

Model 93x-Series Analyzers

Essential Health and Safety Requirements

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Rev H

 **AMETEK**[®] Canada
A DIVISION OF AMETEK PROCESS & ANALYTICAL INSTRUMENTS
Western Research

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About This Document

This document primarily describes the essential health and safety requirements for the Model 931S, Model 932S, Model 933, Model 933S, and Model 934 Analyzers intended for use in explosive atmosphere locations.

The procedures discussed in this document include only abbreviated steps to install, operate, and perform maintenance on the 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 specific analyzer manual.]



NOTE

References to Model 93x in this document refer generally to Model 931S, Model 932S, Model 933, Model 933S, and Model 934 Analyzers, except where specified.

About the Model 93x-Series Analyzers

AMETEK Model 931S/932S Analyzers use photometric analysis to continuously monitor H₂S levels in acid gas (and other) applications or other high dewpoint applications, Model 933/933S Analyzers uses photometric analysis to continuously monitor H₂S levels in pipeline quality natural gas, and Model 934 Analyzers use a number of different sensor technologies to measure the concentration of one or multiple gas species – i.e., hydrogen (H₂), carbon dioxide (CO₂), and/or hydrocarbons (HC) – in a gas stream.

[For detailed information about the applications suited for these analyzers, refer to the specific analyzer manual.]

The measurements can be viewed using a computer connected to the analyzer and running AMETEK's Configurator Software.

Important Safety Information

Before installing, operating, or servicing the analyzer – and before opening it at any time after it has been in operation – read and follow all Warnings, Cautions, and Notes in this document and in the analyzer manual. This information contains important safety and general information about the analyzer.



Always disconnect main AC power and/or alternate power sources (example, for relay contacts) to the analyzer before removing any sample system assemblies and components from the analyzer, or before opening any covers on the analyzer.

If it is necessary to open the Upper/Lower Ex d Enclosures while the circuits are live, test the area for explosive gases and proceed only when it is found to be safe. When the enclosures are open, take appropriate precautions to avoid electrical shock. Hazardous voltages are present inside.



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, and be approved by the Owner Company.



For Division 1/Zone 1 Installations, all cable entry glands (one power cable entry and two signal cable entries) into the flameproof Disconnect Enclosure must be Ex d certified. Conduit or cable seals that comply with the flameproof enclosure cable entry sealing requirements of the local authority must be installed at the entries to the enclosure. In all cases, each unused cable entry port must be plugged with a certified Ex d plug.



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

Specifications

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

Electrical Requirements

Maximum Start-Up Power

Model 931S/932S Analyzers:

Without optional Measuring Cell Heater or Heated Acid Gas Probe:

210 W maximum start-up with continuous average, depending on ambient temperature (excludes Sample/Vent Line power).

With optional Measuring Cell Heater:

310 W (excludes Sample/Vent Line power).

Model 931S/932S/934 Analyzers with optional Measuring Cell Heater and Heated Acid Gas Probe, and Model 933/933S Analyzers:

< 500 W maximum start-up with continuous average, depending on ambient temperature (excludes Sample/Vent Line power).

Supply Voltage / Maximum Current

ATEX/Hazardous Locations

120 V_{AC}, 50/60 Hz, 3 A Maximum

240 V_{AC}, 50/60 Hz, 1.5 A Maximum

Customer Connections

Status Relay Contacts

240 VDC, 2 A Max.

Digital Inputs

For Auto-Cal and Alarm Enable/Clear

0–24 VDC, 30 VDC Max.

Analog Outputs

4–20 mA DC, 30 VDC Max.

Ambient Temperature Limits

From 0–50 °C (32–122 °F).

Model 933/933S Analyzers

The surrounding ambient temperature must be at least 5 °C (9 °F) degrees above the highest expected dewpoint temperature. It is also extremely important to maintain a relatively stable ambient temperature in the vicinity of the analyzer, with no rapid temperature fluctuations.

Model 931S/932S Analyzers

For applications using an unheated Measuring Cell, the surrounding ambient temperature must be at least 5 °C above the sample dew point temperature. In high dewpoint applications, a heated Measuring Cell and heat-traced Sample/Vent Lines must be used to prevent condensation of liquids in the sample system.

Model 934 Analyzer

In high dewpoint applications, heat-traced Sample/Vent Lines must be used to prevent condensation of liquids in the sample system.

