# AMETEK Western Research 5000 Moisture Analyzer

# Essential Health & Safety Requirements

PN 500088003, Rev E

**Process Instruments**
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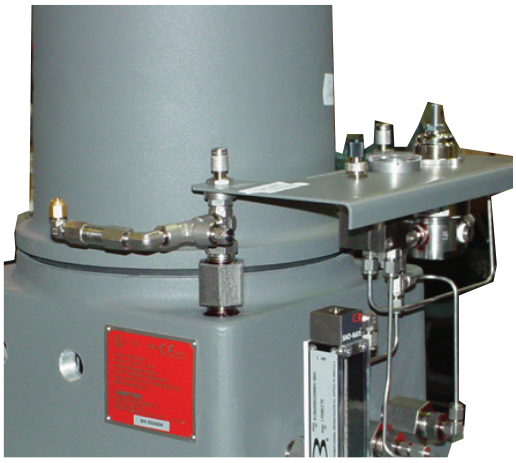
### Analyzer Serial Number Location

The analyzer serial number label is located on the left-hand side of the analyzer base.





This manual is a guide for the use of the Model 5000 Moisture Analyzer (Single Point). 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

## About This Document

This document primarily describes the essential health and safety requirements for the components that make up the Model 5000 Moisture Analyzer intended for use in explosive atmosphere locations. These sections are described below.

The procedures and information discussed in this document include only abbreviated steps to install, operate, and perform maintenance on the Model 5000 Moisture Analyzer. They do, however, include all relevant safety warnings and cautions to ensure the safety of personnel and the analyzer in explosive atmosphere locations. [For complete and detailed descriptions of the procedures discussed in this guide, refer to the analyzer User Manual.]

### 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.*

### Important Safety Information

Before working on the analyzer, read and understand the following Notes, Warnings, and Cautions, which contain important safety and general information that applies to all aspects of working on the analyzer.

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

## Warnings

Review and follow these Warnings to avoid personal injury or environmental contamination.

**WARNING**

*High voltages are present in the analyzer housing. 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.*

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

*When the enclosure is 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 policies 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.*

**WARNING**

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

**WARNING**

*Before working on the analyzer, test the area for flammable gases. If a flammable gas atmosphere is present, do not open any doors without first disconnecting power and/or alternate power sources to the analyzer.*

**WARNING**

*The field unit may contain flammable or toxic process gas. Remove the field unit dome lid in a well-ventilated area only after electrical power is removed and the surrounding are is known to be nonhazardous..*

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

**WARNING**

*If the Sample System Enclosure is heated, the components within it will be hot; take precautions to avoid burning yourself.*

**WARNING**

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


*The sample gas may contain 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 lid for inspection or maintenance.*


*If sampe gases contain highly toxic and corrosive compounds, analyzed sample must be returned to the process or vented to a safe area.*

## Cautions

Review and follow these Cautions to avoid damaging the equipment.


*The electronic circuit boards and other static-sensitive components should be stored and transported in static-shielding carriers or packages.*


*For electrical-shock protection, the analyzer must be operated from a grounded power source that has a securely connected protective-ground contact.*


*If it becomes necessary to handle any of the electronic circuit boards, do not subject the boards to static discharge. The ideal solution is a static-safe work area. Since such areas typically are not available at analyzer installation sites, the use of a wrist strap connected directly to a ground is recommended. If a wrist strap is not available, you should at the very least touch the metal chassis (to ground yourself) before handling or touching the boards.*


*Take extreme care to avoid damaging the threads on the cable entry glands. Clean, defect-free threads are essential to ensure a flameproof connection.*


*The lid weighs 8.2 kg (18 lb). Use proper lifting methods and wear protective footwear when removing.*

## SPECIAL WARNINGS AND INFORMATION FOR USE IN HAZARDOUS LOCATIONS

### 5000 CONTROLLER

This Equipment is Suitable for Use in Class I, Division 2, Groups ABCD,T4, ATEX Zone 1, IIC, T6, or Non-Hazardous Areas Only.


*Explosion Hazard - Substitution of Components May Impair Suitability for Class I, Division 2 and or ATEX Zone 1.*


*Explosion Hazard - Do Not Disconnect Equipment Unless Power Has Been Switched Off or the Area is Known to be Non-Hazardous.*

### 5000 Field Unit


*To reduce the risk of ignition of hazardous atmospheres, disconnect the equipment from the supply circuit before opening. Keep assembly tightly closed when in operation.*


*To reduce the risk of ignition of hazardous atmospheres, conduit runs must have a sealing fitting connected within 18 inches of the enclosure.*

### When 5000 System includes EEx Sample System Components

### Special Conditions for safe use:

The special conditions for safe use give in the European certificates mentioned in the manufacturer technical file are still relevant. Be aware of special instructions and warnings on all sample system components.

When an IS type option is provided, proper grounding, selection of certified barriers, energy considerations, and use of accepted wiring methods is the responsibility of the end user / installer. See manufacturer's certificate for entity parameters.

Refer to Section 501.4(b) of the NEC or 18-152 of the CEC for proper wiring connections to the service and installation accessible field terminals on the customer wiring module. See Section 501-3b(6) of the NEC or 18-172, 174 of the CEC for flexible mains connect.

Do not use the "Alarm" or "Relay" Functions on the customer wiring module to energize motors, pumps, or any other device that could present an overload condition during normal operation.

Refer to Customer Wiring Diagrams and Installation Instructions contained in this Manual and the Document Package included with this Instrument.

## Warning Labels

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

PROTECTIVE CONDUCTOR TERMINAL

CAUTION - Risk of electric shock

CAUTION - Refer to accompanying documents

CAUTION - Hot Surface

# Specifications

For a complete listing of all analyzer specifications, refer to the analyzer User Manual.

### Utility Requirements

All systems are available with choice of nominal AC voltages:

Field Unit:

- 100V ±10%, 50/60 Hz, 175W max.
- 115V ±10%, 50/60 Hz, 175W max.
- 230V ±10%, 50/60 Hz, 175W max.

Controller:

- 95–230V ±10%, 47-63 Hz, 75 W max.

### Outputs

- 80-character vacuum fluorescent display
- Two 4 to 20 mA DC analog signals with completely user-defined span; one analog output is auto-ranging
- RS-485 bidirectional serial port

### Alarm Contacts

- System Alarm
- Concentration Alert
- Range or Verification Alert

  (Contacts rated 30 VAC / 60 VDC, 50 VA maximum, 1A maximum, resistive)

### Allowable Inlet Pressure

207 to 690 kPa gauge (30 to 100 PSIG)

## Operating Pressure

103 kPa gauge (15.0 PSIG)

## Gas Flow Requirements

250 mL/min each at 103 kPa gauge (15 PSIG) for sample, reference, and moisture generator.

## Approvals and Certifications

UL/CSA General Safety Requirements

**Controller:**

UL/CSA Class I, Division 2, Groups ABCD, T4
ATEX, Zone 1,

Ex db IIC, T6 Gb
-12°C ≤ Tamb ≤ 60°C

**Field Unit:**

UL Class I, Division 1, Groups BCD
CSA Class I, Division 1, Groups BCD, special acceptance
ATEX, Ex db IIC, T5 Gb
-20°C ≤ Tamb ≤ 50°C

Electromagnetic Compatibility Directive; 2014/30/EU
EN 61326-1: 2013

Low Voltage Directive; 2014/35/EU
EN 61010-1: 2010

Pressure Equipment Directive

ATEX Directive; 2014/34/EU
EN 60079-0: 2012/A11: 2013
EN 60079-1: 2014

Russian Gosstandart Pattern Approval

Russian Ex Proof Certification 1ExdIICT6

## Analyzer Markings

The Model 5000 Moisture Analyzer will be marked with a corresponding label to indicate its ATEX certification.

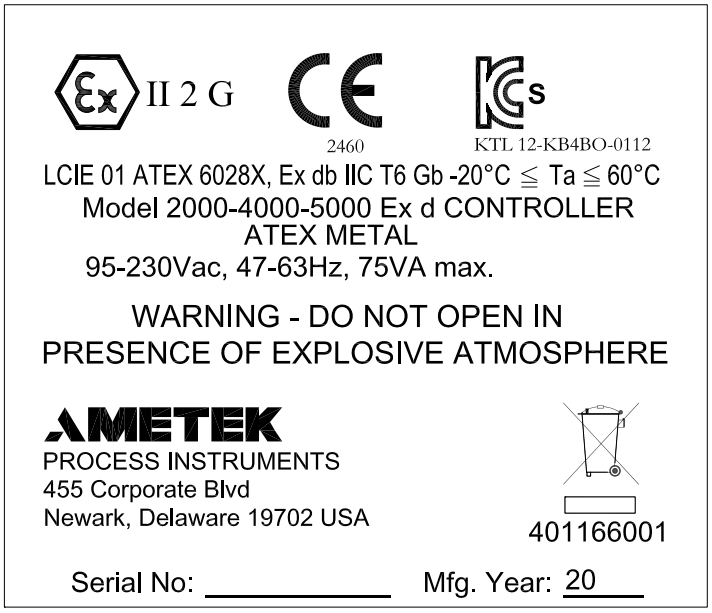



**Figure 1.**
**5000 Field Unit ATEX Label.**

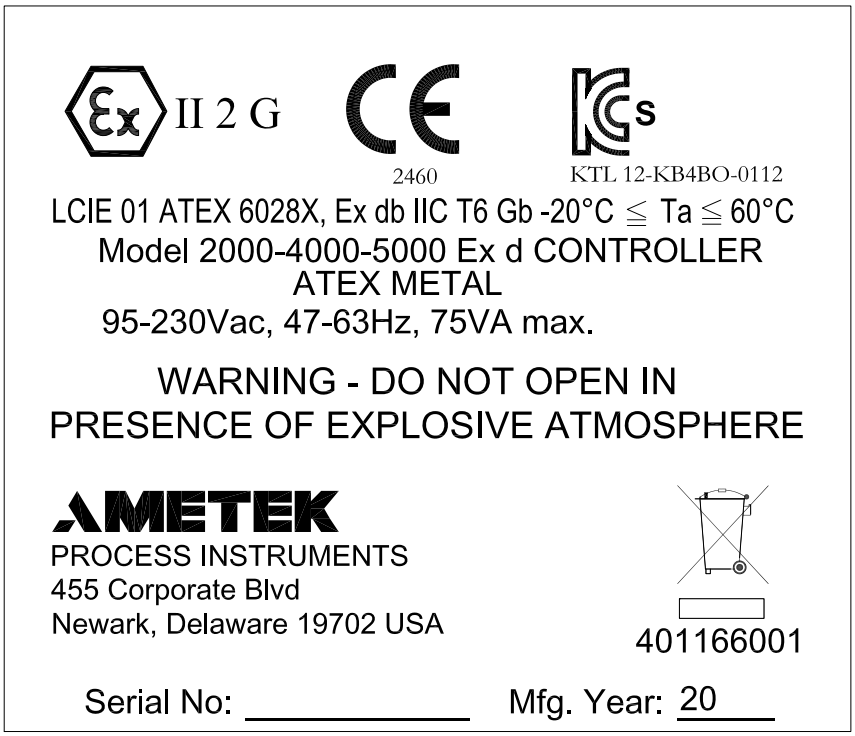



**Figure 2.**
**5000 Controller ATEX Label.**

## Special Conditions of Certification

## Specific Conditions of Safe Use

- There is no intention for any adjustments or repair to be made on the flame-path joints

- All unused openings in protected enclosures must be fitted with blanking elements with protection types and IP ratings compatible with the respective enclosure

- All cable glands used must not invalidate the specific characteristics of the Moisture Analyzer's type of protection

## NPT Union GUF-1-EX:

- All threads MUST be installed wrench-tight regardless of final orientation of the angled components of 'elbow' type fittings or adaptors.

- The fittings are not intended for field installation. Any assembly of enclosure and conduit fitting must be submitted for full approval before installation in a hazardous area.

- The fittings and adaptors MUST NOT be loosened for alignment purposes. Any Equiment certificates issued which utlise these components must re-state this as a Condition of Use for users.

- It is the final assemblers/ users responsibility to ensure the threaded joint between the fitting and the associated enclosure meet all the requirements of the applicable standards for the assembly.

