel Technical Level Required for Installation

Installation must be performed by qualified persons in accordance with local codes and NEC and CEC codes, where applicable. Prior to installation please consult the local codes in order to understand what is acceptable. To the extent this information is not consistent with local codes, the local codes should be followed. **AMETEK recommends that only trained personnel perform these installation steps.**

Unpacking and Inspecting the Equipment

Remove any packing material from the 888 Analyzer shipping crate. Open the analyzer enclosures and inspect all components for obvious damage and broken/loose parts or fittings.

If equipment is damaged, notify the carrier and contact AMETEK Service (https://www.ametekpi.com/customersupport/requestsupport) immediately if parts are missing or damage is found, and to verify if damaged parts will require replacement prior to safely installing and operating the analyzer/equipment.

Analyzer Site Preparation

The 888 Tail Gas Analyzer is approved for installation in hazardous areas classified as Zone 1.

The analyzer must be installed on a horizontal run of the tail gas pipe. A site plan should be prepared defining the system mounting location and provisions for power/data interconnect wiring. It is highly recommended that a servicing platform equipped with safety railings be installed at the analyzer mounting site.

Space Requirements

Refer to Figure 3 (or the "Field Unit Installation" drawing from the Customer Drawing Package). The analyzer weighs approximately 110 kg (243 lb).

Mechanical Installation

Installation Guidelines

- If using an existing sample tap, make sure that it is internally free of solidified sulfur.

- The 888 Analyzer returns the sample gas to the process through the annular space around the O.D. of the probe tube. In most cases, the 1/2-inch O.D. probe tube will be running through a 1-inch bore, leaving a 1/4-inch annulus for sample return. If this annular space is blocked with sulfur, the analyzer's aspirator cannot function properly and may impede sample flow.

- The analyzer's mounting flange has threaded studs (flat washers and nuts provided), welded to the flange. Leave adequate clearance under the analyzer for ease in re-installing the nuts. When lowering the analyzer onto the sample tap, guide the studs into the corresponding holes on the sample tap flange, then attach the flat washers and nuts. Make sure that fittings or other objects do not interfere with rotation of the nuts.

NOTE

A gasket is recommended between the analyzer flange and process valve to prevent process gas leaks.

- The analyzer is shipped with the Demister, sample valve, and probe packaged separately from the Analyzer Oven Enclosure to protect the Demister during shipping. Installation instructions provide assembly details.

- Install the probe only after the analyzer is already in place on the sample tap to minimize escape of process gas.

NOTE

It will be necessary to open the steam-jacketed ball valve on the sample tap during the probe installation process; be sure the valve handle is accessible after probe installation.

- Be careful when removing the Demister temperature sensing probe (RTD) from the Analyzer Oven when installing the probe. The RTD is not designed to be repeatedly bent back and forth or forced into small radius bends. If it must be bent at all, do so slowly and gently, and in a greater than a one-inch radius.

- When installing the Demister assembly, fully insert the tubing in the fitting before attempting to thread the nuts and be careful not to cross thread the Teflon nuts on the stainless fittings. AMETEK will not be responsible for damage to these fittings.

Sample Tap Preparation

The analyzer is pipe-mounted to the process pipe using a probe, ball valve, and flange.

WARNING

The sample pipe contains highly toxic and corrosive substances. Proper personal protective equipment including fresh air breathing apparatus, eye protection, and skin protection MUST BE worn when installing the sample tap.

NOTE

As an additional precaution against escape of toxic gases, AMETEK recommends that a blind flange be installed on the sample tap flange until the analyzer is installed.

CAUTION

Note the bolt-hole pattern and orientation of the analyzer mounting flange in Figure 3. The tail gas pipe flange bolt pattern must line up with the analyzer flange bolt pattern. This will provide two possible analyzer mounting orientations. AMETEK recommends that the analyzer be installed with the backplate parallel to the tail gas pipe.

CAUTION

Ensure that all parts of the sample tap, from the very beginning of the installation process, are kept heated at a minimum 150 °C and insulated from the process pipe to the bottom of the analyzer (including flanges). This will prevent plugging the sample tap with solid sulfur which would interfere with commissioning the analyzer.

NOTE

AMETEK recommends that a heated, 1-inch ball valve with a 2-inch, 150 lb raised face flange (AMETEK PN 203176001) Steam Jacketed Ball Valve or equivalent) be installed on the nozzle.

To install the sample tap:

1. Install the recommended weld neck (two-inch, 150 lb raised face flange) at a 90° angle to the top of a horizontal run of the tail gas pipe.

2. Mount the analyzer directly to this valve flange. Ensure that it is installed plumb and level or the analyzer will not stand straight upon installation (minor angles will not affect analyzer operation). If it is necessary to stand the analyzer off the process pipe by more than 12 inches, use a steam jacketed spool piece. If nozzle length is less than six (6) inches, a heat trace is not necessary. If the nozzle is 6–12 inches, it should be heat-traced at a minimum of 150 °C. Weld necks greater than 12 inches in length are not recommended.

NOTE

Never place the analyzer at such a standoff distance that a sample probe length greater than five feet is required.

3. The sample tap valve handle should be installed so that the handle must be turned down (toward the pipe) to open the valve. If it is installed in such a way that the handle must be turned up (toward the analyzer) to open the valve, the analyzer enclosure may interfere with its being able to fully open.

Installation Drawing

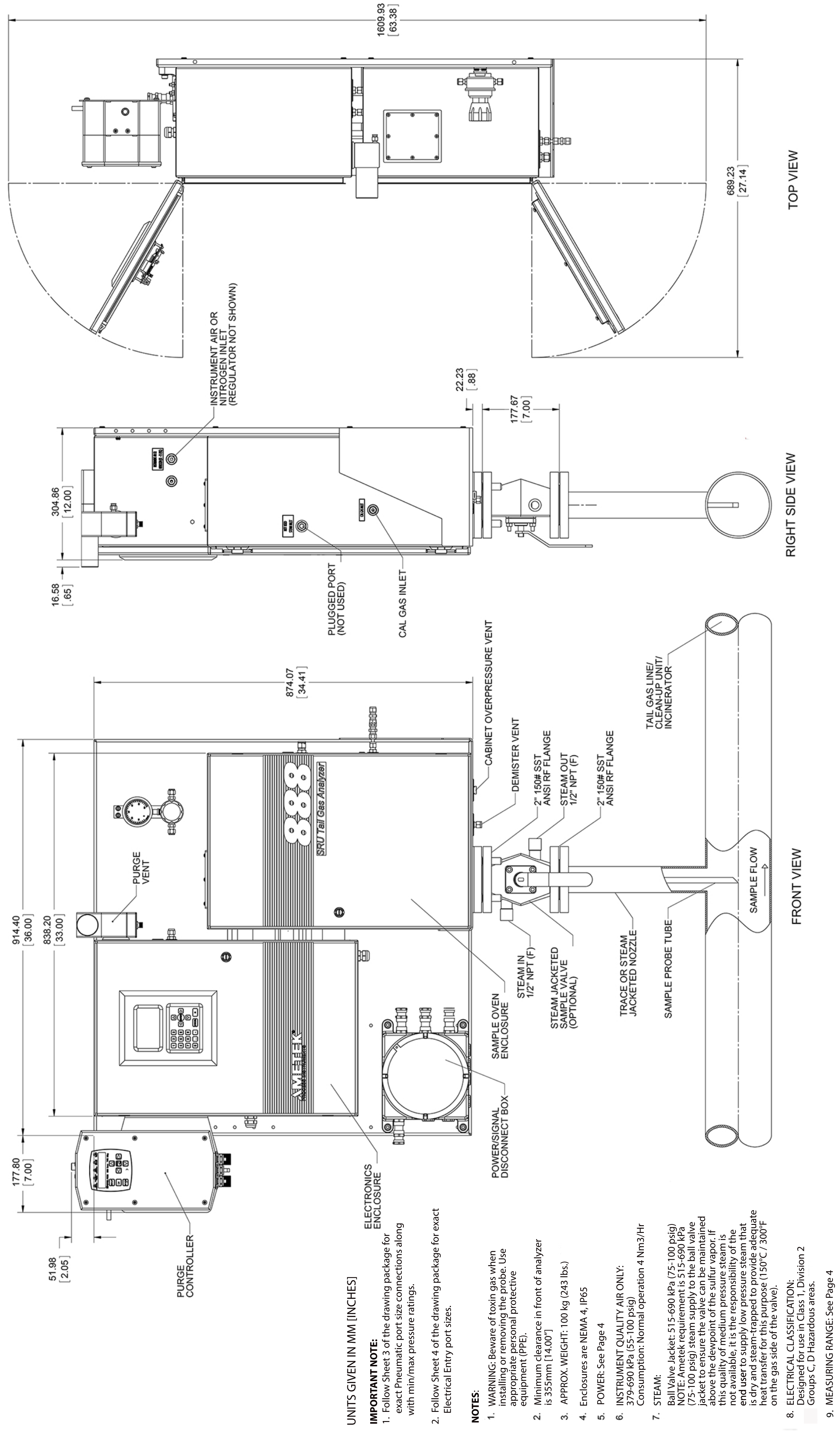


Figure 3.
Installation Drawing.

