

MAXTM

The **Absolute** Standard

MAX-OXTTM

Thermal Oxidizer Module

Operating Manual

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About this Manual

This manual provides instructions for the Thermal Oxidizer Module (MAX-OXT). Instructions are included for the safe installation, setup, and operation of the equipment. Before installing or operating the equipment, please read the entire manual and observe all hazard notices, symbols and labels on the equipment and in the manual.

Contact Information and Technical Support

Safe and reliable operation of this equipment is conditional on all installation, operation and maintenance procedures being carried out in accordance with the appropriate manuals, by personnel having appropriate qualifications, experience, and training. Failure to observe the requirements of the manual may invalidate any warranty. Contact Information:

Max Analytical Technologies, Part of Thermo Fisher Scientific
32 North Road, East Windsor, CT 06088
+1 (860) 386-6878
www.MaxAnalytical.com

System Training and Support

Max Analytical offers both on-site and web-based training programs for companies interested in educating their employees on the proper operation of the equipment. Advanced maintenance, repair, and applications services are also available through the MAX-Advantage Service & Support Contract.

To schedule a training session or set up a support contract, please contact your Max sales representative or MAX Applications for application or technical support:

1. Dial 1-800-532-4752
2. Select “option 2” for Unity Lab Services technical support
3. For your instrument type, select “option 6” for Molecular, Vibrational Spectroscopy Based Spectrometers.
4. Alternatively, you can e-mail for technical support to:
us.techsupport.analyze@thermofisher.com

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1 MAX-OXT Safety

This chapter identifies potentially hazardous conditions which may be present during Installation, operation, and servicing of the equipment.

Equipment Intended Use

The equipment is intended for indoor use in a safe location. The equipment should be kept dry and should not be exposed to an explosive environment. See the installation section of this manual for required operating temperature, power requirements, and other specific requirements for proper installation and operation of the equipment.

Hazard Notices Used in this Manual

The equipment poses potential hazards during installation, operation, and service. In this manual you will find four levels of safety precautions and important notices that conform to ANSI Z535 and ISO 3864. These hazard notices identify the hazard, explain how to avoid the hazard, and identify probable consequences of not avoiding the hazard. These notations are provided primarily in the procedural sections and are intended to complement the ANSI and/or ISO safety labels physically located on the equipment.

DANGER

Avoid hazard. Danger notifications indicate a hazardous situation which, if not avoided, **will** result in serious injury or death. The hazard is imminent.

WARNING

Avoid hazard. Warning notifications indicate a hazardous situation which, if not avoided, **could** result in serious injury or death. The hazard is possible.











CAUTION

Avoid hazard. Caution notifications indicate a hazardous situation which, if not avoided, could result in a moderate or minor injury and/or equipment damage.

NOTICE

Notice notifications provide information to follow to avoid damaging system hardware or losing data.

Symbols Used on the Equipment

	On (Power) IEC 60417, No 5007
	Off (Supply) IEC 60417, No 5008
	Protective Earth Terminal IEC 60417, No 5019
	Fuse IEC 60417, No 5016
	General warning, refer to manual for further instructions ISO 7010, W001
	Warning, risk of electric shock ISO 7010, W012
	Warning, hot surface. ISO 7010, W0017
	Equipment is compliant with requirements for the European Union. See Declaration of Conformity for further details on Directives and Standards used for compliance.
	Equipment is compliant with requirements for Great Britain. See Declaration of Conformity for further details on Directives and Standards used for compliance.
	The equipment should not be discarded as unsorted waste but must be sent to separate collection facilities for recovery and recycling.

General Safety Precautions

This section lists some of the hazards that could be encountered with the equipment. More specific hazards are listed throughout the manual in the relevant sections.

CAUTION

Read the Manual before Operation: All operators should read and understand this manual before using the equipment. It is essential for all personnel to understand the operation procedures and how to avoid potential hazards associated with the use of the equipment.

CAUTION

Only trained and experienced operators should perform maintenance and repairs. Contact Max Analytical for service and/or training.

CAUTION

Do not substitute parts or modify equipment. Do not install substitute parts or perform any modifications to the hardware that have not been authorized by Max Analytical.

CAUTION

Use the proper power cord. Only use a detachable power cord that is rated for the voltage and current specified on the equipment nameplate. The power cord should have a minimum cross-sectional area of 0.75 mm² (18AWG). The power cord should be certified by an appropriately qualified agency such as UL, VDE, or Semko.

DANGER

Explosion Hazard: The equipment will expose sample gas to a thermal oxidizer and is intended for the analysis of non-flammable gas mixtures only. The concentration of flammable gases in the source stream should be less than 25% of the lower explosive limit (LEL). Failure to comply will result in injury or death.

WARNING

Inhalation Hazard: Be sure that any sample exhaust ports are properly connected to a safe vent location to prevent exposure to potentially dangerous gas mixtures. Inhalation of certain gases may cause headache, dizziness, nausea, bodily irritation, irregular heartbeat, or death.

WARNING

Shock Hazard: The system enclosure contains high voltage. The system must be de-energized during all maintenance and service operations. Failure to comply could result in injury or death.

CAUTION

Compressed Gas Hazard: The equipment requires compressed air for valve actuation (≥ 80 psig) and may require calibration gas cylinders for analysis. Check for leaks before turning on any gas supply and wear safety glasses to prevent injury. Failure to comply could result in injury.

 **CAUTION**

Burn Hazard: The equipment contains heated components inside the enclosure and hot fittings on the back panel. Disconnect power and allow the equipment to cool before servicing and avoid touching the fittings on the back of the equipment. Failure to comply could result in injury.

2 MAX-OXT Overview

This chapter introduces the Thermal Oxidizer Module (MAX-OXT), explains the principle of operation, and provides an overview of its components. The MAX-OXT was developed for use with the MAX-iR or other FTIR gas analyzers to assist in the measurement of trace components in the presence of relatively high concentration spectral interferences. An example of this application is the measurement of part-per-trillion (ppt) levels of ethylene oxide in ambient air or stack gas with several percent moisture.