- Only one fitting shall be used at any single entry on the associated enclosure.

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# INSTALLATION


*Read this section of the manual before beginning installation of the Model 5000 analyzer system. Failure to do so may impair the protection against fire, electrical shock, and personal injury originally provided for by this equipment. In addition, failure to follow the installation and start-up instructions may void the instrument's warranty.*

## Prior to Installation

The 5000 Field Unit is approved for the following hazardous area classifications:

- Class I; Group B, C, D; Division 1 as defined by the U.S. National Electrical Code (NEC) and
- Zone 1.

The Model 5000 analyzer system is typically installed with the field unit near the sample tap (normally in a hazardous area) and the 5000 controller located in a control room. The controller is suitable for installation in NEC Class 1 ; Groups A, B, C & D; Division 2 areas. The field unit and controller may be separated by up to 600 meters (2000 feet). Prior to installation, a site plan should be prepared defining the mounting locations of the field unit, controller, and sample system components. The plan should also detail the AC input(s), interconnect wiring, and sample line routing.

## Unpacking and Inspection

Remove components from the packing case(s) carefully and check contents against packing list. Inspect all components for obvious damage and broken/ loose parts or fittings. Notify the carrier and **AMETEK Service (1-800-222-6789)** immediately if parts are missing or damage is found.

## Field Unit Installation

Figure 3-1 shows installation dimensions for standard (Division 1 and 2) and Zone 1 versions of the field unit. Locate the field unit as near as possible to the sample tap and bolt into place. The unit should be protected from direct exposure to weather and located so that the ambient temperature specifications will not be exceeded.

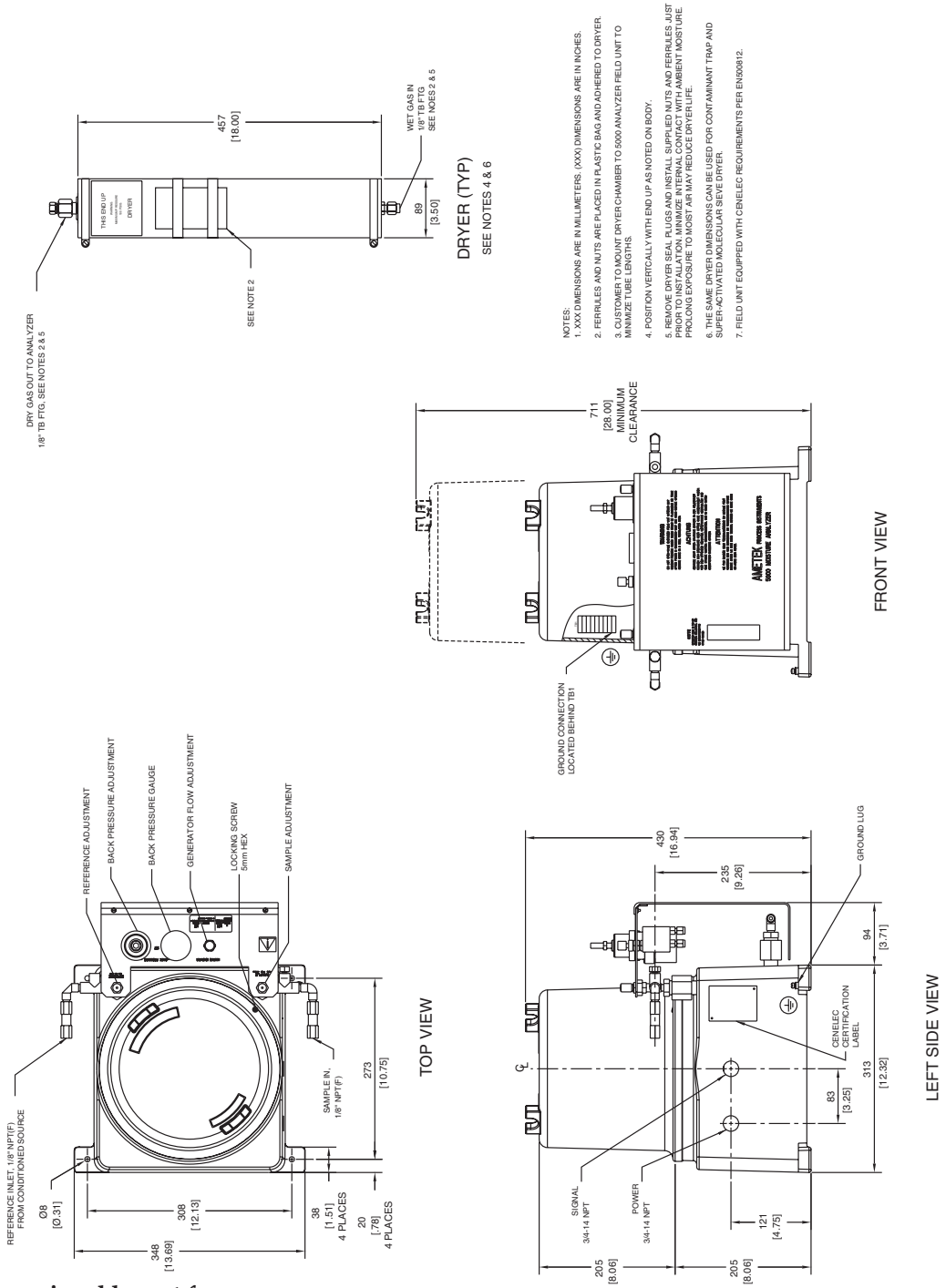



**Figure 2.**
**Installation / dimensional layout for Model 5000 field unit (Zone1)**

## Controller Installation

Mount the controller indoors in desired location and bolt in place. Figures 3-2a through 3-2d show installation dimensions for all controller mounting configurations.