Sample Pressure Requirements

Model 933/933S Analyzers

Without Filterblock Assembly:

830–20 700 KPAG (120–3000 PSIG) or application dependent

With Filterblock Assembly:

830–13 790 KPAG (120–2000 PSIG) or application dependent

Model 931S/932S/933S/934 Analyzers

Without Filterblock Assembly:

Application dependant, refer to Final "As-Built" drawings for maximum pressure ratings for your system.

With Filterblock Assembly:

Application dependant, refer to Final "As-Built" drawings for maximum pressure ratings for your system.

Analyzer Markings

ATEX- and IECEx-certified Model 931S/932S/934 and Model 933/933S Analyzers are marked with these labels.

Figure 1-a.
Model 931S/932S/
934 Analyzers
label.

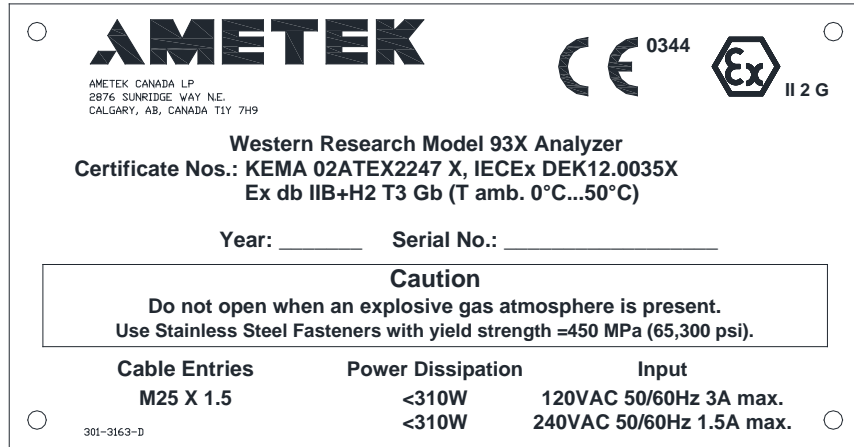
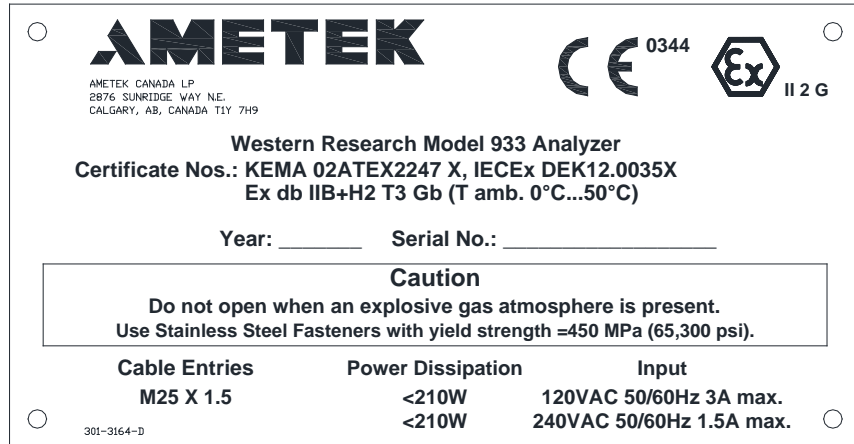


Figure 1-b.
Model 933/933S
Analyzers label.



Installing the Analyzer and the Optical Bench Assembly

The Optical Bench Assembly – shipped in a separate box – must be installed in the analyzer’s Upper Enclosure after the analyzer has been installed.

All electrical connections to the Optical Bench are made via pre-wired connector plugs. No hard wiring is required.

[For complete installation details, refer to “Installing the Mechanical Components” in the analyzer manual.]



NOTE

The Model 934 Analyzer does not use an Optical Bench.



WARNING

Ensure there is no power being supplied to the analyzer while installing the Optical Bench.



CAUTION

While installing the Optical Bench in the Upper Enclosure, take care not to damage the enclosure’s joining areas (flamepath).



CAUTION

After the Optical Bench has been installed, use a soft, nonabrasive cloth to gently clean the joining areas (flamepath) of the Upper Enclosure and its door. Close the door and replace at least one of the M10 screws while completing the installation. This will ensure the flamepath is not inadvertently damaged.