Principle of Operation

The MAX-OXT is a pre-treatment device for processing the sample gas before it flows through the FT-IR gas cell for analysis. The sample gas first flows through a heated catalyst in the MAX-OXT- which is designed to oxidize and remove the target analyte from the sample. This allows for an FT-IR measurement of the gas matrix without the analyte. Then the sample gas is directed through a bypass in the MAX-OXT and the entire sample flows to the FT-IR. A second measurement is made of the whole sample, in which the main interferences (typically H₂O, CO₂ and CH₄) can easily be compensated to allow sensitive detection of very low concentrations of analyte. The oxidize step can be repeated whenever necessary to correct for drifting concentrations of interferences in the sample gas matrix.

The MAX-OXT contains two oxidation catalyst cores in series to ensure complete removal of the target analyte from the sample. The catalysts are heated to an experimentally determined temperature chosen to fully oxidize the target analyte without reducing the concentrations of the spectral interferences.

The MAX-OXT- can be used as a standalone module with an FTIR or integrated in a Max Analytical continuous monitoring system. The MAX-OXT- is controlled by the MAX Acquisition software, and automatic sequencing can be configured to streamline the workflow process with other Max Analytical hardware.

Overview of Hardware

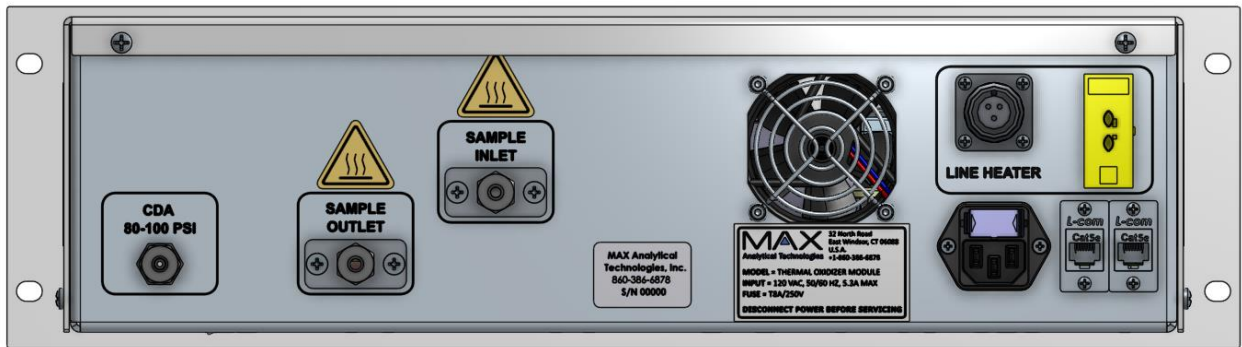
Front Panel

The front panel of the MAX-OXT- includes indicator lights to indicate the gas flow state, either *Bypass Mode* stream or *Oxidizer Mode*. Two temperature controllers show the setpoint and actual temperatures for the two heated zones, Oxidizer Oven, and Transfer Line. The pressure regulator on the front panel controls the clean dry air (CDA) pressure that activates the pneumatic valving and includes a gauge to view the actual pressure.



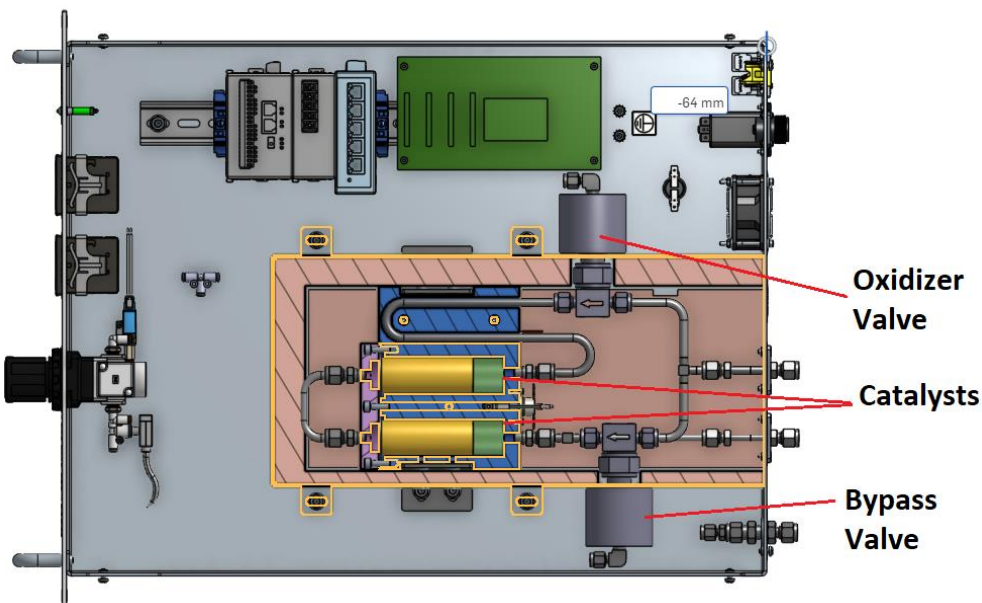
Rear Panel

The rear panel includes the CDA gas inlet, sample gas inlet and outlet, sample line heater connections, power inlet module, and network ports for connection to the system computer and other equipment.



