

Maxum II

PD PA AP Maxum Edition II Detectors

Service Manual

Detector Overview

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Thermal Conductivity Detector

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Appendix A - Change Log

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Descriptions and maintenance procedures for detectors and related components used in Maxum II Gas Chromatographs. The information in this manual supercedes the applicable topics in previous manuals.

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

indicates that death or severe personal injury will result if proper precautions are not taken.
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WARNING
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indicates that death or severe personal injury may result if proper precautions are not taken.

CAUTION
--

indicates that minor personal injury can result if proper precautions are not taken.
--

NOTICE

indicates that property damage can result if proper precautions are not taken.
--

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

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The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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WARNING
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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Detector Overview

Several different types of detector modules are available for the Maxum II as follows:

- **Thermal Conductivity Detector (TCD)** - This is a concentration responsive detector for moderate sensitivity of most components. It is available as an 8 cell version with thermistors or as a 2 cell version with filaments. A 4-cell version is used in the preconfigured analytical modules in the Maxum II Modular Oven model.
- **Flame Ionization Detector (FID)** – The FID is a very sensitive detector for combustible hydrocarbons.
- **Flame Photometric Detector (FPD)** – This is a selective detector used to detect substances containing sulfur.
- **Pulsed Discharge Detector (PDD)** – This detector is manufactured by Valco Instruments Inc. It can be equipped to operate in either the Helium Ionization, Photo Ionization, or Electron Capture modes.

All of the detector modules within the Maxum II can be used in conjunction with both air bath and airless ovens. Depending upon the application requirements, a Maxum II can include up to three detector modules in a single air bath oven, or up to 2 detector modules, one for each oven, in an airless oven. Three detectors are used in special configurations.

With the exception of the thermal conductivity detectors, the detector modules are mounted in the detector compartment. The detector compartment is located between the electronics enclosure (EC) and the oven. The detector compartment houses the detector modules and provides a safe path for the electrical connections between the detector modules and the detector personality module (DPM). It also allows the detector to easily connect to the analytical components in the oven.

The detector specifications given in this section depend on the specific application in which they are installed, and reflect the performance of the component when used in a Maxum II Gas Chromatograph as a system.

1.1 DPM Types

Three DPM types are used for temperature control and detector interface:

- Intrinsic Safe Thermal Conductivity DPM
- Base3DPM
- Temperature Control Module (TCM)

The interfaces available for each are shown in the table below.

Function	TCM	IS-TCD DPM	Base3DPM
Temperature control	x		x
Intrinsic safety		x	
Detector interfaces:			

1.1 DPM Types

Function		TCM	IS-TCD DPM	Base3DPM
	RTD	x		x
	Thermistor		x	
	Filament			x
	FID			x
	FPD			x
	VPD			x

Thermal Conductivity Detector

The Thermal Conductivity Detector (TCD) is a concentration-responsive detector of moderate sensitivity. The detector cell containing the sensing elements is located in the chromatograph oven. The TCD is the only Maxum II detector type that is not mounted in the detector compartment.

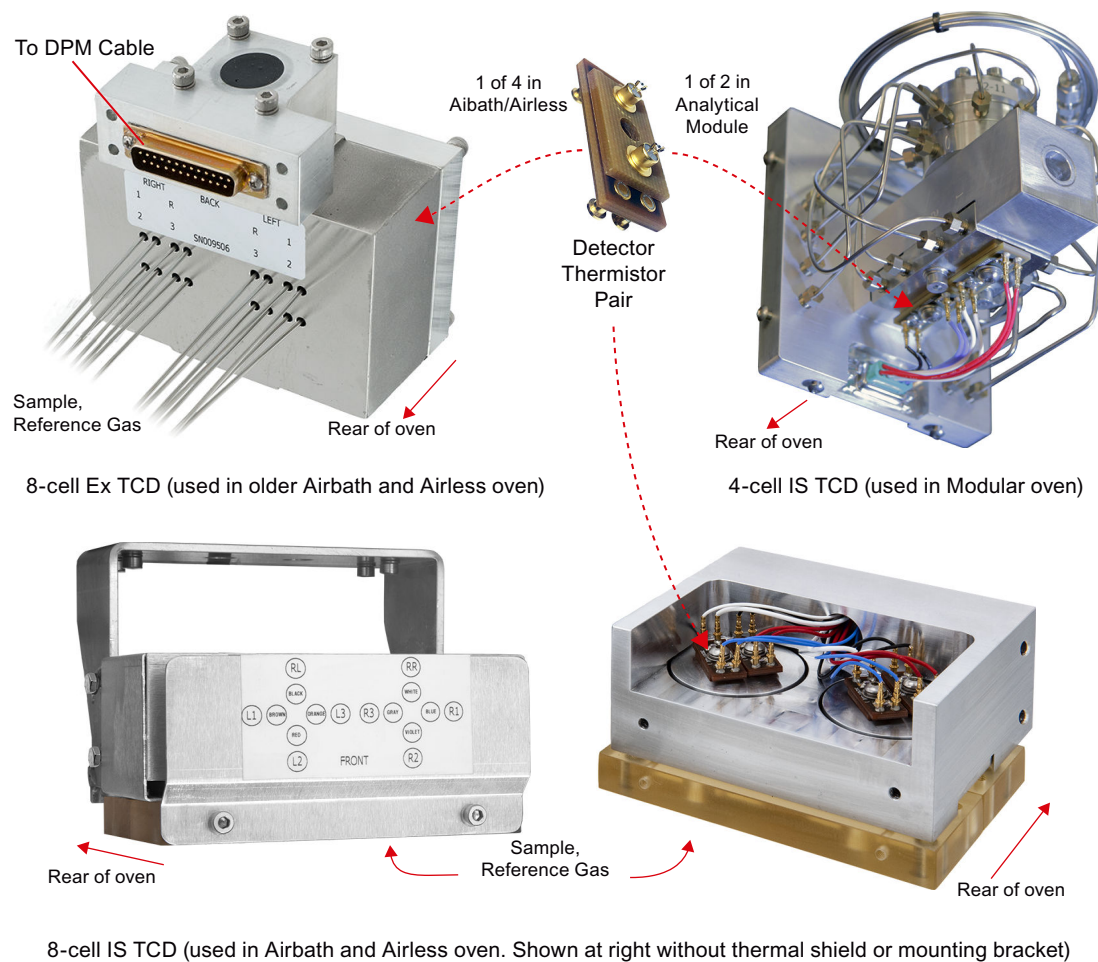


Figure 2-1 Thermal Conductivity Detectors

The TCD works on the principle that the thermal conductivity of the carrier gas is different than the thermal conductivity of the sample components. This means that the carrier gas conducts either more or less heat from the heated element than the sample components. The electronic

2.1 Intrinsically Safe Thermal Conductivity Detector (IS TCD)

circuits sense the change in heat flow and produce a proportional analog voltage signal. Two types of TCD are used within the Maxum II.

- Thermistor Model – This TCD type uses thermistors. It includes six independent measurement cells and two reference cells. This detector connects to the IS TCD DPM, located in the electronics cabinet.
- Filament Model – For higher temperature requirements a 2-cell TCD is available that uses filaments for thermal conductivity sensing. The 2-Cell Filament TCD is often used as an Inter-Column Detector in conjunction with an FPD or FID application. This detector typically connects to a dedicated input channel on the Base DPM.

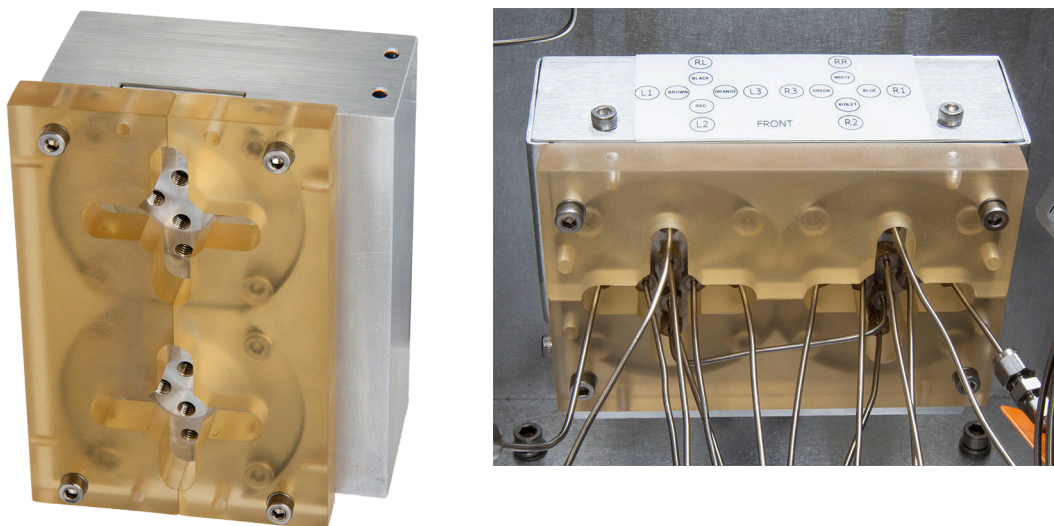
Note

Filament modules must not be installed in an IS TCD. Do not connect a circuit designed for filament inputs to an IS TCD.

2.1 Intrinsically Safe Thermal Conductivity Detector (IS TCD)

The Explosion-Proof/Flameproof TCD (ExTCD), was used in previous versions of the Maxum II. Current versions of the Maxum Airless and Airbath Oven Models are equipped with 8-cell Intrinsically Safe TCDs. Maxum Modular Oven Models use 4-cell IS TCDs in the analytical modules.

The earlier Ex TCD had tubing welded to the detector block to meet requirements for an explosion-proof /flameproof enclosure. The IS TCD has no such requirements, so the ports are on the bottom side as shown below. This allows connecting columns directly to the detector block, reducing the number of fittings and places where leaks could develop.



See the TCD discussions in the Maxum II Explosion Protection Safety Standards Manual (<https://support.industry.siemens.com/cs/document/42017542/maxum-edition-ii%3A-explosion-protection-safety-standards?>), document number A5E02220442001, and the *Using Small Tubing Fittings* section in the Maxum Edition II Valves and Oven Components Service Manual, document number A5E42019844001 (<http://support.industry.siemens.com/cs/products?dtp=Manual&pnid=17741>)

2.2 Intrinsically Safe Thermal Conductivity DPM

Overview

Output signals from the Thermal Conductivity Detector (TCD) in the oven are wired to the associated Detector Personality Module (DPM). The DPM is mounted inside the Electronics Compartment (EC) on the floor of the compartment. The DPM digitizes the incoming analog signal and then passes the data to the system controller via an I²C port. The resulting data is then processed by the Embedded SNE software. Results can then be viewed on the maintenance panel or the workstation.

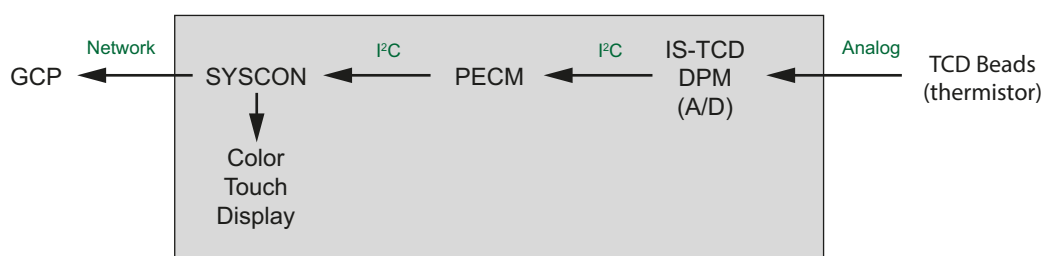


Figure 2-2 Thermal Conductivity Detector Signal Path

The IS TCD DPM is an enclosed unit that is not field repairable. Opening the case voids the safety protection of the device. Service is limited to replacement of the entire DPM.

Part Numbers

The IS TCD4 DPM is compatible with the MAXUM Airbath and Airless platforms for Intrinsically Safe and non-Intrinsically Safe detectors. Where an Intrinsically Safe TCD is used, the safety certification for the MAXUM Airbath and Airless only allow the IS TCD4 DPM. The IS TCD3 DPM is ONLY certified for use with an Intrinsically Safe detector in the Maxum Modular Oven model. (Both IS TCD3 DPM and IS TCD4 DPM are certified for use in the Maxum Modular Oven model). The Maxum Airbath and Airless models that use an Intrinsically Safe detector are certified only when an IS TCD4 DPM is properly installed.

The IS TCD4 DPM (part number A5E43267455001) is installed in current analyzers, and can be used as a replacement for the IS TCD3 DPM by using a blocking plug on pin 1 of the 11-pin connector. However, the IS TCD3 DPM cannot be used as a replacement for the IS TCD4 DPM. See the note under the *Connections* heading.

The IS TCD3 DPM (part number A5E02645923001) can be used as a replacement part for earlier DPMs in Maxum I analyzers using an adapter, part number A5E34938550001. See the publication *IP-0034: Procedure to Replace Various TCD DPMs with Paired IS TCD DPM and TC DPM in a Maxum or Maxum II Analyzer* on the Siemens web site.

Intrinsic Safety

The intrinsic safety feature of this module was not used in early versions of the Maxum II Airless and Airbath Oven model. The following two paragraphs apply only if this feature is used.

The TCD DPM in the Maxum II, as well as the actual detector controlled by the TCD DPM, is protected by intrinsic safety. Intrinsic safety is a method of protection where a circuit is designed such that it will not create a spark or other condition capable of causing ignition of flammable

vapors or gases, even under fault conditions. Various circuits in the Maxum analyzer use this form of protection, including the IS TCD.



WARNING

Observe Intrinsic Safety practices

To preserve the intrinsically safe design protection of the IS TCD, certain measures are required. Failure to adhere to all requirements for use of the IS TCD in the Maxum II could violate the safety protections of the analyzer and cause equipment damage or serious injury. See the Maxum II Explosion Protection Safety Standards Manual (A5E02220442001) for more information on the safe use of intrinsically safe circuitry in the Maxum II.

Connections

The connections to the IS TCD DPM are shown below.

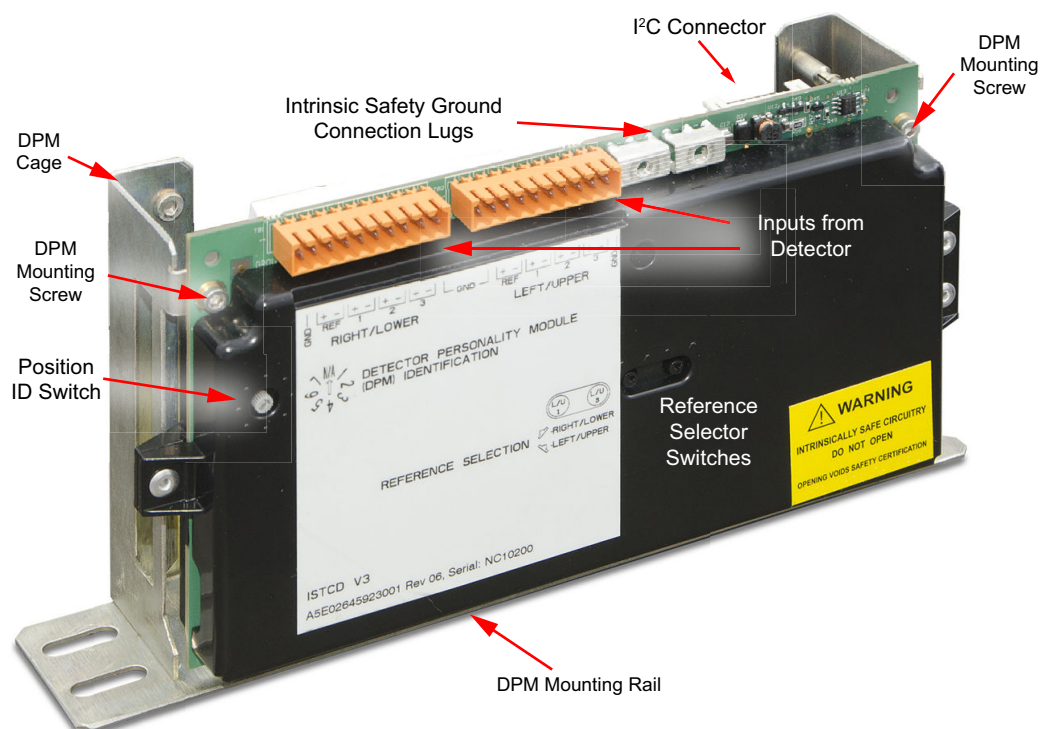
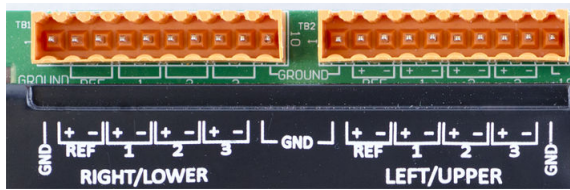
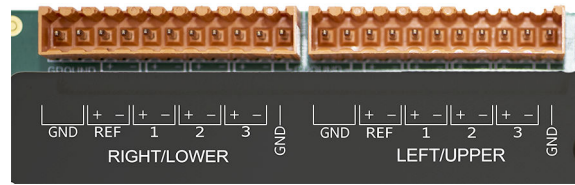


Figure 2-3 IS TCD DPM Connector Locations (IS TCD3 shown, IS TCD4 similar)

Orange connectors to detectors: Each IS TCD DPM has two detector connectors. Each connector can interface to two pairs of TCD elements (four total channels, 1 for reference and 3 for signal).



IS TCD3 DPM 10-pin connectors



IS TCD4 DPM 11-pin connectors

Figure 2-4 Detail of Detector Connectors

Note

While the modules are similar, the detector connectors are not compatible.

- The IS TCD4 DPM **CAN** be used as a replacement for the IS TCD3 DPM with a pin blocking plug.
- The IS TCD3 DPM **CANNOT** be used as a replacement for the IS TCD4 DPM.

See Replacing an IS TCD3 DPM with an IS TCD4 DPM (Page 16) for more information.

Intrinsic Safety Grounds: The intrinsically safe design of the IS TCD DPM requires two ground connections to the chassis terminated to two different terminals. The Maxum II is shipped with these grounds connected correctly. See the Maxum II Explosion Protection Safety Standards Manual (A5E02220442001) (<https://support.industry.siemens.com/cs/document/42017542/maxum-edition-ii%3A-explosion-protection-safety-standards?lc=en-WW&pnid=17741>) for more information on the safe use of intrinsically safe circuitry in the Maxum II.

I²C Bus Connection: The white connector on the reverse side of the DPM connects to the I²C Bus on the PECM.

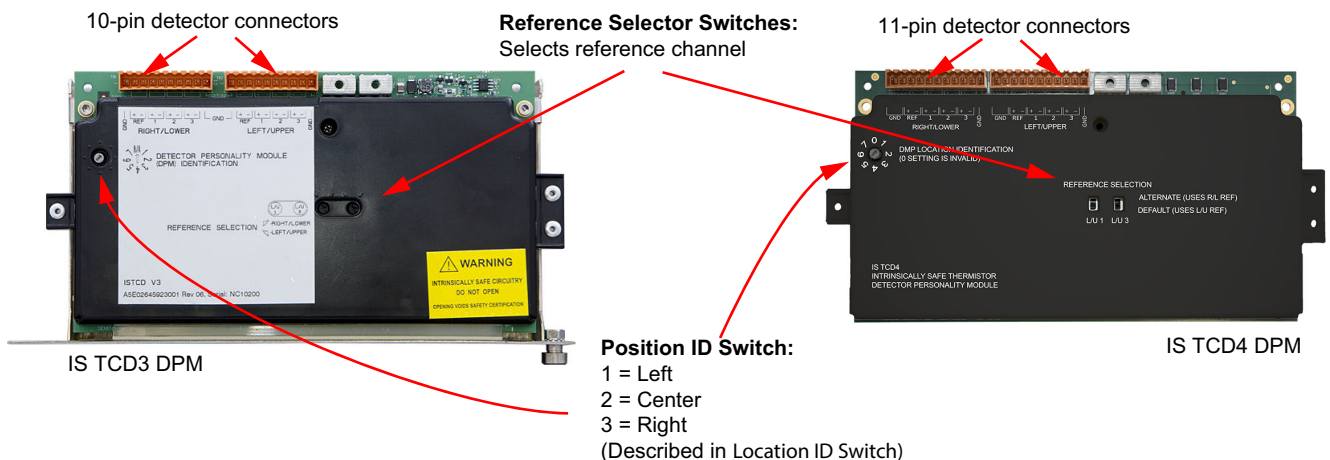


Figure 2-5 IS TCD DPM Switches

2.3 Using the Reference Selector Switches on the IS TCD DPM

A TCD application uses a reference cell and a number of measurement cells depending on the application. If more than 3 measurement cells are needed, measurement channels 1 and 3 in the Left/Upper group can use reference signal from either Alternate (Right/Lower) or Default (Left/Upper). This allows a TCD application to have up to 5 measurement cells using a single reference channel. Channels 1 and 3 are individually selectable, as shown below.