Installing the 888 Analyzer

WARNING

The sample gas contains highly toxic and corrosive substances. Proper personal protective equipment including fresh air breathing apparatus, eye protection, and skin protection MUST BE worn when installing the sample tap.

NOTE

Refer to Figures 3 and 4.1 or 4.2 for locations of system components.

To install the analyzer:

1. Locate and remove the bolts, nuts, washers, and lock washers from the mounting hardware bag. These will be required to connect the flanges, later in this procedure.

2. The sample return valve (**FV2**), located at the bottom of the aspirator, is a 3/8" valve which is closed when the handle is in a horizontal position and open when in a vertical position.

CAUTION

*Verify that this valve (**FV2**) is CLOSED (horizontal) before proceeding. If it is left open, toxic gases from the tail gas line can flow back through the sample system while the probe is being installed.*

3. Verify that the main sample valve on the tail gas pipe is closed.

WARNING

At this point, all personnel in the immediate area must a use fresh-air breathing apparatus.

4. Remove the blind flange from the ball valve. Test to make sure that the valve is not leaking toxic process gases. If toxic gases are not detected in the area, it is safe to remove the fresh-air apparatus until the probe installation late in this procedure.

5. Install a gasket on the top of the steam jacketed main sample valve. Using suitable lifting equipment, lower the analyzer into place so that:

    - The analyzer back plate is parallel with the tail gas pipe, and

    - The sample inlet flange and main sample valve flange bolt patterns line up. Use the nuts, washers, and lock washers (from the mounting hardware bag) to bolt the flanges together. Use a calibrated torque wrench to torque the bolts in a cross pattern to 54.25 Nm (40 lb/ft).

CAUTION

The integrity of the connection between the analyzer sample inlet flange to the tail gas pipe flange is critical as it provides the primary support for the analyzer.

6. Connect clean dry instrument air supply to the 1/4-inch bulkhead on the right-hand side of the cabinet. If air supply quality is in question, connect through two air/oil separators. Back out the air regulator screw so that air lines on the analyzer are not pressurized.

7. Loosen – but do not remove (unless necessary) – the four (4) screws from the oven cover plate at the top of the Oven Enclosure. The cover plate must be loosened, but may not have to be removed. The screws must be replaced and tightened after probe installation.

8. Prepare the probe. The probe tube is 1/2-inch diameter, 316 stainless steel tubing. The probe supplied is approximately 910 mm (36 inches) long. Cut the probe to a length that results in the probe's end extending into the pipe 1/4 to 1/2 of its diameter.

NOTE

Refer to Figure 3 for probe installation drawings.

Installing the Probe

NOTE

Refer to Figures 3 and 4.1 or 4.2 for location of all inlet, valve, and vent locations and component part numbers.

To install the probe:

1. Install the probe into the 1/2-inch tube fitting on the sample inlet ball valve (**FV1**) using the supplied stainless steel ferrule. Make sure the fitting is tight and leak free.

    - Make sure the flange fitting components (nut, SST ferrule, and Teflon® seal) are loosely installed on the flange fitting.
    - Verify that the sample inlet ball valve (**FV1**) is closed.
    - Scribe a mark on the probe just under the ball valve to aid in orienting the probe correctly.

WARNING

All personnel in the immediate area MUST wear a fresh-air breathing apparatus for the remaining installation steps. Do not remove the breathing apparatus until installation is complete and all fittings have been checked for toxic gas leaks.

2. Install the probe through the sample inlet flange, main process valve, and into the process:

    - Slide the probe tube down into the flange fitting. If the probe tube is longer than 16 inches, it may be necessary to remove the Oven Enclosure cover plate and lower the probe/valve assembly through the top of the Oven Enclosure. Tighten the compression fitting enough to create a seal around the probe while still allowing the probe to slide. Refer to Figure 3. Depending on the length of the probe, it may be necessary to remove the valve handle for the valve to fit through the opening in the top of the Oven Enclosure. If this is the case, the handle must be placed in the CLOSED position before removing the handle.
    - Verify that the analyzer sample inlet ball valve (**FV1**) is CLOSED and remains closed. Continue to slide the probe down through the flange. When the probe tip touches the ball of the main sample valve, back the probe out 1/2-inch and etch a mark on the probe at the top of the flange tube fitting. Open the main sample valve slightly and check for leaks, continue inserting the probe as far as possible. Fully tighten the flange compression fitting. This etched mark will be used for probe removal and replacement.
    - Follow instructions in the analyzer *User Manual* for installation of the probe.

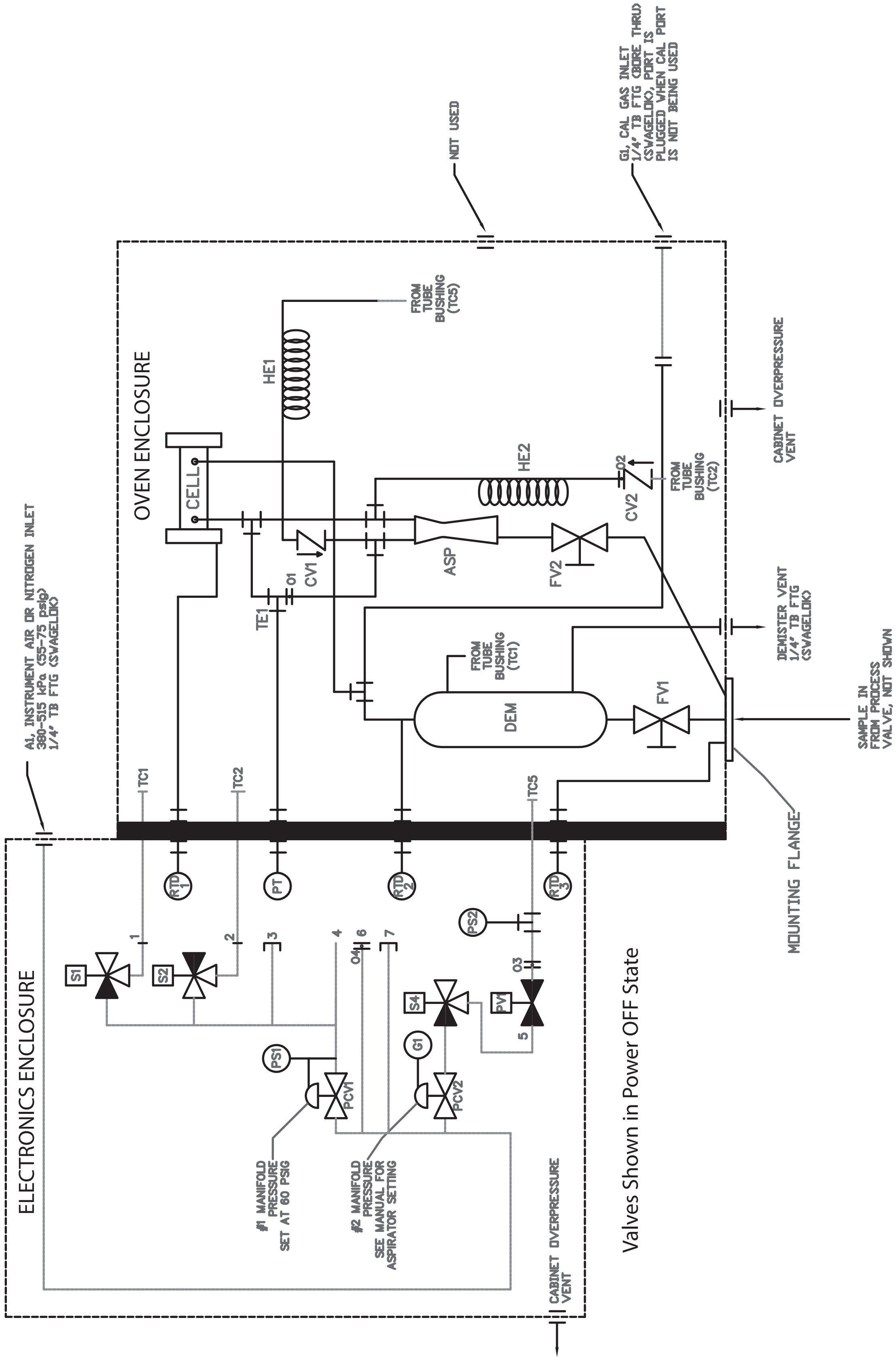


Figure 4.1.
Inlet, Valve, and Vent Location/Flow Diagram, Without Steam Blowback.