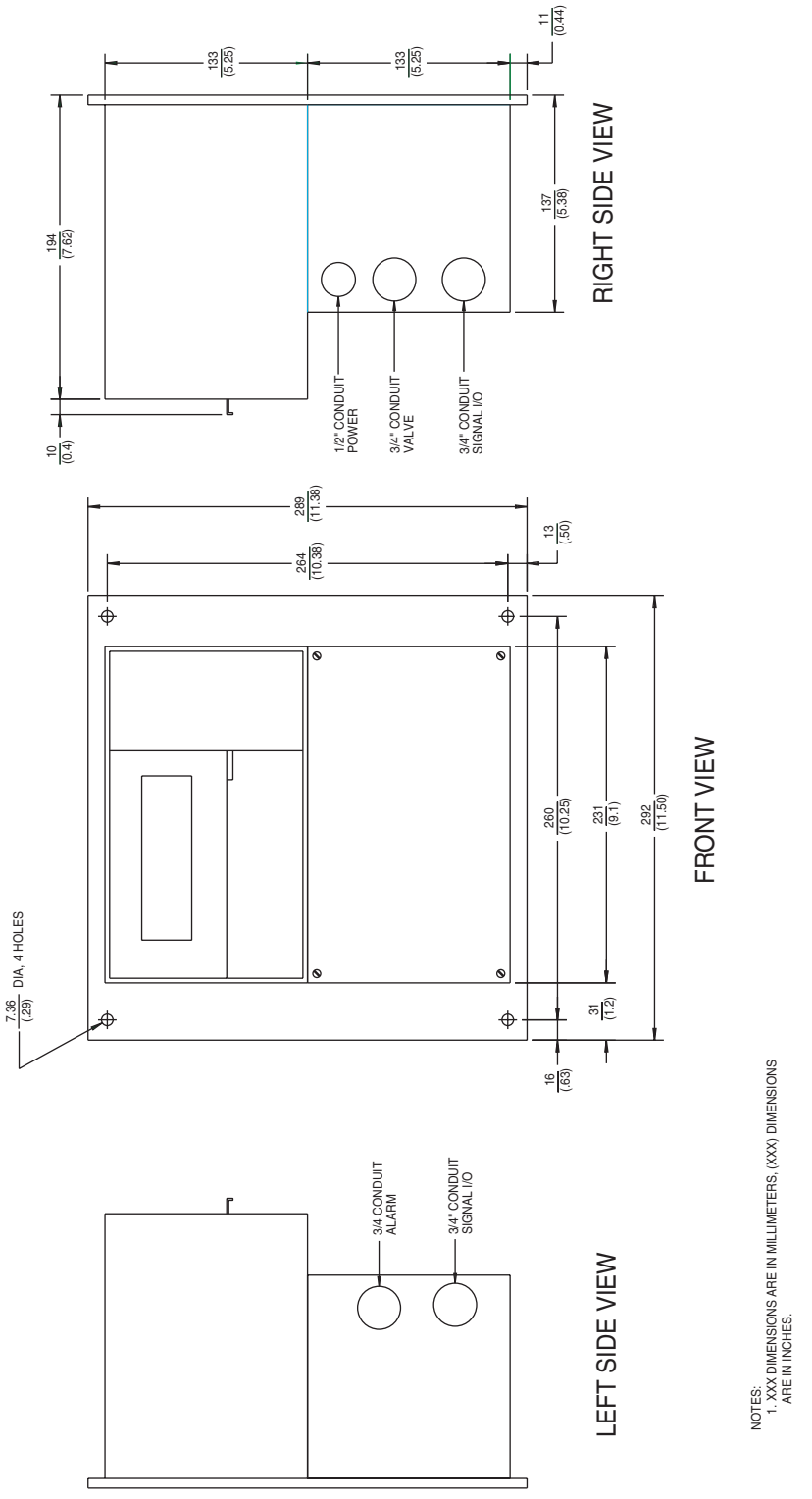



**Figure 3a.**
**Surface Mounted**
**Model 5000 controller.**

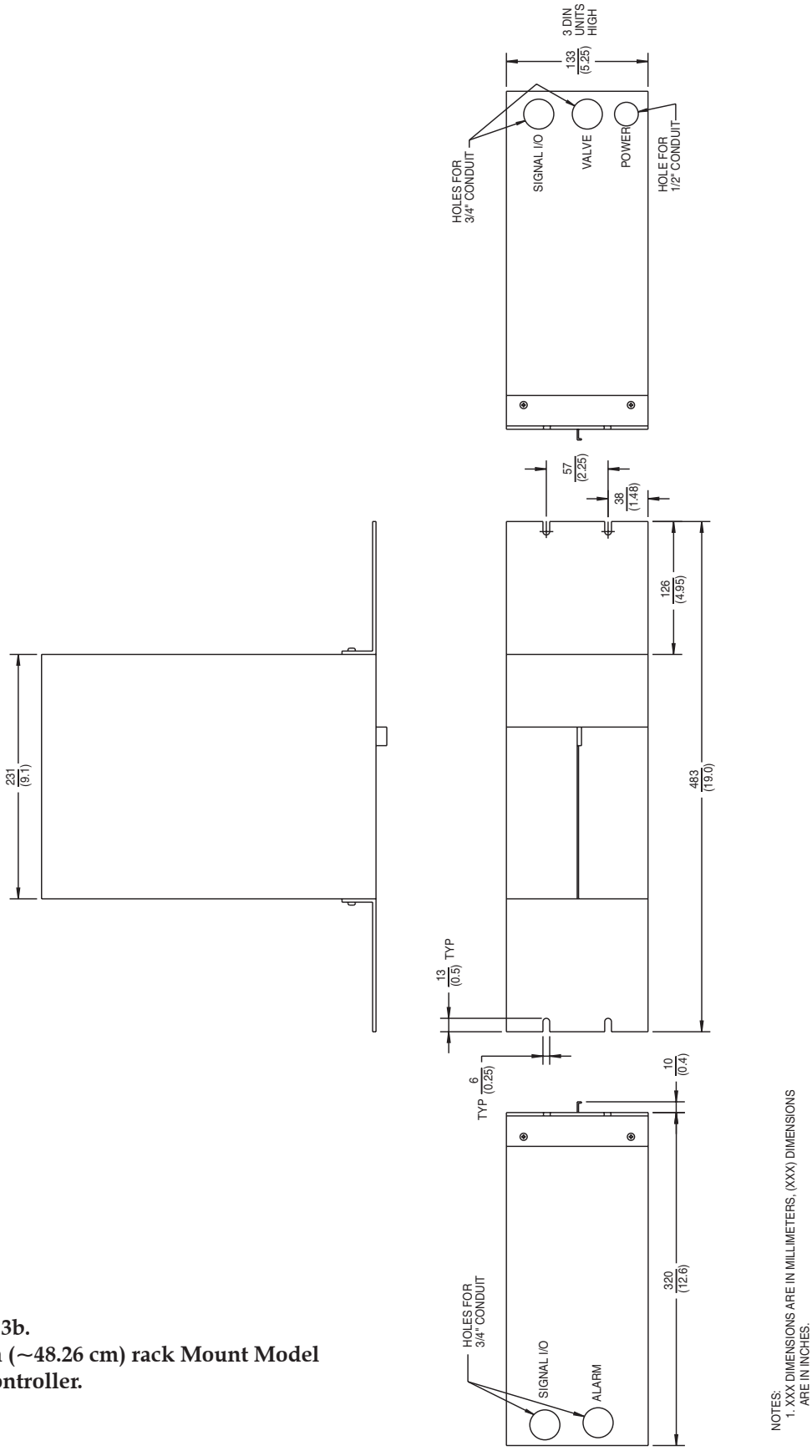



**Figure 3b.**
**19 inch (~48.26 cm) rack Mount Model 5000 controller.**

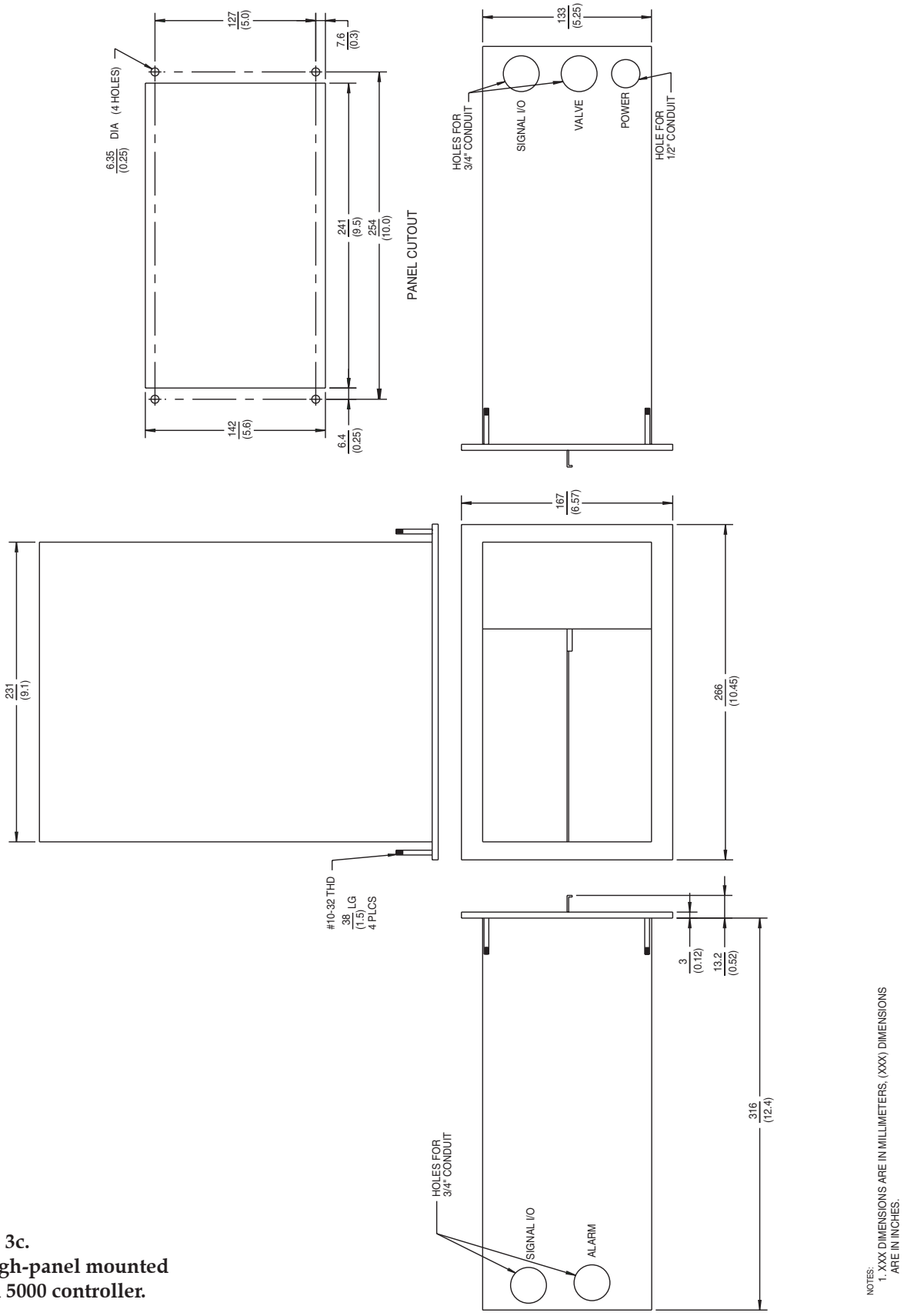



**Figure 3c.**
**Through-panel mounted Model 5000 controller.**

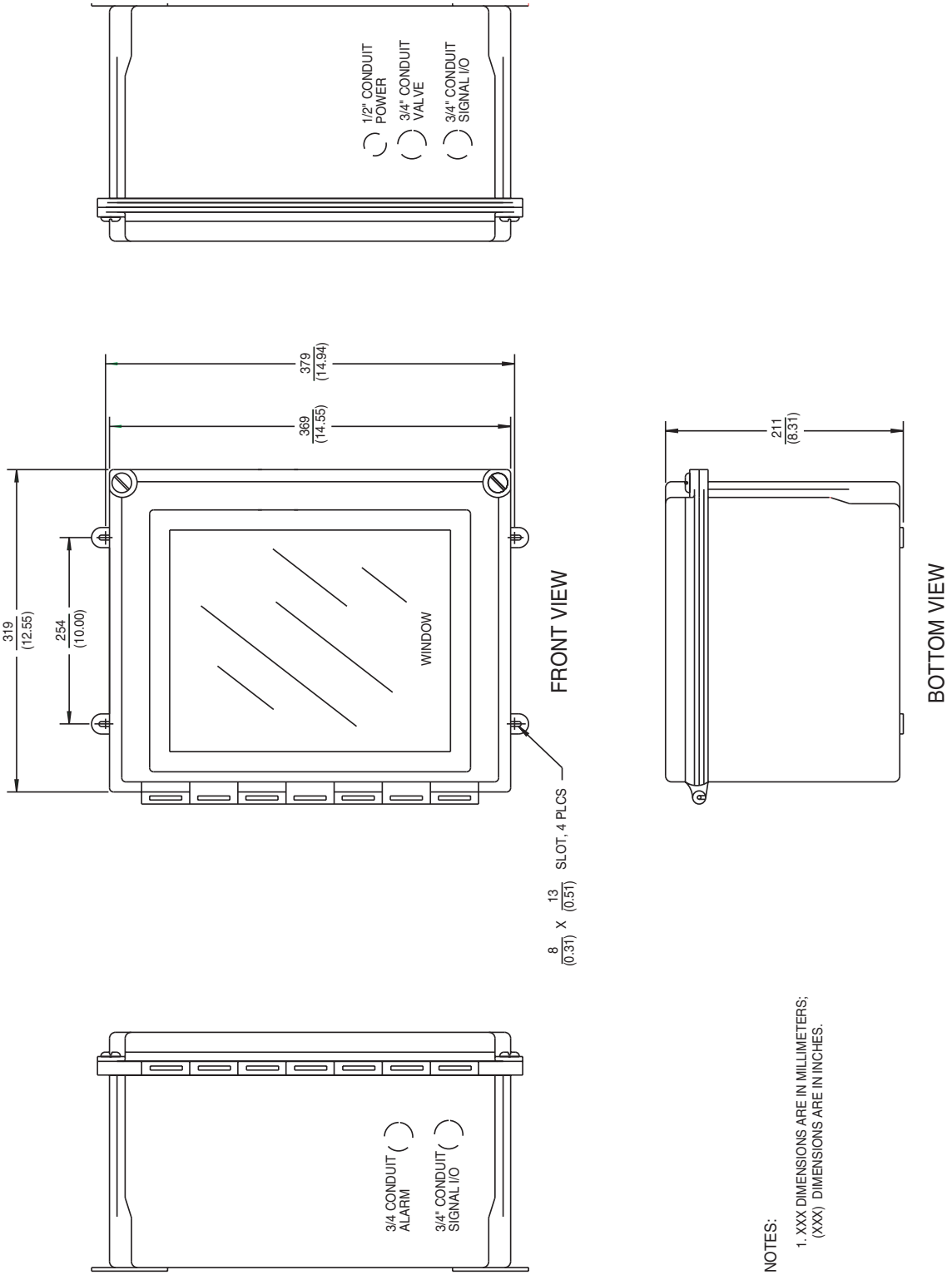



**Figure 3d.**
**Surface mounted Model 5000 controller in NEMA 4X enclosure.**

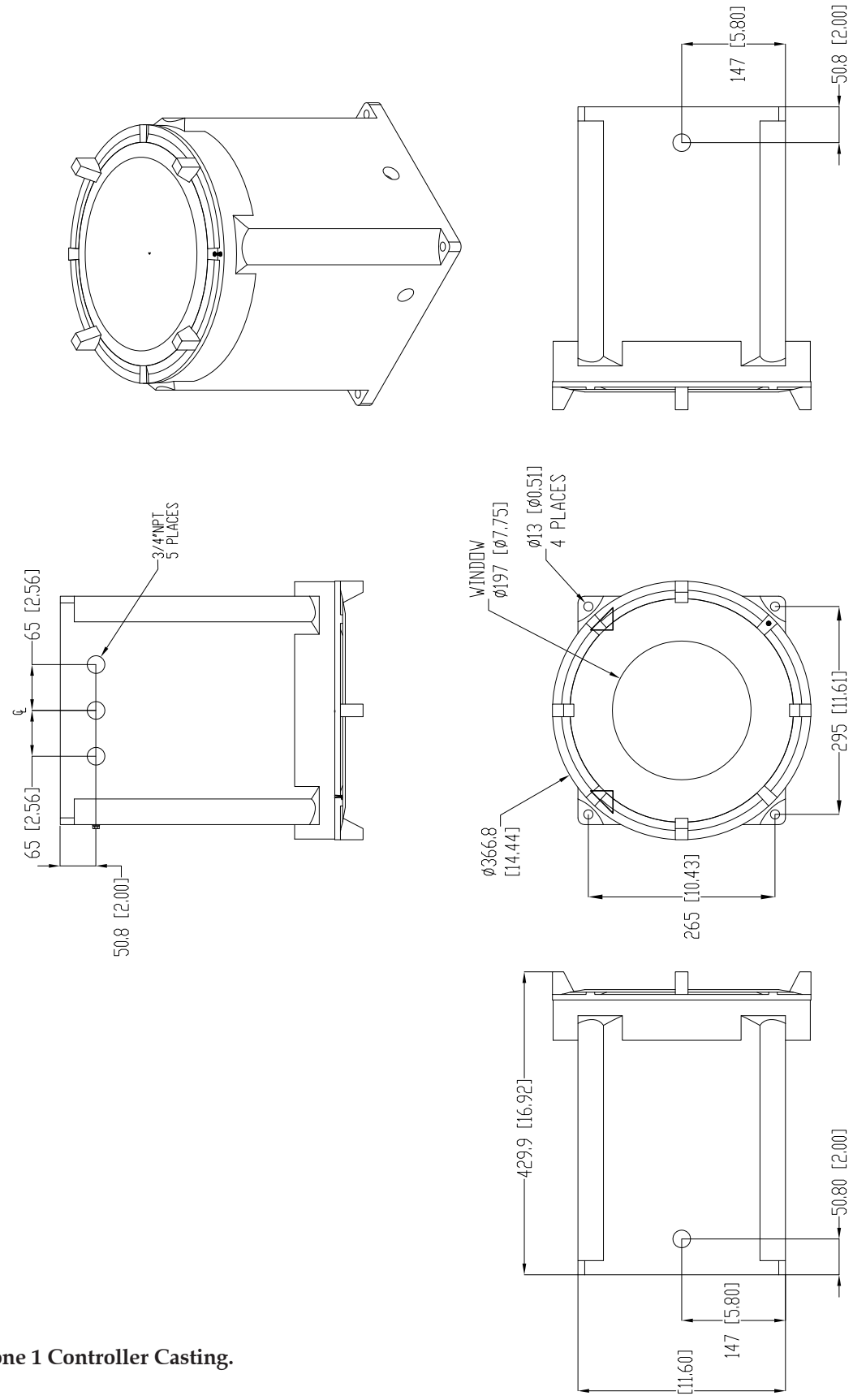



**Figure 3e.**
**Model 5000 Zone 1 Controller Casting.**

## Electrical Connections

NOTE

*Refer to the Customer Drawing (CD) package accompanying this manual for 5000 system interconnect wiring configuration and for 5000 controller back plane terminal locations.*

## Power Requirements

The Model 5000 system components are shipped according to the customer order and are fused and set for the voltage of the required mains power. The power requirements are stated near the power entry for the component and in Chapter 2 of this manual. Supplemental information may appear in the Customer Drawing (CD) package.