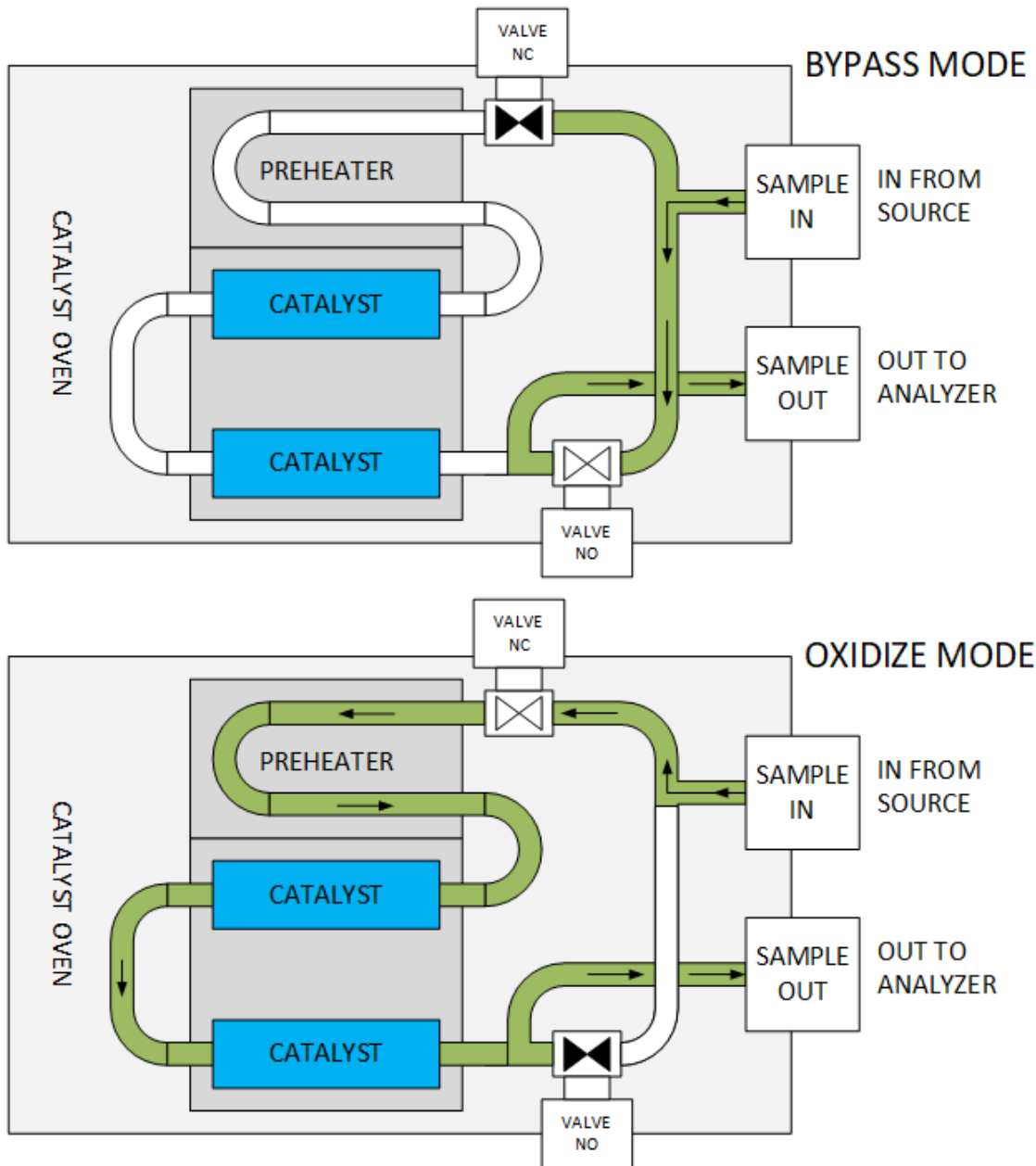
Internal Components

The main internal components include electrical components for heater control, PLC for valve switching and state logic, pneumatic valves to control the flow states, and the heated catalyst cores that are part of the gas flow path.



Overview of Flow Patterns

The figures below show the sample gas flow through the MAX-OXT for *Bypass Mode* and for *Oxidizer Mode*. The valves are configured so the default and power-off condition keep the system in Bypass Mode.



3 Installation and Setup

This chapter describes how to prepare a site for installation as well as procedures for unboxing and initial setup of the MAX-OXT.

Site Requirements

Environmental Requirements

- Location: The equipment is intended for indoor use in a safe location.
- Ventilation: The equipment is cooled by a ventilation fan. Allow at least 6 inches clearance on all sides to ensure adequate cooling.
- Pollution Degree: 2 - Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation may occur.
- Ingress Protection: designed to meet IP20.
- Operating Temperature Range: 10-30°C
- Storage Temperature Range: 5-40°C
- Humidity: 10-90% relative humidity, non-condensing

Facilities Requirements

- Power (US): 120 VAC, 60 Hz, 5.3 A. The power cord has a NEMA 5-15 flat blade plug.
- Power (US): 208-240, 50/60 Hz, 2.7 A. The power cord has a NEMA 6-15 flat blade plug.
- Power (EU): 230 VAC, 50 Hz, 2.7 A. The power cord has a CEE7/7 plug (Schuko).
- Overvoltage Category: Category II - Residential distribution, devices connected to standard 2 pole + earth electrical outlets.
- Mains supply voltage fluctuations: $\pm 5\%$
- CDA In: Instrument-grade compressed dry air (CDA) or ultrahigh purity (UHP) Nitrogen gas, 80--100 psig. Use $\frac{1}{4}$ " O.D. high purity HDPE tubing and $\frac{1}{4}$ " Swagelok compression fittings. Compressed dry air ISO 8573.1 classification for process analyzers should have a dewpoint of -20°C or lower.

CAUTION

Read and understand the manual before installation.

WARNING

Use only in ordinary location. The equipment is not designed to operate in a location containing potentially explosive gases.

CAUTION

Use correct voltage power supply to the equipment. Observe the ratings specified on the equipment nameplate.

Unpacking the Equipment

If the MAX-OXT is ordered as an accessory, then it will be shipped separately in its own shipping container. If it is ordered as part of a larger system (such as in a MAX-IAQ or EMS-10), then it will be installed in the system rack or enclosure, with pneumatic and electrical connections already made in the system.