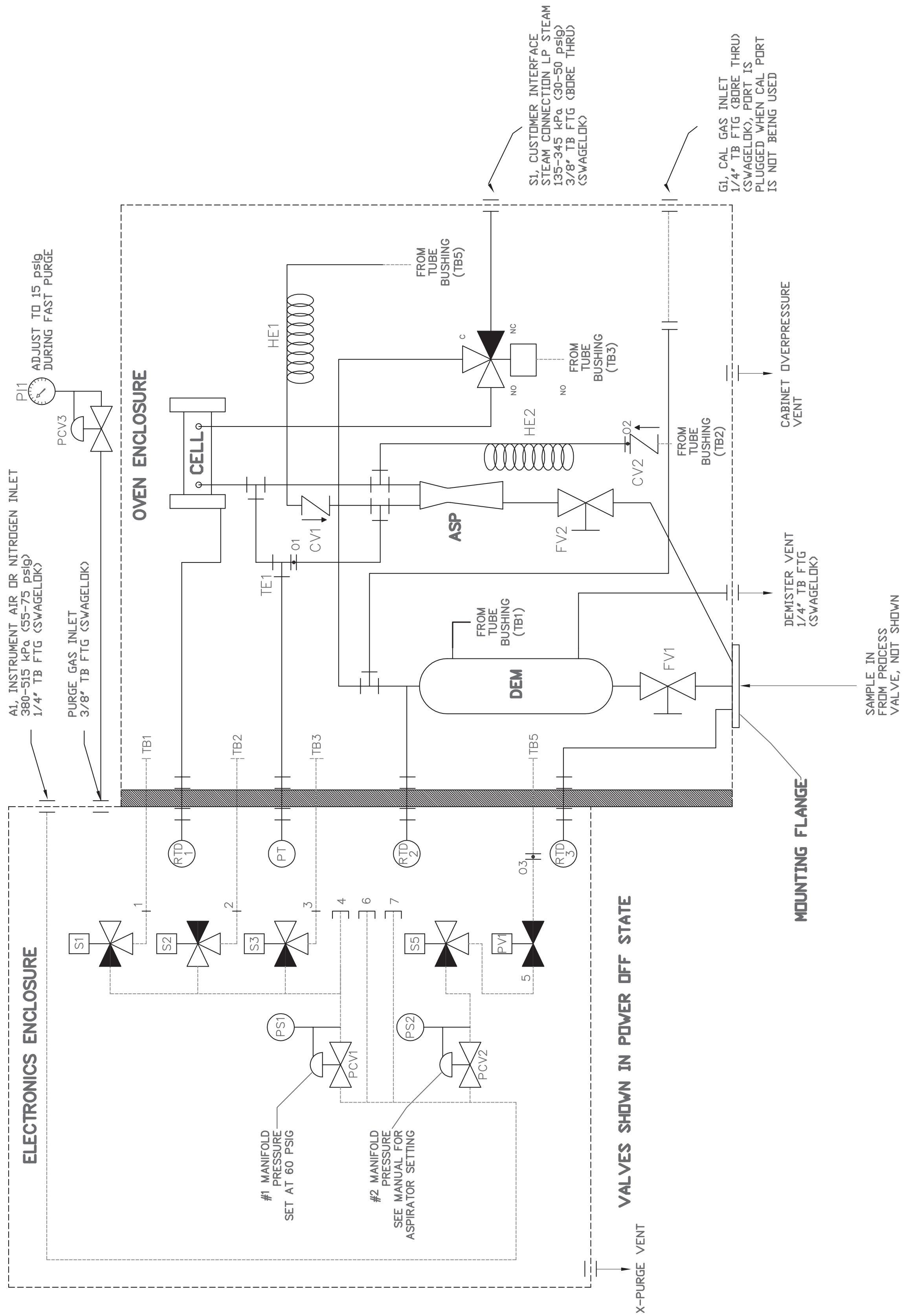


Figure 4.2.
Inlet, Valve, and Vent Location/Flow
Diagram, With Steam Blowback.

Item	Description	Part No.
PV1	Valve, Sample Inlet	271446001
DEM	Demister Assembly, Steam	883026903
	Demister Pad, Teflon	272177001
	Demister Pad, Stainless Steel	271653001
FV2	Valve, Sample Return	273383001
CELL	Cell Assembly, Low Range, 5"	883034901
	Cell Body, 5"	883077001
	Window, Fused Silica, 1.5"	200887001
	O-ring, Viton, 028	202813026
	Gasket, Teflon	880042001
ASP	Aspirator	407300902
FV3	Valve, Steam/Cell Isolation	883096001
CV1	Check Valve, Aspirator	203790001
CV2	Check Valve, Zero Flush, 200 micron orifice	883035001
O2	Orifice, Zero Flush, 200 micron	273454001
O1	Orifice, Pressure Transducer Purge, 50 micron	273455001
HE1	Heat Exchanger, Aspirator Drive	N/A
HE2	Heat Exchanger, Zero Flush	N/A
PCV1	Pressure Regulator, Manifold, 0–100 PSIG	301-0431
PCV2	Pressure Sensor, Aspirator, 0–30 PSIG	301-0430
PS1	Pressure Sensor, Manifold, 0–100 PSIG	403464901
PS2	Pressure Sensor, Aspirator, 0–30 PSIG	403464903
S1,S2,S3,S5	Solenoid Valves (Demister, Zero Flush, Steam Blowback/Cell Isolation, Aspirator)	301-0424
PV1	Valve, Proportional Control, Aspirator	273408001
RTD1	RTD, Cell	883095001
RTD2	RTD, Demister	273402001
RTD3	RTD, Flange	883095002
PT	Pressure Transducer, 0–50 PSIA	273291001
PI1	Gauge, Purge, 0–60 PSIG	273472001

Figure 5.
Parts Legend (refer to Figures 4.2 and 4.2).

Installing the Demister

> *Take necessary precautions to ensure that neither the analyzer sample inlet ball valve (**FV1**) nor the sample return valve (**FV2**) is inadvertently opened during the Demister installation procedure.*

WARNING

To install the Demister:

1. Place the Demister on top of the sample inlet ball valve (**FV1**). Make sure that the 1/8-inch tube fitting is facing the Electronics Enclosure.

2. Locate the 1/8-inch Demister RTD from the Electronics Enclosure and insert it into the 1/8-inch fitting towards the top of the Demister.

3. Push the Demister onto the probe as far as necessary until it meets with the 3/4-inch compression fitting connecting the Demister to the sample inlet ball valve. It may be necessary to slightly loosen the compression fitting on the sample inlet flange and pull the probe/valve assembly up slightly to line up the Demister RTD connection. Loosen only as required.

CAUTION

> *Make sure that the seal between the probe tube and the compression fitting is maintained so that no process gas leaks around the fitting.*

4. Retighten once the 3/4-inch compression fitting is secured.

5. Mate the outlet of the Demister (and calibration gas port depending on sample system selection) to the installed sample system components.

6. Install the remaining tubing connections packaged separately. Refer to the Flow Diagram in the Customer Drawing Package for appropriate connections.

7. Using recommended tightening procedures, verify that all compression fittings inside the Analyzer Oven are tightened.

8. Test all sample tap connections and the sample inlet ball valve to make sure there are no toxic process gas leaks. When satisfied that no leaks are present, remove the breathing apparatus and proceed with the remainder of the start-up procedure.

9. Remove handle of the steam jacketed main sample ball valve to ensure valve cannot be closed while the sample probe is in place. Secure handle nearby so that it is available when needed.