The 5000 Field Unit is fused internally with a 1-Amp fuse for nominal 230 VAC applications, and 2-Amp for 100 and 115 VAC. The rupture speed is either a type M or T (slow blow). The voltage is set by specific wiring in the unit. Information on the various wiring configurations is contained in the CD package.

The 5000 Controller uses a universal DC switching power supply and will accommodate a voltage range of 85 to 265 VAC. The power supply has an on-board fuse which serves as the controller's power protection at any voltage in the range.

Other components of an extended or custom 5000 system will have power requirements, fusing or breakers, and voltage information contained in the CD package.

CAUTION

*Do not alter these factory set configurations. Only qualified service personnel may access these settings for modification or inspection. The power requirements labeling on the exterior of a system component must be clearly re-marked to indicate any new AC source information. If qualified personnel are not available to perform these tasks, contact AMETEK service.*

Physical wire types for power and interconnects should be an agency-approved type (UL/CSA/Harmonized, etc.) for the region of installation. The CD package contains suggestions for wire gauges and/or information on current/power requirements in the case of power cable.

## Explosion Hazard Warning

- If the 5000 controller is located in a Class I, Division 2 area, you must shut down the power source before service or maintenance. Never disconnect power at the analyzer until you are sure that the area is known to be nonhazardous.

- Do not substitute parts as this may impair the analyzer's suitability for Class I, Division 2 use.
- If a specific procedure requires the unit to be energized, a hot work permit may be required; check with your safety consultant.
- Power, input and output wiring (I/O) must be in accordance with Class I, Division 2 wiring methods [Article 501-4 (b) of the National Electrical Code, NFPA 70] and in accordance with the authority having jurisdiction.

## Installation Requirements

These components are meant to be permanently connected devices. Qualified installation personnel must adhere to the nationally recognized standards for power cable type and building breaker or fusing for use with this type of equipment. These must be in compliance with the power requirements stated in the CD package and for use in the intended environment (general purpose or hazardous).

NOTE

*This equipment is designed to operate from local branch circuits (Installation Category II).*

In addition to these requirements, the power connections must have the following characteristics:

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

### Hazardous installation requirements

### Zone 1

For Zone 1 sample system installations, no cable glands or strain reliefs are supplied with the system. Only removable gland plates and junction boxes with threaded entries are provided. It is the customer's responsibility to provide for the complete installation of

this system. (Refer to Chapter 2 and CD package.) This includes supplying and installing external fittings, cabling, strain reliefs, suitable cable glands, etc. Only qualified personnel should perform this installation with adherence to all the additional electrical and mechanical requirements for this type of installation and location.

### NEC Division 1 and 2

For NEC Division 1 and 2 sample system installations, the internal seal-offs or fittings are supplied in the system, but must be sealed by the customer before being put into service. All other external fittings, cabling, conduit, etc. are the responsibility of the customer. (Refer to Chapter 2 and CD package.) Only qualified personnel should perform this installation with adherence to all the additional electrical and mechanical NEC requirements for the installation type and location.

## Installation Procedure

This procedure makes the following assumptions:

- The shielded interconnecting cable between the field unit and controller is already in place with wires clearly identified at both ends
- An AC power source of adequate current rating is available at both locations.

1. Unscrew and remove the lid from 5000 Field Unit.
2. Connect controller signal and alarm outputs to user recording equipment as shown in the CD package.
3. Connect AC power source to:

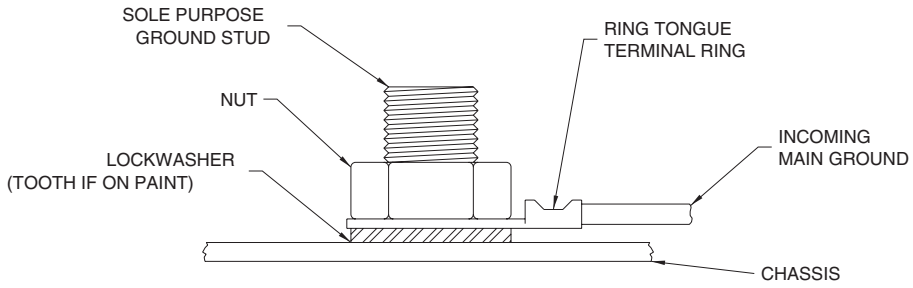
   Field Unit — TB1-1 AC line, TB1-2 AC Neutral, and GND to TB1-3 or to chassis ground stud.

   Controller—TB5-1 AC line, TB5-2 AC NEUT, and GND lug. TB5-3 can be used to jumper line voltage to Sample and Alarm Common.

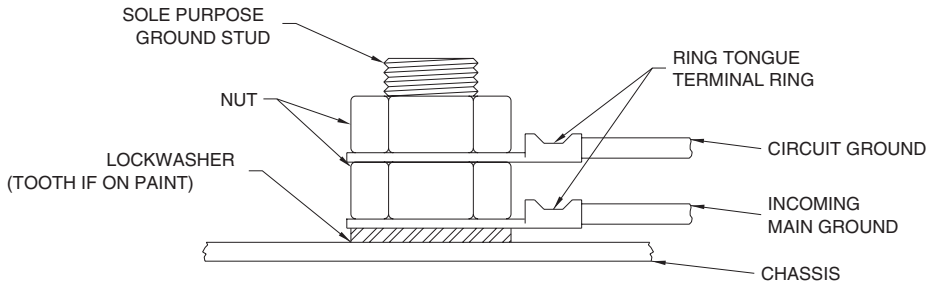
4. Instrument grounding is mandatory. Performance specifications and safety features are void if the unit is operated from an improperly grounded source. Check ground integrity to all portions of the analyzer before power up. See Fig. 3-3 for proper internal grounding instructions.

**WARNING**

*Do not power up AC source(s) at this time.*

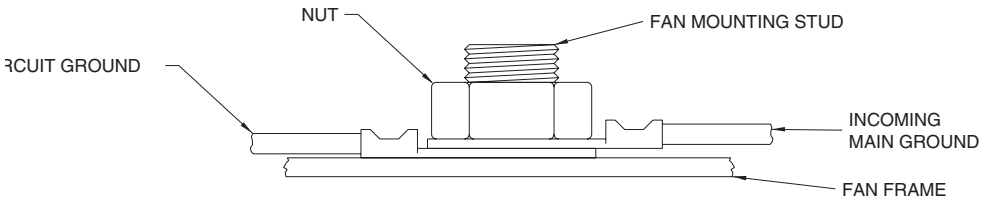



Proper Single Ground Screw




Circuit ground can be removed for servicing independently of incoimg main ground. No lockwasher. Stud not sole purpose.

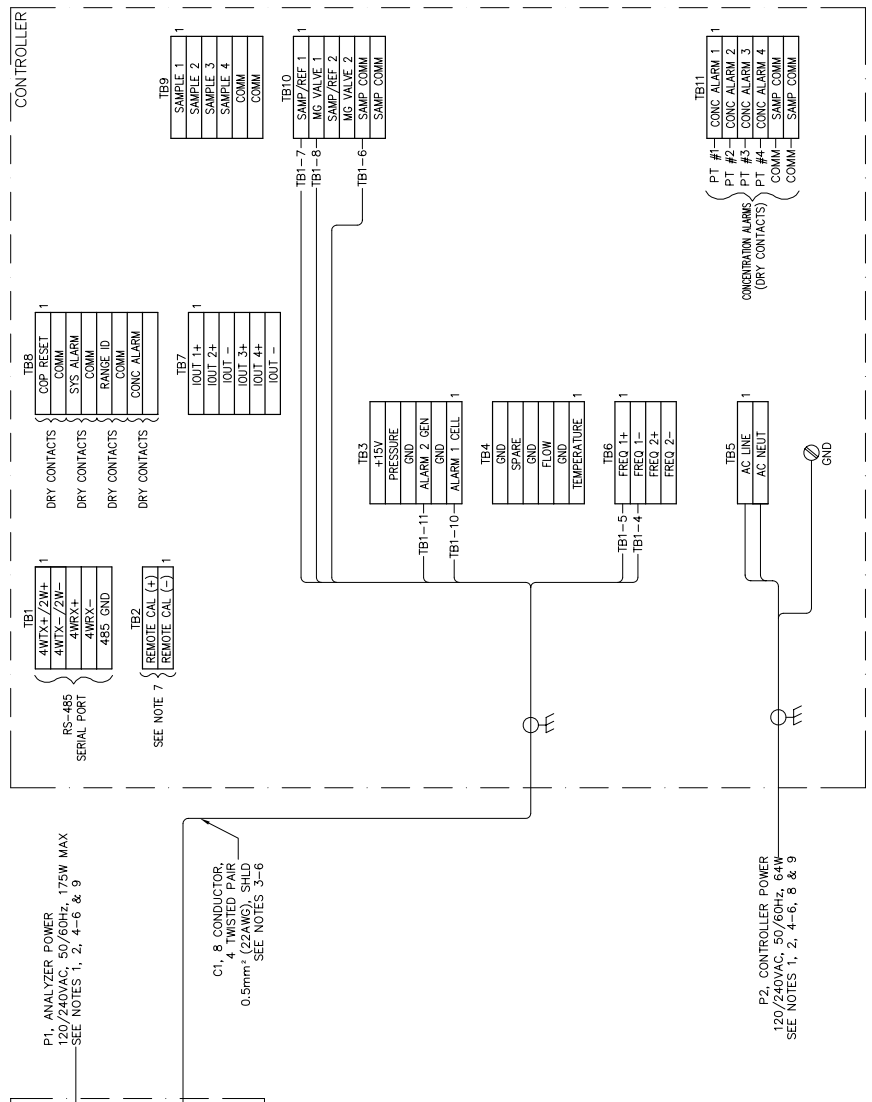
Proper Multiple Ground on Single Screw




Circuit ground cannot be removed for servicing fan without disturbing incoimg main ground. No lockwasher. Stud not sole purpose.