AC Power and Signal Connections

The nominal operating voltage and power consumption is indicated on a label on the front of the Ex d Lower Enclosure. Verify that the operating voltage indicated on the label agrees with the operating voltage indicated on the documentation supplied with the analyzer.

[For complete installation details, refer to “Electrical Connections” in the analyzer manual.]



For Division 1/Zone 1 Installations, all cable entry glands (one power cable entry and two signal cable entries) into the flameproof enclosures must be Ex d certified. Conduit or cable seals that comply with the flameproof enclosure cable entry sealing requirements of the local authority must be installed at the entries to the enclosure. In all cases, each unused cable entry port must be plugged with a certified Ex d plug.



Refer to “Electromagnetic Compatibility (EMC)” near the beginning of this manual for information about the EMC Directive regarding techniques and wiring practices to be followed.

To maintain EMC compliance in European installations, AMETEK recommends using metallic glands and shielded cable (at least 85 % coverage) for both power and signal cable connections.



An explosion-proof power-disconnect switch (breaker), rated for at least 250 VAC, 3 A (analyzers without a heated Measuring Cell or Oven) or 250 VAC, 4 A (analyzers with a heated Measuring Cell or Oven), must be connected to, and mounted near, the analyzer. To satisfy local electrical codes, the switch (supplied by the customer) must be certified by the local authority for the appropriate hazardous area.

For safety reasons during maintenance, this switch allows the main AC power to be disconnected from the analyzer prior to performing service on the analyzer.

Making AC Power Connections in the Lower Enclosure

The AC electrical supply cable, which must be approved by local wiring regulations and electrical codes for the hazardous area, enters the Lower Enclosure through the Power Cable Entry on the bottom of the enclosure (Figure 2).

The AC power connections are made at the terminals designated “**H**”, “**N**”, and “**PE**” (at **TB1**) on the AC Terminal Strip (Figure 2, Detail A).

Making Signal Connections in the Lower Enclosure

The analog input/output (and alarm relay) terminations are made on the **Customer I/O** board in the Lower Enclosure. Signal wires, contained within cable that is approved locally for the hazardous area, enter the Ex d Lower Enclosure through one of the Signal Cable Entries on the bottom of the enclosure.

[The terminal assignments are identified in the *Customer Connections* Final “As-Built” drawing in the analyzer Documentation Package.]