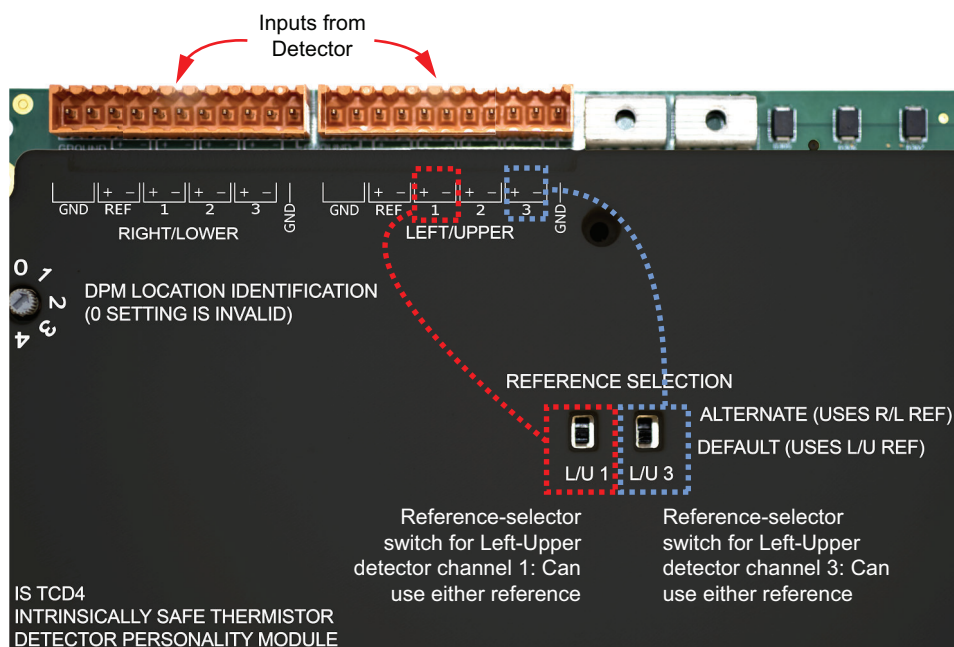


Figure 2-6 IS TCD DPM Reference Selection Switches

2.4 Troubleshooting TCD Detector Balance Errors

The information path for the TCD is shown below. Gasses flowing over the 8 thermistors inside the detector block produce varying signals that are amplified and digitized inside the TCD DPM. The steps in this section help to identify a potential problem along this path.

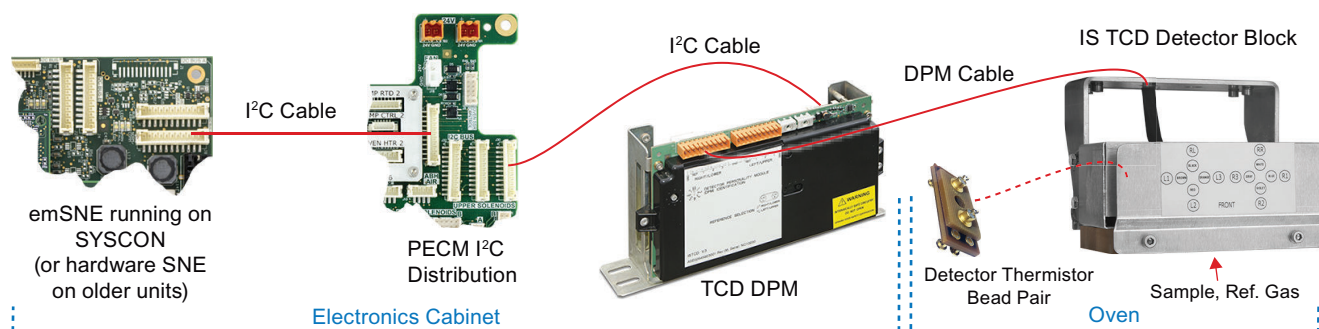


Figure 2-7 TCD Information Path (Air-Bath and Airless Oven models)

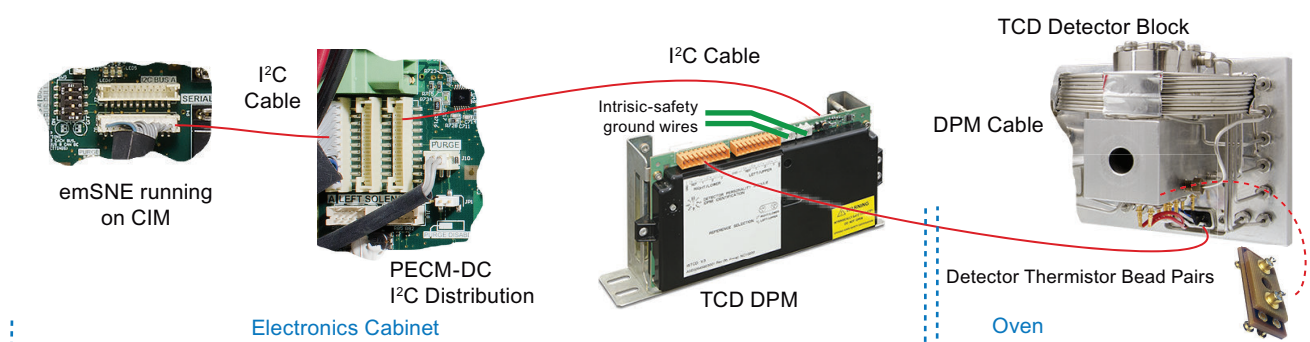


Figure 2-8 TCD Information Path (Modular Oven model)

Preliminary Verification

1. Verify that the carrier and sample pressures are normal.
2. Verify that both reference and sense detectors have carrier flow.
3. Confirm that the oven temperature is stable.
4. Confirm that the balance event is scheduled at a time where it does not interfere with the start and end of acquisition. The balance event time, the time of start, and end of acquisition time are defined in the Method Cycle Events Table. The Balance Detector time is set in the Program table and the detector acquisition times are set in the detector table.
A balance failure will occur if the acquisition is started or stopped while the balance is in progress. A balance failure will also occur if the balance is scheduled during the calibration of the Analog to Digital Converter (ADC). This calibration takes place automatically following the start and stop of acquisition. In summary the balance should be scheduled at least 3.5 seconds before the start or end of acquisition, or at least 1.5 second after the start or end of acquisition.
5. Scheduling a balance outside of the allowed time period will work most of the time but may unexpectedly cause a balance failure. In addition, with the TCD PIC rev 1.000 firmware, this would cause a crash of the I²C bus and therefore must absolutely be avoided.
6. Verify that the balance event is scheduled in a baseline area of the chromatogram where it is at least 5 sec away from the beginning or ending of any peak. The balance will fail if the detector signal is not stable.
7. Confirm that the SIMULATE_SIGNAL DO is not defined or is turned off. A balance failure will systematically occur if the simulate signal is active.
8. Look for an A/D failure error, error 1919 or 1920. An A/D failure error will automatically result in a balance failure. In case of an A/D failure, cycle power to the analyzer and try again. If the A/D failure does not go away, replace the DPM.
9. If the Left/Upper and Right/Lower groups are used and if the balance failure is on the Left/Upper channels only or Right/Lower channels only then a quick test can be done to narrow the scope of the problem. Simply swap the DB-25 connectors inside the detector block housing. If the problem follows the beads then the DPM, feed-through and cable are good, and the problem must be elsewhere. If the problem remains on the Left/Upper or Right/Lower block then the DPM, feed-through and cable should be checked.

Thermistor Bead Resistance

With the beads installed on the detector block, disconnect the detector signal cable from the DPM, then measure the resistance across each bead. The resistance value measured is not really important, consistency is the key issue. The nominal resistance at ambient temperature is 30 k Ω , and decreases as the bead temperature increases. A deviation of more than 10% between the beads installed on the same block is a clear indication of a problem. Also, measure the resistance between each side of the beads and the detector block. Confirm that there is no continuity to the block. Reconnect the detector signal cable.

Thermistor Bead Test

Measure the voltage on each side of each bead relative to the block. One side should read $-12 (\pm 0.5)$ Volts. If it does not, disconnect the corresponding detector signal cable connector and perform a continuity check between each side of the bead and the detector block. Any continuity means that the beads need to be replaced. If the voltage was not near -12 Volts and there is no continuity, then something is wrong with the DPM.

The Voltage on the other side of each bead should all match within ± 0.5 Volts of the voltage measured on the reference and should read between 3 to 5 Volts. If it all matches but still does not balance then the DPM should be replaced. A measured voltage around -9 Volts is an indication that the bead is not connected or opened.

If the bead's voltages do not match, there might be other reasons beside a defective bead. Unequal temperature or gas compositions between the bead chambers are major factors to explain an unequal bead voltage. With a flow diverter, the flow is a small factor as long as it is within a reasonable range but it can be a significant factor with a low volume insert. To eliminate the effect of the variation of the gas composition and flow between beads, a test can be made by connecting all detectors in series.



WARNING

Adequate safety practices must be followed whenever a change is made to the analyzer's plumbing.

Failure to follow established safety practices may release flammable or explosive gasses and cause severe injury or death, and damage to equipment.

To connect the detector in series:

1. With sample and carrier shut-off, disconnect the detectors fittings
2. Connect, with a union (or tubing with required fittings), the output of the reference detector to the input of channel #3.
3. Connect the other detectors similarly, the output of channel #3 to the input of channel #2, the output of #2 to input of #1 and the output of #1 to the vent. This will ensure a consistent gas composition and flow through all the channels.
4. Turn-on the carrier, set to a normal pressure. Wait for 1 or 2 minutes for things to stabilize.
5. Measure the voltage of the beads relative to the reference bead. If the voltage is still not within 0.5 Volts from the reference then the beads are defective or not matched properly and need to be replaced. If it matches, try to balance and confirm that the balance error is gone.
6. Reconnect tubing to original setup.

2.5 Replacing an IS-TCD DPM

Note

While the IS TCD DPMs are similar, the detector connectors are not compatible.

- The IS TCD4 DPM **CAN** be used as a replacement for the IS TCD3 DPM with a pin blocking plug.
- The IS TCD3 DPM **CANNOT** be used as a replacement for the IS TCD4 DPM.

See Replacing an IS TCD3 DPM with an IS TCD4 DPM (Page 16) for more information.

Removing the IS TCD DPM

See the illustration IS TCD DPM Connector Locations for connector locations.

1. Back up and shut down the unit using the *General Analyzer Shutdown Procedure* in the *Maxum Edition II Analyzer General Maintenance Manual*.
2. Open the electronics enclosure door.
3. Disconnect the detector cables by unplugging the orange connectors.
4. Disconnect the I²C/power cable.
5. If present, take out screws holding the IS ground cables.
6. Remove the nut on the bottom-front of DPM bracket.
7. Slide the unit forward to disengage the rear mounting lug.
8. Lift the unit up and out of the enclosure and place on an ESD-safe work surface.
9. Remove the two mounting screws near the upper corners and remove the old unit from the DPM bracket.

Configuring the New IS TCD DPM

Set the location ID switch and reference-selector switches on the replacement unit to match those on the unit being removed.

Note

For the reference-selector switches, the IS TCD4 DPM uses slide switches in place of the 2-position rotary switches on older units. The function is the same.

Installing the Replacement IS TCD DPM

1. Install the new unit into the DPM cage. Insert the bottom edge into the slot in the plastic DPM mounting rail on the DPM cage, and secure with the two screws removed from the old unit.
2. Insert the rear lug into the slot at the rear of the DPM mounting position with the mounting stud at the front inserted through the slot in the DPM bracket.
3. Slide backward to lock the rear mounting lug into the slot.

- 4. Reinstall the nut on the threaded stud to secure the DPM.
- 5. Reconnect the I²C/power cable.
- 6. Reconnect the IS ground cables if used.
- 7. Reconnect the detector cables.
- 8. Follow the steps in the *General Analyzer Startup Procedure* in the *Maxum Edition II Analyzer General Maintenance Manual*.

2.6 Replacing an IS TCD3 DPM with an IS TCD4 DPM

After August 2018, when an IS TCD3 DPM is ordered with part number A5E02645923001, the order is filled with a kit with an IS TCD4 DPM and two blocking plugs to install on each detector cable connector on pin 1. The 10-pin terminal block plugs then only fit onto the right-most 10 pins of the connectors.

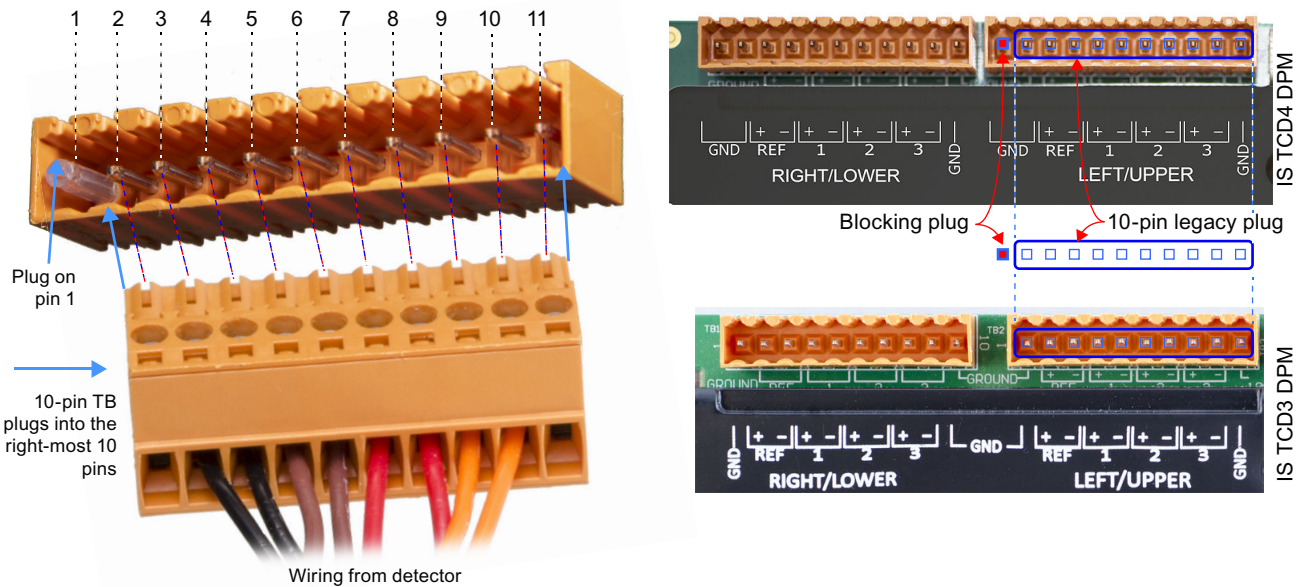


Figure 2-9 Using a blocking plug to install the IS TCD4 DPM to replace an IS TCD3 DPM

2.7 TCD Thermistor Bead Kit

A thermistor bead kit is available for the TCD.

Table 2-1 Thermistor Bead Kit, 2020176-001

Part Number	Description	Quantity
2017636-001	30K Ohm Thermistor Bead Matched 2-Board Set (4 Beads)	1
1312421-070	Screw, M4X10, Socket Button Head Cap, Stainless Steel	2
1312530-007	Washer, M4, Helical Spring Lock, Stainless Steel	2

Part Number	Description	Quantity
1312530-005	Washer, M4, Flat, Stainless Steel	2
O39006	O-Ring, Size 006, 1/8 ID X 1/16, Viton	4

See also

Replacing an IS TCD3 DPM with an IS TCD4 DPM (Page 16)

2.8 Servicing the Ex TCD

2.8.1 Replace TCD Thermistor Beads/Filaments Introduction

This section provides the procedure to replace the Thermistor Board or Filament Board for the Thermal Conductivity Detector (TCD).

Possible configurations for the TCD include the 2-Cell Filament Detector and the 8-Cell Thermistor Detector. The drawings in this section are for the 8-Cell Thermistor Detector. However, replacement of the Filament Board on the Filament Detector follows the same basic procedure. It is possible to replace the Filament/Thermistor Board with the detector installed in the analyzer.

TCD parts should be removed or replaced only by a trained Siemens maintenance engineer or by the user's maintenance personnel trained by Siemens.

Note

Do NOT attempt to open the TCD with the power on.

Note

When removing materials from the analyzer, all items must be placed on a clean, non-abrasive surface. Use a clean lint-free cloth.

2.8 Servicing the Ex TCD

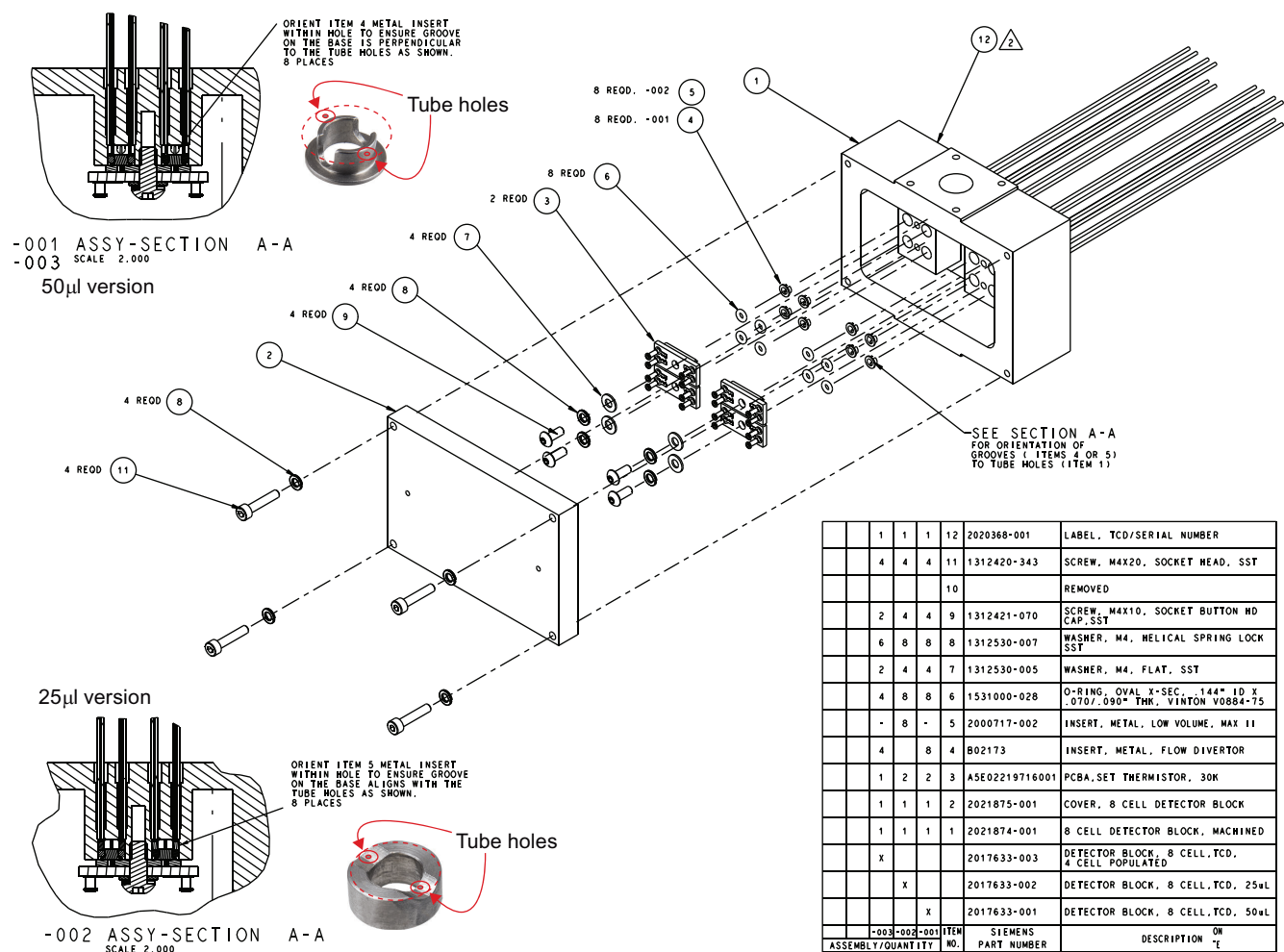


Figure 2-10 8-Cell TCD Block Exploded View

2.8.2 Procedure to Replace Thermistor Beads

Within this procedure, the numbers in parenthesis denote parts referenced in the list contained in the Exploded Diagram earlier in this section. Refer back to the figure for locations.

1. Shut off flows and shut down power to the analyzer using the *General Analyzer Shutdown Procedure* in the Maxum Edition II Analyzer General Maintenance Manual. Allow the detector to cool down. The detector must cool down so that the screws will not break from temperature related galling.
2. Remove the 4 screws (11) and lock washers (8) that secure the cover to the detector block (1) and remove the cover.
3. Unplug the wires from the Thermistor/Filament Board (3) that is to be removed.
4. Remove the Board (3) by removing the Button Head Hex Screw (9), the Lockwasher (8), and the Flat Washer (7).
5. Discard board (3) and O-rings (6). Do not attempt to reuse old O-rings.

6. Remove the two metal inserts (4 or 5). These CAN be reused.
7. Before installing the new board, examine the mounting surface and the holes for the thermistors to verify there is no contamination or scratches on the machined surface. If there is contamination on the surface, clean it using a lint free cloth and a cleaning solvent such as acetone or hexane. If the surface is scratched it may be necessary to replace the complete assembly.

Note

The elements on the board are exposed and are very delicate. Handle the board only by its edges.

Hands and tools must be clean.