The MAX-OXT is carefully packed to reach its destination in excellent condition. When the instrument is received, please inspect the box for any defects to be certain that damage has not occurred during shipment. If you find any damage, please notify your carrier and Max Analytical Technologies immediately. If it is necessary to return the unit, you must first obtain a Return Material Authorization (RMA) number from Max Analytical Technologies before shipping back in the original packaging material.

Physical Installation

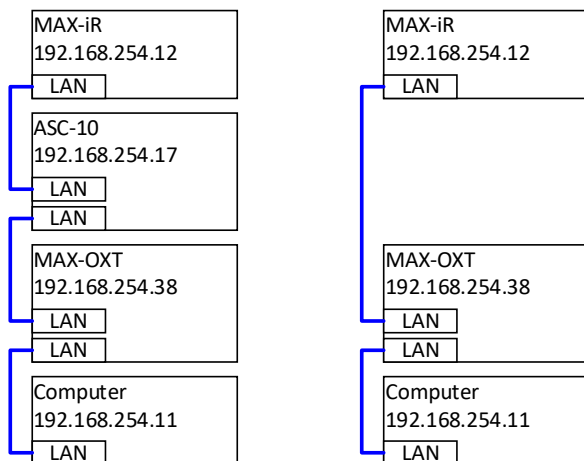
The MAX-OXT is a 3U rack-mountable enclosure and weighs approximately 11 kg. If mounting the equipment in a 19" rack, a shelf rated for the weight should be used to support the unit. The unit should also be secured to the rack rails using the four mounting holes in the front panel.

The MAX-OXT can also be installed on a bench or cart rated for the weight. Care should be used to ensure that the unit is mounted securely.

Ethernet Connections

The equipment requires a dedicated ethernet port on the computer to be used with the MAX-OXT, although this can be shared with a MAX-iR and ASC-10. This equipment operates on a private subnet reserved for the equipment. If the MAX-OXT is installed in a system, then the ethernet connections to the computer will already be made. The computer ethernet adapter connected to the MAX-OXT should be configured with a fixed IP=192.168.254.11, subnet=255.255.255.0, gateway=192.168.254.1 (or blank).

If the system includes a MAX-iR and/or an ASC-10, then the connections should be made as shown in the following figure. The ASC-10 and MAX-OXT have internal ethernet switches with two external ports to allow daisy chaining the ethernet connections.

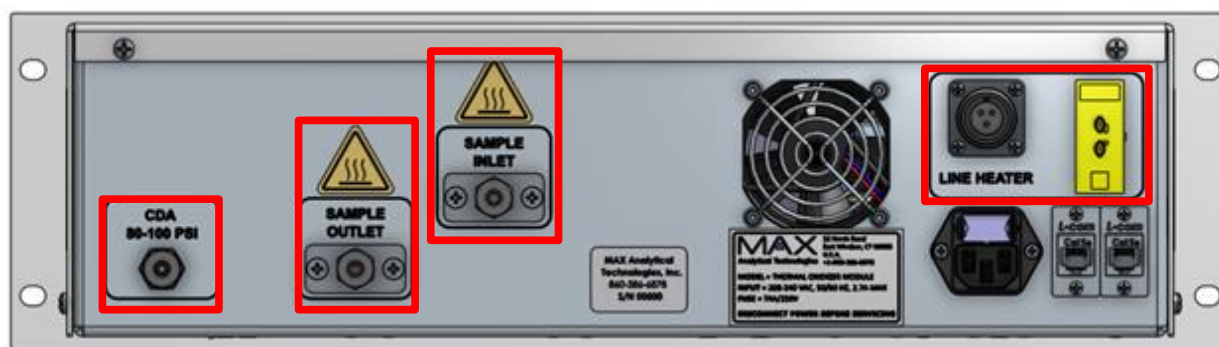


Pneumatic Connections

Connect CDA and the sample inlet and sample outlet lines before connecting power to the MAX-OXT.

TABLE 1. KEY MAX-OXT MECHANICAL CONNECTIONS AND FUNCTIONALITY

Connection	Function
CDA 80-100psi	Compressed Dry Air (CDA) or Ultra-high purity (UHP) N2 used to actuate the pneumatic valve for stream switching.
Sample Inlet	The sample gas stream from the sample source or pump is connected to the Sample Inlet on back of the MAX-OXT.
Sample Outlet	The sample output from the MAX-OXT is connected either an FTIR or to sampling system, depending upon the system configuration.
Line Heater	This connection is used to providing power and control to the heated sample line connected the MAX-OXT sample outlet.



CAUTION

Disconnect the power cord before making any pneumatic connections to the back of the MAX-OXT.

WARNING

The gas fittings on the back of the MAX-OXT may be hot. Allow the system to cool before making sample line connections.

CDA Connection

Connect the supply line for compressed air to the CDA input using the 1/4" Swagelok connector on the back panel. Ensure that the pressure regulator on the front panel is set to 80 psig.

Sample Inlet Connection

Connect the sample gas line from the sample source to the sample inlet port.

Sample Outlet Connection

Use the provided heated sample line to connect the sample outlet port from the MAX-OXT to the sample inlet of the analyzer system. Electrical connections are provided on the back of the MAX-OXT to control the heater in the heated sample line.

⚠ CAUTION

Use only the heated line provided with the equipment. The Line Heater power connector is only intended to control the heated line (2-foot or 5-foot) provided with the equipment. Do not connect third-party heated sample lines to this connector.

⚠ CAUTION

Ensure that the voltage rating for the heated line matches the voltage rating for the MAX-OXT.

⚠ WARNING

Inhalation Hazard: Be sure that any sample exhaust ports are properly connected to a safe vent location to prevent exposure to potentially dangerous gas mixtures. Inhalation of certain gases may cause headache, dizziness, nausea, bodily irritation, irregular heartbeat, or death.