About the Purge System

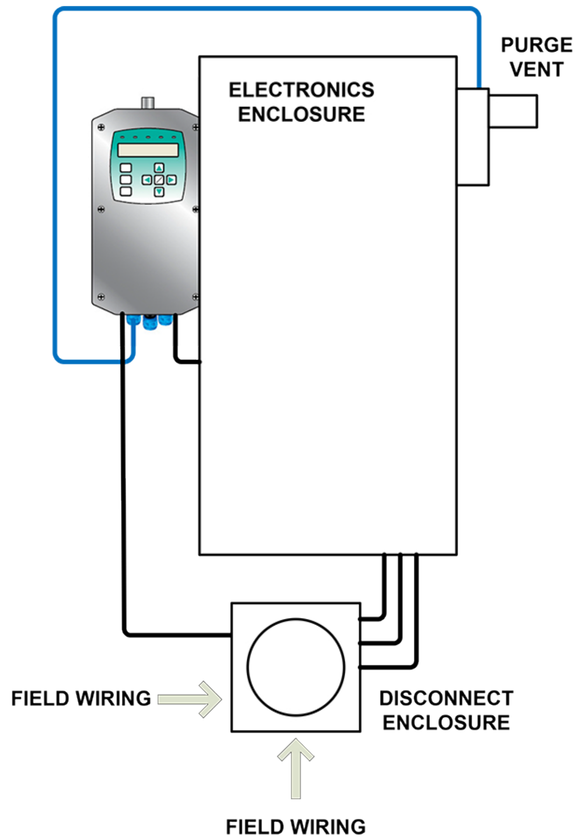


Figure 6.
X-Purge Installation.

1. Maximum non-hazardous area voltage must not exceed 250 V.
2. Installation in accordance with Canadian Electrical Code (CEC), Part I for installation in Canada.
3. Install in accordance with the NEC (ANSI/NFPA 70) and (ANSI/ISA RP 12.6) for installation in the United States.
4. Install in accordance with the IEC60079-11 and IEC60079-14 for ATEX and IECEx installations.
5. Resistance between barrier ground and equipment ground must not exceed 1 ohm.
6. Wiring for alarm circuit and supply circuit must be routed separately or each must be protected by a grounded shield cable.

AC Power and Signal Connections

WARNING

Check ground continuity to all electrical enclosures before applying power.

WARNING

Connections to the AC source must be made only by qualified electricians. AC source must be single-phase, grounded-neutral type.

WARNING

Cable glands suitable for use in a Zone 1 area must be used for all field wiring. The enclosure has been machined to accept M25-size glands.

WARNING

The Customer Connection Enclosure of the 888 Analyzer must be terminated in accordance with country and local electrical codes.

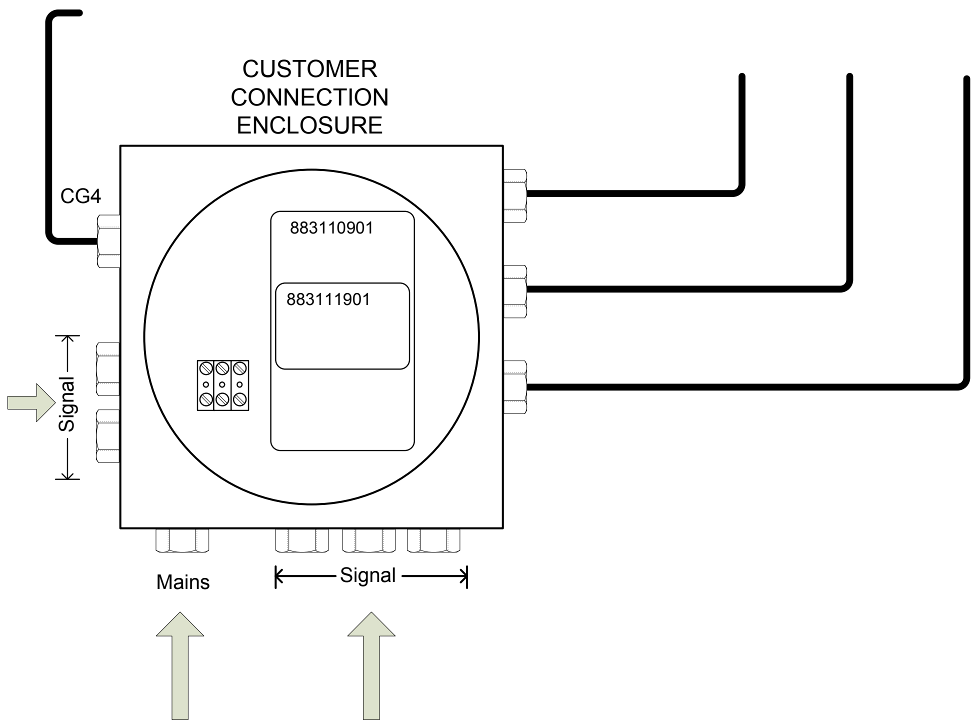


Figure 7.
Customer Connection Enclosure.

NOTE

See Appendix A in the 888 Tail Gas Analyzer User Manual *for all wiring options.*

To make the AC power and signal connections:

1. The 888 Analyzer is considered outdoor, permanently connected and stationary equipment. It is supplied, as ordered by the customer, configured as either a 120 VAC or a 240 VAC unit and contains voltage-dependent subassemblies. Do not attempt conversion in the field by unqualified personnel. Power requirements for the equipment are found both in the Specifications section of this document and on the labels applied near the power inlet located on the equipment or inside the Electronics Enclosure door.

2. AC mains power connection to the analyzer is made in the flameproof enclosure (Customer Connections Enclosure – see Figure 7) mounted below the Electronics Enclosure. AC power must be three-wire, single phase, with line hot (18 AWG), grounded neutral (AWG 18), and separate earth/protective ground (**PE**) (14 AWG). The analyzer must be externally connected to an M5 stud via a 14 AWG wire located to the right side of the customer connections enclosure. Refer to Figure 3-5 for connection details. **DO NOT CONNECT SPLIT-PHASE POWER TO THIS ANALYZER.** Six (6) M25 holes are provided for power and signal cable gland entry/installation. If the incoming power cable is too large, a separate junction box must be provided that can accept the main cable and suitable jumpers used from this box to the analyzer's junction box. Ensure that all unused M25 holes are plugged with hardware appropriate to the area classification.

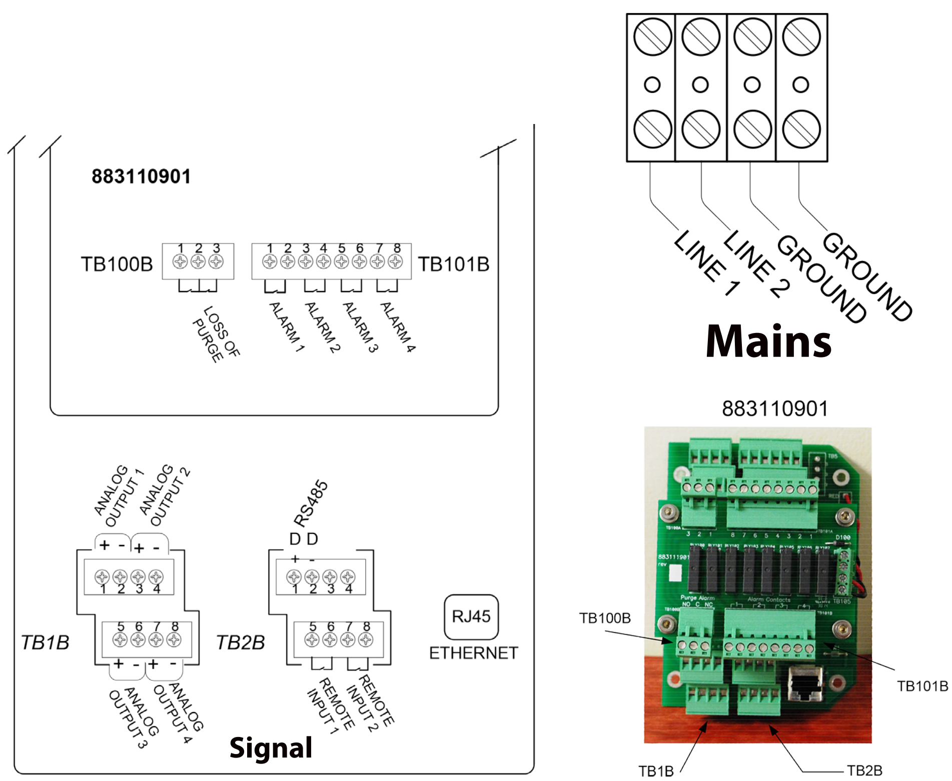


Figure 8.
Interconnect Wiring Diagram.