8. Install the metal inserts (4 or 5) in the detector block (1). These inserts should be installed with the groove perpendicular to the tube holes in the block (so that air cannot flow in a straight path between the holes). Instructions for orienting the 25 μ l or 50 μ l inserts are included in the Exploded Diagram.
9. Install the new O-rings (6) in holes in the Detector Block (1).
It is also possible to install the O-rings on the Thermistor / Filament board (3) instead of in the hole. If installing the O-rings on the board, be careful not to damage the element.
10. Install the Board (3) into the Detector Block (1). When installing the board, exercise caution not to damage the exposed elements.
11. Reinstall the Flat Washer (7), Lock Washer (8), and Button Head Hex Screw (9). Do not over tighten the screw as this can damage the Board (3).
12. Reconnect wiring to the board (3). Wiring MUST be connected to the same cells as before. Verify all termination points.
Note: The color coding information for the wiring should be on the Detector Certification Label. Also note that there are two wires of each color. For a specific cell it does not matter which wire is connected to which lead as long as the color is correct.
13. Before installing cover back on the Detector Block (4), turn on carrier gas to verify there are no leaks between the Board (3) and the Block (1). Turn off carrier gas after this check is complete.
14. Set the cover in place and reinstall the 4 screws and lockwashers that secure the cover to the detector block.
15. Follow the steps in the *General Analyzer Startup Procedure* in the Maxum Edition II Analyzer General Maintenance Manual.

2.9 Servicing the IS TCD

2.9.1 IS TCD Service and Operating Positions

If desired, the IS TCD block can be tilted for servicing.

After the metal shields are removed the IS TCD block can be tilted for easier access to the bottom of the block.

2.9 Servicing the IS TCD

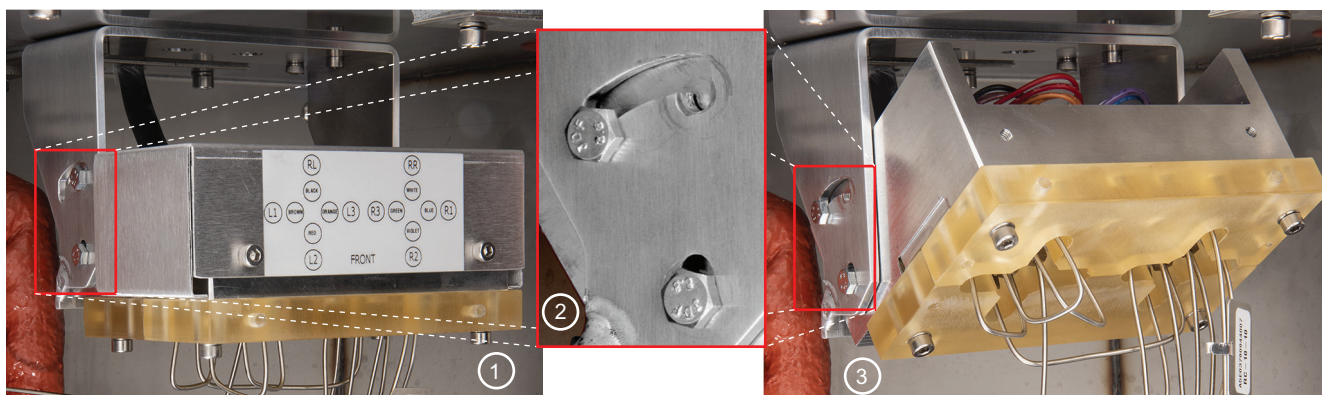


Figure 2-11 Tilting the Detector Block

Item 1 in the photo above shows the TCD in operating position with the front thermal shield removed. The top thermal shield, shown installed, must be removed in order to tilt the TCD block or to disconnect the detector wires.

Item 2 shows the bolts loosened, with the TCD block tilted.

Item 3 shows the TCD block tilted in service position.

Note

The Maxum II with an IS TCD is built with service loops in the tubing to allow the detector block to be tilted, and to allow the Thermistor Cell Subassembly to be removed with the tubing attached. If the tubing is rearranged during service it is important to maintain these service loops.

In the illustration below, the service loop is primarily formed by right-angle bends in the tubing so that the TCD block can pivot without placing excessive stress on the tubes. The tubing is routed up the side of the oven, then toward the back and across, then outward to connect to the detector.

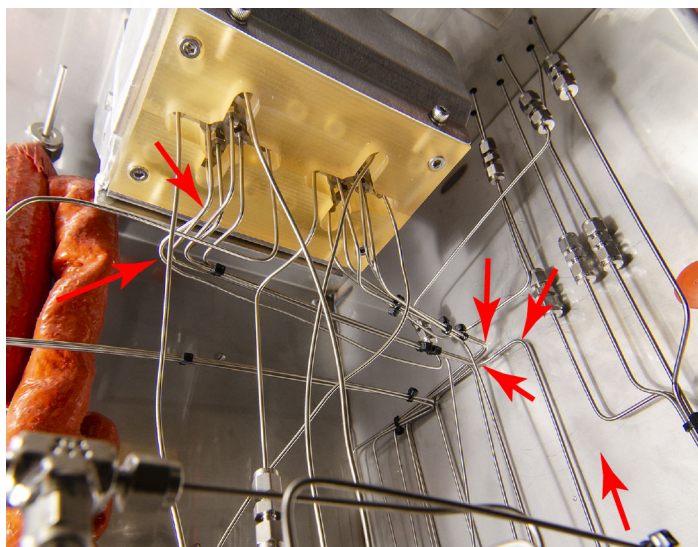


Figure 2-12 IS TCD service loop example

The figure below is an exploded view that shows the overall construction of the detector.

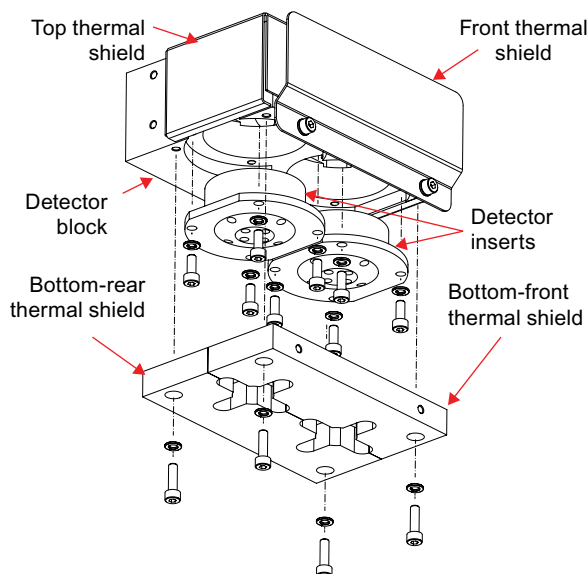


Figure 2-13 IS TCD exploded view

2.9.2

Thermistor Bead Replacement Options in the IS TCD

Two options are available for changing the thermistor beads in the IS TCD.

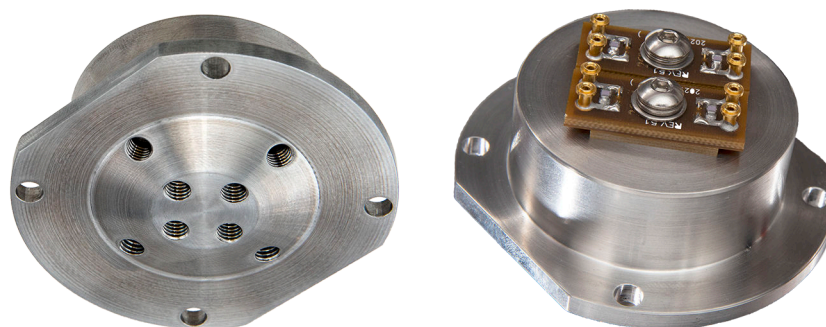


Figure 2-14 IS TCD Thermistor Cell Subassembly

1. The thermistor-bead pairs can be changed individually as described in Replacing the Thermistor Bead Modules in the IS TCD (Page 22).
2. The entire 4-cell subassembly can be replaced with a new subassembly that has the thermistor beads pre-installed and leak tested. This procedure is given in Replacing the 4-Cell Thermistor Subassembly (Page 26).

2.9.3 Replacing the Thermistor Bead Modules in the IS TCD

Removing the Thermal Shields

The IS TCD block has 4 thermal shields that can be removed for servicing. These are secured by M3 socket-head screws.



Remove the front thermal shield.



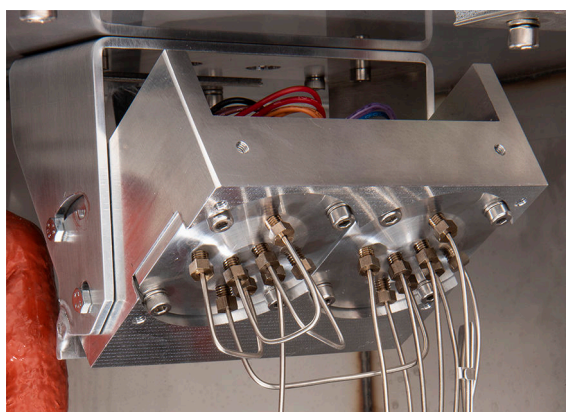
Remove the top thermal shield.



Remove the bottom-front thermal shield.



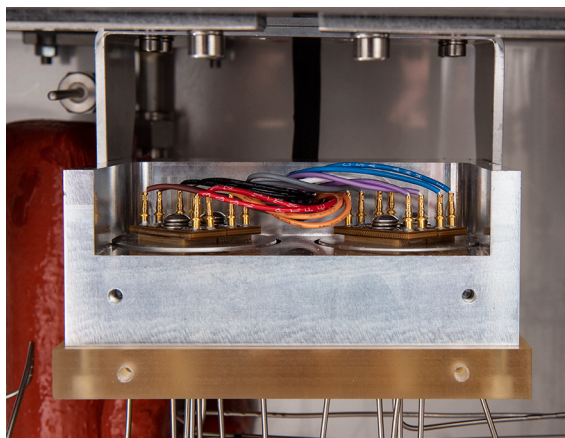
Remove the bottom-rear thermal shield.



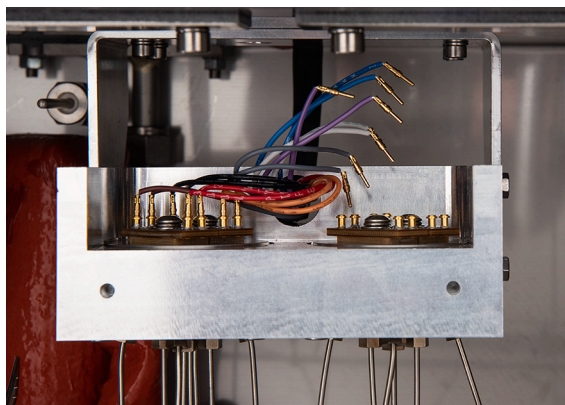
Removing the TCD Wires

The detector wires are accessed by removing the front and top thermal shields.

Record the colors and positions of the wires.



Disconnect the 8 wires from the thermistor sockets.



This procedure is similar to the procedure for the Ex TCD block described in Procedure to Replace Thermistor Beads (Page 18). Review that procedure before beginning this one.

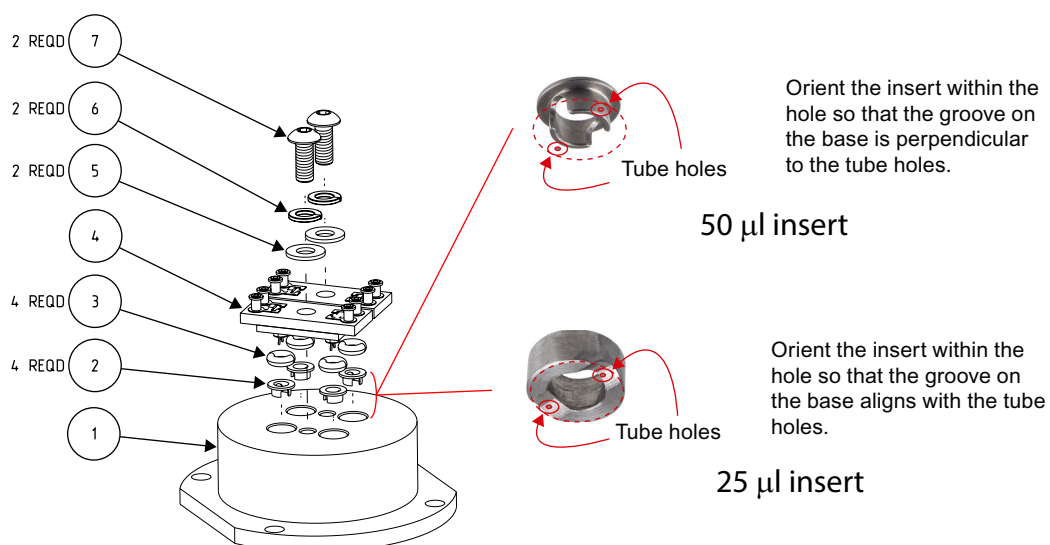


Figure 2-15 IS TCD insert exploded view

Changing the Bead Pairs with the Thermistor Cell Subassembly in Place

Numbers in parentheses correspond to item numbers in the drawing above.

1. Remove the bead-pair retaining screw (7), along with the lockwasher (6) and flat washer (5).
2. Gently pull out the bead module (4).
3. Discard the O-rings (3).
4. Verify proper orientation of inserts (2). Use an inspection mirror during this procedure.
5. install O-rings (3) on the new bead module (4).
6. Carefully plug bead module into the cells.
7. Install the retaining screw (7), lockwasher (6) and flat washer (5).
8. Pressurize the cells and check for leaks using an approved leak detector.
9. Plug in the wires.

Changing the Bead Pairs with the Thermistor Cell Subassembly Removed

If desired, the tubing can be left connected and the subassembly removed from the detector block. This may give better access to the thermistor bead pairs in some situations.

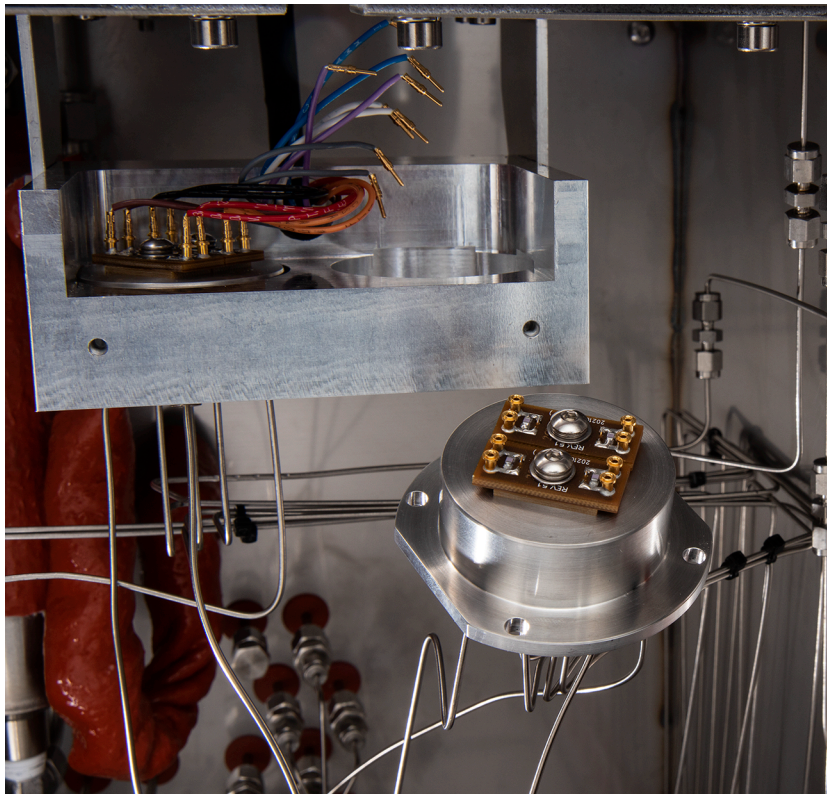


Figure 2-16 IS TCD Thermistor Cell Subassembly Removed From Block

2.9.4 Replacing the 4-Cell Thermistor Subassembly

A spare part, #A5E36852549001 is available as an alternative to replacing bead pairs. The Thermistor Cell Assembly has two thermistor-bead pairs properly mounted in the insert and leak tested.

Removing the Thermistor Cell Subassembly

1. Remove the thermal shields and wires as described previously in Replacing the Thermistor Bead Modules in the IS TCD (Page 22).

**CAUTION**

Label all tubing that will be disconnected.

If the tubes are reconnected to the wrong ports, it will cause the analyzer to malfunction, and may result in an unsafe condition.

2. Label all tubes that will be disconnected. The front thermal shield has a diagram that is useful for this purpose.
3. Remove the front thermal shield.
4. Remove the top thermal shield.
5. Remove the bottom-front thermal shield.
6. Remove the bottom-rear thermal shield.
7. Disconnect all 8 tubes by unscrewing the fittings on the bottom of the subassembly.
8. Remove the 4 screws holding the thermistor-cell insert. This frees the subassembly for removal.

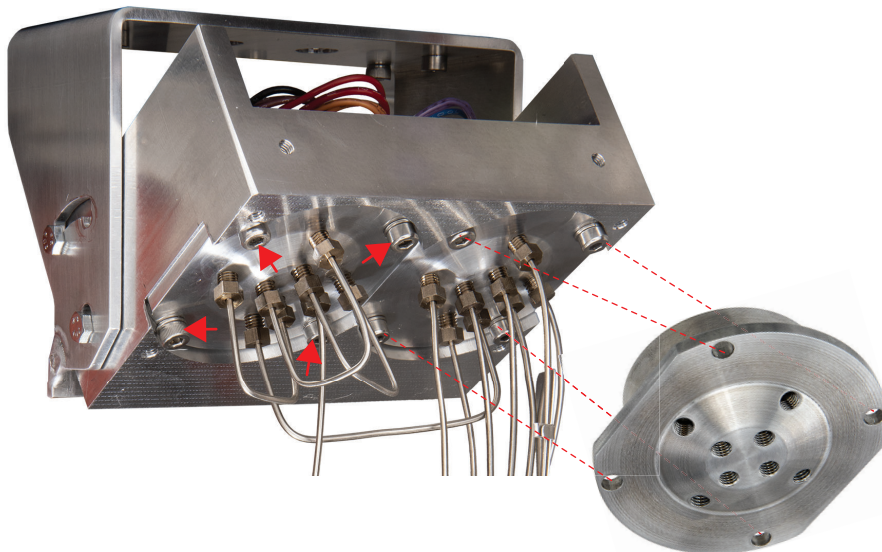


Figure 2-17 Thermistor Cell Subassembly Mounting Points

Replacing the Thermistor Cell Subassembly

1. Position the new subassembly and install the 4 retaining screws and split-ring lockwashers. Tighten enough to compress the washers. Do not overtighten.
2. Reinstall the tubing in the correct locations as noted when they were disconnected.
3. Test for leaks using an approved leak-detector fluid.
4. Reinstall the bottom thermal shields.
5. If not already in operating position, return the TCD block to operating position.
6. Reinstall the top and front thermal shields.

2.10 TCD Specifications

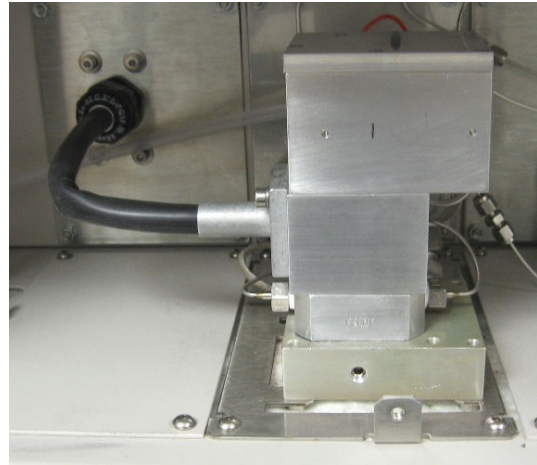
Table 2-2 Thermal Conductivity Detector (TCD)

Parameter	Value
Target Components	All
Measurement Type	Concentration
Smallest Measuring Range (at 60°C oven temperature)	0 to 20 ppm $\pm 5\%$
Typical Measuring Range (at 60°C oven temperature)	0 to 500 ppm $\pm 2\%$ FS up to 0 to 100% $\pm 0.5\%$ FS
Dynamic Range	10^5
Linear Range	10^4
Selectivity	None
Temperature Range (Thermistor bead detector inside oven compartment)	5 to 120°C
Temperature Range (Filament detector inside oven compartment)	5 to 180°C

Flame Photometric Detector

The Flame Photometric Detector (FPD) is a selective detector that can detect sulfur based on the intensity of light during combustion. Two versions of the FPD have been available for the Maxum II. In 2007, enhancements were made to the original FPD that improved the performance. The enhanced FPD is called FPD II. Other than their performance, the original FPD and FPD II are very similar.

The FPD is shown at right without cover or insulation.



The FPD detects sulfur by combusting the sample components in a hydrogen rich flame. This generates light of specific wavelengths. A filter passes light wavelengths which are characteristic for sulfur. This is converted into an electrical signal using a photomultiplier device.