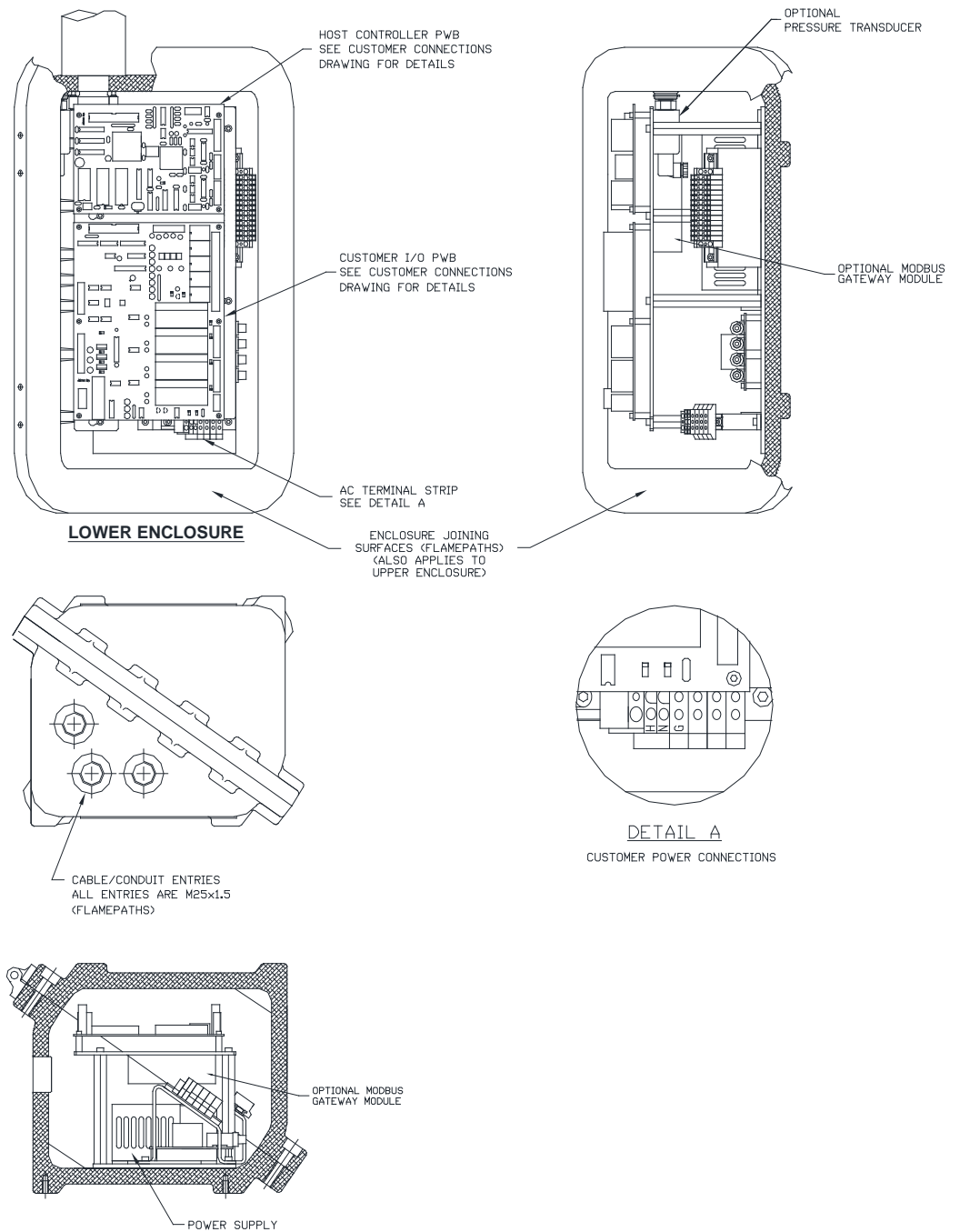


Figure 2.
Conduit entries,
AC power
connection and
flamepath
locations (Ex d
Lower Enclosure).

Start-Up and Verification

When powering up the analyzer, certain checks should be performed to ensure the analyzer is operating properly and is ready to be commissioned into operation.

[For detailed power-up information, see “Start-Up and Verification” in Chapter 3 of the analyzer manual.]

If you cannot verify these checks, refer to “Troubleshooting Diagnostics and” in Chapter 6 of the analyzer manual for assistance. Resolve any problems before proceeding to the next start-up stage.



Hazardous Locations

Before proceeding, test the area around the analyzer for explosive gases and proceed only when the area is found to be safe.

Do not remove the cover of the Explosion-Proof Digital Communications Port on the front of the Lower Enclosure, do not connect a serial cable to the Communications Port, do not open the Upper/Lower Enclosures, and do not power up/down the analyzer or computer if there is an explosive gas atmosphere present.



Before operating the analyzer for the first time, following a power-up or reset, or after maintenance, you must manually block in the sample gas flow.

Also, for verification and troubleshooting purposes during power up, it will be necessary to work with the Upper/Lower Enclosures open. Before powering up the analyzer, test the area for explosive gases. If an explosive gas atmosphere is present, do not apply power to the analyzer or any alternate power sources that supply power to the analyzer components. Proceed only when the area is found to be safe.

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



Do not apply power to the analyzer if any of its flamepaths appear to be scratched, dented, or worn. Applying power to an analyzer with a damaged flamepath is dangerous and could result in serious injury or death and/or serious damage to equipment. See “Examining and Caring for the Flamepaths” in Chapter 6.

Replace parts immediately if damage or wear is apparent. Contact AMETEK if there is any doubt about the integrity of any flamepath.

Maintenance and Troubleshooting

Follow the “Analyzer Preventive Maintenance Schedule” [in Chapter 6 of the analyzer manual] to ensure continued and proper operation of the analyzer. This section also describes parts that require replacing and the frequency in which they should be replaced.

Establishing Communication Between the Analyzer and Computer

Communicating with the analyzer is accomplished via a computer running AMETEK’s Configurator Software.

The analyzer Configurator Software provides a graphical interface to configure and control the analyzer. You will also use the Configurator Software to perform maintenance or troubleshooting.



Hazardous Locations

Before proceeding, test the area around the analyzer for explosive gases and proceed only when the area is found to be safe.

Do not remove the cover of the Explosion-Proof Digital Communications Port on the front of the Lower Enclosure, do not connect a serial cable to the Communications Port, do not open the Upper/Lower Enclosures, and do not power up/down the analyzer or computer if there is an explosive gas atmosphere present.