As a permanently connected piece of equipment without an accessible power switch, the installation must have the following characteristics:

- The installation must include an external disconnect device, such as a switch or circuit breaker, included as part of the installation. The electrical specifications of this device must accommodate the power and environmental requirements of the equipment for the particular application.
- This disconnect device must be in close proximity to the equipment and in easy reach of an operator.
- The device must be permanently marked as the disconnect device for this equipment.

Signal I/O connections are also made in the same flameproof enclosure (Customer Connections Enclosure) mounted below the Electronics Enclosure. Refer to Figures 7 and 8 for details. All customer wiring must have a minimum working voltage of 300 VRMS. Refer to the Specifications section in the 888 Tail Gas Analyzer *User Manual* for customer signal input voltage and current restrictions. A separate junction box may be required if the signal cables are too large for the cable glands provided.

NOTE

If a remote indication of Loss of Purge is desired locations 1, 2, and 3 on terminal block ***TB100B*** *can be used. Refer to Specifications (in the 888 Analyzer* User Manual*) for more information regarding the Loss of Purge contact.*

System Start-Up and Operation

> **NOTE**
> *For complete details about the operation of the analyzer, refer to the analyzer* User Manual.

Sample System Leak Check

Before power is applied and before the sample inlet valve is opened to the process gas stream, it is necessary to ensure that no leaks are present in the sample system.

> **NOTE**
> *AMETEK recommends that the sample system be leak checked after any maintenance or modifications.*

Leak Checking (Without Power)

Necessary Equipment:
Pressure gauge, shut-off valve, and a regulated air supply. Arrange the components as indicated below.

Regulated Air Supply	⟶	Shut-Off Valve ('A')	⟶	Pressure Gauge	⟶	Utility Gas Inlet Port (Analyzer Oven)

To leak check the sample system:

1. Ensure there is no AC power being supplied to the analyzer.

2. Close the Sample Inlet valve (**FV1**) and Sample Return valve (**FV2**) located inside the analyzer Oven Enclosure.

3. Connect a line from a source of regulated instrument air to the Utility Gas Inlet Port (**G1**) on the Oven Enclosure, adding the Shut-off Valve and Pressure Gauge as indicated.

4. Set the instrument air to 50 PSIG (Figure 9) and open the Shut-Off Valve (**Valve A**) to pressurize the system for at least 15 seconds. Record the pressure displayed on the "Test Pressure Gauge" and then close **Valve A** to lock in the air.

5. Observe the Pressure Gauge for 15 minutes to check for a drop in pressure. The pressure must not drop more than 1 PSIG over this period. If there is a leak, use a suitable detergent-based leak detection fluid (e.g. Snoop®) to leak check all of the fittings.

CAUTION

Do not use a leak detection fluid on hot fittings. If the analyzer system is at operating temperature, the components must be allowed to cool down before using a leak detection fluid on the fittings.

6. Repeat this procedure until the system has passed the leak test.

7. Remove the leak check equipment and replace the plug on the Utility Gas Inlet Port (**G1**).

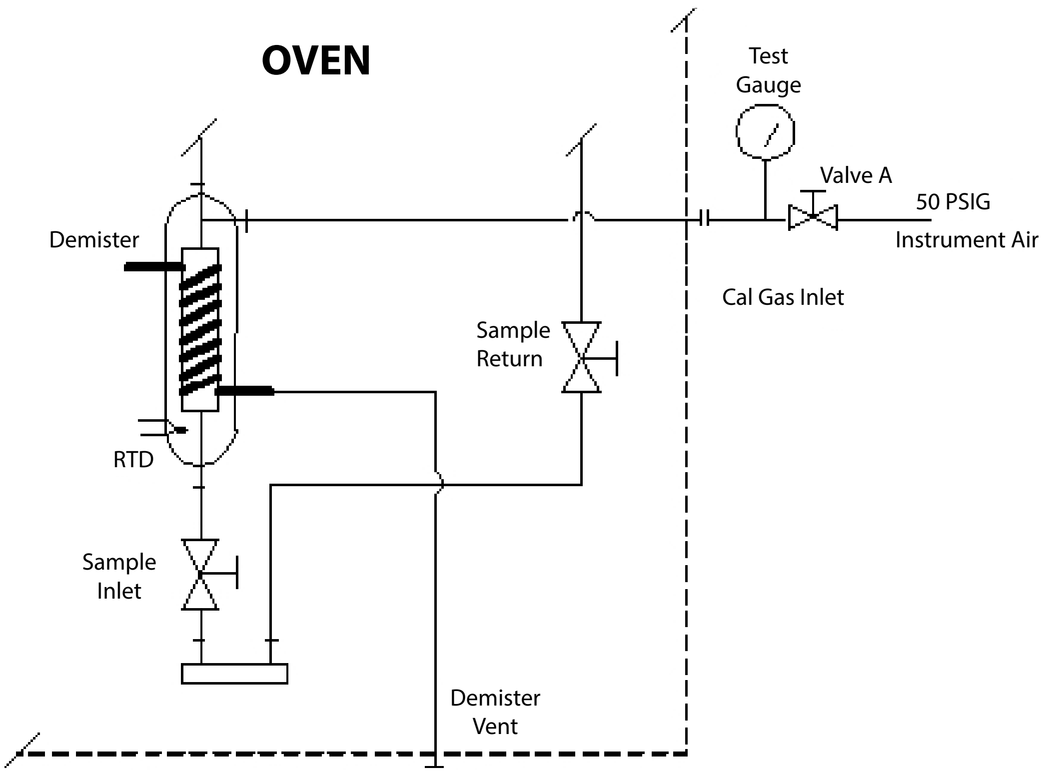


Figure 9.
Sample system leak test equipment setup.

Purging the Electronics Enclosure

A purge controller and vent system maintain a positive pressure preventing explosive gases from entering the Electronics Enclosure. On start-up, the purge controller will automatically monitor the purge gas flow to ensure a minimum of five (5) air exchanges before providing power to the Electronics Enclosure. The controller then monitors the enclosure's internal pressure. In the event that positive pressure is lost, power will be disconnected from the electronics. All input and output signals are disconnected by relays in the flameproof enclosure should power be interrupted by the purge controller.

CAUTION

A regulated supply of instrument air or nitrogen must be connected to the purge gas regulator. The regulator is located to the right of the Electronics Enclosure. Refer to the Specifications chapter in the analyzer User Manual for specifications.

CAUTION

The installer must install a second pressure regulator on the input of the unit to mitigate any risk from a single regulator failure in the system.

CAUTION

After the analyzer is installed on a process gas pipe, instrument air pressure must be maintained at all times, even when the analyzer is powered down or off-line, to keep corrosive gases and moisture out of the enclosures and prevent damage.

For the Electrical Enclosure Purge System to operate properly the enclosure's door must be securely closed.

Adjusting the Purge Controller

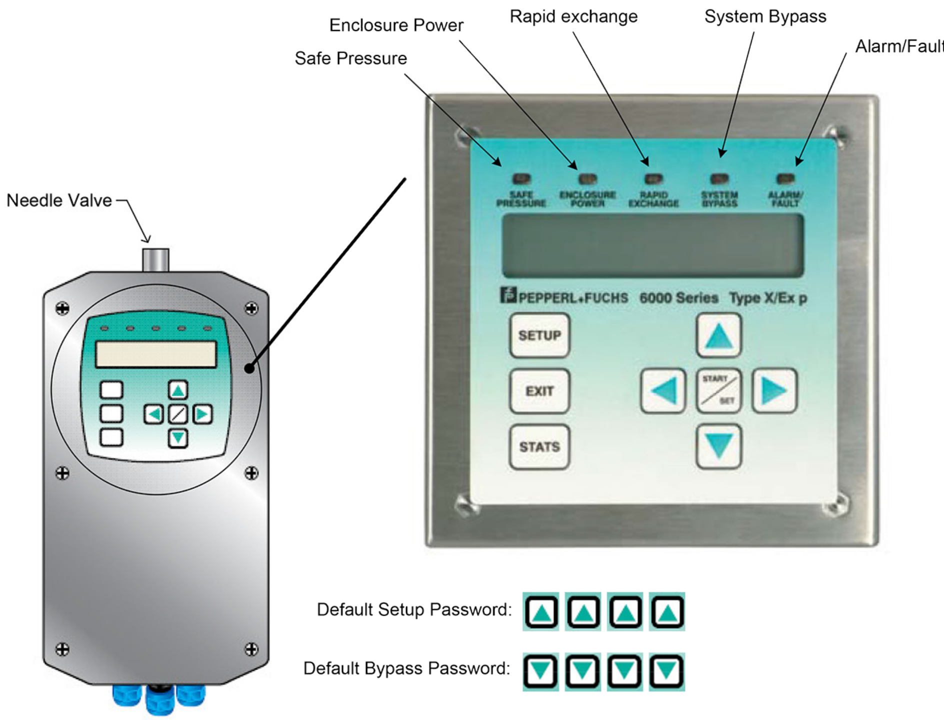


Figure 10.
Purge Controller and Default Password.