Improper Multiple Ground on Single Screw

**Figure 4.**
**Proper and improper protective ground connections.**




NOTES:

1. WARNING: BEFORE APPLYING POWER, TEST AND VERIFY CONNECTION OF "HOT, NEUTRAL & GROUND" WIRES TO CORRECT TERMINALS. POWER APPLIED TO INCORRECT TERMINALS CAN DAMAGE EQUIPMENT OR CREATE A SAFETY HAZARD.
2. THE MAXIMUM PERMITTED RESISTANCE FROM EARTH GROUND TO THE FIELD UNIT OR CONTROLLER IS 20 OHMS.
3. INTERCONNECTING CABLES ARE TO BE SUPPLIED AND INSTALLED BY CUSTOMER, UNLESS OTHERWISE SPECIFIED ON SALES ORDER.
4. POWER STATED IS ACTUAL LOAD FOR CIRCUIT. SIZE CIRCUIT BREAKER, DISCONNECT SWITCH, AND WIRE GAUGE ACCORDING TO NEC OR LOCAL CODES FOR CUSTOMER SPECIFIC INSTALLATION.
5. 100% FOIL (ARMOR CAN BE SUBSTITUTED FOR FOIL) IS REQUIRED.
6. GROUND CABLE SHIELDS AT BOTH ENDS TO GROUND STUDS OR GROUNDING RINGS (AS SHOWN ON DRAWING 520403). KEEP SHIELD WIRE LENGTH LESS THAN 2" LONG.
7. CONNECTIONS FOR OPTIONAL REMOTE CALIBRATION INITIATION SWITCH CLOSURE.
8. CONTROLLER POWER REQUIREMENT INCLUDES THE POWER DEMAND OF THE DEVICES CONNECTED TO TB9.
9. POWER & SIGNAL CABLES SHOULD BE RUN SEPARATELY.
10. POWER STATED IS ACTUAL LOAD FOR CIRCUIT. SIZE CIRCUIT BREAKER, DISCONNECT SWITCH, AND WIRE GAUGE ACCORDING TO NEC OR LOCAL CODES FOR CUSTOMER SPECIFIC INSTALLATION.

**Figure 5.**
**Interconnecting wiring diagram for 5000 field unit and 5000 controller.**

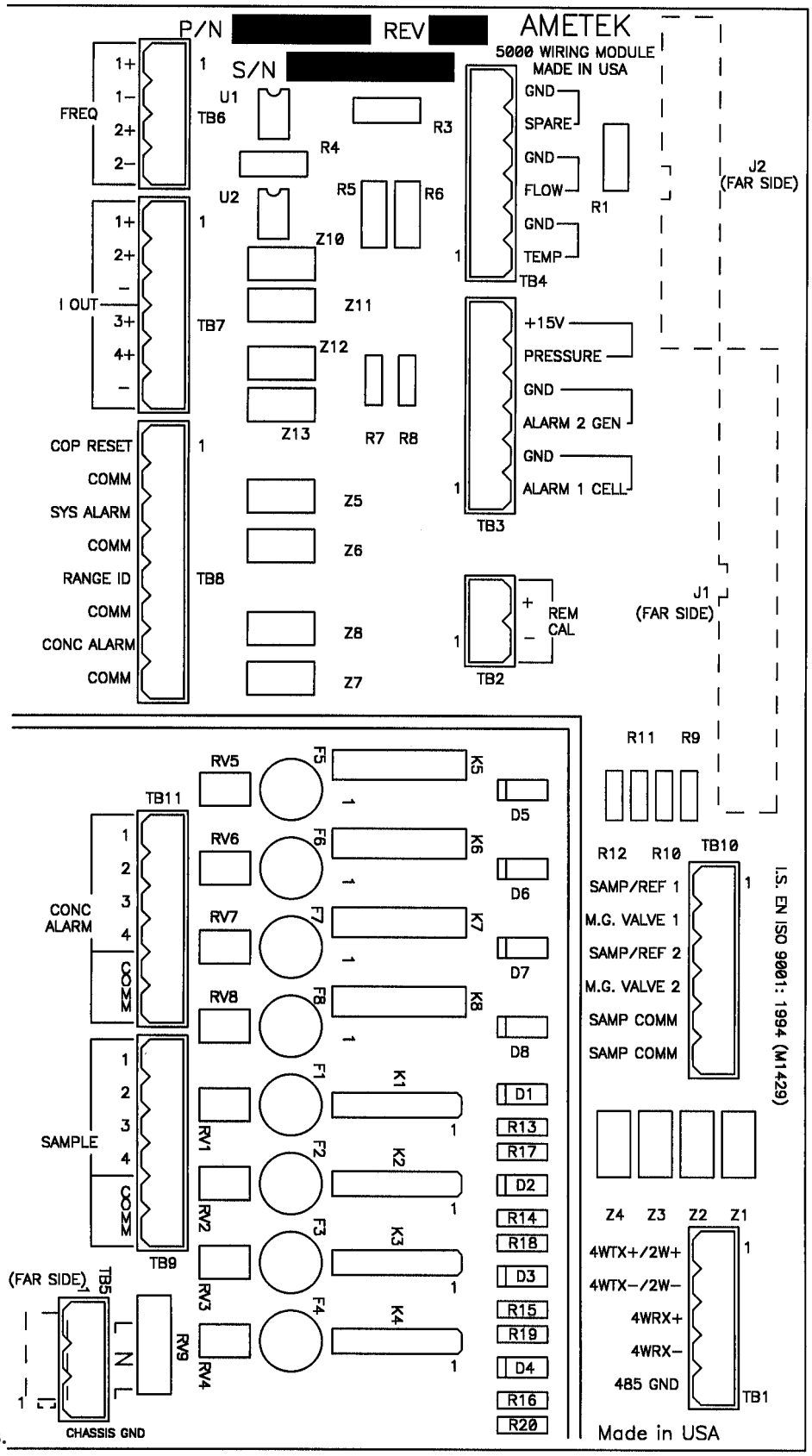



**Figure 6.**
**Model 5000 controller back panel connections.**

## Sample System

## Sample Tap

To ensure the sample is free of contaminants from the walls of the sample pipeline, we recommend a probe extending into the pipe. The probe tip should be cut to a 45° angle and located about 20-30% into the pipe ID. Mount the probe through a ball valve (shut-off valve) on a horizontal section of the pipe as shown in Figure 3-6.

CAUTION

*The sample gas, or gases to be monitored by the analyzer may be toxic, corrosive, and / or flammable. AMETEK strongly recommends that trained service personnel use proper protective equipment including air breathing apparatus, eye protection, and skin protection whenever the gas line(s) or Field Unit are accessed for installation or maintenance.*

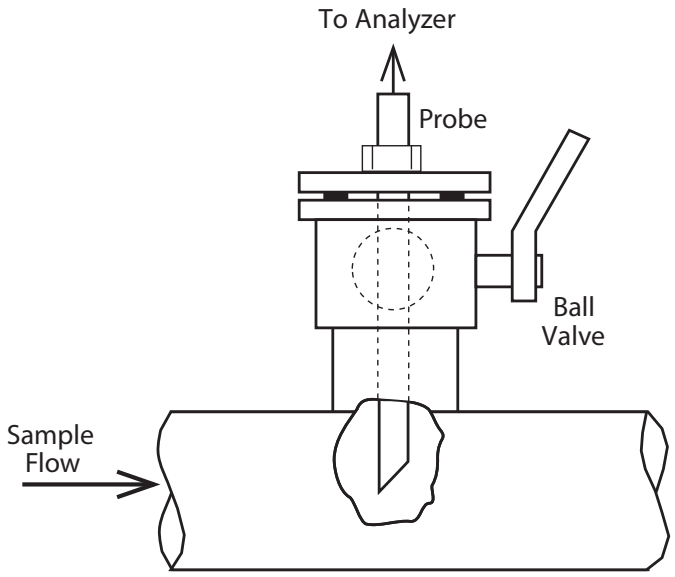



**Figure 7.**
**IProbe to analyzer.**

## Sample Pressure, Temperature, and Flow Rate

A pressure reducer/regulator should be installed near the sample tap. Variations in flow of 10 percent will not affect instrument accuracy. Nominal sample pressure to the system should be 520 kPa (75 PSI) gauge with a minimum pressure of 200 kPa (30 PSI) gauge. Temperature of the incoming sample gas should not exceed the analyzer cell temperature of 60 °C (140 °F). Sample, reference, and moisture generator flow rates through the cell are set to 250 cc/min (at 2 atm) at the field unit. A bypass flow valve located near the analyzer will improve analyzer response time.

## Sample Lines & Connections

Cleaned and passivated 316L stainless steel* with 0.125 to 0.25 in. OD sample line tubing is recommended for use throughout the sample system. Note that ordinary stainless steel tubing can have an internal finish that may cause moisture holdup and slow analyzer response. Exhaust vent tubing should have an OD of 0.25 inch or greater to prevent back pressure from affecting the flow rate to the measuring cell.

To avoid sample contamination, the sample stream should not come in contact with plastic, rubber, oil, grease, or dirt. Use Teflon® fluorocarbon resin tape or Loctite® 545 on all threaded (not compression) connections. Check all sample line connections with a bubble-type leak detector.

Low temperature and/or high pressure can cause moisture to condense on the sample line walls. Water (or other liquids) in the sample line can migrate to the analyzer cell causing the crystal to stop oscillating. This will result in erratic moisture concentration data until the liquid evaporates and the crystal returns to normal operation state. If this happens, the calibration of the instrument will no longer be valid. Full calibration and span adjustment will be necessary.

NOTE

*Water migration to the analyzer cell will destroy the hygroscopic crystal coating. If analyzer function does not return to normal, the cell must be replaced.*

## Sample Conditioning

Conditioned sample gas is normally used as the reference gas for moisture analysis. Instrument air or nitrogen may be used if the sample has a high level of particulate or if sample flow rate is too low. Whether from the sample or a separate source, the reference gas passes through a standard dryer containing a 3A molecular sieve and an in-line filter (both included) before entering the field unit. Note that the use of a reference gas different from the sample gas can cause background interference. Refer to Appendix C for data correction procedure.

** PN 571061017 - stainless steel tubing, 0.125 in. OD x 10 ft.*

For some special applications, we recommend that the sample should also be run through a contaminant trap and a super-activated dryer. Refer to the supplemental information supplied with the system to determine if these optional components are to be used.

NOTE

*Moisture contamination of the dryer(s) can cause incorrect sample moisture data. To prevent this contamination, never leave either end of a dryer open and exposed to atmospheric moisture.*

### Conditioned sample gas used as reference

Configure sample system as shown in Figure 3-7a. Standard and optional conditioning components (dryers, contaminant traps) should be strapped in the **upright position** to support beams.

NOTE

*Dryer(s) must be vertical to avoid channeling (voids in the sieve).*

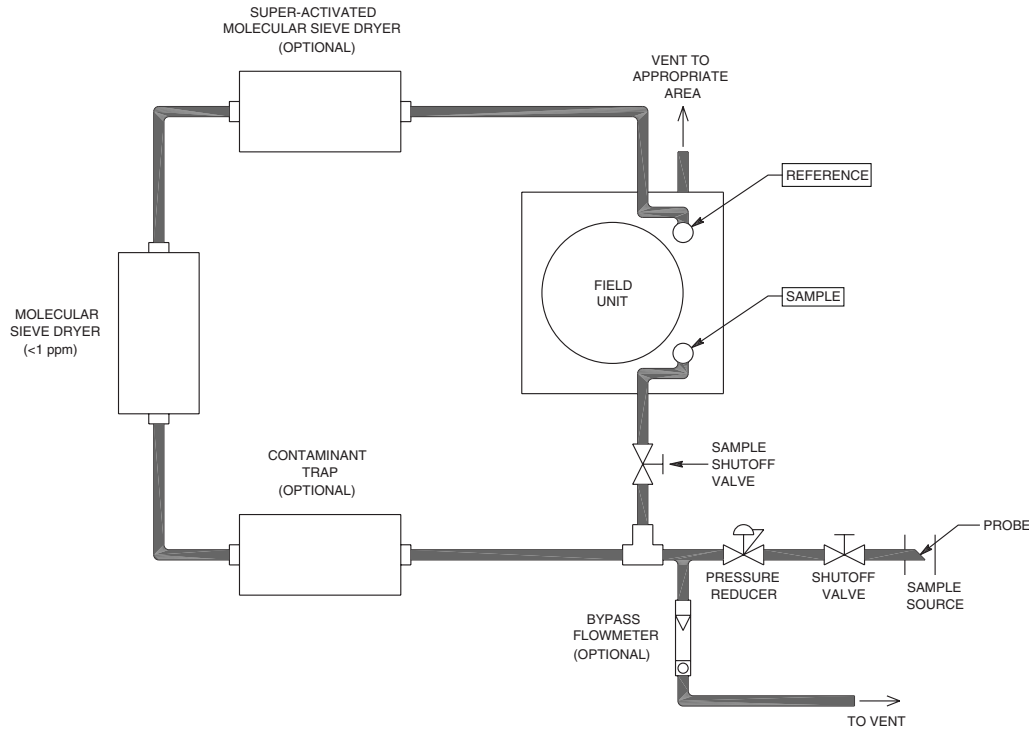



**Figure 8.**
**Sample system using conditioned sample gas as reference.**

### Separate Gas Source Used As Reference

Configure sample system as shown in Figure 3-7b. Standard and optional conditioning components (dryers, contaminant traps) should be strapped in the **upright position** to support beams.