Power Connection

Once all other connections have been made, connect the system power cord to an appropriate electrical power source. Be sure to use a power source that matches the voltage rating on the equipment nameplate.

⚠ CAUTION

Use the correct voltage power supply for the equipment. Observe the ratings specified on the equipment nameplate.

⚠ CAUTION

Use the proper power cord. Only use a detachable power cord that is rated for the voltage and current specified on the equipment nameplate. The power cord should have a minimum cross-sectional area of 0.75 mm² (18AWG). The power cord should be certified by an appropriately qualified agency such as UL, VDE, or Semko.

System Fuses

The electrical system in the equipment is protected by two fuses in the power inlet module and are accessible from the back panel of the equipment. To inspect or change the system fuses, disconnect the power cord, then remove the fuse block from the power module. Insert fuses of the proper type and rating for the equipment and reinsert the fuse block before reconnecting the power cord to the equipment.

120 VAC MAX-OXT: Fuses = T8A/250V

208-240 VAC MAX-OXT: Fuses = T4A/250V

⚠ CAUTION

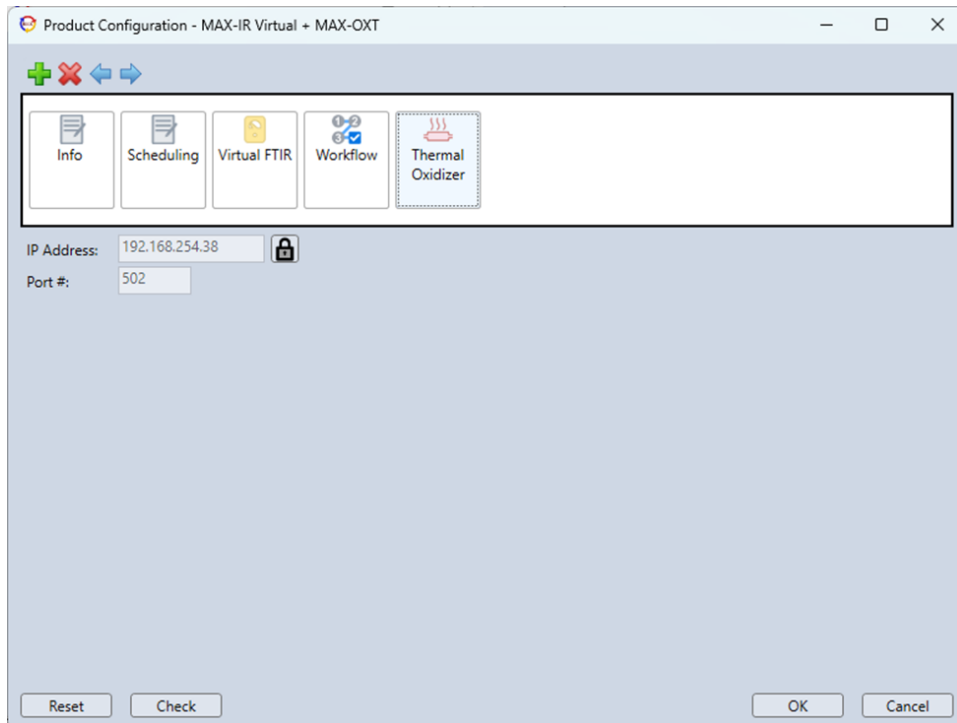
Use the correct fuses for the equipment. Use fuses of the correct type and rating as indicated on the equipment nameplate and in the manual.

Cleaning

The equipment should only be cleaned by wiping with a dry cloth. Do not spray any liquids on or in the enclosure.

MAX-OXT Setup and Verification

After all connections have been made and power has been provided, start the MAX Acquisition software and check that the MAX-OXT is communicating properly. After adding the MAX-OXT (Thermal Oxidizer) in the product configuration, the below menu should pop-up. This is where the IP address is verified and/or reset. Refer to the MAX Software manual for more details regarding the use of the MAX Acquisition Software.



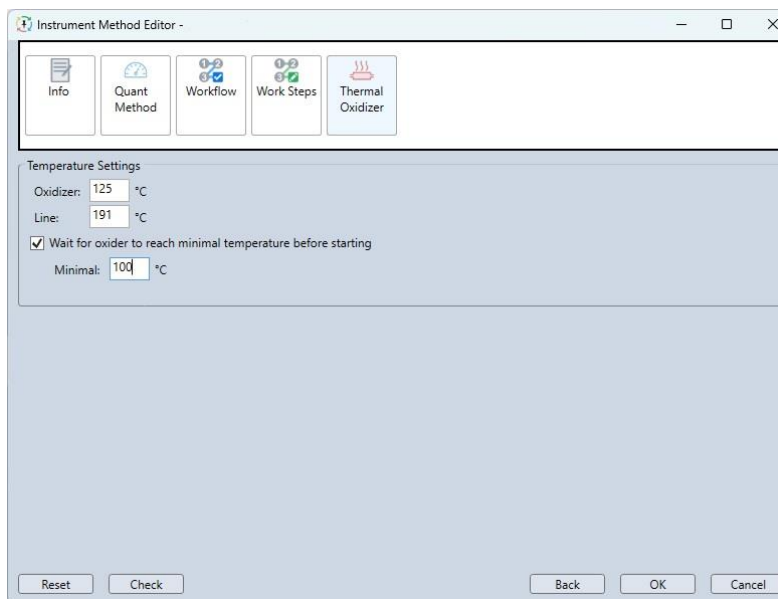
After starting the software, load an instrument configuration and method that includes the MAX-OXT hardware. Verify that the driver has correctly connected to the hardware and verify the settings and diagnostics for the MAX-OXT.