The purge controller is programmed at the factory to run automatically. However, it may be necessary to make adjustments based on the utilities present at the installation site.

1. Connect a regulated source of instrument air or nitrogen to the purge inlet.
2. Locate the terminal block inside the flameproof enclosure. Apply AC mains power to the terminal block.
3. After power has been applied, the purge controller will start a fast purge of the Electronics Enclosure.

   If a fast purge does not start:
   Check the BLUE "**SAFE PRESSURE**" indicator on the purge controller to ensure that it is turned On.

*If the BLUE "**SAFE PRESSURE**" indicator is not turned On:*
Locate the adjustment valve at the top of the purge controller. Use a flat-blade screwdriver to adjust the pressure (maximum 60 PSIG). Turn the valve slowly counter-clockwise until the BLUE indicator turns On ensuring that the purge enclosure senses sufficient pressure.

- Locate the adjustment valve at the top of the purge controller. Use a flat blade screwdriver to adjust the pressure.

- Turn the valve slowly counter-clockwise until the blue indicator turns on ensuring that the purge enclosure senses sufficient pressure.

4. The purge controller will purge the Electronics Enclosure for a minimum of five (5) air exchanges. After a short period, the time remaining for the fast purge will be displayed on the purge controller. Once the time displays, it will take three (3) minutes for the fast purge to complete.

5. The gauge on the regulator at the right side of the panel should read a nominal 104 kPa (15 PSI) during the fast purge. Adjust the regulator if necessary to read the nominal pressure.

6. Once the fast purge is complete, the purge controller will connect power to the analyzer electronics. The flow rate will drop noticeably and the gauge on the purge regulator will increase several PSI. This change in the pressure reading is normal. Do not readjust the regulator.

NOTE

Refer to the Pepperl + Fuchs 6000 Series Purge Controller Instruction Manual for further details on the purge controller.

NOTE

Default passwords are indicated in Figure 10.

Starting Normal Operation

1. Connect the air supply and set the pressure regulator for approximately 55–75 PSIG.

2. Close Aspirator air valve (**FV1**). Back off the Aspirator Regulator (**PCV2**) by manually turning the adjustment knob on the Aspirator Regulator counter-clockwise to reduce pressure to 0 PSIG .

3. Open the sample inlet ball valve (**FV1**) and the sample return valve (**FV2**) at the bottom of the aspirator. Close and tighten the latches on the Oven Enclosure.

4. Verify that the Electronics Enclosure and Detector Enclosure doors are closed and properly secured.

5. Apply AC power and observe the User Interface display screen activity.

Figure 11.1.
Start-up screen.

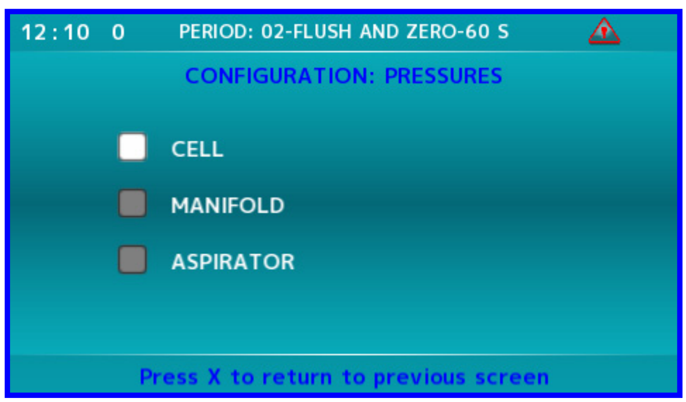


Figure 11.2.
Configuration Pressures screen.

The analyzer will start in Period 1 “Special Flush” and will advance to Period 2 “Flush and Zero” when the default Period 1 timer elapses. Air (or nitrogen) will be flowing back through the sample system; this prevents sample gas from entering the system until the sample cabinet is up to proper operating temperature (nominally 150 °C). Refer to the Timing/Logic Tables and Flow Diagrams in the Customer Drawing Package.

When the analyzer components reach operating temperature, the controller will perform an auto-zero of the photometer and then enter Period 3 "Sample Flush."

Sample will not flow through the Measuring Cell until positive flow is attained by adjusting the aspirator pressure.

Allow 2-4 hours for complete thermal stabilization of the Measuring Cell and Demister.

Setting the Sample Gas Flow

To set the sample gas flow, navigate to the menu item CONFIGURE on the **HOME** screen and press the **Enter** "↵" key.

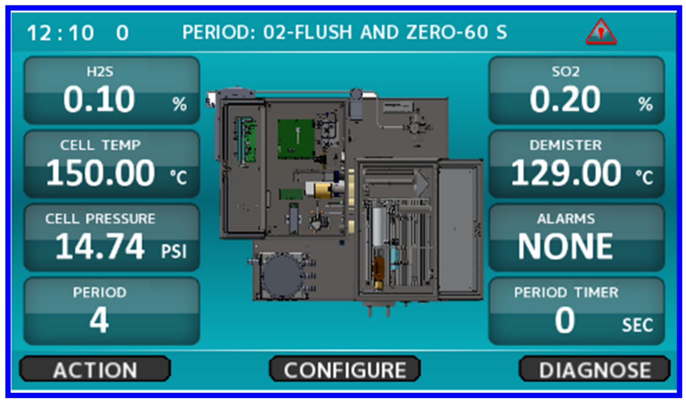


Figure 12.1.
HOME screen, LCD Display (User Interface).

Use the right and left Arrow keys to advance to the **PRESSURES** screen. Press the **Enter** "↵" key to select the **PRESSURES** menu.

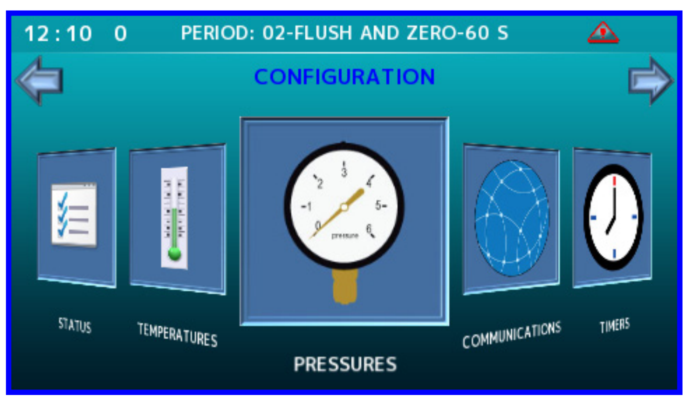


Figure 12.2.
Pressure Menu.

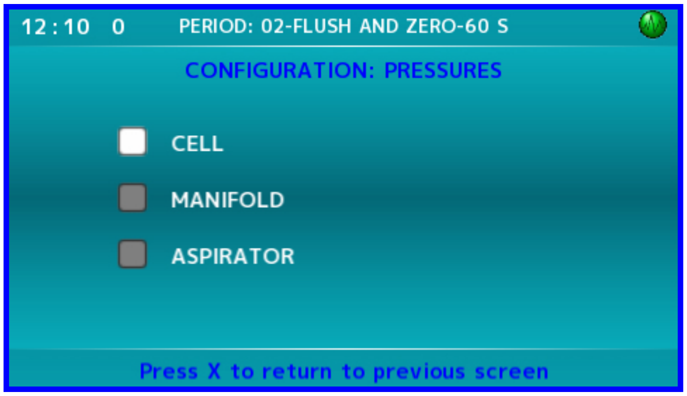


Figure 12.3.
Pressure Configuration screen.