To establish communication between the analyzer and computer:

1. Connect the supplied serial cable between the computer and the analyzer’s Digital Communications Port on the front of the Lower Enclosure.
[For other communications options, refer to the analyzer manual.]
2. Power up the computer, start the Configurator Software, and establish communications between the computer and analyzer, as described in the analyzer manual.

3. Perform the operation or maintenance procedure required [described below in point form, with detailed descriptions in the analyzer manual]. This can include but is not limited to:
 - Checking to ensure full-scale ranges are correct for the current sample.
 - Checking if output and analyzer values are within range (which can suggest that the Measuring Cell and/or Optics require cleaning).
[Excludes Model 934 Analyzers.]
 - Performing maintenance, such as:
[Refer to “Changing Out Replaceable Parts” in Chapter 6 of the analyzer manual.]
 - Cleaning and replacing parts in the analyzer sample system.
 - Cleaning and replacing parts in the Optical Bench Assembly.
[Excludes Model 934 Analyzers.]
 - Performing diagnostics and troubleshooting if the analyzer displays Warning or Fault alarm error messages that indicate a faulty component that requires replacement.
[Refer to “Host Controller Board Alarm Conditions and Corrective Actions” and “Microcontroller Board Alarm Conditions and Corrective Actions” in Chapter 6 of the analyzer manual.]
 - Resetting the analyzer, such as when there are *communication* (or *internal communication*) errors or *analytical data* errors.
[Refer to “Analyzer Information” (**Information** dialog box) in Chapter 4 of the analyzer manual.]



If you will be working with the computer powered up for prolonged periods, periodically test the area around the analyzer for explosive gases, according to your company's safety policies.

Before powering down the computer or disconnecting the serial communications cable from the Digital Communications Port, test the area for explosive gases and proceed only when the area is safe.

4. After you have completed communicating with the analyzer, close the Configurator Software, power down the computer, and disconnect the serial cable from the Digital Communications Port on the Lower Enclosure.
5. Slide the cover of the analyzer's Digital Communications Port to the left and hand-tighten the hex screw to secure the cover in place.

Preventive Maintenance

The “Analyzer Preventive Maintenance Schedule” lists general maintenance to follow, to ensure continued and proper operation of the analyzer. [This schedule can be found in Chapter 6 of the analyzer manual.]

To clean and/or replace parts in the various assemblies that make up the sample system:

[For detailed information on performing all software operations, refer to Chapter 4 of the analyzer manual.]

1. Take all necessary steps to safely power down the analyzer and prepare it for maintenance, as described in each maintenance section in Chapter 6 of the analyzer manual.
2. Disassemble, clean, replace parts in, and reassemble the sample system components and all associated sample system tubing:
 - **Measuring Cell Assembly (excludes Model 934 Analyzers)**
[For information about when and how to clean and replace these parts, refer to “Measuring Cell Maintenance” in Chapter 6 of the analyzer manual.]
 - **Source Lamps (excludes Model 934 Analyzers)**
[For information about when and how to replace the source lamps, refer to “Source Lamp Replacement” in Chapter 6 of the analyzer manual.]



It is necessary to work with the Ex d Upper Enclosure door open after replacing source lamps so that adjustments can be made to the lamps.

- **Chopper Assembly (Model 932S/933/933S Analyzers)**
[For information about when and how to clean and replace these parts, refer to “Chopper Assembly Maintenance” in Chapter 6 of the analyzer manual.]
- **Column Block (Model 933/933S Analyzers) or Filterblock Assembly (Model 933/933S Analyzers; optional on M931S/932S Analyzers)**
[For information about when and how to clean and replace these parts, refer to “Column Block Maintenance” or “Natural Gas Filterblock Maintenance” in Chapter 6 of the analyzer manual.]



[While working on the Column Block Assembly]:
The joining surface of the Column Block and Column Block Flange is a flamepath.

Take care to avoid damaging this flamepath when disassembling and reassembling the Column Block.

3. After cleaning and replacing analyzer parts, take all necessary safety precautions to prepare the analyzer for power up, then restore AC power to the analyzer and power up the computer.
4. If necessary, perform a leak (pressure) check on the sample system fittings that were disconnected/reconnected.
[Refer to "Sample System Leak Check" in Chapter 3 of the analyzer manual.]
5. Prepare the analyzer to properly commission it into operation.