- CDA Pressure should be green. If not, then check that the CDA line is connected and turned on and that the CDA regulator on the front panel reads 80 psig.
- Thermal Limit should be green. If not, contact customer service to diagnose possible electrical problems within the equipment.

Verify the MAX-OXT temperature settings are correct:

1. Run the MAX-OXT for at least an hour so the heated zones are at temperature and stabilized.
2. Check the Oxidizer and Transfer Line temperatures on the front panel and validate that they are at the correct temperature for the application.
3. If the system has been in long-term storage or undergone maintenance since its last use, purge the MAX-OXT. Flow ambient air at 2-7 L/min through the system for up to 1 hour.
4. Ethylene Oxide Monitoring example:

- Oxidizer temperature should be set to 125°C.
 - Transfer Line temperature should be set to the same temperature as the FTIR gas cell (typically 150°C or 35°C).
5. If you need to change the MAX-OXT Temperature Setpoints:
- The Temperature setpoints can only be changed with the MAX-Acquisition Software.
 - In the MAX-Acquisition main panel top toolbar select Edit > Acquisition Method.
 - Highlight the Acquisition Method you are using and press the Edit (✎) Icon.
 - Select the Thermal Oxidizer tab and enter the new temperature values here.
 - Press OK to save the new values.



4 Setting Up MAX-Acquisition for MAX-OXT Control

This chapter describes the steps necessary to set up the MAX-Acquisition software to automatically control the *MAX-OXT* and *MAX-iR* FTIR and begin acquiring data. The MAX-Acquisition software and the *Acquisition Method* control all aspects of data acquisition including programmed *Work Steps*, timing, subcomponent setpoints, FTIR instrumental parameters, data saving and the MAX-iR *Quant Method*. Within the *Acquisition Method*, the *Quant Method* contains the MAX-iR calibrations and analysis parameters for all gases of interest as well as the *Modbus Map*, if this option was purchased.

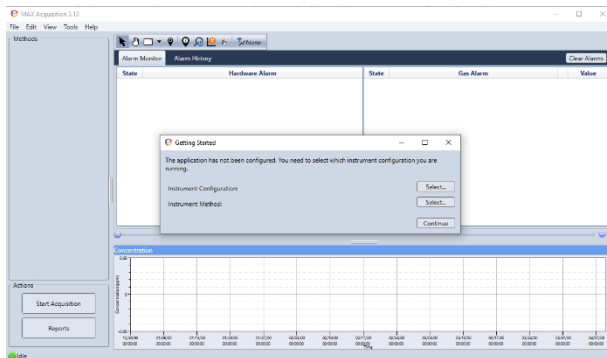
Launch the MAX-Acquisition Software

Follow the instructions in this section if this is the first time the software is used to set up the *MAX-OXT* with an *Acquisition Method* for use with the *MAX-OXT*.

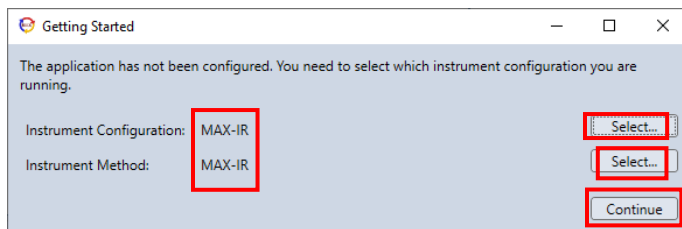
NOTICE

Note that Quantification Method Development is beyond the scope of this manual and can be found in the MAX-Acquisition Operating Manual.

1. Launch the MAX-Acquisition software from the desktop icon

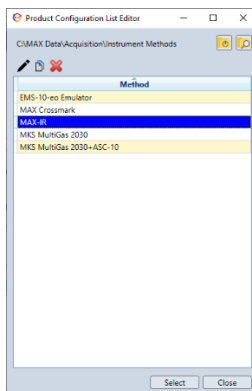


- Press the *Select* button for the *Instrument Configuration* set up on the *Getting Started* pop up panel.





2. *Select the Instrument Configuration.*

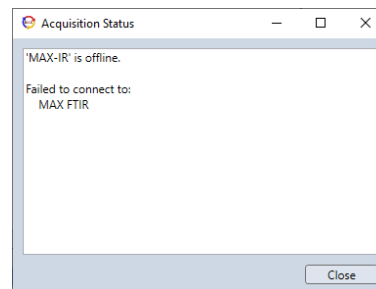
- Highlight *MAX-iR* and press the *Select* button at the bottom.
- The *Getting Started* pop up should now have *MAX-iR* listed next to *Instrument Configuration* and *Acquisition Method*.
- Add the *MAX-OXT* instrument to the configuration as shown in [MAX-OXT Setup and Verification](#)
- Rename the configuration to something descriptive, such as “MAX-iR + OXT”



- Press *Continue*.

3. *Verify the software is connected to the hardware.*

- A status indicator in the lower left corner of the user interface will display ‘ Connected’ once the software connects to all the hardware.
- If the software cannot connect to the hardware:
 - A pop-up will indicate that the *Acquisition Status* of the MAX-iR is offline and failed to connect.
 - The User Interface will display ‘ Offline’ status in the lower left corner.
 - *Close* the pop-up panel.
 - Check that all Ethernet and USB connections from the *MAX-iR* and *MAX-OXT* are connected to the control computer.



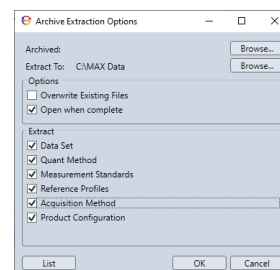
Installing an Acquisition Method

If an *Acquisition Method* was purchased from Max Analytical, it will contain the instrument and application specific method that controls all aspects of data acquisition including stream switching (if applicable). Pre-programmed *Work Steps* with timing, subcomponent setpoints, FTIR instrumental parameters, Modbus map (optional), and the FTIR application specific *Quant Method* are part of the *Acquisition Method*. There is a *Quantification Method* that contains the FTIR calibrations and analysis parameters for all gases of interest, however this will not be discussed in this manual.