NOTE

*Dryer(s) must be vertical to avoid channeling (voids in the sieve).*

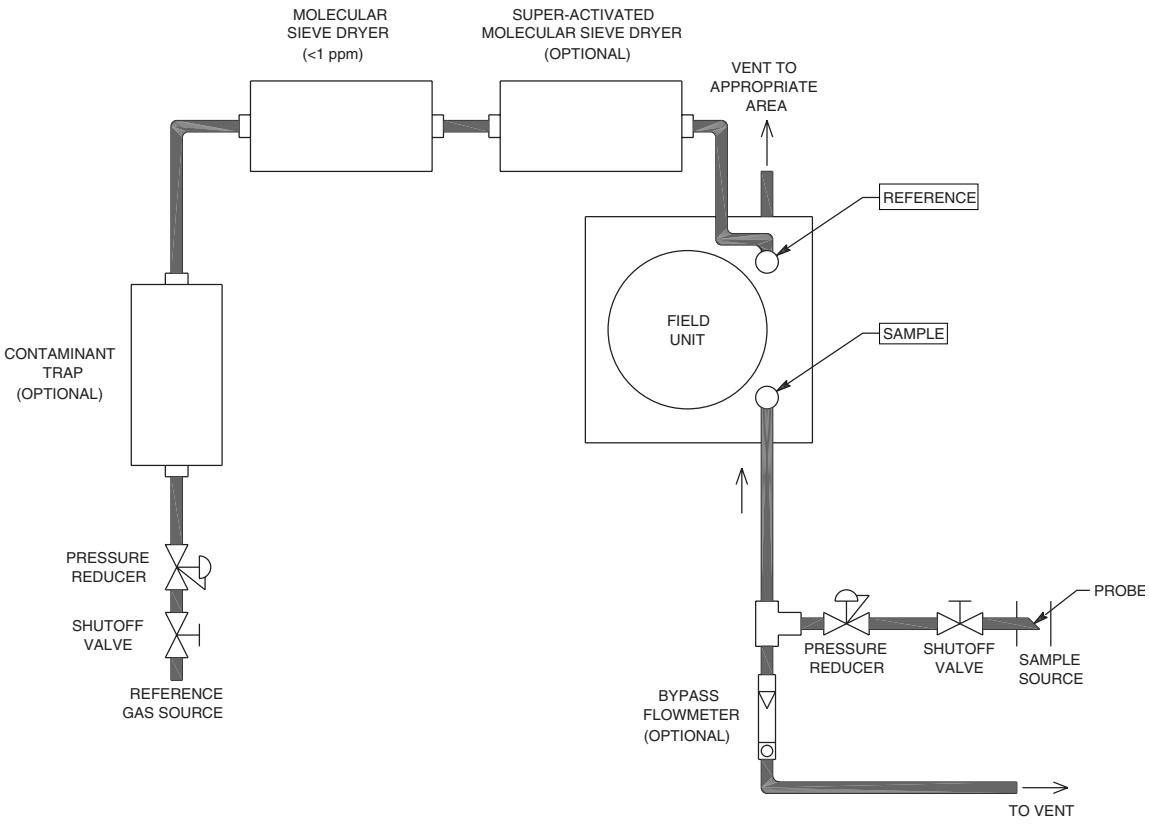



**Figure 9.**
**Sample system using separate gas source as reference.**

NOTE

*A separate source (if present) should also be run through an oil/air separator to remove trace quantities of oil from the gas. Oil in the reference stream will cause rapid contamination of the analyzer cell.*

## Gas Connections to Analyzer


*Proper sample line purge must be performed before connecting the sample line to analyzer. Condensate in the sample line can migrate to the cell which may result in irreparable damage to the crystal oscillator.*

1. Open the main process sample line valve and pressure reducer carefully. Vent the line to an appropriate area and purge it with clean, dry instrument air or nitrogen.
2. Close the process sample line valve and pressure reducer and connect the sample line to the $^1/_8$ inch sample inlet fitting.
3. Connect the conditioned reference gas line (from either the sample or a separate source) to the $^1/_8$ inch reference inlet fitting.
4. Connect vent line to analyzer $^1/_4$ inch exhaust port fitting.
5. Vent the line to appropriate area.


*Consult plant safety personnel for appropriate venting guidelines.*

# TROUBLESHOOTING AND MAINTENANCE

WARNING

*Any troubleshooting or maintenance to this analyzer that requires access to the interior of the components must be performed only by qualified service personnel . There are no operator-level serviceable parts, expendables, or maintenance needs inside this analyzer.*

## System Alarms

The system alarm contacts are activated when there is a condition that makes the analyzer output questionable. The error messages in Figure 10 will be displayed on the bottom line of the analyzer display when a system alarm condition exists.

| | |
|---|---|
| CELL TEMP ALERT | Moisture Cell temperature control is suspect (signal sent from field unit). |
| LOW CELL FREQUENCY | Activates when measured cell frequency is < 500 Hz. |
| HIGH CELL FREQUENCY | Activates when measured cell frequency is > 3500 Hz. |
| NEGATIVE DELTA FREQUENCY | Activates when delta frequency is < –1 Hz. |
| GEN TEMP ALERT | Moisture Generator temperature control is suspect (signal sent from field unit). |
| CAL ERROR | Activates when the new calculated span value (Moist_Span) exceeds the limits Max_Cal_Err or Max_Span. Refer to Chapter 4, "Alarm Button" for more information. Deactivates after successful calibration. |
| DISPLAY OVER-RANGED | A displayed value exceeds the allotted display area. |
| MEMORY IS CORRUPTED | The RAM or RAM battery has failed causing factory default parameters to be loaded into memory. |

**Figure 10.**
**System Alarm error messages.**

NOTE

*It is common for some of these system alarms to activate momentarily during normal operation, especially during equilibration periods between measurement cycles. If the system alarm persists, there may be a problem with the measuring cell, the moisture generator, or the thermal controller.*

## Computer Operating Properly Alarm

This alarm, also known as the COP or watchdog alarm, activates when normal CPU logic flow is disrupted. Possible triggers of this alarm are:

- power failure
- internal power failure
- software problems, or
- extreme electronic interference.

When activated, the COP alarm generates a system reset but retains software configuration parameters. You do not have to reconfigure the system.

## System Tests Menu

Numerous self-test routines can be run periodically or used to assist in troubleshooting the analyzer. Press the **Test/Config** key and enter the Level 1 or higher password. Scroll down to **System Tests Menu** and press **Enter**. Select a test from the following list and then follow directions displayed on screen.


NOTE

*Normal serial communications are disabled while system tests are running.*

**Test Display**

Verifies that each segment of the display is functioning properly by displaying a checkerboard pattern for several seconds and then reversing it. Press **Enter** to begin test or **Cancel** to quit.

**Test Analog Out**

Sets the signal on the analog output to an mA value corresponding to any percentage of full scale for those outputs. Default percentage is 0% which sets the outputs to 4 mA. A different percentage from –15% to +100% may be entered at the "New Value?" prompt. Figure 11 lists the correct value of the 4 to 20 mA signal for various percentages. Press **Enter** to begin test or **Cancel** to quit.

**Test Analog Inpts**

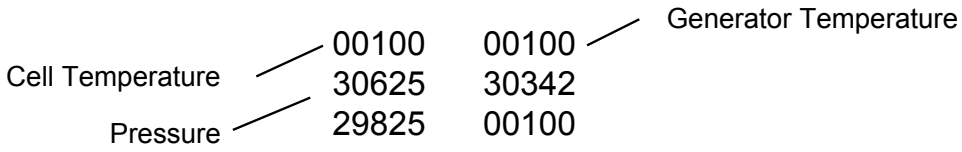
Verifies that alarm voltage signals from the cell and moisture generator ovens and process pressure transmitter (if live pressure input is being used) are present and tracking. Press **Enter** to begin test or **Cancel** to quit. First three lines of the display will appear as follows:

| % of Full Scale | % of Output (mA) | % of Full Scale | Output (mA) | Full Scale | Output (mA) |
|---|---|---|---|---|---|
| -15 | 1.6 | 25 | 8.0 | 65 | 14.4 |
| -10 | 2.4 | 30 | 8.8 | 70 | 15.2 |
| -5 | 3.2 | 35 | 9.6 | 75 | 16.0 |
| 0 | 4.0 | 40 | 10.4 | 80 | 16.8 |
| 5 | 4.8 | 45 | 11.2 | 85 | 17.6 |
| 10 | 5.6 | 50 | 12.0 | 90 | 18.4 |
| 15 | 6.4 | 55 | 12.8 | 95 | 19.2 |
| 20 | 7.2 | 60 | 13.6 | 100 | 20.0 |

**Figure 11.**
**4 to 20 mA signal for percentage output.**

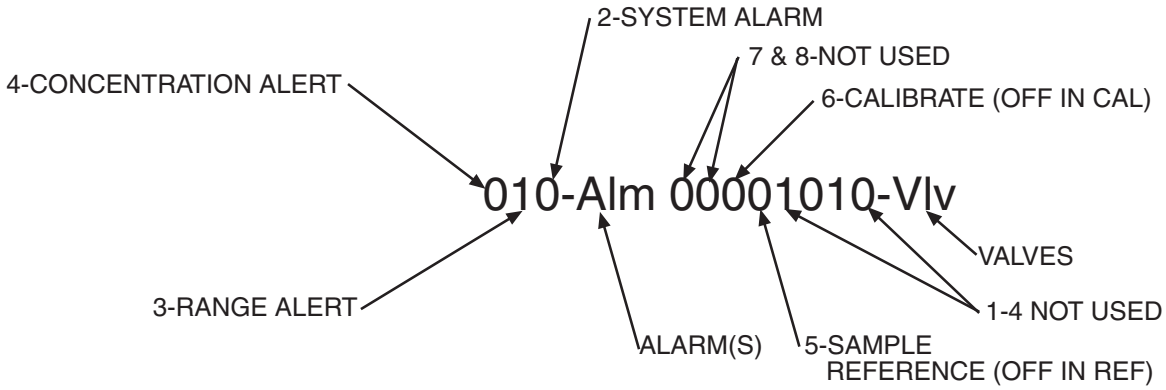
The numbers shown here are for example only. Count values in active input fields will be changing. A reading of 32,767 indicates an interruption of signal has occurred.

When running Test Valve Relays or Test Alarm Relays, it is useful to assign display flag 14, **Status of Valve and Alarm Relays**, to one of the display lines. The flagged display line will read as follows:




**Test Alarm Relays**

Verifies function of alarm contacts. All alarm relays are energized (= 1) when the test begins. At the "Number Key to Toggle?" prompt, press 2 for **System Alarm** contacts, 3 for **Range Alert** contacts, or 4 for **Concentration Alert** contacts. Press **Enter** to begin test or **Cancel** to quit. Selected alarm contacts will toggle to de-energized (= 0).




**Test Valve Relays**

Verifies function of valve relays. All valve relays are de-energized (= 0) when the test begins. At the "Number Key to Toggle?" prompt, enter the number of the relay to test (1 through 8). Press **Enter** to begin test or **Cancel** to quit. Selected valve contacts will toggle to energized (= 1).

NOTE

*Relay 6 has opposite logic. It will be energized when logic=0 and de-energized when logic=1*

**Test Watchdog**

Verifies function of the **Computer Operating Properly** (watchdog) alarm by introducing an anomaly in the computer logic which should activate the alarm. If functioning properly, a system reboot will occur and the display will return to normal operating screen. If test fails, system will not reboot. Press **Enter** to begin test or **Cancel** to quit.

**Test Serial Port**

Verifies the data flow to the RS-485 serial port. The serial port connector must be removed from the port to run this test. If using the four-wire serial communication mode, you must provide a feedback loop by connecting 2W+/4WTX+ to 4WRX+ and 2W-/4WTX- to 4WRX-. Press **Enter** to begin test or **Cancel** to quit.