Examining and Caring for the Flamepaths

The analyzer is designed with flamepaths that will prevent flame propagation from within the analyzer's Ex d Electronics Enclosures to the outside, should an internal explosion occur. For other flamepaths not mentioned here, contact AMETEK.

The flamepaths on the analyzer consist of:

- The Ex d Upper and Lower Enclosure flanges (Figure 2), cable entry ports (Figure 2), and the Digital Communications Port Body-Cover joining surfaces (Figure 4).

During each analyzer maintenance, use a feeler gauge to check the flamepath gap of the Upper and Lower Enclosure flanges (enclosure doors and housing joining surfaces). The surfaces of the flanges must be flat (0.05 mm or better) and the minimum flamepath must be at least 38 mm. When the bolts are tightened, the gap must not exceed 0.1 mm (Group IIB) or 0.04 mm (Group IIB+H2).

Also, check the Communications Port Body-Cover joining surfaces. These joining surfaces must be flat (0.05 mm or better) and the minimum flamepath must be at least 7 mm. When the bolt is tightened, the gap must not exceed 0.1 mm (Group IIB) or 0.04 mm (Group IIB+H2).

Model 931S/932S/933S/934 Analyzers:

Check the (Cell/Oven) Heater Block and (Cell/Oven) Heater Block Lid joining surfaces. The flamepath gap must not exceed 0.1 mm (Group IIB) or 0.04 mm (Group IIB+H2).

If any gap exceeds its maximum flamepath gap value, contact AMETEK for advice. See Warning below. In all locations, use stainless steel fasteners with yield strength ≥ 450 MPa (65,300 psi).

- Enclosure (Electrical) Connection Seal, Cell Window Housing, and Solenoid Junction Box.

These areas are not typically disassembled for general or preventive maintenance and therefore should remain intact. However, if there is ever any indication of damage or wear to these flamepaths, use a feeler gauge to check the flamepath gap.

The flamepath gap must not exceed 0.1 mm (Group IIB) or 0.04 mm (Group IIB+H2); if the gap exceeds this value, contact AMETEK for advice. See Warning below. For the dimensions of other flamepaths not mentioned here, contact AMETEK.

- **Model 933/933S Analyzers:**

All separable joints in the Heated Column Block Assembly (Figure 4). These parts include the joining surfaces of the Column Block Assembly housing and its cover, and the connecting tube to the analyzer.

During each analyzer maintenance, use a feeler gauge to check the flamepath gap of the Heated Column Block flange (Column Block and Column Block Flange joining surfaces). The gap must not exceed 0.05 mm (Group IIB) or 0.04 mm (Group IIB + H2); if the gap exceeds this value, contact AMETEK for advice. See Warning below.



Take extreme care to avoid damaging the threads on the cable entry glands on the Lower Electronics Enclosure and all threaded parts on or in the Solenoid Junction Box, Solenoid Block, Heated Column Block (Model 933/933S Analyzers only), and optional Display assemblies. Clean, defect-free threads are essential to ensure a flameproof connection.



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.



Do not apply AC power to the analyzer if any of its flamepaths appear to be scratched, dented, or worn. Applying power to an analyzer with a damaged flamepath is dangerous and could result in serious injury or death to personnel and/or serious damage to equipment.

Replace the parts immediately if damage or wear is apparent. Contact AMETEK immediately if there is any doubt about the integrity of a flamepath.

Upper/Lower Electronics Enclosure Flamepaths (Joining Surfaces)

Any time either Ex d (Upper or Lower) Electronics Enclosure is opened for maintenance, inspect the enclosure flamepath for scratches, indentations, or other damage. Carefully clean the flamepaths (joining surfaces) with a soft, nonabrasive cloth just before closing it.



Before opening the analyzer's Ex d Upper/Lower Enclosure, follow all necessary safety procedures to ensure the area is nonhazardous (main AC power to the analyzer is off, explosive gas atmosphere is not present, etc.).

Before performing maintenance on the analyzer, shut off main AC power and all alternate power supplies (if used) to the analyzer.



When the Ex d Upper/Lower Enclosure is opened for maintenance or repair, take extreme care to avoid scratching or damaging its flamepaths.

If at any time the enclosure door is open and service personnel are not working on the Ex d Upper/Lower Enclosure, close the door and secure it with at least one screw. This will reduce the risk of inadvertently scratching or damaging the flamepath.