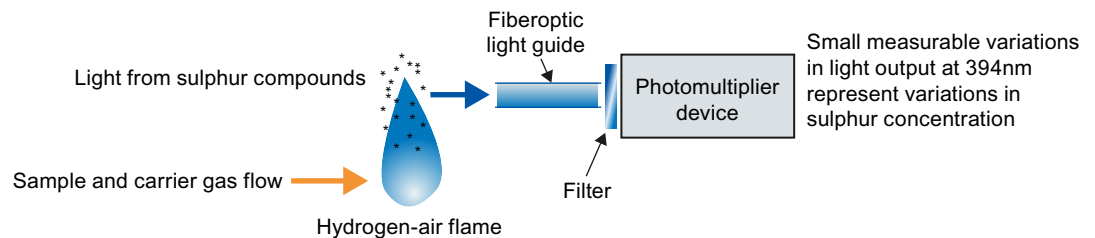


Figure 3-1 FPD basic function

Components

The FPD comprises:

- Bottom part contains connections for combustion gas, combustion air, column and exhaust, and a burner nozzle.
- Top part contains combustion chamber, glow plug and fiber optic interface.

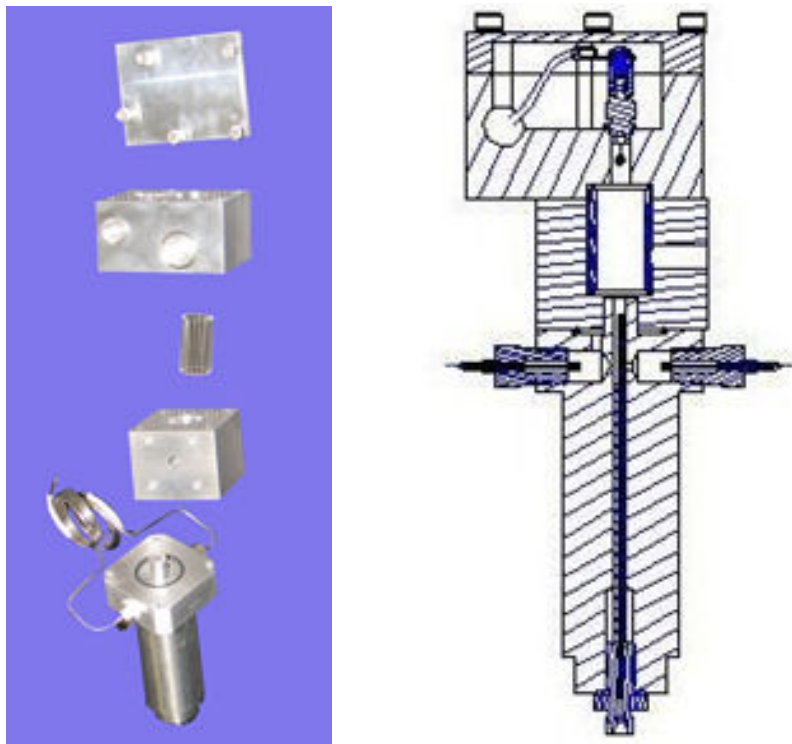


Figure 3-2 Flame Photometric Detector Major Components

Combustion Chamber

- The burner nozzle consists of two annular gaps. The combustion gas H_2 flows out of the outer annular gap and mixes with the combustion air from the inner gap. The carrier gas flows from the nozzle into the dome-shaped flame.
- The exhaust is taken from the combustion chamber output via a flameproof joint.
- The glow plug is located above and to the side of the burner.
- The flame burns in a recessed area shielded from the fiber optic interface.
- The ignition cable of the FPD is routed through an EEx-e feed through to the EC.

Optics

- The fiber optic cable connects to the photo multiplier tube (PMT) module in the EC.
- The optical interference filter is built into the PMT module
- All connections between the combustion chamber and the photomultiplier are absolutely light-tight.

Heater

The FPD is supplied with an external heater. Condensation would be formed in the FPD at temperatures below 80°C and have a negative influence on the measuring properties. The detector is insulated to prevent moisture from entering it.

The detector temperature is factory set depending upon the application. The temperature is normally set equal to or higher than the oven temperature and at minimum 80°C.

Detector Gas Supply

For information on detector gas-supply requirements, search for the Maxum II Official Product Specifications (A5E03012338001) (<https://support.industry.siemens.com/cs/document/109742522/maxum-ii-official-product-specifications?>) on the Siemens Maxum edition II User Manuals page (<http://support.industry.siemens.com/cs/products?dtp=Manual&pnid=17741>). This publication gives approximate requirements. Specific requirements depend on the application.

Note

The FPD is a very sensitive detector. The gases and their supply lines must be extremely clean and sulfur free to achieve a high signal/noise ratio.

Selection of Carrier Gas

Nitrogen, helium, argon or hydrogen can be used as the carrier gas. If hydrogen carrier is used, the required flow of hydrogen flame fuel will be reduced. For the FPD II, the total hydrogen flow (combined flame fuel and carrier) will be ~100-130 mL/min.

Increasing the Sensitivity

The sensitivity of the FPD can be increased by reducing the flow of combustion air. Most of the time, the FPD cannot be ignited with a normal air/hydrogen ratio. If an electronic pressure controller (EPC) is used for the combustion gasses an event will be written at the factory, which will automatically adjust the flows during the ignition sequence. To obtain the recommended flow settings for an analyzer, refer to the custom documentation supplied with that analyzer.

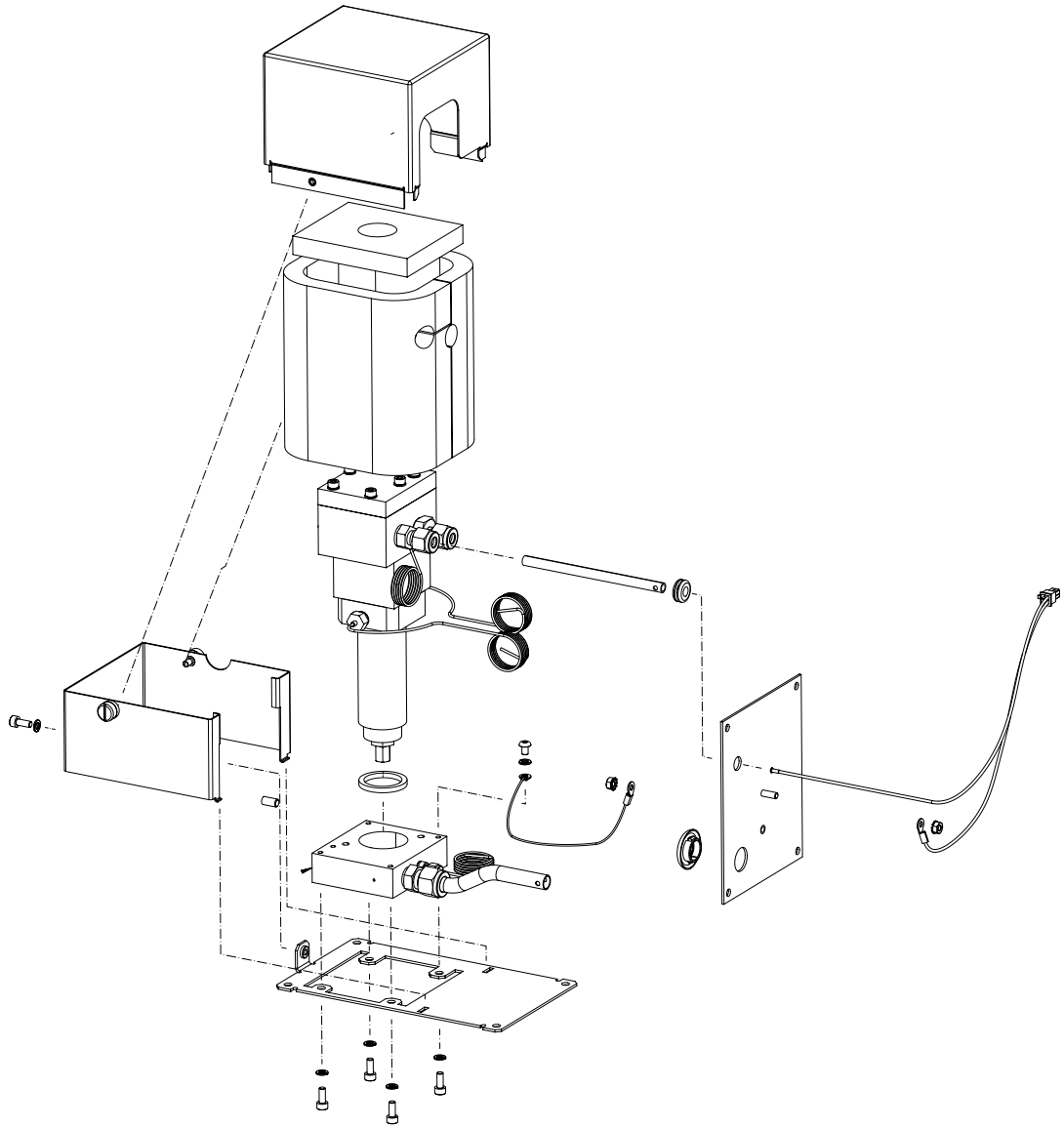


Figure 3-3 FPD Exploded View

3.1 Upgrading the FPD

The Flame Photometric Detector (FPD) is a selective detector that can detect sulfur based on the emission of light during combustion. This section describes the procedure to replace the original Flame Photometric Detector (FPD I) in the Maxum II with a newer version FPD II, a more sensitive and more consistent detector.

The existing light pipe and photomultiplier tube from the FPD I will be reused. It will be necessary to power down the analyzer for this procedure.

3.1.1 Intended Users

This procedure is intended for either Siemens personnel or for highly skilled users who have been trained by Siemens to perform this type of procedure. Users of this procedure must have strong working knowledge of the safety systems of the Maxum II analyzer and have the knowledge to safely power the analyzer down and back up. Users must also have a good working knowledge of the Maxum II hardware and should be very familiar with the operation and day to day maintenance of the analyzer.

Replacing the Flame Photometric Detector may impact the safety protection of the analyzer. This procedure should only be executed with the approval of applicable local safety personnel and/or the local authority having jurisdiction.

3.1.2 Safety and Certification Information

This retrofit may impact the safety protection of the analyzer. This procedure involves a retrofit of the Flame Photometric Detector (FPD). The FPD is an explosion-proof device that is equipped with required safety systems. It is important that these safety systems not be compromised. All instructions and warnings in this procedure must be followed.

Maintenance work on the Maxum II analyzer should only be performed when the area is known to be safe for the work to be done.

Note

This procedure must only be executed with the consent and approval of all applicable local safety personnel and/or the local authority having jurisdiction.

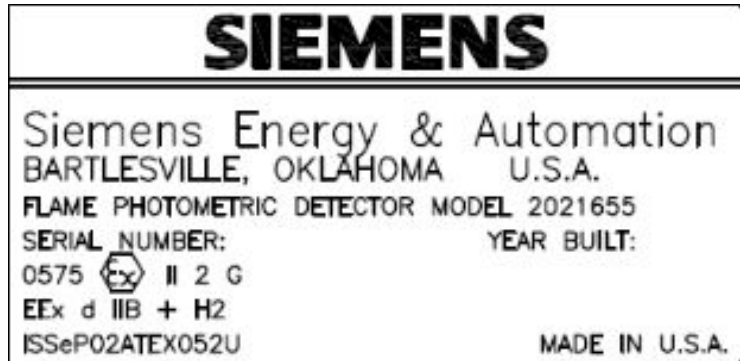
Conditions for Safe Use per ATEX Certificate

- The FPD shall be protected against mechanical damage by mounting inside another enclosure.
- The relative maximal pressure existing inside the flameproof enclosure shall not exceed 0.065 bar.

3.1 Upgrading the FPD

- The grounding of the FPD shall be ensured by mounting to a metallic frame.
- The external part of the bushing shall be protected by pressurized enclosure “p”; not included in the ATEX certificate.

Original FPD Label



FPD II Label

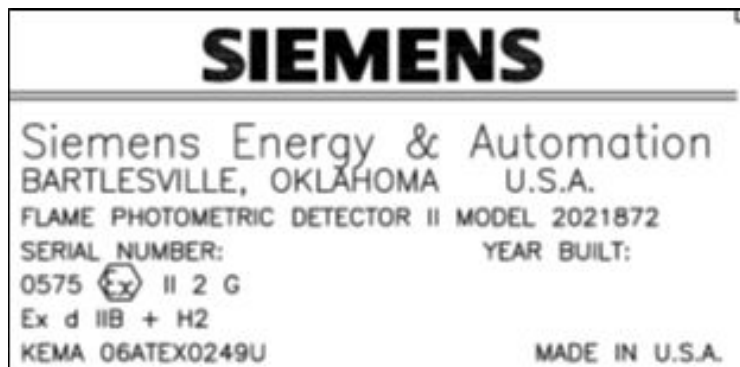


Figure 3-4 Example FPD Certification Labels

For more information see the *Maxum II Explosion Protection Safety Standards Manual* (A5E02220442001) (<https://support.industry.siemens.com/cs/document/42017542/maxum-edition-ii%3A-explosion-protection-safety-standards?lc=en-VW&pnid=17741>).

3.1.3 Procedure - Upgrade FPD I to FPD II

Note

The existing light pipe and PMT module are kept and used for the FPD II.

Note

Because this procedure is intended for expert users, many of the steps have limited detail.

1. Put the analyzer in Hold.
2. Turn off the flame to the FPD by stopping the flow of hydrogen to the detector. Wait at least 15 minutes for the water vapor to clear the detector.
3. Turn off the power to the analyzer. Allow the detector block to cool before proceeding to the next step.

4. If the analyzer has mechanical regulators, shut off the hydrogen and air supplies to the detector.



CAUTION

Potential burn hazard. Handling hot components may result in personal injury.

Detector may still be hot during removal. Exercise care when handling detector parts.

5. Remove the cover and insulation from the old detector. Use caution at this point as the detector may still be hot.
6. Disconnect the hydrogen and air lines to the detector and the detector vent line from the back of the detector.
7. Disconnect the column from the detector in the Maxum II oven.

NOTICE

Sensitive components. Failure to observe proper procedures may damage the equipment.

The photomultiplier in the FPD is sensitive to light. Avoid prolonged exposure of the multiplier to excessive light, even when powered down. Never subject the light entry window to a bright light source.

8. Disconnect the light pipe from the side of the analyzer. Remove and discard the brown Viton O-rings on the light pipe. The new FPD does not require O-rings in this location.
9. Remove the screws from the detector mounting plate and the cover plate on the back of the mezzanine.
10. Remove the detector from the Maxum II along with its mounting bracket, heater and cover plate. The heater wiring, glow plug supply wiring and the associated purge tubes need to be taken out as well. Note the wiring connections as you remove them from the DPM.
11. Before installing the new detector, the cover and insulation need to be removed. Replacing the insulation and cover will be the last step in the installation.
12. Install the FPD II. As you install the detector feed the wiring through the mezzanine and up to the DPM. Connect the screws on the mounting plate.
13. Attach the mezzanine cover plate.
14. Connect the heater, thermocouple, and glow plug wiring to the DPM.
15. Connect the column inlet, hydrogen and air supplies, detector vent and the light pipe.
16. Replace the insulation and cover on the detector. Restore power to the Maxum II.
17. After the Maxum II has had time to heat up, check the flows and light the flame.

3.2 Base3 Detector Personality Module (DPM)

Output signals from any of the detectors connect to each associated Detector Personality Module (DPM) input. The transfer of detector data is based on the database method. The DPM digitizes the signal and then passes the data to the SYSCON via an I²C port. Results can then be viewed on the Color Touchscreen or the workstation.

3.2 Base3 Detector Personality Module (DPM)

The method is the part of the application that contains the parameters for controlling the hardware used by one cycle clock. It provides peak areas and component concentrations and includes all cycle clock timed events. There is one cycle clock per method.

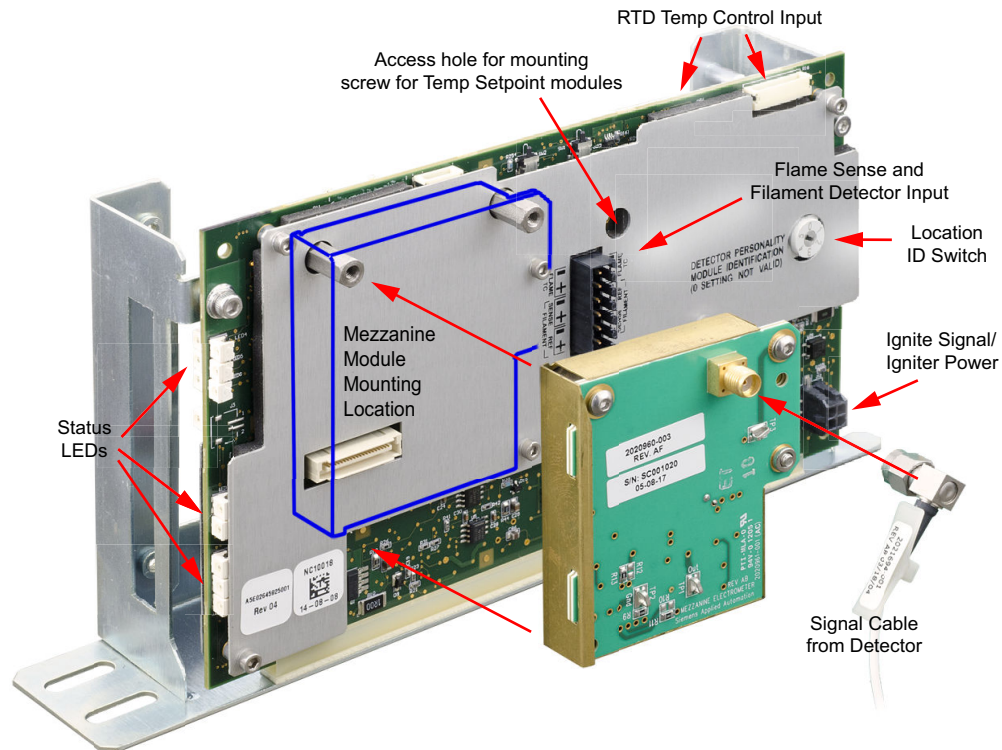


Figure 3-5 Base3DPM With Mezzanine Module

Part Number

The Base3 DPM (Part Number A5E02645925001) is shipped with current analyzers. It can be used as a replacement part for earlier DPMs in Maxum I analyzers using an adapter, part number A5E34938458001.

Overview of DPM Functions

The Base 3 Detector Personality Module (DPM) combines these functions in a single module:

Including Mezzanine Modules	FID	Input from detector via mezzanine module
		Ignite signal / glow-plug output
		Range-select output
		300-V bias output
		Flame-sense input (used in Maxum I analyzers only)
	FPD	Input from detector via mezzanine module
		Ignite signal / glow-plug output
		Range-select output
		Enable signal output
		300V bias output
		Flame-sense input (used in Maxum I analyzers only)
	Analog volt- age input	Input from detector via mezzanine module
		Range-select output
Filament Detector		Input via connector on right side (as viewed inside analyzer EC)
Temperature control		Temperature setpoint module connector
		Two RTD inputs
		Two heater-control outputs
System communication		I ² C port with ID-select switch

Input Signal Paths

The input-signal functions are shown below.

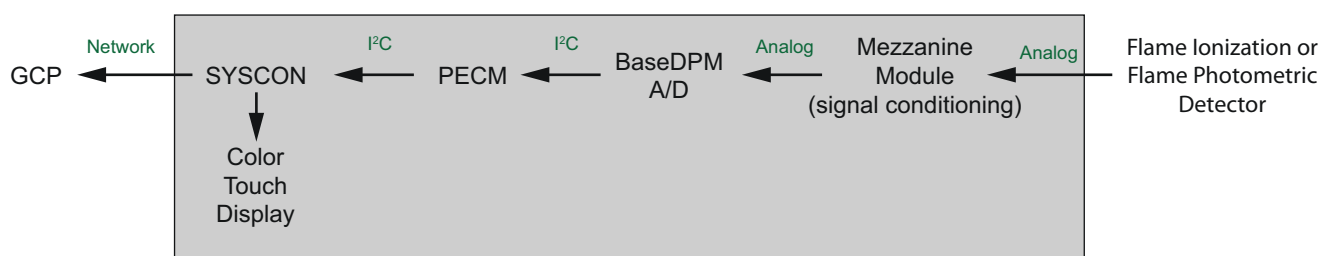


Figure 3-6 FID, FPD, or Analog Input Detector Input Signal Path

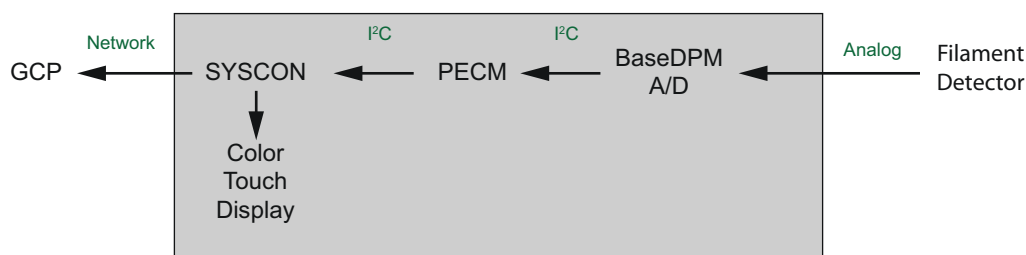


Figure 3-7 Filament Detector Input Signal Path

Detector Control Paths

Several control signals are available to control various detector functions as shown below.