The following steps allow the operator to upload and configure the *MAX-Acquisition* software with the new *Acquisition Method* by following these simple steps:

1. *Load the (*.zip) file that contains the custom method(s) or libraries provided by Max Analytical:*

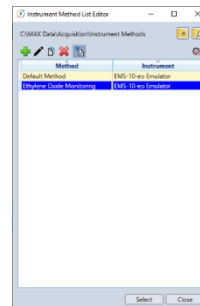
- In the main viewing panel go to the top toolbar and select *Tools > Extract Archive*.
- Check / select the *Archive Extraction Options* boxes as shown in the figure on the right.
- Press the top *Browse* button to navigate to and select the zipped (not extracted) *Archived* file (*.zip).
- Then click *OK* in the *Archive Extraction Options* pop-up
- In the next pop-up panel, select *Close* to return to the main viewing panel.



NOTICE

Do NOT extract the Archive file – leave it in the original format as a ‘*.zip’ as the program requires this format to properly upload all the information and files. Only select ‘Overwrite Existing Files’ if you are updating an existing method and instructed to do so by Max Analytical.

2. *If more than one Acquisition Method was created:*
 - In the main viewing panel go to the top toolbar and select *Edit > Acquisition Method* to open the *Acquisition Method List Editor*.
 - Click / highlight the appropriate *Acquisition Method* in the list.
 - Click the *Select* button at the bottom of the pop up.



5 MAX-OXT Quality Assurance and Diagnostics

Quality Assurance Procedures

MAX-OXT Overview

The MAX-OXT was developed for the MAX-iR and other FTIR systems to compensate for spectral mismatches of key interference gases when the library spectral match is not enough. It is typically used for low level measurements of a single analyte and has been successfully implemented along with the StarBoost Technology to achieve part-per-trillion (ppt) levels of detection of ethylene oxide.

NOTICE

Not all applications will be able to use the MAX-OXT to compensate for Interference Spectral mismatches. Contact the MAX Applications team at +1 (860) 386-6878 or your local Max Analytical sales representative to discuss specific applications.

Generally, the sample gas steam is sent through the MAX-OXT unit in the *Bypass* mode, passing through the unit unchanged. However, when a new MAX-OXT *Filter Spectrum* is required the sample stream in the MAX-OXT is switched to *Oxidizer* mode. The sample stream is now sent to an oxidation catalyst which removes and Ethylene Oxide in sample gas stream.

This oxidized gas stream is then sent to the FTIR where a *Filter Spectrum* is created and automatically updated into the calibration method. Because the *Filter Spectrum* was created on the actual instrument, the water peaks within the *Filter Spectrum* will now closely match the water in the actual sample.

The total amount of the target gas that is removed from the gas stream during this process is referred to as the destruction efficiency and it is key to the success of the MAX-OXT process. The destruction efficiency of the target compound is dependent upon the condition of the catalyst, the temperature of the catalyst, and the sample flow rate. Recommended oxidizer temperature settings are listed in the table below. We do not recommend running the oxidizer oven above 300 °C.

To ensure that emissions data are not biased low due to incomplete removal of the target compound, destruction efficiency tests should be assessed under the same sampling conditions as the emissions data.

TABLE 2. RECOMMENDED OXIDIZER TEMPERATURE SETTINGS

Gas	Temperature Setting
Ethylene Oxide	125 °C
Formaldehyde	125 °C
Benzene	200 °C

MAX-OXT Efficiency Test

Performing a Destruction Efficiency Test should be undertaken by a skilled technician familiar with performing Standard Addition or Spike Recovery testing with an extractive sampling system. This test should be done every 12 months to ensure the catalyst is still functioning properly.

1. *Spike the Sample Gas Stream with Target Analyte Gas*
 - Make sure the MAX-OXT is set to *Bypass Mode*.
 - Make sure the FTIR sampling system is in *Sample Mode* so that the flow rate through the MAX-OXT and the FTIR is the same as a normal sample stream collection.
 - Blend into the sample gas stream (at the probe) a known concentration of the target analyte.
 - Do **not** dilute the Sample stream by more than 10%.
2. *Equilibrate the MAX-OXT*
 - The MAX-OXT is in *Bypass Mode* and the FTIR is in *Sample Mode* still.
 - Allow the MAX-OXT and FTIR to run while monitoring the gas concentration of methane (CH₄) or water (H₂O) until they are stable.
 - Record the equilibrium value of the Target Analyte.
3. *Collect Spectrum of Oxidized Target Analyte*
 - Switch MAX-OXT to the *Oxidizer Mode*, leaving the FTIR in *Sample Mode*.
 - Allow the MAX-OXT and FTIR to run while monitoring the gas concentration of methane (CH₄) or water (H₂O) until they are stable.
 - Record the Oxidized value of the Target Analyte.
4. *Determine the Destruction Efficiency Value for Target Analyte*
 - Divide the Oxidized Target Analyte value collected in Step #3 above by the Equilibrium Target Analyte value collected in Step #2 above.
 - Multiply this value by 100 to report as a percentage value.

$$\text{Destruction Efficiency} = \frac{\text{Oxidized Target Analyte Value (Step \#3)}}{\text{Equilibrium Target Analyte Value (Step \#2)}} \times 100$$

- The Destruction Efficiency value of the Target Analyte should be >99%.
- If the Destruction Efficiency value ≤ 99% then:
 - Change the sampling conditions such as lowering the flow rate or increasing the MAX-OXT temperature

- See section [4](#) *Error! Reference source not found.* for instructions on how to change the temperature of then MAX-OXT.
- Repeat the tests
- If the test results after the changes are successful,make sure any changes in flow rate and temperatures are updated in the Acquisition Method.