Use the Arrow keys to navigate to **Aspirator Pressure** configuration screen and press the **Enter** "↵" key.

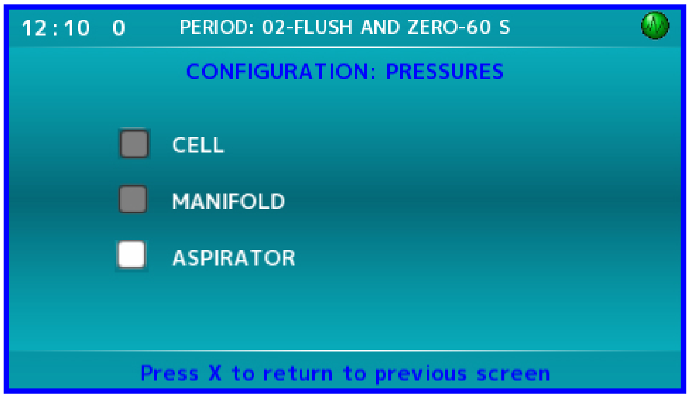


Figure 12.4.
Configuration screen.

To set the Sample Gas flow:

1. Locate the Aspirator Regulator Pressure gauge (bottom regulator in drawing). Set the aspirator regulator pressure until the gauge reads approximately 10 PSI above the process pressure.

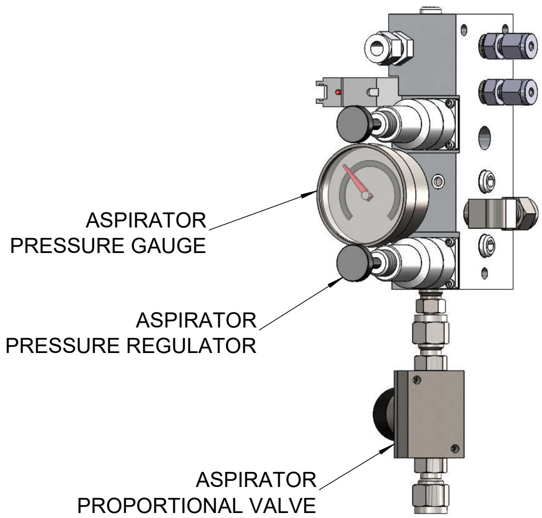


Figure 13.
Aspirator Regulator and Proportional Solenoid Valve (inside Analyzer Oven).

2. Make sure the **Aspirator Override** slide switch is in the **No** position.

Figure 14.
Neutral, de-activated position.

3. Check that the **Flow Setpoint** is set to 1.5.
4. The analyzer will now regulate sample flow automatically in Period 4 "Measure."
5. Press the "**X**" key to return to the previous screen and then the "**#**" key to return to the **HOME** screen.

Analyzer Timing/Logic Table

All 888 Tail Gas Analyzer functions are broken down into 14 Timing periods. See Timing/Logic Table.

- Periods 1–4 are the normal Sample cycle and Zero calibration periods.
- Periods 1–11 are fully programmable and are run for a length of time in seconds.
- Periods 12–14 are special "Hold" Timing periods.

NOTE

Descriptions of events during various timing periods are for typical operation only. Some events can be altered by changing period timers.

	Period	Name	Time (s)	SV1 - Demister, Normally Closed	SV2 - Flush Solenoid, Normally Open		SV3 - Steam Blowback Solenoid, Normally Closed	FV3 - Steam Blowback Valve, Steam Blowback (Normally Closed)	PV1 - Aspirator Proportional Valve, Normally Closed
Zero Calibration	1	Special Flush	0	Controlling	De-energized	Open	De-energized	Closed	Closed
	2	Flush and Zero	60	Controlling	De-energized	Open	De-energized	Closed	Closed
Sample Cycle	3	Sample Flush	60	Controlling	Energized	Closed	De-energized	Closed	Open
	4	Track Sample	N/A	Controlling	Energized	Closed	De-energized	Closed	Open
Zero and Photospan Calibration	5	Flush and Zero	60	Controlling	De-energized	Open	De-energized	Closed	Closed
	6	Track Zero	0	Controlling	De-energized	Open	De-energized	Closed	Closed
	7	Photospan Calibration	60	Controlling	De-energized	Open	De-energized	Closed	Closed
	8	Track Photo Calibration	10	Controlling	De-energized	Open	De-energized	Closed	Closed
Steam Blowback Cycle	9	Pre-Steam Flush	10	Controlling	De-energized	Open	De-energized	Closed	Closed
	10	Steam Blow Back	20	Controlling	De-energized	Open	Energized	Open	Closed
	11	Post Steam Flush	60	Controlling	De-energized	Open	De-energized	Closed	Closed
Special Periods	12	Continuous Flush	N/A	Controlling	De-energized	Open	De-energized	Closed	Closed
	13	Continuous Hold	N/A	Controlling	Energized	Closed	De-energized	Closed	Closed
	14	Continuous Sample	N/A	Controlling	Energized	Closed	De-energized	Closed	Open

*This Logic Table depicts the 888 Analyzer with Steam Blowback option selected. Please contact factory for more information.

1. Restarting the main timer will cause the controller to advance immediately to Period 2.
2. When Period 4 elapses, the analyzer remains in **Sample Tracking** mode. Normally, Period 4 ends only when the Zero Timer or the Calibration Timer elapses. If both of those timers are Off then the analyzer remains in Period 4 indefinitely. When the Zero Timer elapses, either a Zero calibration or a Steam Blowback Cycle is started. Period 4 can be manually terminated by initiating a Zero only or Zero and Photo Span Calibration.
3. During a Zero and Photo Span Calibration the analyzer advances from Period 7 to Period 8, unless the steam counter reaches '**0**' and initiates the Steam Blowback cycle.
4. SV1 cycles on and off at a given duty cycle, based on Demister temperature. As the Demister heats above its upper setpoint, it opens; as it falls below the lower set point, it closes. It is not dependent on analyzer Timing periods.
5. Special Periods 12, 13, 14 are only to be accessed and used by factory-trained service personnel, or per guidance from AMETEK Service representatives.

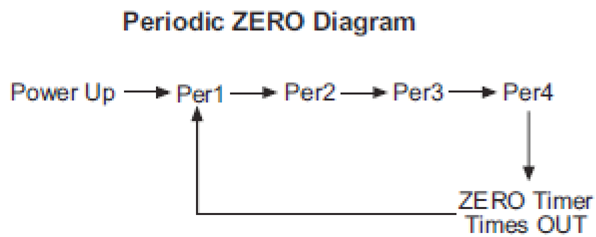
   They are never used during normal analyzer operations.

Figure 15.
Timing/Logic Table.

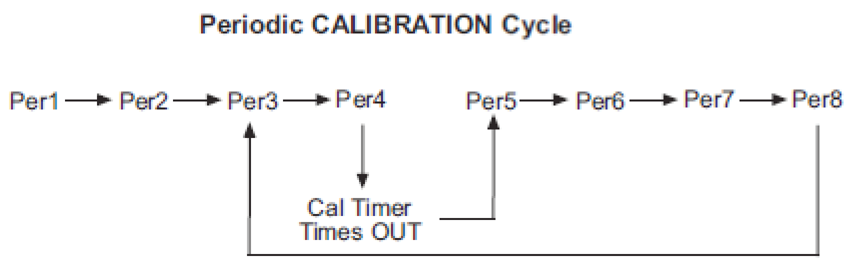
Normal Timing Sequence

The Timing/Logic Table (Figure 15) shows the sequential timing Periods 1–14. When power is first applied, the controller starts at Period 1 and cycles through to Period 4 "Sample Tracking" which continues indefinitely until one of the following events occurs:

1. When the Zero Timer elapses, normally a Zero calibration is started immediately, but when the option is available, a Steam Blow Back Cycle can also be started. When this timer elapses, the Zero calibration begins at Period 1, advances to Period 2 where the Zero Offset values are recorded, advances to Period 3 and on to Period 4. This cycle, 1→ 2 → 3 → 4 → 1 etc., is the normal sampling operation loop.



2. When the Calibration Timer elapses, a Calibration Cycle starts immediately. The calibration cycle begins at Period 5 in which the Zero Offset values are recorded. It then tracks the Zero values through Period 6, advances to Period 7 where the Photo Span values are verified or adjusted, tracks the Span values through Period 8, and returns to Period 3 to resume the normal Sampling Cycle 3 → 4.