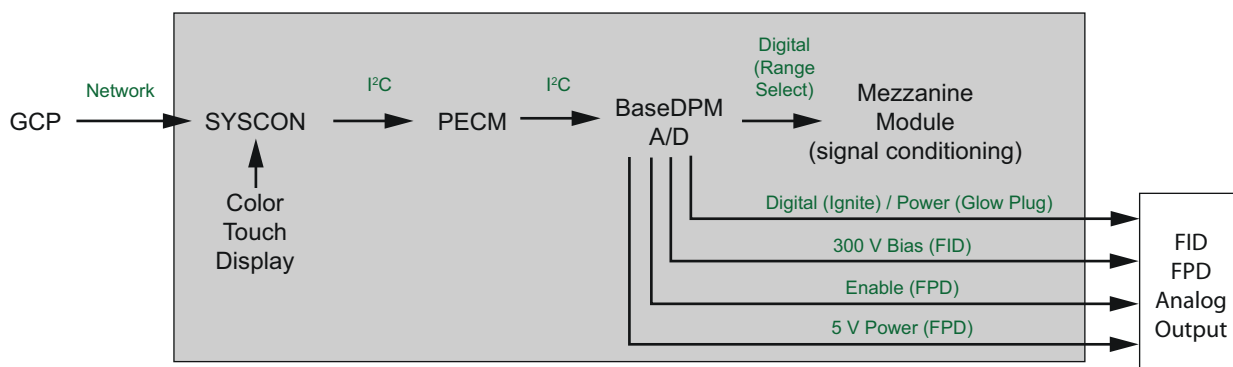


Figure 3-8 Maxum II Detector Control Functions

Location ID Switch

The Location ID Switch, shown previously in the photograph, selects the DPM location that is incorporated in the address, to be reported in the results.

The DPM I²C port is connected directly to the system controller via the PECM or a wiring distribution board. In this scenario, the following values are applied:

Switch Value	Location
1	Left
2	Center
3	Right

NOTE:

If the DPM I²C port is connected to an SNE, the value is always set to "1". The actual location value is determined by the SNE.

DPM-Based Temperature Control

The Base3 DPM has two temperature-control channels. Two RTD inputs feed two comparator circuits to drive two heater-control outputs. The heater-control outputs connect to inputs on the PECM in most analyzers. The control path is shown below.

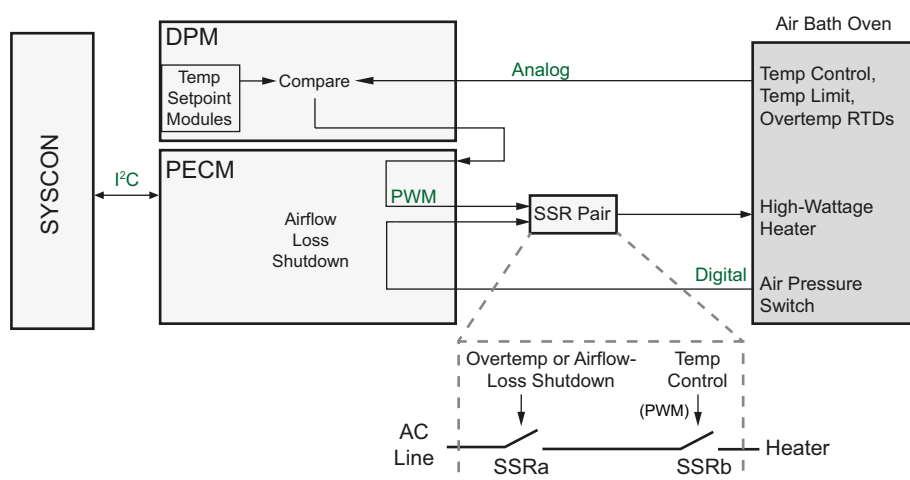


Figure 3-9 Heater Control Path Using DPM

A mounting location and connector are provided for two Temperature Setpoint Modules. The modules are installed on the left side (back) of the DPM, shown below. This same position is used in the *Temperature Control Module (TCM)*.

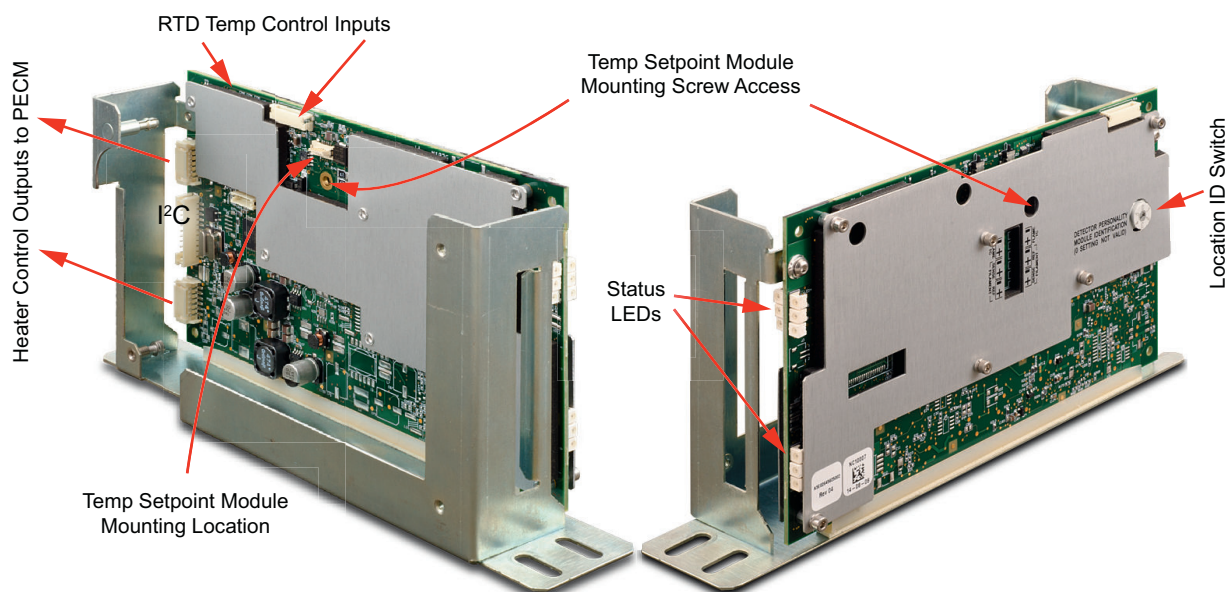


Figure 3-10 Temperature Setpoint Modules Installed on Left Side of Base3 DPM (Temperature Control Module shown, Base3 DPM similar)

Mezzanine Modules

A mezzanine module conditions the signal from a non-conductivity detector. The mezzanine plugs into the Base3 DPM in order to tailor the DPM for a specific measurement.

Three primary types of mezzanine are available to accommodate FID and FPD detectors, and various detectors that produce a scaled analog output (AI) mezzanine. Some of the mezzanines have a dual range function for maximum flexibility. See the table below for details relating to the various mezzanine options.

The AI mezzanine can be used for reading a detector voltage signal from a specialized or third party detector, such as the Valco PDD, where the device only supplies a scaled voltage output. The AI signal will be treated like a normal detector signal, with a 50% balance range.

Table 3-1 Mezzanine Part Number Descriptions

Mezzanine	Detector Sub Module Type	Usage	Normal Range	Alternate Range
2020960-001	FID	Low level FID	0.2nA	none
2020960-003		Standard FID	1nA	20nA
2021328-002		Large Scale FID	100nA	1000nA
2021328-001	FPD	FPD	100nA	none
2021328-003		FPD, 0.18 Hz Filter	100nA	none
2021326-001	Universal	Voltage AI	±1V	±10V
1901614-001 Dummy Plug		When Base DPM is Filament only, and no mezzanine required	none	none

3.2.1 Base3DPM Status Indicator LEDs



Figure 3-11 Base3DPM Status LEDs

3.2.2 Replacing a Base3DPM

Removing the Base3DPM

See the illustration *Base3 DPM With Mezzanine Module and Temperature Setpoint Modules Installed on Left Side of Base3DPM* for connector and module locations.

1. Back up and shut down the unit using the *General Analyzer Shutdown Procedure*.
2. Open the electronics enclosure door.
3. Disconnect the detector signal cable from the mezzanine module.
 - FID and FPD mezzanine modules use SMA coaxial cables. Unscrew the nut to unplug the cable.
 - Analog input mezzanine modules use small terminal block connectors that can be unplugged.
4. Disconnect the filament detector cable if present.
5. Disconnect the RTD temperature input cables (top rear of unit, if present).
6. If present, take out screws holding the IS ground cables (typically only installed on modular oven models).
7. Remove the nut on the bottom-front of DPM bracket.
8. Slide the unit forward to disengage the rear mounting lug.
9. Lift the unit up and part way out of the enclosure.
10. Disconnect the I²C/power cable and temperature control output cables from the rear edge of the board.
11. Remove the unit from the analyzer and place on ESD-safe work surface.
12. Unscrew the two mounting screws at the top corners of the mezzanine module, and unplug it from the Base3 DPM.
13. Unscrew the mounting screw for the temperature setpoint module stack using the access hole in the metal plate near the filament detector input.
14. Unplug the temperature setpoint module stack from the left side of the board.
15. Remove the two mounting screws near the upper corners and remove the old board from the cage.

Configuring the New Base3DPM

Set the location ID switch on the replacement unit to match the unit being removed.

Installing the Replacement Base3DPM

1. Install the new unit into the DPM cage. Insert the bottom edge into the slot in the plastic DPM mounting rail on the DPM cage, and secure with the two screws removed from the old unit.
2. Plug the temperature setpoint module stack onto its mount on the left side of the unit.

3.3 FPD Specifications

3. Reinstall the screw to secure the temperature setpoint module stack through the access hole on the right side of the unit.
4. Plug the mezzanine module onto its connector on the right side of the unit, and reinstall the two screws ear the top edge.
5. Insert the rear lug into the slot at the rear of the DPM mounting position with the mounting stud at the front inserted through the slot in the DPM bracket.
6. Slide backward to lock the rear mounting lug into the slot.
7. Reinstall the nut on the threaded stud to secure the DPM.
8. Reconnect the I²C/power cable and temperature control output cables from the rear edge of the board.
9. Reconnect the RTD temperature input cables (top rear of unit, if present).
10. Reconnect the filament detector cable if present.
11. Reconnect the detector signal cable from the mezzanine module.
12. Follow the steps in the *General Analyzer Startup Procedure*.

3.3 FPD Specifications

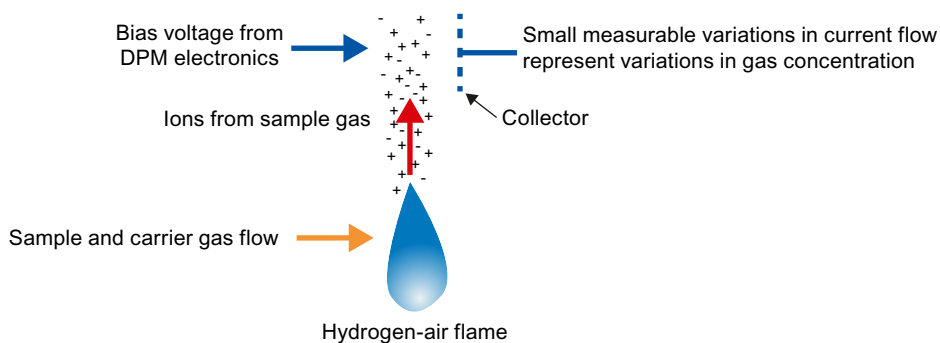
Table 3-2 Flame Photometric Detector (FPD)

Parameter	Value
Target Components	Sulfur
Measurement Type	Mass
Smallest Measuring Range (at 60°C oven temperature)	0 to 1 ppm ±5%
Typical Measuring Range (at 60°C oven temperature)	0 to 10 ppm ±3% FS up to 0 to 500 ppm ±2% FS
Dynamic Range	10 ²
Linear Range	70 (70:1) linearized
Selectivity	10 ⁴ to 1 Sulfur to Carbon
Temperature Range	105 to 150°C
Ignition type	Glow Plug
Electrical Data	2V at 3A (Maximum, only for flame ignition)

Flame Ionization Detector

The Flame Ionization Detector (FID) is a very sensitive detector that is used for measuring hydrocarbons. It responds to most carbon containing compounds. Using a methanator, the FID can also detect carbon monoxide (CO) and carbon dioxide (CO₂). Operation of the FID involves combustion of the sample compounds. This combustion produces ions. The ions are captured by an electrode in the FID, creating an electrical signal current.

The FID is very sensitive to all types of hydrocarbons and to any contamination in gases or supply lines. For a high signal/noise ratio, ensure that the supply gases (Hydrogen and Air) and carrier gas have a purity of 99.999% and hydrocarbon content below 2 ppm*. For special detection sensitivity, filter supply gases using a molecular sieve filter. If plant air is used, a catalytic Air Treater is strongly recommended to reduce the possible hydrocarbon content of the air. The FID is shown at right without cover or insulation.



* 2 ppm refers to the total hydrocarbon concentration expressed as methane.

4.1 FID Maintenance Considerations

4.1.1 Intended Users

This procedure is written to be understood by personnel who are trained to perform maintenance and troubleshooting of the Maxum II analyzer. Users of this procedure must have strong working knowledge of the safety systems of the Maxum II analyzer and have the knowledge to safely power the analyzer down and back up. Users must also have a good working knowledge of the Maxum II hardware and should be very familiar with the operation and day to day maintenance of the analyzer.

This procedure involves opening and servicing the Flame Ionization Detector which may impact the safety protection of the analyzer. This procedure should only be executed with the approval of applicable local safety personnel and/or the local authority having jurisdiction.

4.1.2 Safety and Certification Information

This retrofit may impact the safety protection of the analyzer. This procedure involves servicing of the Flame Ionization Detector (FID). The FID is an explosion-proof device that is equipped with required safety systems. It is important that these safety systems not be compromised. All instructions and warnings in this procedure must be followed.

Maintenance work on the Maxum II analyzer should only be performed when the area is known to be safe for the work to be done.

Note

This procedure must only be executed with the consent and approval of all applicable local safety personnel and/or the local authority having jurisdiction.

For more information see the *Maxum II Explosion Protection Safety Standards Manual* (A5E02220442001) (<https://support.industry.siemens.com/cs/document/42017542/maxum-edition-ii%3A-explosion-protection-safety-standards?lc=en-WW&pnid=17741>).

4.1.3 Available FID Repair Kits

The following repair kits can be ordered from Siemens for the FID:

Repair Kit, FID Seal (Maxum II)	2020387-701	May be needed any time the FID must be removed. See the illustration Hotspot-Text.
Repair Kit, FID Filter (Maxum II)	2020388-701	Used for mesh filter replacement. See Replacing the FID Mesh Filter (Page 45)
Repair Kit, FID Quartz jet (Maxum II)	2020389-701	Used for quartz jet replacement. See Replacing the FID Quartz Jet (Page 48)
Kit, FID Igniter (Maxum II)	202273-001 (115V) 202273-002 (230V)	Repair and upgrade igniter and heater block assemblies. See Replacing the FID Igniter (Page 49)

4.1.4 Purge Coil and Filter

Older analyzers had coils of stainless-steel tubing to provide an exhaust path for purged spaces. In newer analyzers this has been replaced by a metal filter or eliminated altogether. The two devices are shown in the photo below.



Figure 4-1 Purge Coil compared with Metal Filter

4.2 Replacing the FID Mesh Filter

This section describes the procedure to replace the mesh filter inside the FID in the Maxum II. The mesh filter is a small round filter located inside the combustion chamber of the FID. This filter is for the combustion air input. Because of the very small diameter of the air restrictor through which combustion air passes, it is unlikely that the filter will become clogged.

Because it is difficult to remove this filter without damaging it, in the event that the filter does become clogged or it should become necessary to remove the filter for some reason, then it should be replaced and not reused.

It will be necessary to power down the analyzer for this procedure. When performing this procedure, it should NOT be necessary to remove the FID from the Maxum II.

The following figures are intended for use as a reference throughout the procedure. The numbers in the diagrams relating to individual components are referenced in parentheses in the procedure steps.

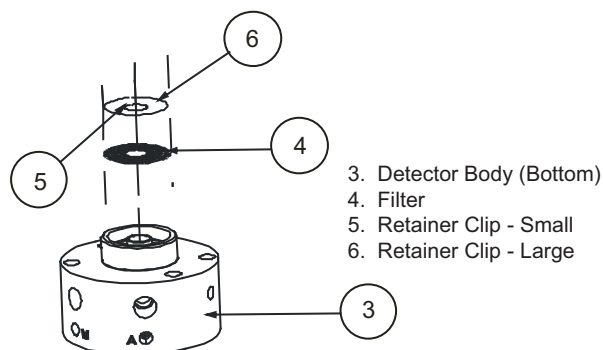


Figure 4-2 FID Mesh Filter and Retaining Clips

4.2 Replacing the FID Mesh Filter

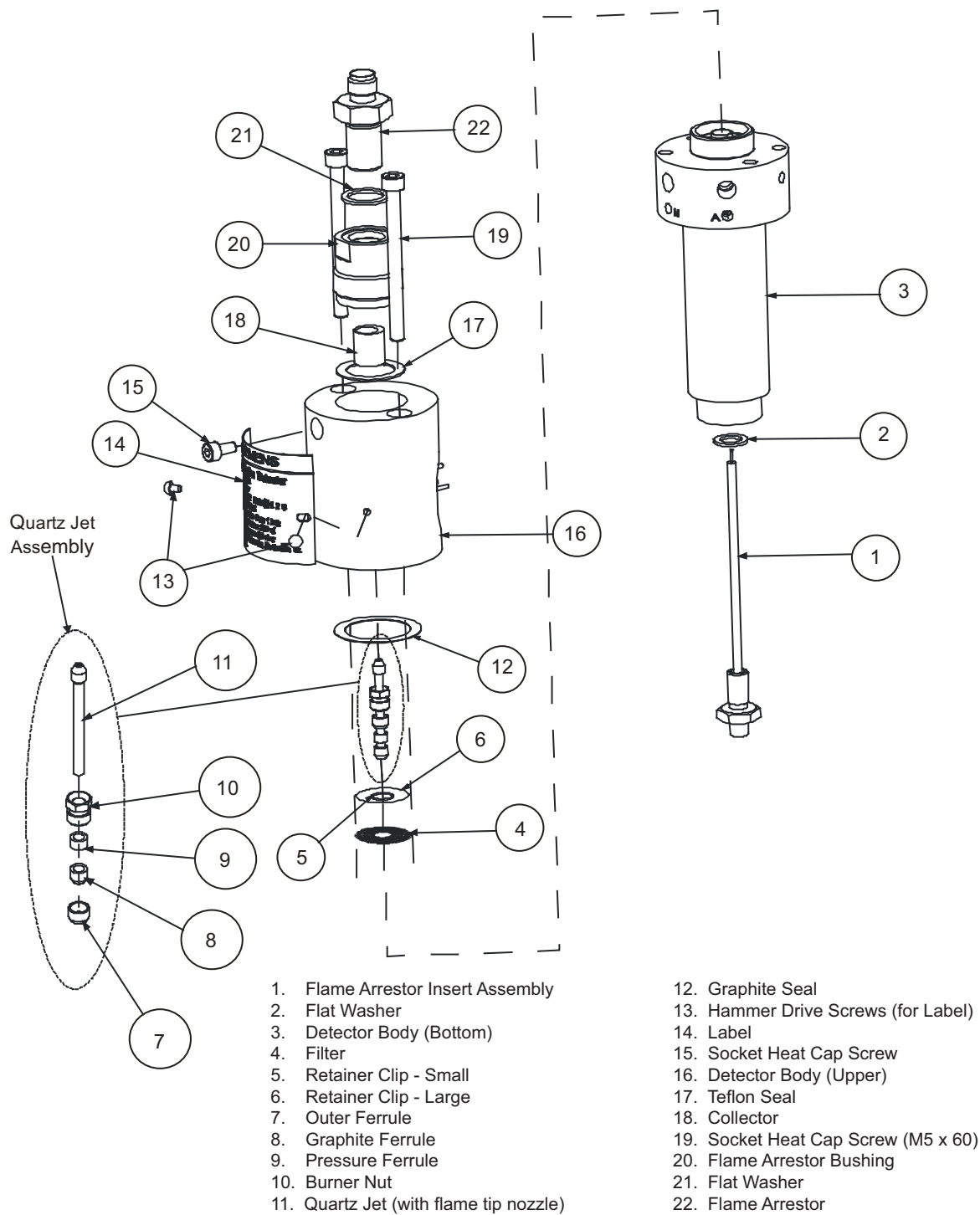


Figure 4-3 FID Assembly

4.2.1 Procedure to Replace Mesh Filter

1. Shut off the detector Hydrogen and allow the detector to cool down. Carrier gas should remain on during cool down to prevent condensation.
2. Turn off all supply gasses.



WARNING

Possible ignition source. Failure to follow proper safety procedures may result in injury or death.

If the analyzer is equipped with a purged methanator and explosive gasses are present, it is necessary to wait at least 8 minutes for the methanator to cool after powering down the analyzer before opening the analyzer door.

3. Power off the analyzer.
4. Remove Cap Screws (19) and detach Upper Detector Body (16) from Lower Detector Body (3).



CAUTION

Possible ignition source. Failure to follow proper safety procedures may result in injury or death.