**Test RAM**

Verifies the operation of the computer's random access memory. At "System Will Not Run - Remove Power Now" prompt, turn off AC source. Wait at least 20 seconds and turn on power. If RAM test is successful, "RAM Tested Good - Enter To Continue" will be displayed. Press **Enter**. Boot-up information will be displayed for several seconds and then the display will return to normal operation screen. This test runs every time the analyzer is rebooted.

## Scheduled Maintenance

### Weekly

- Operate internal generator to verify calibration.
- Adjust Span, if necessary.

### Quarterly

- Perform system inspection and leak check.
- Replace the filter frit.

### Yearly

- Replace or refill the dryer molecular sieve.
- Replace or refill the trap's activated charcoal.
- Replace the super dryer.
- Refill the moisture generator with distilled or deionized water (>12 Mohms resistivity).
- Replace scrubber cartridge ( use only with acid gas option). See Appendix B.

## System Inspection

WARNING

*Inspection and maintenance should be done only by qualified personnel.*

1. With Snoop® PN 202887000 or a soap solution, check the sample line for leaks.

2. Verify that flowmeters, regulators, valves, gauges, and filters are in good condition and securely mounted.

3. Verify the integrity of all power supply and interconnecting wiring. Check the circuit cards in the field unit and controller for signs of overheating or contamination. Use clean, low pressure air to blow off any accumulated dust and debris.

4. Repair or replace any damaged part. Correct any unsatisfactory condition as necessary.

5. Exterior enclosures of the field unit and sample system can be cleaned with mild, non-abrasive detergent or spray cleaner. The controller enclosure can be cleaned in the same manner but the cleaner must not be sprayed or applied directly. Moisten the applicator first before cleaning.

# Troubleshooting

| Troubleshooting Guide for 5000 Analyzer | | |
|---|---|---|
| **Possible Cause** | **Isolation Procedure** | **Corrective Action** |
| **Field Unit LEDs do not light** | | |
| Blown fuse F1 | | Replace F1. |
| Blown thermal cutoff S2 | | Replace S2 |
| Faulty power supply<br>Fault connections | Check for 24 VDC between red and black test points TP2 (+) and TP1. | If voltage is not present and CB1 is closed, check power supply of T1 and diodes CR4 and CR5. |
| **Controller Alarms not operating** | | |
| Incorrect operating parameters | | Check and secure all connectors between boards. Check that all relays are secure. Verify software parameters. |
| Faulty relay | Perform **Test Alarm Relays** routine | If relay works, place analyzer on-line. If relay does not function, replace the CPU board. |
| Faulty CPU board | | Replace CPU board. |
| **Display Reads Low in calibrate or operate modes** | | |
| Incorrect operating parameters | | Check all values against Calibration Data Sheet. |
| Incorrect back pressure | | Check, and if necessary, reset back pressure. |
| Incorrect sample flow rate | Check flow rate with Bubble-O-Meter | Reset flow, if necessary. |
| Incorrect operating temperatures | Check and, if necessary, set oven and | moisture generator operating temperatures. |
| Contaminated sample cell crystal | Read cell frequency | If cell frequency input is >3500 Hz, replace the cell. |
| Contaminated dryer | Substitute with known good dryer. | Replace or re-activate dryer. |

| Troubleshooting Guide for 5000 Analyzer | | |
|---|---|---|
| **Possible Cause** | **Isolation Procedure** | **Corrective Action** |
| **Analyzer Reads High** | | |
| Incorrect flow rate | | Check, and if necessary, reset flow rate. |
| Incorrect back pressure | | Check, and if necessary, reset back pressure. |
| Incorrect operating parameters | | Check all values against Calibration Data Sheet. |
| Leaks in sample tubing | | Correct leaks as necessary. |
| Low oven temperature | | Set oven temp to 60 °C ± 0.25 °C. |
| **Moisture Generator Output Reading Incorrect** | | |
| Incorrect flow rate or back pressure | | Check, and if necessary, reset flow rate or back pressure. |
| Incorrect operating parameters | Calibration has exceeded Max_Span and/or Max_Cal_Err limits. | Check all values against Calibration Data Sheet. |
| Incorrect calibration values entered | | Run display routine and check all values against those listed on Calibration Data Sheet. Re-enter values if necessary. Recalculate Span values. |
| Dry moisture generator reservoir | Check flow rates, generator temperature, and back pressure unit board. | If reading are OK, check, and if necessary, fill the reservoir. |
| Incorrect moisture generator temperature | Measure temperature of moisture generator J2 Pins 2 and 3 of field unit board. | Adjust R26 on field unit board as necessary to obtain 60 °C. |
| Faulty reservoir tubing bundle | | Replace generator. |
| **Cell_Temp_Alert** | | |
| Environmental Temp | Check for CR1 blinking | Housing or ambient temperature is too hot or too cold for the electronic control amplifier to control cell temperature. |
| Faulty electronic control ampplifier | Remove cell oven connector J1, CR1 will go on short pins 1 and 4 together on the electronic control amplifier PCB and CR1 will go off. | If not, replace electronic control amplifier PCB. |

| Troubleshooting Guide for 5000 Analyzer | | |
|---|---|---|
| **Possible Cause** | **Isolation Procedure** | **Corrective Action** |
| **Gen Temp Alert** | | |
| Environmental Temp | Check for CR14 blinking | Housing or ambient temperature is too hot or too cold for the electronic control amplifier to control moisture generator temperature. |
| Faulty electronic control amplifier PCB | Remove moisture generator cable J2, CR14 will go on. Short Pins 2 and 3 on electronic control amplifier PCB, CR14 will go off. | If not, replace electronic control amplifier PCB. |
| Faulty moisture generator heater thermistor | Remove J2 and check Pins 1 and 4 for 28Ω. | If not, replace a moisture generator heater assembly. |
| Faulty moisture generator thermistor | Remove J2 and remove thermistor from moisture generator, check for =100KΩ @ 23 °C. | If not 100KΩ, adjust R26 as necessary. If adjustment will not work, isolate either the moisture generator heater or field unit board. |
| **Low Cell Frequency** | | |
| Faulty Cell | | Replace cell. |
| **High Cell Frequency** | | |
| Contaminated sample cell | | Replace cell. |
| Contaminated dryer and/or trap | | Replace trap and/or dryer and flush out sample system. |
| Excessive moisture | Leak test system | Dry-down system. |
| | Verify sample gas is not above analyzer specifications. | Dry-down system. |
| **Negative Delta Frequency** | | |
| Incorrect flow rate or reference leak | | Verify and adjust flow rates. |
| Faulty dryer | Substitute dryer with known good one. | Replace and/or refill dryer. |
| | Supply known dry sample. | Replace and/or refill dryer. |
| **Memory Is Corrupted** | | |
| Faulty RAM or RAM battery | | Replace battery. |

**NOTE**

*To ensure correct moisture operation, refer to "Display Reads Low in Calibrate or Operate Modes," or "Moisture Generator Output Incorrect."*

## Field Unit Electronics

## Power Distribution

- The AC supply is applied through circuit breaker CB1 and thermal cutout S2 to the primary of transformer T1.
- The T1 secondary (35 VAC) is connected directly to rectifier and regulator circuits on the electronic control board.
- Diodes CR4 and CR5 supply unregulated +24 volts and feed the series-connected voltage regulators.
- VR1 supplies +12 volts and VR2 supplies +5 volts.
- Diodes CR2 and CR3 supply unregulated +24 volts for the cell oven.
- CR15 and CR16 supply unregulated +24 volts for the moisture generator oven.

### Power distribution failure symptoms

- Valves do not switch, but output reading could be on display.
- One or more LEDs do not light, depending on faulty circuit.
- No moisture generator heat.
- No oven heat; CR1 and CR14 on steady.

### Electronics control board voltage checks

- +5 volts — TP5 J7
- +12 volts — TP4 J6
- +24 volts — TP2 J4 (0 volt — TP1 J3)

## Heat Control

There are two, identical, +24-volt heat control circuits: one for the cell oven and one for the moisture generator. Each has a heater, an inverting amplifier (U1 or U2), a thermistor (RT1 or RT2), a triac (Q1 or Q2), an LED (CR1 or CR14), a temperature adjustment pot (R17 or R26), and miscellaneous resistors and capacitors.

- The thermistor has a negative coefficient: heat decreases, resistance increases. This decreases the voltage to its amplifier, making the output go high, gating the triac on, applying +24 volts to the heater.

- As less heat is needed, the reverse occurs. Capacitor C6 (C9) and resistor R20 (R28) provide positive feedback to start U1(U2) oscillating and to establish a time constant for frequency control. These oscillations gate the triac on and off at a control frequency rate so that heat increases and decreases gradually. The LED lights when heater voltage is on.

The outputs of U1 and U2 also are fed to dual pulse detector U3. If an output is steady-state [(not oscillating) (fault)], a Q output of U3 turns off either transistor Q7 or Q8, which generates a fault number.

There also is a field unit environmental heater comprised of resistors R1 and R2 and a 40 °C thermostat switch S1.

## Solenoid Control

There are two, similar, +24-volt solenoid circuits: one cycles wet/dry solenoids L1 and L2 and the other operates the moisture generator/sample flow solenoids simultaneously. Their circuits include transistor switches, diodes, LEDs, and current limiting resistors.

With no valve signal (0 volt) at TB1-7, transistor switch S6 is biased on, grounding the control side of the solenoid L1 winding and lighting LED CR11. Sample gas flows through the cell.

Every 30 seconds, +5 volts is applied to transistor Q5, turning it on, grounding the control side of solenoid winding L2 and LED CR10. The solenoid opens reference gas flow through the cell, and the LED lights.

In normal operation, +5 volts is on TB1-8, biasing transistor switch Q4 on, turning Q3 off, de-energizing solenoids L3 and L4, allowing sample gas to flow. Pressing the MOIST GEN key applies 0 volt to the base of Q4, turning it off. This turns Q3 on, grounding the control sides of L3 and L4, opening moisture generator gas flow.

## Cell Output

There are two crystal oscillator ($Y_1$ — reference and $Y_2$ — measure) circuits with amplifier/inverters U1 and U2 and rc filters. Except for their frequencies, the two oscillators function alike.

U2A-1/-2 and U2F-13/-12 provide positive feedback to sustain the $Y_1$ (Reference) and $Y_2$ (Measure) nominal oscillations at 8.982500 MHz and 8.982000 MHz, respectively.

U2B/C and U2E/D amplify the outputs.

Assuming a dry $Y_2$ frequency of 8.982000 MHz, (L2 energized) and a $Y_1$ frequency of 8.982500 MHz, low pass filter C9 develops a difference frequency of 500 Hz ($DF_2$). This frequency is amplified to produce a square-wave voltage of 0 to 12 at 500 Hz applied to the controller processor.

During the 30-second wet cycle, moisture is sorbed in the crystal cell which adds to its weight. The additional weight decreases the frequency to 8.981000 MHz (assumed), which produces a wet difference frequency ($DF_1$) of 1500 Hz (8.982500 – 8.981000 = 0.0015 MHz). This frequency is amplified and applied to the microprocessor as a square-wave voltage of 0 to 12 at 1500 Hz.