3. When the Calibration Timer elapses and the following occurs, then a Steam Blow Back Cycle is started instead of a Calibration Cycle.

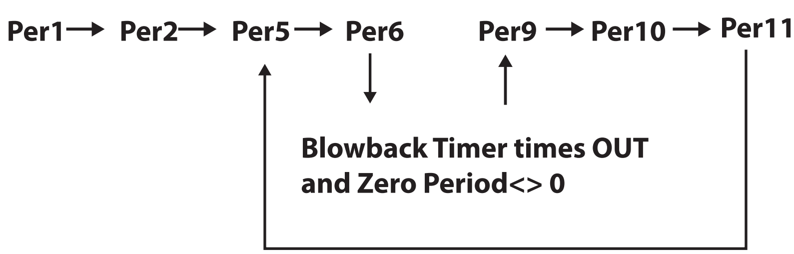
   - The Zero Period parameter, which defines the number of Zero or Calibration cycles between Steam Blowback cycles, is not equal to zero; and

   - The Zero Period number of Zero or Calibration cycles have elapsed since the last Steam Blowback.

4. Steam Blow Back Cycle.

   - Period 9 "Pre-Steam Flush" – flushes the system with air.
   - Period 10 "Steam Blowback" flushes steam back through the Demister and probe.
   - Period 11 "Post-Steam Flush" flushes the system with air again before beginning the Calibration Cycle by advancing to Period 5 "Flush and Zero."

Periodic STEAM BLOW BACK Diagram



NOTE

*If using the automatic Steam Blowback function, do not set the **Blowback Interval** to a value less than 16 or run the cycle more than once per day.*

WARNING

If your analyzer requires Steam Blowback to run more than once per day, contact AMETEK Service.

For detailed information about the analyzer Periods and Timing sequence, please refer to the analyzer *User Manual*.

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Maintenance and Troubleshooting

Generally, little maintenance is required to ensure the analyzer remains operating at peak efficiency, other than that described in the section "Cleaning and Replacing Parts" in the Troubleshooting and Maintenance chapter of the 888 Analyzer *User Manual*. This maintenance, which includes parts that require scheduled replacement and cleaning, is intended to ensure continued and proper operation of the analyzer.

WARNING

*Before performing maintenance on the analyzer, be sure to follow appropriate actions and precautions to prepare the analyzer for service, such as properly isolating the analyzer from the sample gas stream/duct, backpurging the sample line (**Flush/Zero** mode), powering down the analyzer (unless it is necessary to keep the analyzer operating), and opening the Electronics Enclosure.*

For certain procedures, such as replacing source lamps, it is not required to isolate the analyzer sampling system from the sample gas stream. Refer to the Maintenance and Troubleshooting chapter of the analyzer *User Manual*.

CAUTION

Take precautions against ESD (electrostatic discharge) damage while performing the following operations. Precautions include using a grounded wrist strap, working on a grounded/anti-static work surface, and storing electronic assemblies in anti-static packaging.

CAUTION

Always disconnect power and/or external power sources to the analyzer before opening any covers or doors on the analyzer to check on any components or to perform maintenance within the enclosures.

WARNING

If it is necessary to open the analyzer's covers or doors while the circuits are live, first test the area for flammable gases and proceed only when the area is safe.

Cleaning/Replacing Parts in the Sampling System

NOTE

For information about how to determine if and when analyzer parts require cleaning or replacement, refer to appropriate sections in the Maintenance and Troubleshooting chapter of the analyzer User Manual.

To clean and/or replace parts in the analyzer sampling system:

1. Manually Zero the analyzer (**Flush/Zero** mode), isolate the analyzer sampling system from the sample gas stream, and power down the analyzer as described in the analyzer *User Manual*.

2. Continue with the procedures to disassemble, clean or replace parts, and reassemble the appropriate sampling system components and all associated sample system tubing.

3. Restore power to the analyzer as described in procedures in the analyzer *User Manual*.

4. Perform a leak (pressure) check on all sample system fittings that were disconnected/reconnected.

Other Maintenance

WARNING

If it is necessary to perform maintenance on the analyzer while its circuits are live and with its Electronics Enclosure door open, first test the area for flammable gases and proceed only when the area is safe.

When the Electronics Enclosure is open, take appropriate precautions to avoid electrical shock. Hazardous voltages are present inside.

If a procedure for a certain maintenance task is not described in the analyzer User Manual, contact AMETEK Service Personnel for details about performing the required maintenance.

WARNING

When performing equipment maintenance in hazardous areas, all safety standards and procedures must be followed, as specified by the Owner Company, local electrical-inspection authority, and National/ EU regulations.

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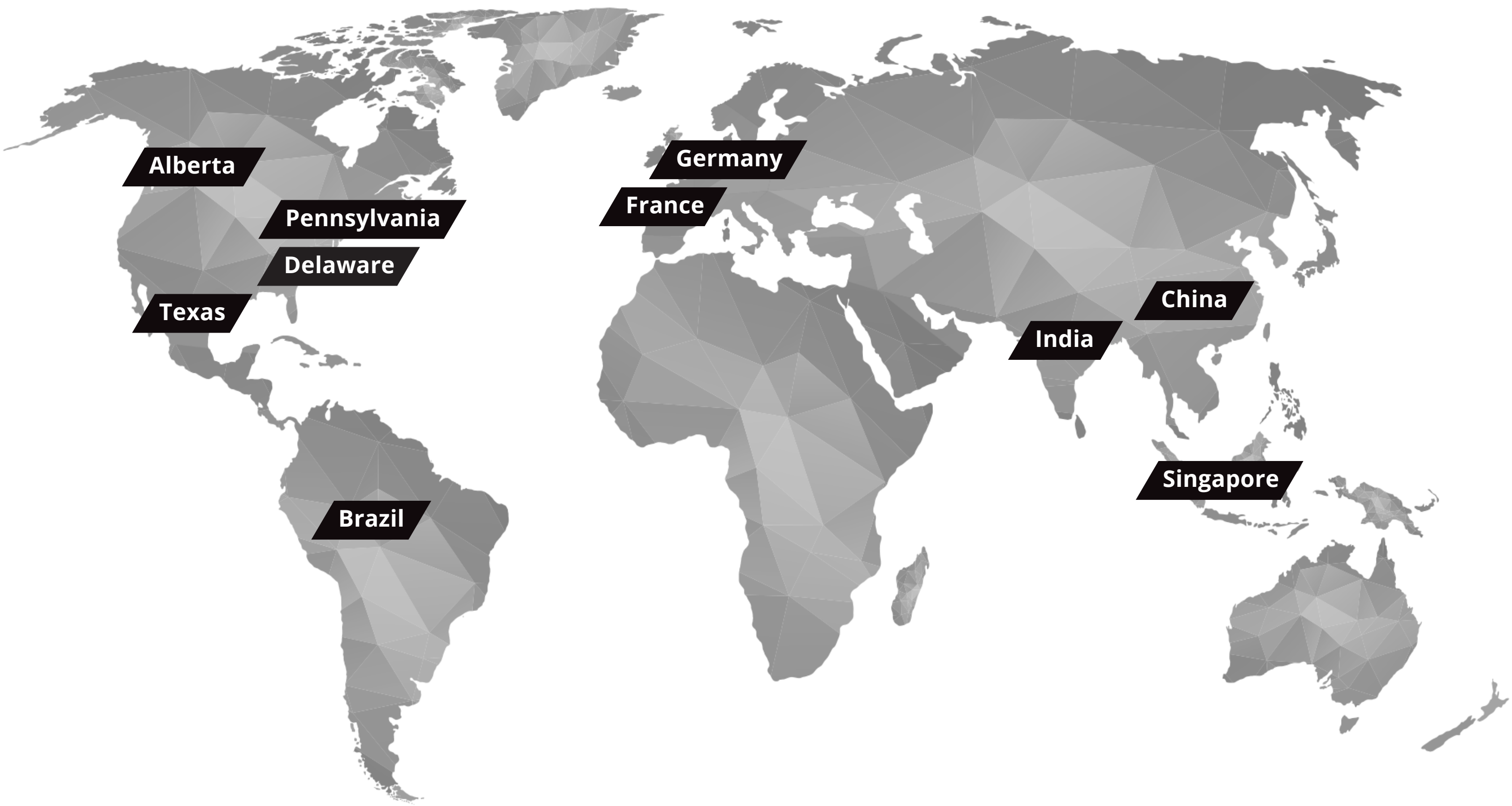

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