Do not open the FID with the flame burning or with the power on.

5. Unscrew Burner Nut (10) and remove the Quartz Jet and attached hardware (7, 8, 9, 10, and 11). Set these items aside on a clean, lint free cloth.
6. Using a small flat-head screwdriver or similar tool, remove the Small and Large Retainer Clips (5 and 6).
7. Turn on the air supply to the FID in order push the Mesh Filter (4) up so that it can be removed.
If turning on the air supply does not dislodge the Mesh Filter (4), use a flat screwdriver to carefully pry up the Filter (be careful not to scratch the surface of the FID body).
8. Turn off the FID combustion air.
9. Discard the old Mesh Filter (4) and install a new one in the FID.
10. Re-install the Small and Large Retainer Clips (5 and 6)
11. Re-insert the Quartz Jet and attached hardware (7, 8, 9, 10, and 11) into the FID Bottom Body (3). Verify that the nozzle tip of the Quartz Jet (11) is still adjusted correctly (there should be 10.5 mm from the nozzle tip to the Lower Body (3)).
12. Tighten the Burner Nut (10) with fingers. Then retighten one quarter to one half rotation using a wrench. The nozzle can break if it is tightened more.
13. Replace the graphite seal (12) before reassembling the FID body.
14. Reattach Upper Body (16) and Lower Body (3) and reinstall Cap Screws (19). Tighten Cap screws firmly but do not over tighten (about 1/2 turn past finger tight).
15. Power the analyzer back on.
16. After the oven and FID has had time to heat up, check the flows and light the flame.

4.3 Replacing the FID Quartz Jet

This section describes the procedure to replace the Quartz Jet inside the FID in the Maxum II. The Quartz Jet is a thin quartz tube that includes the burner nozzle tip for the FID flame. This item rarely needs replaced.

It will be necessary to power down the analyzer for this procedure. When performing this procedure, it should NOT be necessary to remove the FID from the Maxum II.

4.3.1 Procedure to Replace Quartz Jet

1. Shut off the detector Hydrogen and allow the detector to cool down. Carrier gas should remain on during cool down to prevent condensation.
2. Turn off all supply gasses.



WARNING

Possible ignition source. Failure to follow proper safety procedures may result in injury or death.

If the analyzer is equipped with a purged methanator and explosive gasses are present, it is necessary to wait at least 8 minutes for the methanator to cool after powering down the analyzer before opening the analyzer door.

3. Power off the analyzer.
4. Remove Cap Screws (19) and detach Upper Detector Body (16) from Lower Detector Body (3).
5. Unscrew the Burner Nut (10) and remove the Quartz Jet and attached hardware (7, 8, 9, 10, and 11).
6. Detach the Quartz Jet (11) from the Ferrules (7, 8, 9) and the Burner Nut (10). Make note of the way they are assembled.
7. If Quartz Jet (11) is dirty or clogged, it may be possible to clean it using solvent in an ultrasonic cleaner. However, replacement is recommended. If attempting to clean the quartz jet, allow any excess solvent to evaporate before reinstalling.
8. Assemble the replacement (or cleaned) Quartz Jet (11) and associated hardware (7, 8, 9, and 10).
9. Reinsert the Quartz Jet (and other hardware) into the Lower Detector Body (3). Before tightening the Burner Nut (10), adjust the nozzle (flame tip). The distance from nozzle tip to the Lower Body (3) should be 10.5 mm. Tighten the Burner Nut (10) with fingers. Then retighten one quarter to one half rotation using a wrench. The nozzle can break if it is tightened more.
10. Replace graphite seal (12) between the Upper Detector Body (16) and Lower Detector Body (3) before reassembling the FID body.
11. Reattach Upper Body (16) and Lower Body (3) and reinstall Cap Screws (19). Tighten Cap screws firmly but do not over tighten (about 1/2 turn past finger tight).

12. Power the analyzer back on.

13. After the oven and FID has had time to heat up, check the flows and light the flame.

4.4 Replacing the FID Igniter

This section describes the procedure to retrofit the FID igniter in the Maxum II. This involves replacing the original FID igniter module with a new version FID igniter module. The procedure also involves replacing of some of the related hardware, such as the purge tube and heater assembly. It will be necessary to power down the analyzer for this procedure.

4.4.1 Procedure - Parts

A parts kit (Siemens part number 2022073-001 for 115V, 2022073-002 for 230V) is required for this procedure. This kit contains the following items.

Part Number	Description	Quantity
A5E41666926001	TUBE, FID PURGE	1
A5E41666941001	GASKET, FID PROTECTIVE PIPE	1
1317001-031	GROMMET, 1-1/32 ID, 1/16 GR, 1-3/4 OD	1
A5E41666802001	BUSHING, FID PURGE TUBE	1
1312420-331	SCREW, M3X 4, SOCKET HEAD CAP, SST	2
1312530-006	WASHER, M3, HELICAL SPRING LOCK, SST	1
A6X19905099	O-RING, SIZE 020, 0.964 X .070, KALREZ	1
2021925-001	IGNITER, FID ASSEMBLY, MAXUM II	1
A5E41666948001	STRAP, GROUND, FID	1
A5E41666957001 (115V)	ASSEMBLY, HEATR, FID/FPD	1
A5E41666957002 (230V)		
A5E35374578001	COVER, DETECTOR, FID	1
A5E41381855001	PURGE FILTER, 2.0 MICRON, 10-32 THREAD	1
A5E41849023	WASHER, .375"X.190"X.031", 25% GF PTFE	1

The list above is provided for reference only. The official parts list for the kit is included with the kit when it is shipped.

Also required is an appropriate tool kit. A lubricant such as Krytox 240 AC or equivalent will be needed in order to lubricate the new grommets. If the EC Cover Plate Gasket (Part Number 2021171-001) is damaged, a replacement gasket will be required as well. Read this entire procedure before planning the work to make sure that necessary items are on hand.

4.4.2 Procedure - Removing the Detector

Note

All figures are located at the end of this procedure.

1. From GCP, create a database backup of the Maxum analyzer that is to be modified (See the Gas Chromatograph Portal User Manual for instructions).
2. From GCP, verify operation of analyzer. Verify that there are no alarms or that all alarms are accounted for. (See the Gas Chromatograph Portal User Manual for instructions).
3. Verify that all parts of the new FID igniter kit are on site prior to starting. Contents of the kit are listed in the inventory list that is shipped with the kit.
4. Extinguish the flame to the FID either by shutting off the air supply to the detector (for hydrogen carrier) or shutting off the hydrogen to the detector (if not using hydrogen carrier). In order to prevent condensation in the detector, allow carrier to flow for several minutes after flame is extinguished. Use a mirror to check for condensation at the FID vent to verify the flame is not lit (no condensation means the flame is not lit).



WARNING

Possible ignition source. Failure to follow proper safety procedures may result in injury or death.

If the analyzer is equipped with a purged methanator and explosive gasses are present, it is necessary to wait at least 8 minutes for the methanator to cool after powering down the analyzer before opening the analyzer door.

5. Power down the analyzer.

6. Open the electronics enclosure door, mezzanine door, and oven door. Use a 4mm Allen wrench if necessary and be careful not to place tension on the ribbon cable connecting to the Maintenance Panel.

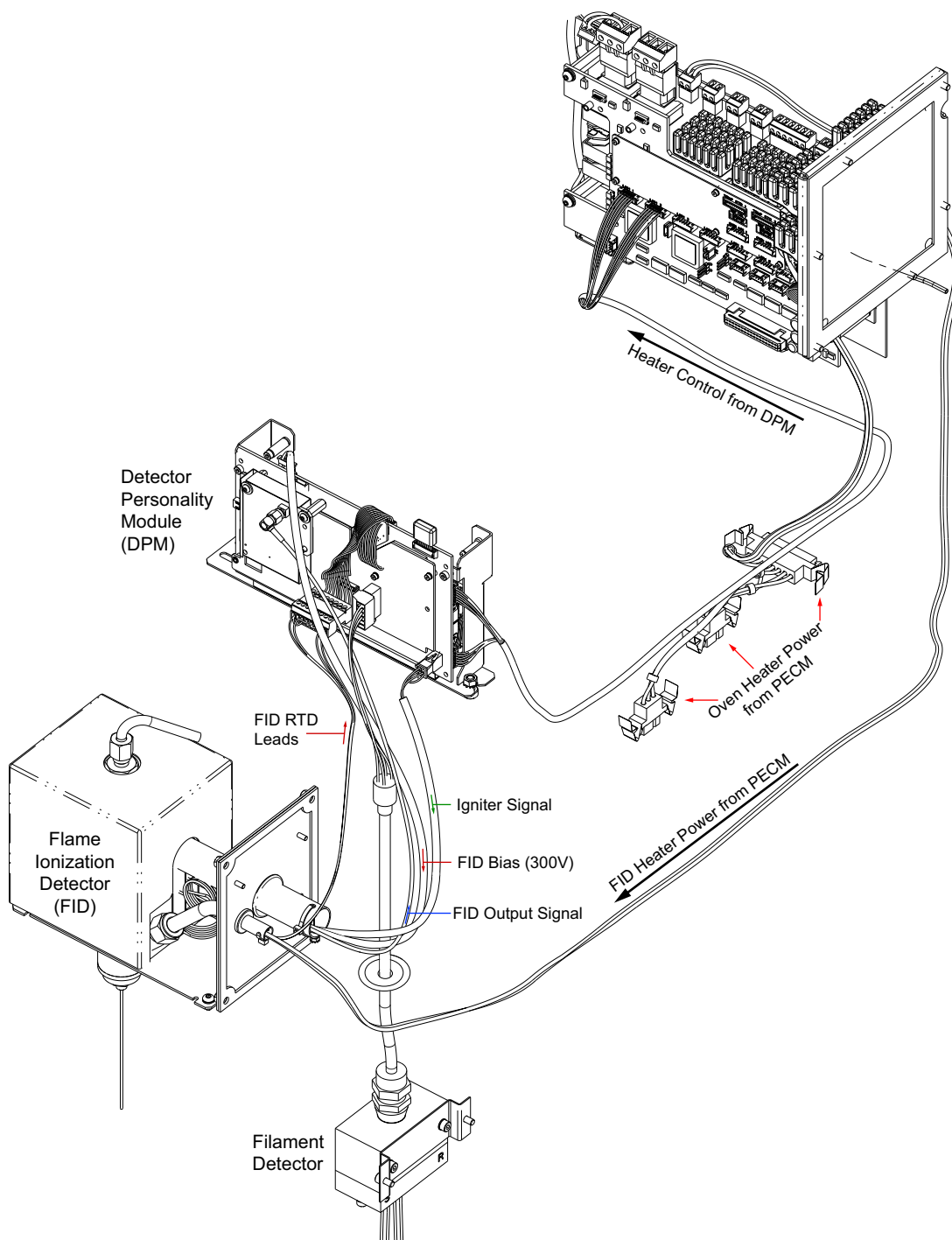


Figure 4-4 Typical FID Connections

7. Disconnect the FID heater power cable from the PECM. Note the connector location.
8. Disconnect the FID heater RTD cable from the DPM connector board. Note the connector location.

4.4 Replacing the FID Igniter

9. Disconnect the FID bias, igniter, and signal cables from the DPM making note of the connector locations.
10. Disconnect tubing from the FID flame arrestor insert tube in the oven.

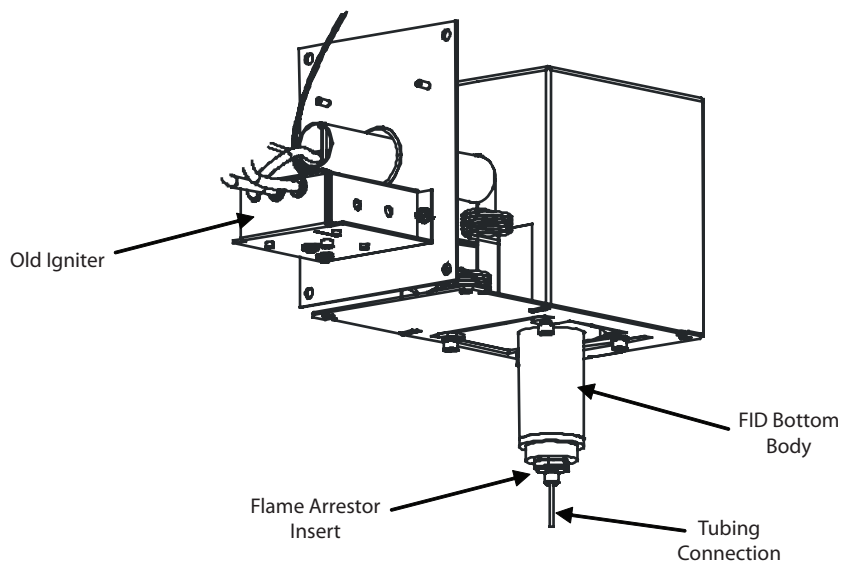


Figure 4-5 FID Assy Bottom with Original Igniter

11. Remove the flame arrestor insert from the FID bottom body using a 9/16" open-end wrench.

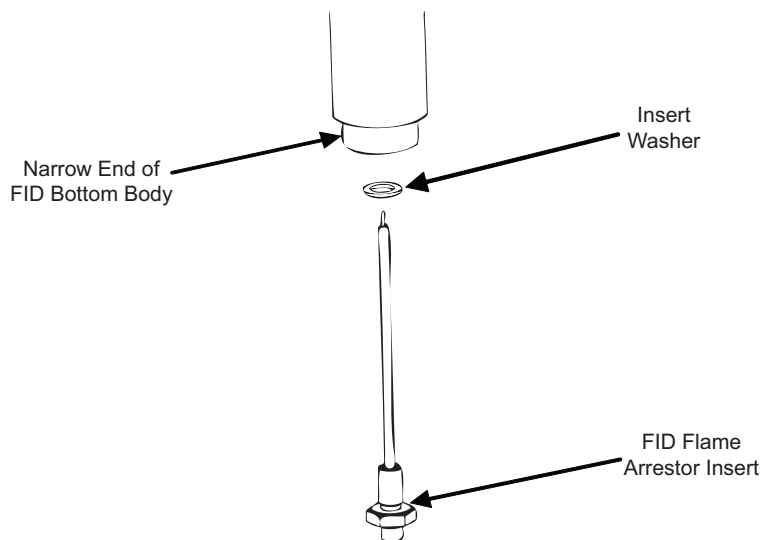


Figure 4-6 FID Flame Arrestor

12. Remove the 1/4 " vent tube from the top of the FID block using a 9/16" open-ended wrench.

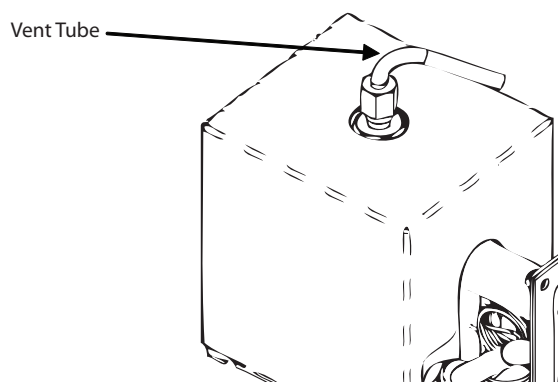


Figure 4-7 FID Vent Tube Location on FID Assy

13. Using a 3.0mm Allen wrench, remove the FID cover set screw from the front of the FID Assembly.

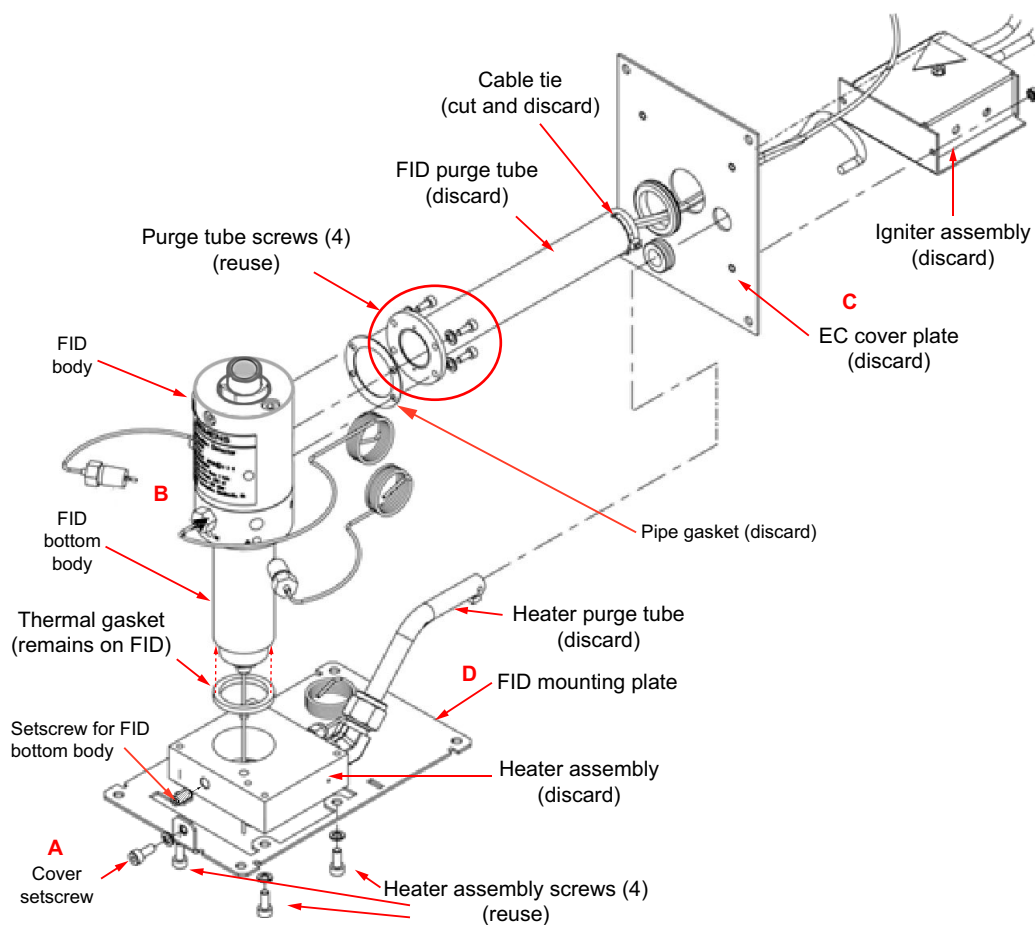


Figure 4-8 FID Parts (with Old Igniter)

14. Remove the cover from the FID block by pulling up and out, and then remove the insulation from the FID block.

4.4 Replacing the FID Igniter

15. Disconnect utility gas lines from the FID at the connecting union using a 5/16" open-end wrench. Temporarily label the gas line leads to make sure they can be reconnected correctly.

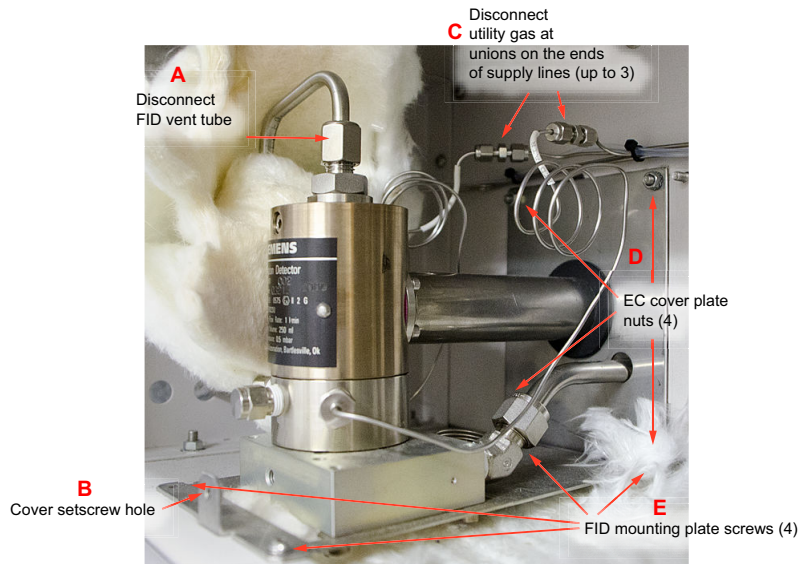


Figure 4-9 Removing the FID Assembly (Typical Installation)

16. Remove the four M4 nuts from the FID EC cover plate using a 7mm nut driver.
17. Using a 2.5mm Allen wrench, remove the four M4 screws that secure the FID mounting plate to the mezzanine.
18. Remove the FID assembly from the mezzanine by pulling up and then out when the FID bottom body clears the hole.

4.4.3 Procedure - Igniter Replacement

Note

A clean work surface should be used for disassembly of the old igniter and installation of the new igniter. This is to prevent contamination of the detector gas inputs and electrical contacts.