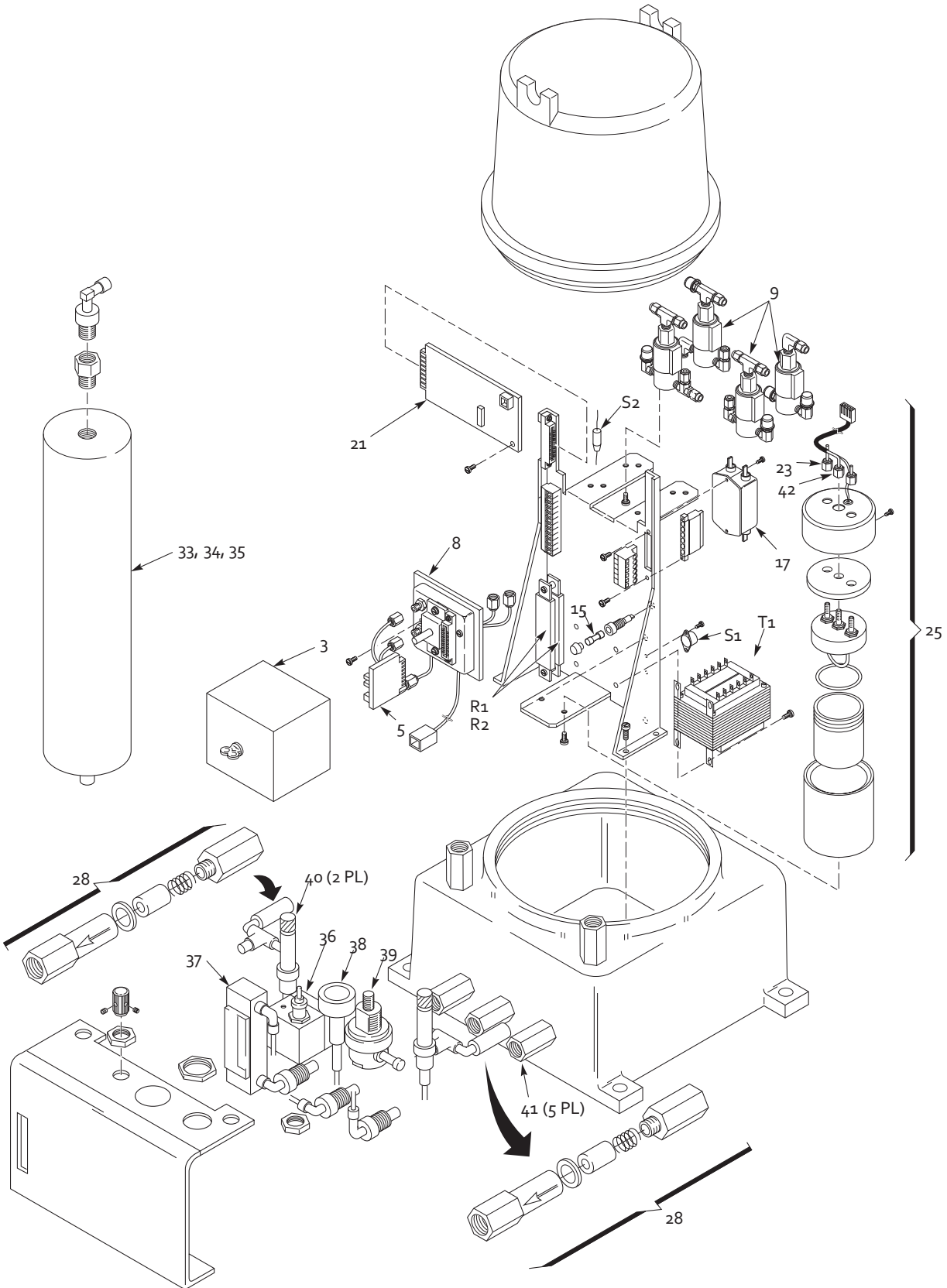



**Figure 12.**
**Field Unit parts replacement.**

## Field Unit

Numbers in parentheses refer to find numbers in Figure 12.

WARNING

*The Field Unit may contain flammable or toxic process gas. Remove the lid in a well-ventilated area only after electrical power is shut off and the surrounding area in known to be non-hazardous.*

NOTE

*The lid weighs 8.2 kg (18 pounds). Handle with care.*

## Lid Removal

1. Shut off system power and sample and reference gas flows at their sources.
2. Unscrew the lid (1), using a bar across the slots on the top if required.
3. Carefully lift off the lid and set it aside.

## Cell Replacement

1. Shut off system power and sample and reference gas flows at their sources.
2. Carefully remove the lid and set it aside.
3. Remove the oven cover wing nut (2); tilt the cover (3) up and carefully slide it from the assembly.
4. Loosen the two tubing nuts (4) and disconnect the lines.
5. Unplug the cell and board (5).
6. Carefully plug the new cell and board into its connector.
7. Connect and secure the two tubing nuts.
8. Install the oven cover and wing nut.
9. Do a leak test and re-install the lid.
10. Apply power and verify flows, back pressure and cell frequency.
11. Input new cell poly coefficients per instructions on page 5-9.

## Cell Oven Replacement

1. Shut off the system power and sample and reference gas flows at their sources.
2. Carefully remove the lid and set it aside.

3. Remove the wing nut (2) from the oven cover.
4. Tilt the cover up and carefully remove it from the assembly.
5. Loosen the two tubing nuts (4), disconnect the lines, and unplug the cell board (5).
6. Remove the plugs (6 and 24) from electronics control board sockets J1 and J2, and unplug the control board.
7. Loosen the tubing nuts (8A) and disconnect the tubes from solenoids SV1 and SV2 and from the lower part of the oven assembly.
8. Disconnect the oven wires from TB1-4 and -5.
9. Remove the oven mounting screws (7) and lift off the oven assembly (8).
10. Carefully hand bend the two oven lines to match the original installation as near as possible to preclude interference with the control board and the oven cover.
11. Position the new oven assembly on the bracket and install the screws.
12. Connect the lines to the solenoids and to the lower part of the oven assembly. Secure the tubing nuts.
13. Reconnect the oven wires to TB1-4 and -5.
14. Insert the control board in its socket and connect the plugs to J1 and J2. Secure the screws.
15. Install the cell board and connect and secure the two tubing nuts.
16. Install the oven cover and wing nut.
17. Do a leak test and re-install the lid.
18. Apply power to the system, allow it to warm up, and resume operation.

## Moisture Generator Sample/Reference Valve Assy

1. Shut off system power and sample and reference gas flow at their sources.
2. Carefully remove the lid and set it aside.
3. Loosen the tubing nuts from the fittings (10).
4. Disconnect the solenoid wires from TB2 (11).
5. Remove the two mounting screws (12) and the valve assembly (9).
6. Position the new assembly on the chassis and install the mounting screws.
7. Connect the solenoid wires to TB2.
8. Connect and tighten the tubing nuts.
9. Do a leak test and re-install the lid.
10. Apply the power to the system, allow it to warm up, and resume operation.

## Electronics Control Board

1. Shut off system power and sample and reference gas flows at their sources.
2. Carefully remove the lid and set it aside.
3. Disconnect the plugs from J1 and J2.
4. Remove the two screws (22), pull the board slightly forward to clear the bracket, and pull the board from its connector.
5. Firmly press the new board into its connector and install the two screws.
6. Connect the plugs to J1 and J2.
7. Re-install the lid.
8. Apply power to the system, allow it to warm up, and resume operation.

## Thermal Cutout Link S2

1. Shut off system power.
2. Carefully remove the lid and set it aside.
3. Determine reason for thermal runaway inside of the field unit. S2 is a 72 °C device. Inside temperature is normally regulated at 40 °C.
4. Disconnect the link from TB3-5 and -6.
5. Connect the new link to TB3-5 and -6.
6. Re-install the lid.
7. Apply power to the system, allow it to warm up, and resume operation.

## Moisture Generator Reservoir Refilling

NOTE

*Perform this procedure as quickly as practicable to keep downtime to a minimum and heaters from cooling.*

1. Shut off system power.
2. Carefully remove the lid and set it aside.
3. Remove the thermistor from the top of the moisture generator with a $^{7}/_{16}$-in. wrench; pull the thermistor straight out.
4. Obtain a syringe (5 or 10 mL) and a $^{1}/_{16}$-in. plastic tubing to fit the nozzle. Cut the tube to a length so that it reaches a nominal 0.75 inch straight into the generator.

CAUTION

*Take care you do not puncture the permeation tube inside the generator.*

5. Insert the tube straight into the generator a nominal 0.75 inch and withdraw the syringe piston.
   - If you draw water into the tube, the generator water level is good.
   - If you do not draw water into the tube, continue.

6. Fill the syringe with distilled or deionized water and fill the generator until you can withdraw water down to the halfway point. Level must be at the halfway point.
7. Install the thermistor and tighten the fitting.
8. Re-install the lid.
9. Apply power to the system, allow it to warm up, and resume operation.

## Filter Frit (PN 560503901) Replacement

1. Shut off sample and reference gas flows at their sources.
2. Disconnect the inlet tube.
3. Remove the filter (28) and unscrew the end (30).
4. Tap the filter against a bench to remove the frit (31).
5. Install a new frit. Be sure that the open end of the frit is in the direction of the arrow on the filter.
6. Assemble the filter and install it in the line.

## Dryer or Trap Refilling


NOTE

*If the dryer or trap is to be moved to another area to replace the molecular sieve in the dryer or the activated charcoal in the trap, place caps over the fittings while transporting the unit. This will prevent fitting damage.*

1. Shut off sample and reference gas flows at their sources.
2. Unscrew the two ferrule nuts (32) and disconnect the two lines from the dryer or trap.
3. Unstrap the dryer or trap (33) from its mount.
4. Remove the fill plug (34) and the snubber (35), and empty the contents.
5. Clean the inside thoroughly (do not use water). Be sure it is completely dry.
6. Fill the dryer with new molecular sieve (dried), or fill the trap with new activated charcoal.
7. Install the fill plug and snubber.
8. Do the following to the superactivated dryer:

   - Attach the bottom fitting to a flowmeter with a valve.

- Carefully place the cylinder in an oven with a source of dry gas < 0.1 PPM (known good superactivated dryer) connected to the top fitting.


*Make sure that one end fitting is open before applying heat to the cylinder. If the sieve is moisture-laden and the fittings are capped, the cylinder could explode when heated.*

- Adjust oven heat to 125 °C and purge flow to 100 mL/min. Allow it to run at temperature for 12 hours.

- Shut off purge and oven heat, and allow the cylinder to cool for at least one hour.


*Wear gloves. The cylinder will still be hot.*

- Disconnect and cap both ends and remove the cylinder from the oven.

9. Install the unit and connect the lines.

## Leak Testing

1. Carefully remove the lid and set it aside.
2. Cap the back pressure exhaust and reference gas inlet tubes.
3. Apply 200 kPa (30 PSI) gauge instrument air pressure to the sample inlet.


*Pressures over 30 PSI could destroy the gauge.*

4. Close the Sample gas flow control valve while maintaining the applied pressure in the analyzer.
5. Generously apply a soap solution to all gas connections fittings. Check for leaks and tighten fittings if necessary. Wipe off excess liquid.
6. Repeat Steps 3, 4, and, if necessary, Step 5.
7. Re-install the lid.

## Valve Operation and Heater Cycling

*The field unit may contain flammable or toxic process gas. Remove the field unit lid in a well-ventilated area only after disconnecting power.*

Check valve solenoid and heater operation by removing the lid and observing the LEDs.

## Oven Temperature Adjustment


NOTE

*Perform this procedure as quickly as practicable to keep cooling from affecting the readings.*

1. Carefully remove the field unit lid and set it aside.
2. Remove the plug from electronic control board socket J1.
3. Quickly connect a DVM, set to read ohms, between pins P1-1 and -4 (on body of J1) and check for the resistance specified on the oven thermistor label (also on J1), ± 200 ohms.
4. If necessary, adjust R17 one turn for each 1000-ohm (»1°C) difference between the specified and actual resistances. (Turn clockwise to decrease resistance.)
5. Remove the DVM and connect the oven plug to J1.
6. Re-install the lid.
7. Apply power to the system and allow it to warm up.
8. If necessary, repeat the procedure until no further adjustment is required to maintain 60 °C.

## Moisture Generator Temperature Adjustment


NOTE

*Perform this procedure as quickly as practicable to keep cooling from affecting the readings.*

1. Carefully remove the field unit lid and set it aside.
2. Remove the plug from electronic control board socket J2.
3. Quickly connect a DVM, set to read ohms, between pins P2-2 and -3 and check for the resistance specified on the moisture generator label, ± 200 ohms.
4. If necessary, adjust R26 one turn for each 1000-ohm (»1°C) difference between the specified and actual resistances. (Turn clockwise to decrease resistance.)
5. Remove the DVM and connect the moisture generator plug to J2.
6. Re-install the lid.
7. Apply power to the system and allow it to warm up.
8. If necessary, repeat the procedure until no further adjustment is required to maintain 60 °C.