Before closing the door, gently clean the flamepaths with a soft, non-abrasive cloth and make sure the surfaces are free of debris.



If it is necessary to use a cleaning agent, make sure the AC power to the analyzer is off. Also, the agent must be non-abrasive and must not attack aluminum (example, a suitable agent is Isopropanol). Following any maintenance and/or cleaning – and after the cleaning fluid has evaporated completely – immediately close the Ex d Upper/Lower Enclosure.

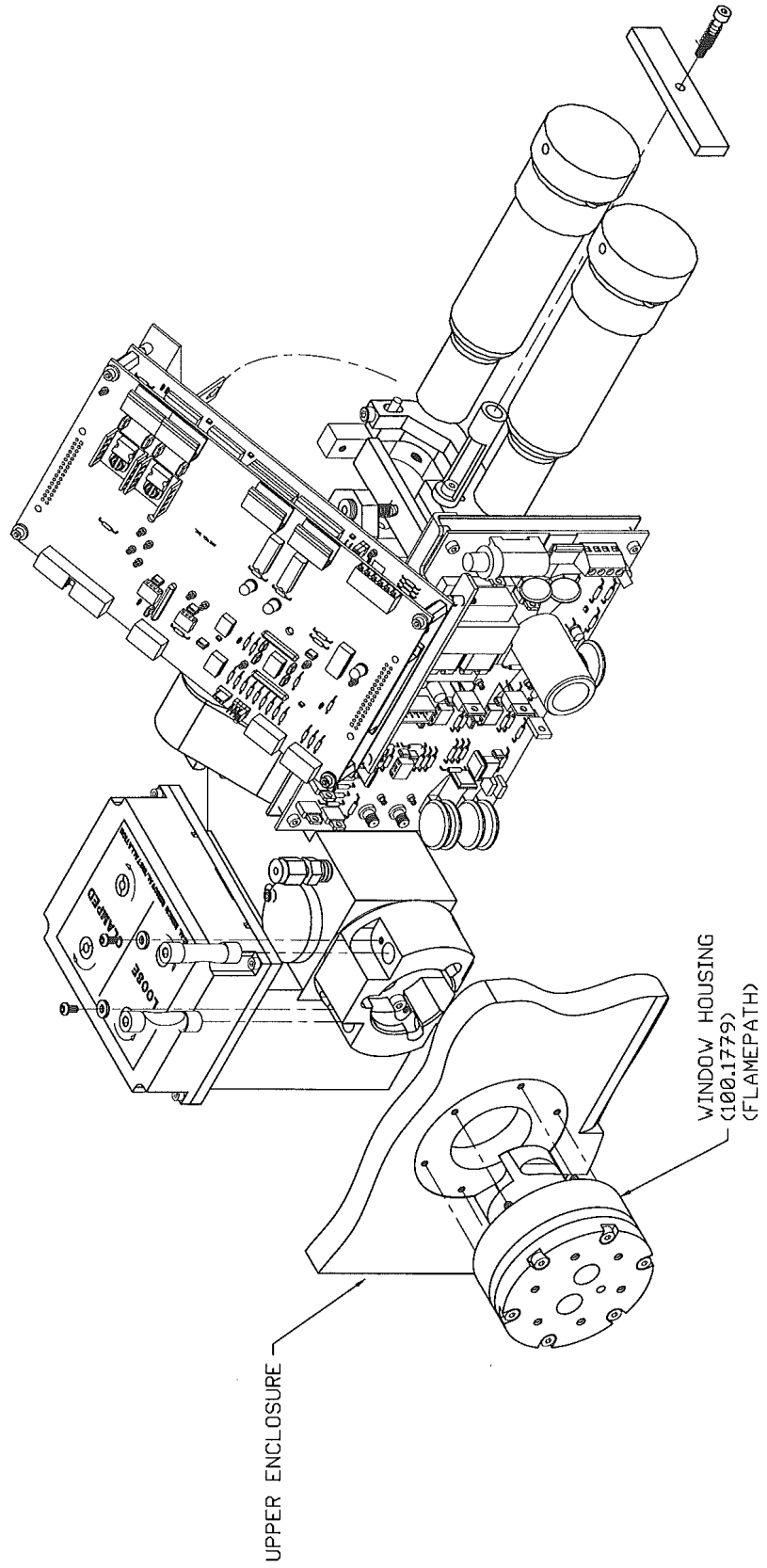
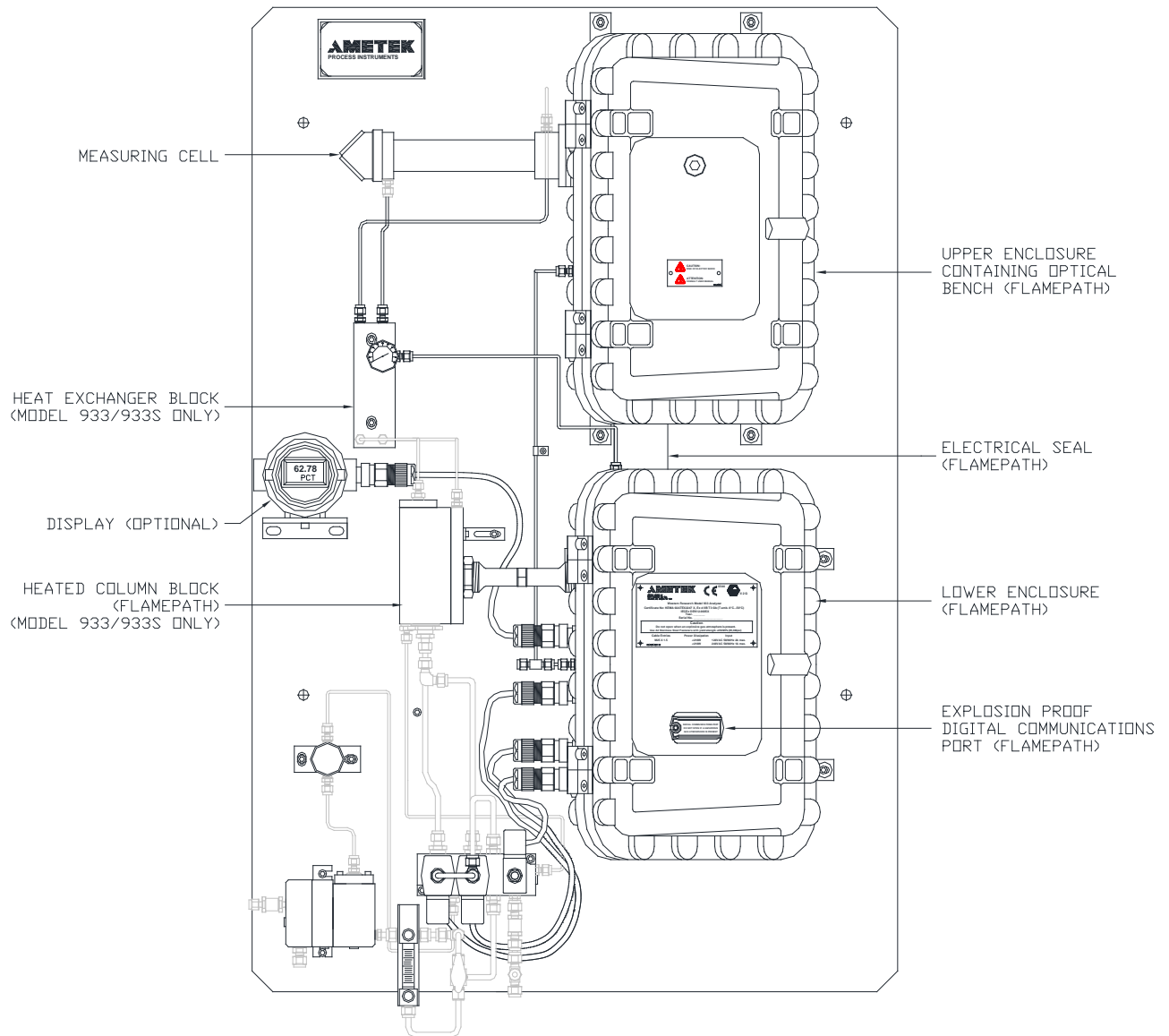


Figure 3.
Flamepath
location, Optical
Bench Assembly.



NOTE: PLUMBING SHOWN IS FOR TYPICAL MODEL 933.
ACTUAL PLUMBING MAY VARY.

REFERENCE:
 CERTIFICATE NO: KEMA 02ATEX2247 X
 CERTIFICATE NO: IECEx DEK12.0035X

Figure 4.
Flamepath locations.

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