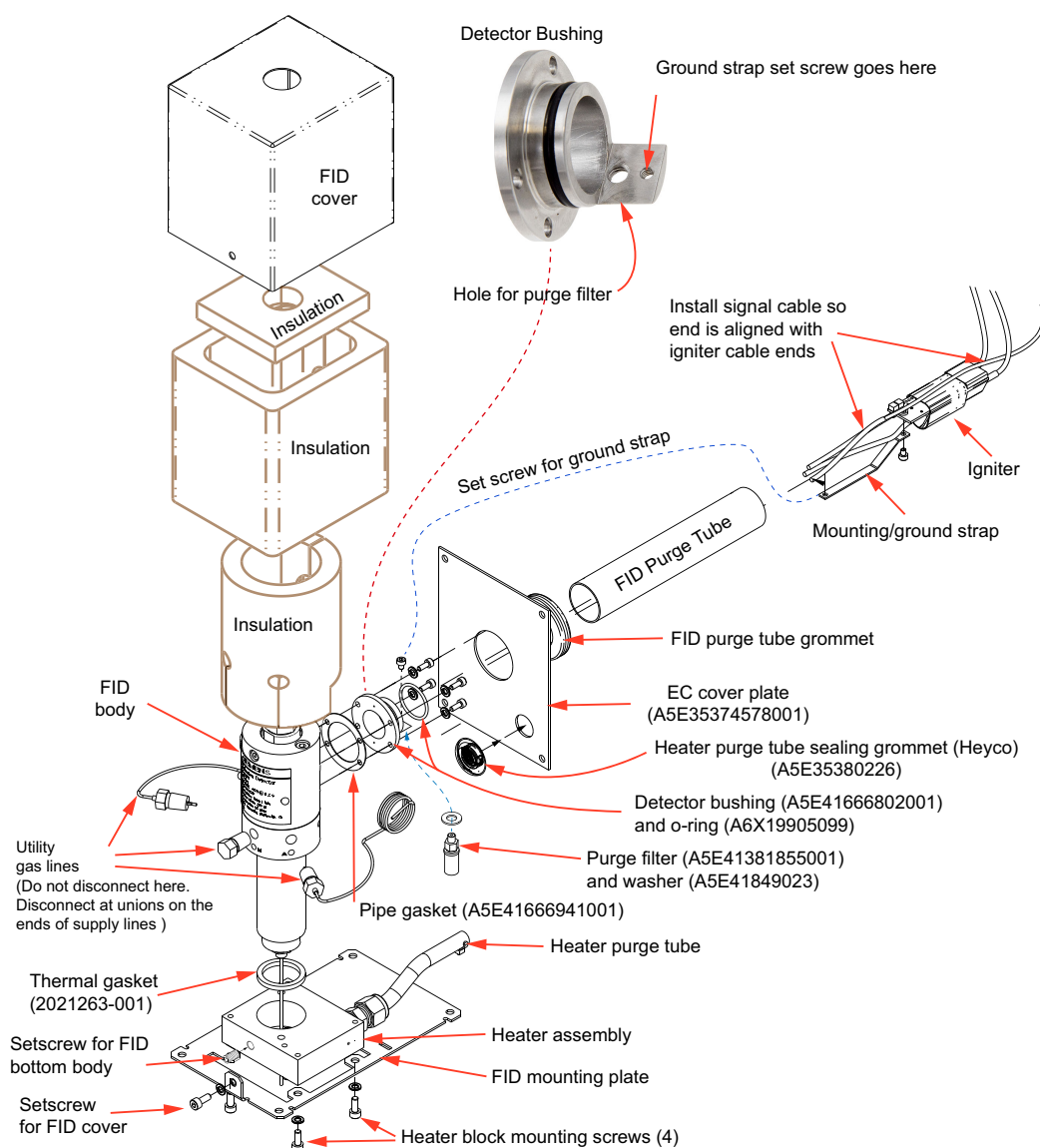


Figure 4-10 FID Installation Exploded Diagram

1. Remove the four screws that secure the purge tube to the electrodes of the detector.
2. Pull the purge tube about 1 inch away from the detector assembly and carefully remove the wires from the electrodes.
3. The purge tube with its bushing and gasket, EC cover plate, and igniter assembly will not be reused. Set these items aside. However, the screws that were used to connect the tube to the detector will be reused.
4. Remove the setscrew for the FID bottom body to separate the detector heater and mounting plate.
5. Remove the old heater assembly. (2021266) This will not be reused.

4.4 Replacing the FID Igniter

6. Install the new FID heater assembly (A5E41666957001 for 115V, A5E41666957002 for 230V) on the FID mounting plate using the 4 screws removed from the old heater assembly.

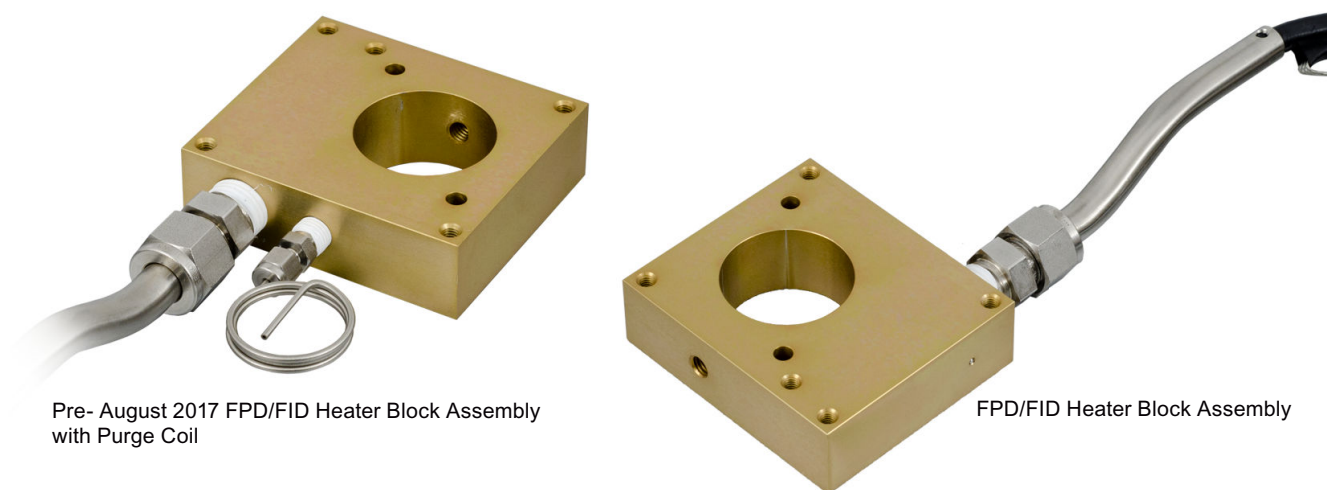


Figure 4-11 Heater Assembly

Note

Do not disassemble the heater block assembly.

Disassembling the heater block voids the 'hi-pot' testing.

7. Install the Kalrez high-temperature O-ring (A6X19905099) into the groove on the new purge tube bushing. See New Bushing (with Tab for Connecting Strap).
8. Install the new purge tube bushing (A5E41666802001) onto the FID using the 4 screws removed from the purge tube earlier in this procedure. The new pipe gasket (A5E41666941001) should be positioned between the bushing and the FID body. Install the bushing such that the tab (used to attach the igniter fastening strap) is on the bottom.
9. Using a 2.5mm hex wrench, attach the mounting strap to the new igniter board. Use an M3 x 4 socket head cap screw (1312420-331) from the kit for this connection. See New Igniter Attachment to Detector.

Note

Because the wires from the igniter to the electrodes are stiff, it is best to plug the wires in before attaching the strap to the bushing.

10. Plug both igniter wires into the appropriate detector electrode positions. The wires from the igniter board to the DPM should not be connected yet.
11. Using a 2.5mm Allen wrench, attach the new igniter board to the bushing on the detector assembly using the fastening strap. Use a socket head cap screw (item 6) and lock washer (item 7) from the kit for this connection. Note that the igniter board is installed with the flat side up and the round transformer down. See New Igniter Attachment to Detector.

12. Plug the white signal wire (from the DPM) into the appropriate detector electrode position. See Electrode Connections for New Igniter. The wire should not be connected at the DPM end yet.

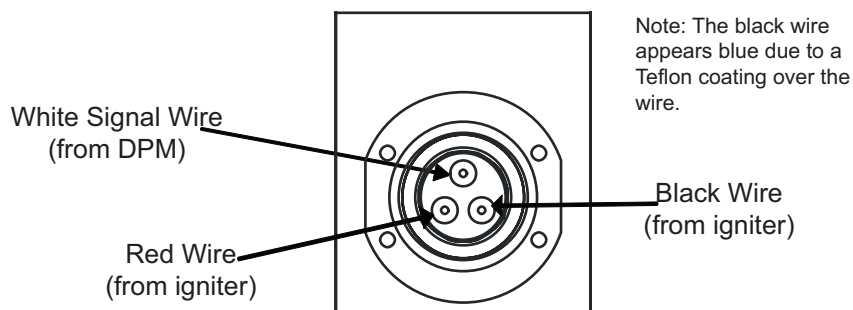


Figure 4-12 FID New Igniter Electrode Connections

13. Place the white signal wire (from the DPM, often covered by black heat-shrinkable tubing) across the top of the new igniter board.

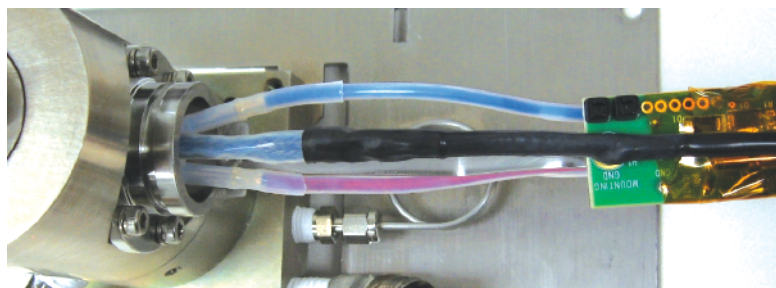


Figure 4-13 FID Wiring

14. Insert the unplugged ends of the wires into the new FID purge tube and slide the purge tube over the igniter board and wiring. Make sure that the white signal wire remains positioned against the flat top side of the igniter board. Place the end of the purge tube with the flat area around the hole towards the detector.

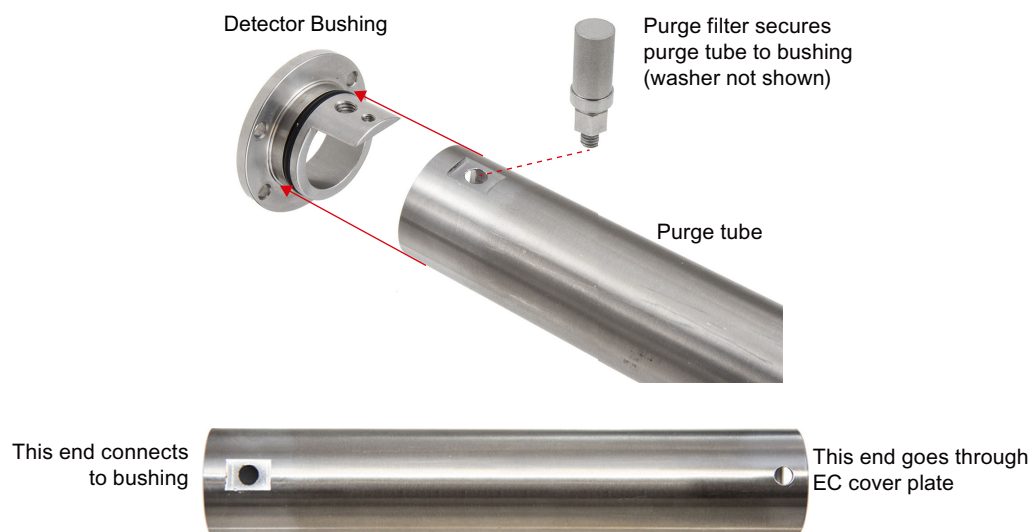


Figure 4-14 FID Purge Tube and Bushing Orientation

15. Line up the hole on the new purge tube with the hole on the bushing. The holes will be on the bottom of the purge tube when the assembly is in the upright, operating position.

4.4 Replacing the FID Igniter

16. Insert the purge filter (A5E41381855001) through the washer (A5E41849023), and screw into the bushing to secure the purge tube.
17. If the new grommets are not installed in the holes on the new EC cover plate or on the purge tubes, then install them now.
18. Apply a coating of Krytox 240 AC or similar lubricant around the inside diameter of the grommets to allow for easy sliding of the new purge tube.
19. Feed the detector wiring through the appropriate holes on the new EC cover plate and install the cover plate onto the detector assembly.

4.4.4 Procedure - Reinstalling the Detector

1. Inspect the FID EC cover plate gasket (2021171-001) and replace if worn or damaged.
2. Inspect the FID thermal gasket (2021263-001) and replace if damaged. Retrieve any gasket fragments that may have remained in or on top of the oven. If replacing the gasket, clean the mating surface on the FID, and remove the paper backing to expose the adhesive.

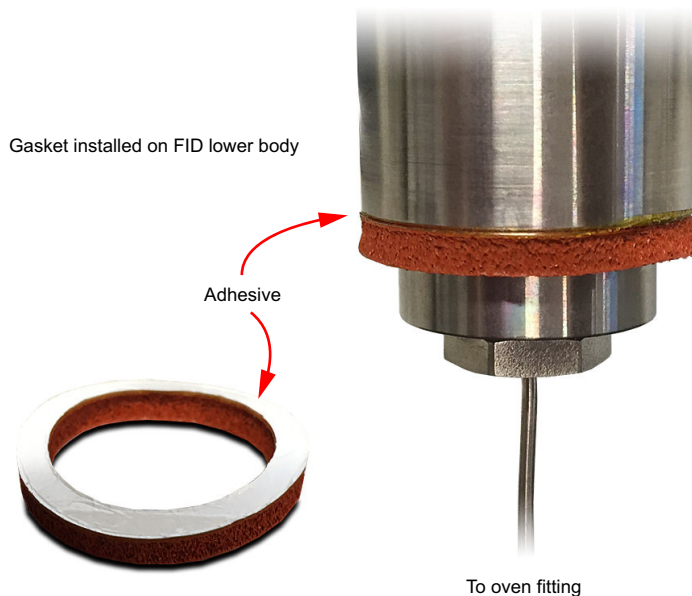


Figure 4-15 FID Thermal Gasket

3. Route the FID Module Assembly wiring into the EC and install the module into the analyzer. Make sure that the FID bottom body fits into the hole at the bottom of the mezzanine section.
4. Install the 4 M4 screws into the FID mounting plate and tighten using a 2.5mm Allen wrench.
5. Make sure that the EC cover plate gasket is in the correct position and install the 4 M4 nuts. Tighten the nuts using a 7mm nut driver. Verify that the nuts are not over-tightened by making sure that the gasket is not pushed out more than about 1/16" along the edges of the EC cover plate.
6. Connect the utility gas lines to the correct connecting unions and tighten using a 5/16" open-end wrench. Remove the temporary labeling that was added earlier in this procedure.
7. Place the insulation and then the FID cover onto the FID block.

8. Install the FID cover set screw and tighten using a 3mm Allen wrench.

Note

The next step is important in order to maintain the explosion proof protection of the FID. The threads of the FID flame arrestor must be clean and lubricant or other substances must NOT be applied to the threads.

9. Place the FID flame arrestor insert and washer into the FID bottom body and tighten using a 9/16" open-end wrench. Make sure the flat washer fits into the recessed cavity at the lower end of the FID bottom body to prevent leaks. See Figures 3-4 and 3-5.
10. Connect the FID flame arrestor insert tubing to the correct connection union in the oven using either a 1/4" or 5/16" open-end wrench depending on the fitting size.
11. Route the bias cable, the igniter cable, and the signal cable through the EC and connect them to the FID DPM board locations from which they were unplugged earlier in this procedure.
12. Route the FID heater RTD cable through the EC and plug it into the DPM location from which it was unplugged earlier in this procedure.
13. Route the FID heater power cable through the EC and plug it into the PECM location from which it was unplugged earlier in this procedure.
14. Route the FID heater ground braid through the EC and connect to the appropriate ground lug from which the old one was disconnected.
15. Turn on utility gases and check for leaks.
16. Turn on power to the analyzer and switch the valves checking all possible flow paths for leaks. Refer to plumbing diagram provided in the custom documentation package for flow paths.
17. Turn up oven air to the normal setting and allow the oven to come to temperature and stabilize.
18. Set all gas flows after the detector is up to its temperature set point.
19. With the new igniter, it will be necessary to start Real Time Chromatograms on the HMI in order to light the FID flame. On the HMI, choose the Maintenance Menu, and then select option 5 (Detectors & Real Time Chrms). Then highlight the appropriate FID and then press "View Chrom".
20. At this time you can ignite the FID using the HMI.
21. After 15 to 30 minutes the analyzer will be ready for operation. Verify that the FID operates correctly and put analyzer back on line.

4.5 FID Specifications

Table 4-1 Flame Ionization Detector (FID)

Parameter	Value
Target Components	Carbon
Measurement Type	Mass

Parameter	Value
Smallest Measuring Range (at 60°C oven temperature)	0 to 1 ppm $\pm 3\%$
Typical Measuring Range (at 60°C oven temperature)	0 to 100 ppm $\pm 1\%$ FS up to 0 to 100% $\pm 0.5\%$ FS
Dynamic Range	10^7
Linear Range	10^6
Selectivity	Combustible Components
Temperature Range	105 to 260°C

4.6 Filament Detector

The Filament Detector is a two-cell device that provides a reference and a sample sense signal, typically used in applications along with the FID.

Component Locations

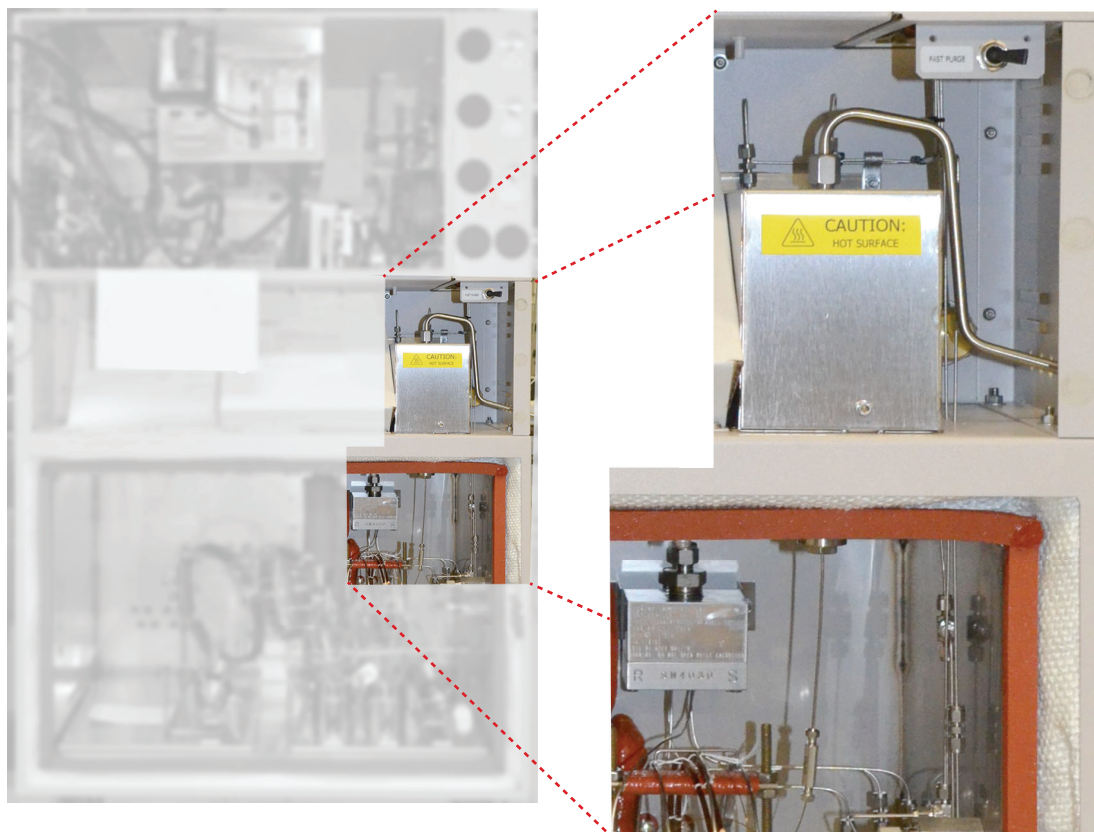


Figure 4-16 FID and Filament Detector in Typical Analyzer

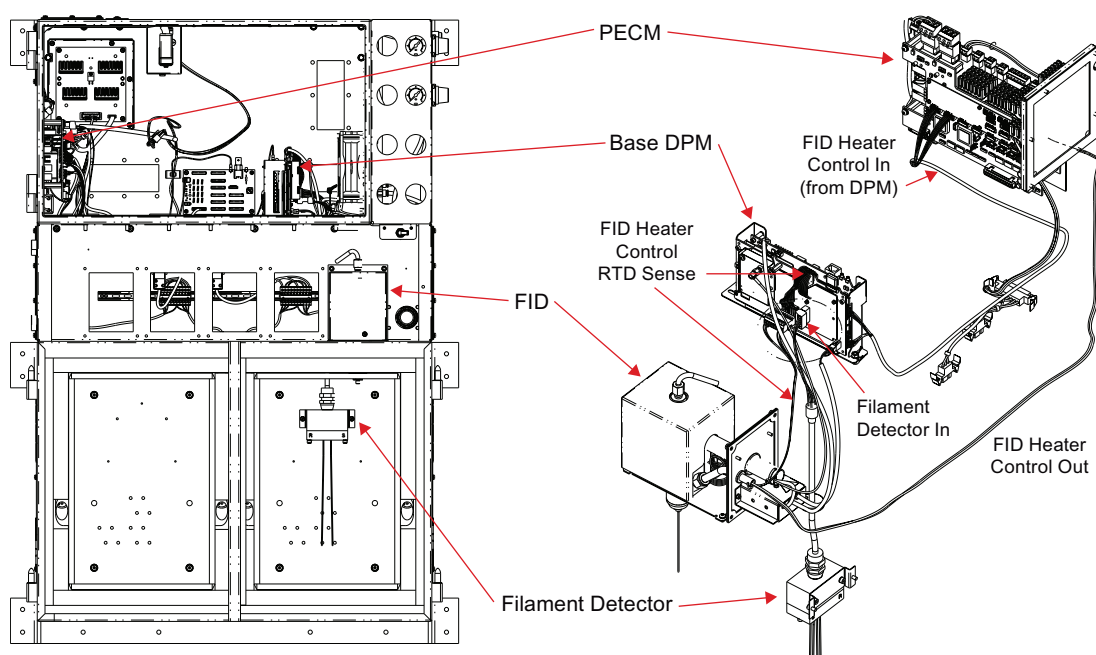


Figure 4-17 FID with Filament Detector, Typical Application

Filament Detector Assembly Details

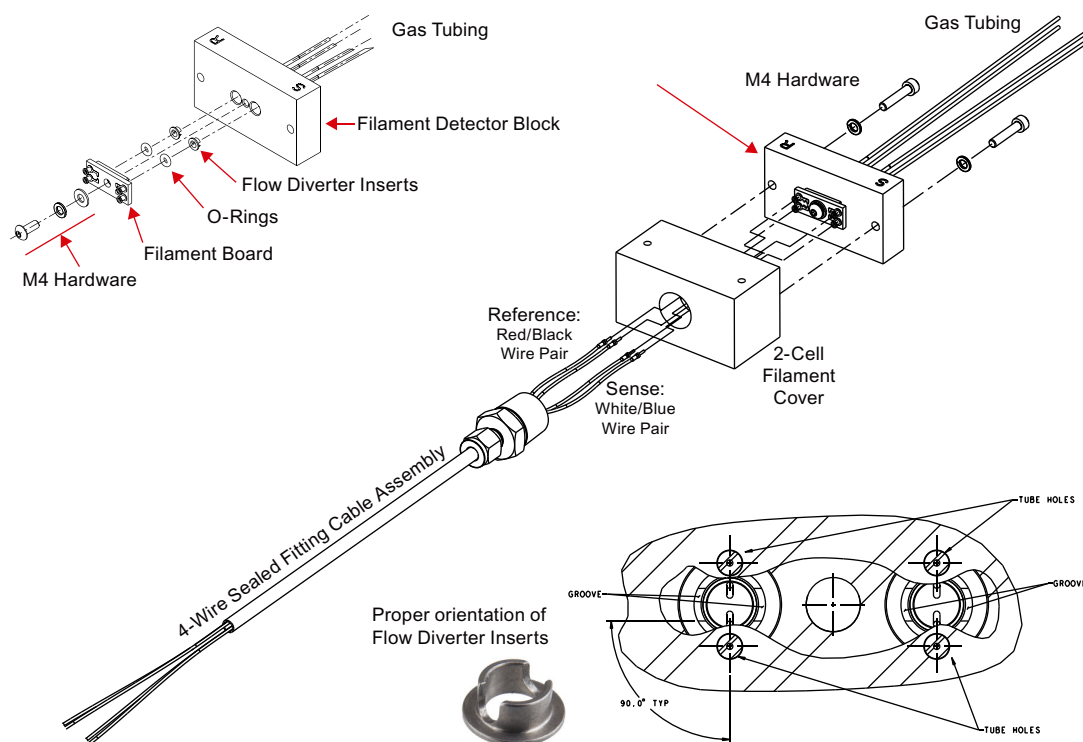


Figure 4-18 Filament Detector Exploded View

4.6.1 Replacing the Filaments

1. Remove the two bolts in the bottom of the detector block.
2. Separate the detector body (bottom) and detector cap (top) to allow access to the filament board.
3. Note location of each wire and disconnect from board. Wires are paired; Sense is White and Blue, and Reference is Red and Black.
4. Remove the screw and both washers holding the board in place.
5. Carefully lift board out of Detector block.
6. Discard the board and O-rings. Do not attempt to reuse old O-rings.
7. Remove the two metal inserts. These CAN be reused.
8. Inspect the metal flow diverter inserts for damage.
9. Before installing new board, examine the mounting surface and the holes for the filaments to verify there is no contamination or scratches on the machined surface. If there is contamination on the surface, clean it using a lint free cloth and a cleaning solvent such as acetone or hexane. If the surface is scratched it may be necessary to replace the complete assembly.

Note

The elements on the board are exposed and are very delicate. Handle the board only by its edges. Hands and tools must be clean.

10. Install the metal inserts in the detector block. These inserts should be installed with the groove perpendicular to the tube holes in the block (so that air cannot flow in a straight path between the holes).
11. Install the new O-rings in hole in the Detector Block. It is also possible to install the O-rings on the filament board instead of in the hole. If installing the O-rings on the board, be careful not to damage the element.
12. Install the Board into the Detector Block. When installing the board, exercise caution not to damage the exposed elements.
13. Reinstall the Flat Washer, Lock Washer, and Button Head Hex Screw. Do not over tighten the screw as this can damage the Board
14. Reconnect wiring to the board. Wiring MUST be connected to the same cells as before. Verify all termination points.

Note

The color coding information for the wiring should be on the Detector Certification Label. Also note that there are two wires of each color. For a specific cell it does not matter which wire is connected to which lead as long as the color is correct.

15. Before installing cover back on the Detector Block, turn on carrier air to verify there are no leaks between the Board and the Block. Turn off carrier after this check is complete.
16. Set the cover in place and reinstall the 4 screws and lockwashers that secure the cover to the detector block.

4.7 Methanator

4.7.1 Methanator Function

The methanator is used with a Flame Ionization Detector (FID) when it is necessary to detect carbon dioxide (CO₂) or carbon monoxide (CO). In the methanator CO₂ and CO are chemically changed to methane using excess hydrogen and a catalytic reaction. The concentration of methane, which can be detected using an FID, is proportional to the concentration of CO₂ and CO. In this manner, it is possible to detect CO₂, CO and other types of gases using an FID.

The methanator design consists of a stainless steel tube that is filled with a catalyst. The tube is heated using a heater cartridge, and an RTD temperature sensor and control circuit regulates the temperature. The tube is heated to approximately 400°C and the sample with hydrogen carrier is passed through the tube. The CO₂ and/or CO (depending on the exact temperature) are converted into methane for detection by the FID.

Two versions of the methanator exist for use in the Maxum edition II. The original is protected by purging/pressurization. The more recent version is protected in an explosion proof enclosure. Both versions are installed in the detector compartment of the Maxum II Airbath/Airless Oven configuration.

Features of Both Methanator Models

As protection measure, the gas inlets and outlets that enter and leave the methanator are configured as flame arrestors. In addition, both versions of the methanator assembly are insulated to prevent the surface temperature of the methanator from exceeding 180°C.

Surface temperatures for the explosion proof/flameproof methanator are significantly lower than 180°C.

NOTICE
Installation of a Methanator restricts the temperature range of the analyzer
The ambient temperature operating range of a methanator-equipped analyzer is 0°C ≤ T _a ≤ +50°C.

4.7.2 Purged Methanator

Although the purged/pressurized methanator assembly is installed in the detector compartment, it is installed inside a protective cover that limits air passage. The interior of the assembly is connected to the EC using a pipe which contains the electrical wiring for the methanator. This pipe and the protective cover over the assembly effectively make the interior assembly part of the pressurized EC. This higher pressure area prevents flammable vapors and gases from entering the methanator.

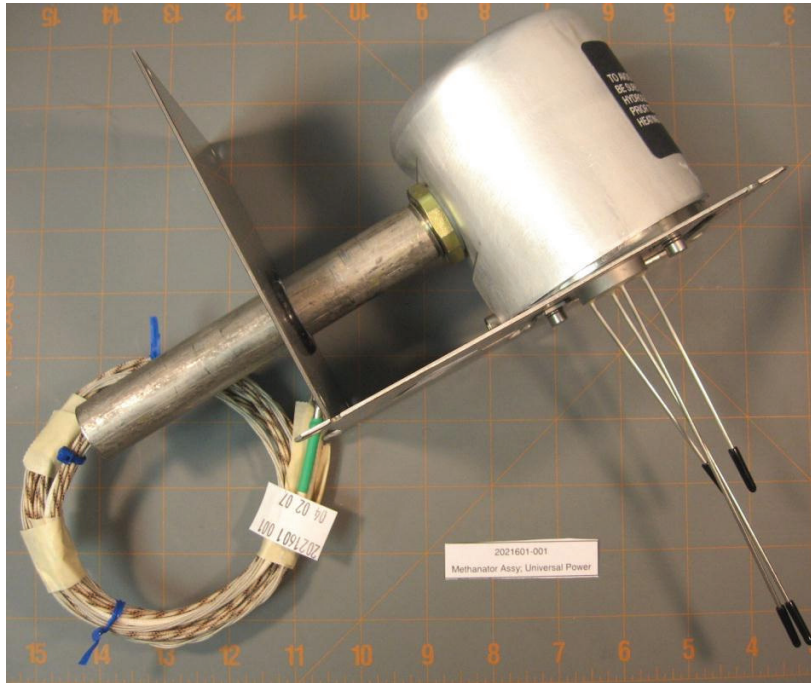


Figure 4-19 Purged Methanator

The purged methanator was replaced by the explosion-proof methanator described in the following section.

4.7.3 Explosion-Proof Methanator

The more recent version of the methanator is designed with an explosion proof/flameproof enclosure. This design eliminates the need to maintain a pressurized methanator enclosure as well as reducing some of the necessary safety measures required for maintenance of the Maxum II when a methanator is installed.

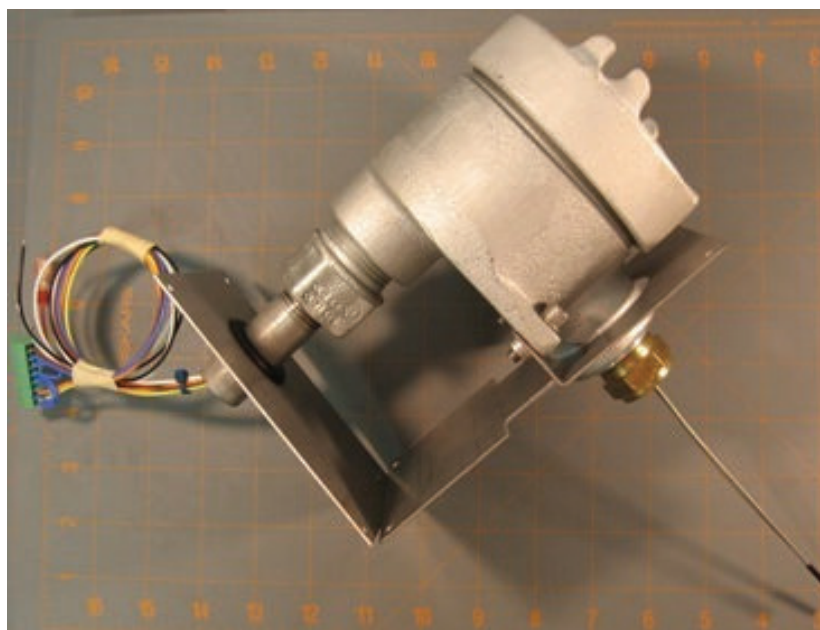


Figure 4-20 Explosion-proof Methanator

For more information see the *Maxum II Explosion Protection Safety Standards Manual* (A5E02220442001) (<https://support.industry.siemens.com/cs/document/42017542/maxum-edition-ii%3A-explosion-protection-safety-standards?lc=en-WW&pnid=17741>).

4.7.4 Methanator Specifications

Table 4-2 Methanator

Parameter	Value	
	Non-Ex Methanator	Ex Methanator
Classification	n/a	Ex d IIB+H2
Maximum Operation Temperature	400°C	400°C
Heater	115 or 230 VAC	115 or 230 VAC
Gas Supply	H ₂ , 35-45 ml/minute	H ₂ , 35-45 ml/minute
Ambient operating temperature for Methanator-equipped Maxum II	0 - 50°C	

4.7.5 Methanator Maintenance Considerations

Purged Methanator

The methanator should be inspected regularly to ensure there is no physical damage affecting the integrity of the protective cover and to verify that the protective cover is fastened securely in place. The conduit pipe should be attached snugly in accordance with local safety practices. Seals for pipe and cover should fit securely to prevent excessive escape of purge air from around the device.

All gas connections must be made through the tubing that is supplied from the factory and is part of the methanator assembly. This tubing should never be cut or shortened. If there is any physical damage, remove power from the device and replace it.



WARNING

Risk of ignition and explosion

The purged/pressurized methanator must not be operated without purge/pressurization unless it has been verified that the area is free of explosive gases and vapors. This includes opening the door to the EC for routine maintenance.

If the purge air supply of the Maxum II is interrupted during operation, it is imperative that the analyzer be powered down. Once powered down, the electronics-cabinet door must be kept closed for at least 30 minutes. A 30-minute delay is necessary to give the methanator time to cool down sufficiently. If the door to the electronics cabinet is opened prematurely, explosive gas or vapor can ignite by entering the electronics cabinet and then entering the methanator through the conduit tube.

Failure to follow proper safety procedures may result in equipment damage, severe injury, or death.

Explosion Proof Methanator

The methanator should be inspected regularly to ensure there is no physical damage to the enclosure and to verify the screw-on cap is fully tightened. Secure the setscrew sufficiently to require a tool to open the device.

The conduit pipe screws into a seal at the methanator housing. Up to that point, it is part of the purged space of the EC. The pipe should be attached securely in accordance with local safety practices. The seals for the pipe entry into the EC should fit securely to prevent excessive escape of purge air.



WARNING

Risk of ignition and explosion

The screw-on cap of the explosion proof/flameproof methanator must not be removed unless it has been verified that the area is free of explosive gases and vapors or unless the methanator has been given sufficient time to cool down (at least 30 minutes without power).

Failure to follow proper safety procedures may result in equipment damage, severe injury, or death.

4.8 Air Treater

The FID is an extremely sensitive sensor of hydrocarbons. As part of the sensing system, the FID uses a flame that burns hydrogen fuel mixed with air. Because the FID is so sensitive, the air used in the combustion process must be completely free of hydrocarbons. Otherwise noise appears on the detector signal.

To provide clean air for the Flame Ionization Detector (FID), the Maxum II uses a catalytic device known as an Air Treater to remove hydrocarbons from ordinary plant instrument air. The Air Treater is an independent unit mounted near the Maxum II. It consists of an extremely hot combustion chamber and a catalyst. Instrument air flows through the combustion chamber and interacts with the catalyst to convert any trace hydrocarbons into CO₂ and water. The resulting clean air and any formed water vapor are then delivered to the analyzer detector system.

The combustion chamber of the Air Treater is housed in an insulated explosion proof enclosure. This enclosure prevents hot surfaces from contacting the atmosphere in the area of analyzer installation, and will contain an explosion if combustible gases get inside the air treater.

The Air Treater is connected to electrical power by means of wiring installed in approved conduit. Wiring connections are not supplied by the factory and must be made in the field.



Air Treater

The instrument air flows into and out of the explosion proof enclosure through specified flame arrestors. These flame arrestors are supplied by the factory and are firmly attached to the Air Treater assembly.

4.8.1 Air Treater Maintenance Considerations

The Air Treater must be inspected regularly for any physical damage. It must be handled carefully and not dropped or damaged in any other way. If it is damaged, remove power and replace the unit.

The electrical power connections to the Air Treater must be made with wires installed in conduit or connected through cable glands using practices that conform to local safety requirements. All conduit and wiring connections must be tightened and made according to local practice. The completed installation must be inspected by personnel trained in safety practices.

4.8 Air Treater

The instrument air connections must always be made through the attached flame arrestors.

The Air Treater must be firmly mounted to the wall, the floor, or a rack on which the analyzer is mounted. Install the Air Treater so that it cannot be damaged during normal maintenance operations.

4.8.2 Air Treater Specifications

Table 4-3 Air Treater

Dimensions	Approximately 210 x 210 x 300 mm (8 ¹ / ₄ " x 8 ¹ / ₄ " x 11 ³ / ₄ ") (w x d x h) A minimum of 400 mm (15 ³ / ₄ ") total clearance is required in depth for removal of the bottom cover
Weight	10.5 kg (23 pounds)
Power requirements	115 or 230 VAC, 50 watts
Installation	Panel, rack, or wall mounted near the analyzer
Construction	300 Series Stainless Steel in contact with the treated air. Mounted in an explosion proof aluminum enclosure
Input air quality	• Meet or exceed ISO8573-4 (Class 3) requirements. • Maximum total hydrocarbon content less than 1 ppm and • Dew point -20°C (-4°F)
Input air flow	• 250 to 1500 ml/min (depending on requirements)
Input pressure	34 to 1034 kPa (5 to 150 psig), depending on flow rate desired
Warm-up time	Approximately 90 minutes
Treated air purity	Up to 95% of the trace hydrocarbons typically found in instrument quality air are removed by the air treater
Catalyst life	Catalyst is not consumed as part of the air treatment so the life is indefinite. However the catalyst can be poisoned when exposed to sulfur compounds.
Safety	• CSA certified for use in Class I, Division 1, Groups B, C, D Hazardous Locations for US and Canada • ATEX certified for use in Zone 1 or 2, gas group IIB + H2 explosive atmosphere (II 2 G) (Ex d IIB +H2 T5 Gb) • Temperature Class Rating: T5

Valco Pulse Discharge Detector

The detector can be used in three different versions: HID (helium ionization detector), ECD (electron capture detector) and PID (photo ionization detector). Installation in the Maxum GC is possible without further modification, and the detector can only be used in non-hazardous areas. The PDD uses stable, pulsed DC discharges in helium as the ionization source. The detector's performance data is equal to or better than that of detectors which use radioactive ionization sources. Since a radioactive source is not used, the complex directives for radiation protection need not be observed by the customer.

5.1 PDD Specifications

For information on detector gas-supply requirements, see the Maxum II Official Product Specifications (A5E03012338001) (<https://support.industry.siemens.com/cs/document/109742522/maxum-ii-official-product-specifications?lc=en-VW&pnid=17741>). This publication gives approximate requirements. Specific requirements depend on the application.

Table 5-1 Pulse Discharge Detector, Helium Ionization Mode

Parameter	Value
Target Components	All
Measurement Type	Mass
Smallest Measuring Range (at 60°C oven temperature)	0 to 2 ppm $\pm 5\%$
Typical Measuring Range (at 60°C oven temperature)	0 to 5 ppm $\pm 5\%$ FS
Dynamic Range	10^3 at fixed attenuation
Linear Range	10^3 at fixed attenuation
Selectivity	None without He and Ne
Temperature Range	70 - 110°C (higher temperature ranges on request; system configuration dependent)

Table 5-2 Pulse Discharge Detector, Electron Capture Mode

Parameter	Value
Target Components	Components with electron affinity
Measurement Type	Mass
Smallest Measuring Range (at 60°C oven temperature)	0 to 2 ppm $\pm 5\%$
Typical Measuring Range (at 60°C oven temperature)	0 to 5 ppm $\pm 5\%$ FS
Dynamic Range	10^3 at fixed attenuation
Linear Range	10^3 at fixed attenuation

5.1 PDD Specifications

Parameter	Value
Selectivity	Components with electron affinity to carbon 10^3 to 1
Temperature Range	70 - 110°C (higher temperature ranges on request; system configuration dependent)

Table 5-3 Pulse Discharge Detector, Photoionization Mode

Parameter	Value
Target Components	Photon sensitive components
Measurement Type	Mass
Smallest Measuring Range (at 60°C oven temperature)	0 to 2 ppm $\pm 5\%$
Typical Measuring Range (at 60°C oven temperature)	0 to 5 ppm $\pm 5\%$ FS
Dynamic Range	10^3 at fixed attenuation
Linear Range	10^3 at fixed attenuation
Selectivity	Photon sensitive components (example: benzene to hexane 10^3 to 1)
Temperature Range	70 - 110°C (higher temperature ranges on request; system configuration dependent)

Appendix A - Change Log

A.1 July 2018 Changes

1. Added description of IS TCD block.
2. Added description of Reference Selection Switches (Page 12) on IS TCD DPM.
3. Added section, Troubleshooting TCD Detector Balance Errors (Page 12)
4. Added parts list for TCD Thermistor Bead Kit (Page 16)
5. Renamed section "Replacing TCD Components" to Servicing the Ex TCD (Page 17)
6. Corrected item numbers in Procedure to Replace Thermistor Beads (Page 18).
7. Added section, Servicing the IS TCD (Page 19)
8. Corrected link to MAXUM Edition II User Manuals (Page 29) page in the Detector Gas Supply subsection.

See also

Intrinsically Safe Thermal Conductivity Detector (IS TCD) (Page 8)

Appendix B - Contact Information

Register at the Siemens Industry Online Support (SIOS) website:
<https://support.industry.siemens.com>

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