NOTICE

Any changes made to the sampling system or MAX-OXT that resulted in passing the Destruction Efficiency Test must be updated in the Acquisition Method.

MAX-OXT Daily Events

The MAX-OXT is typically set up within the MAX-Acquisition software to automatically perform the action of equilibrating the MAX-OXT oxidizer and then collect and replace the MAX-OXT Filter Spectrum. See *Error! Reference source not found.* [Section 4](#) for details on how to modify the parameters and settings.

TABLE 3. DAILY AUTOMATIC AND MANUAL VERIFICATION OF MAX-IR KEY PARAMETERS

Procedure	Frequency
Equilibrate the Oxidizer	Once per day
Create Filter Spectrum	Once per day

Preventative Maintenance

There are no preventative maintenance items or consumables specific to the MAX-OXT. If the recommended operating procedures are followed, the catalyst core is expected to maintain its efficiency for several years.

Spare Parts

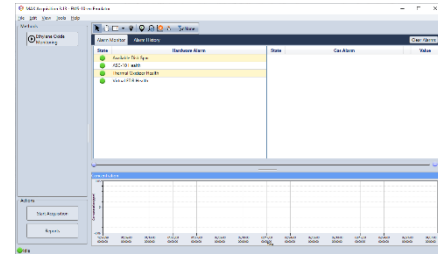
Thermo Fisher Scientific maintains a spare parts depot in East Windsor, CT. For critical spare parts with extended delivery times (denoted below), the user should consider maintaining spare parts on-site to minimize downtime.

TABLE 4. MAX-OXT CONSUMABLES

Description	Yearly Qty	Replacement Interval
Bellows Valve, 1/4" Tube, Polyimide Stem Tip, Normally Closed Actuator	1	As needed
Bellows Valve, 1/4" Tube, Polyimide Stem Tip, Normally Open Actuator	1	As needed
Regulator with Gauge	1	As needed

System Diagnostics and Alarms

System diagnostic information and alarms can be viewed in the *Monitor View* in the *MAX Acquisition* software, accessed by the top toolbar, and selecting *Edit > Monitor View*.



The tables below list the standard *Hardware Alarms* and the potential *Gas Alarms* and provide the *Status* functionality.

Alarm TCP/IP Settings

TABLE 5. ALARM TCP/IP SETTINGS

Function	Setting
IP Address	Determined during system installation
TCP Port	502
Poll Frequency	1 second minimum recommended

Alarm Monitor

Alarms are designed to alert the operator to maintenance and performance issues, which must be addressed in a timely manner.

Alarm Monitor		Alarm History		Clear Alarms	
State	Hardware Alarm	State	Gas Alarm	Value	
●	Inlet Temperature	●	Calibration Check		
●	Cabinet Temperature	●	Ethylene Oxide Limit on Line 1		
●	Thermal Oxidizer CDA Pressure	●	Ethylene Oxide Limit on Line 2		
●	Thermal Oxidizer Thermal Limit	●	Ethylene Oxide Limit on Line 3		
●	iAQ Themocouple	●	Ethylene Oxide Limit on Line 4		
●	MAX FTIR Health	●	Ethylene Oxide Limit on Line 5		





The following alarms are standard for the MAX-OXT:

TABLE 6. MAX-OXT ALARM OR NOTICE

Alarm / Notice	Function
MAX-OXT CDA Pressure	CDA is used to actuate the valves within the Thermal Oxidiser Module (MAX-OXT) system. A drop in the CDA gas pressure will prevent the MAX-OXT from zeroing out the unit and equilibrate triggering this error.
MAX-OXT Thermal Limit	Thermal Oxidizer Module (MAX-OXT) system temperature controllers require maintenance. When this alarm is tripped, the system enters an error recovery state and the MAX-OXT automatically switches to bypass mode.

The table below lists the standard MAX-Acquisition Alarm symbols and meanings:

TABLE 7. GENERAL ALARM MONITORING STATUS

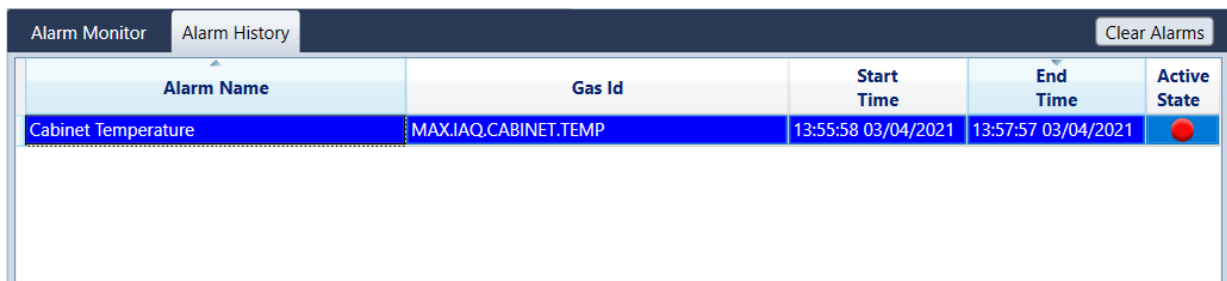
ICON	Meaning	Function
	Good	No user intervention is required. Alarm criteria are currently false.
	Active Alarm	The system requires maintenance or attention from an operator. Alarm criteria are currently true.
	Latched Alarm	Critical system alarms are programmed to latch to draw user attention to maintenance and performance issues. Alarm criteria are currently true and will remain in this alarm state until manually cleared by the user.
	Previously Alarmed	The system does not currently require user intervention, but the user should be aware of an earlier issue. Alarm criteria is currently inactive but was active at some point since alarms were last manually cleared by the user.


Refer to the **MAX-OXT Alarm Troubleshooting** guide in the next section for instructions on how to address each alarm. Once the issue is resolved, the operator must press the “Clear Alarms” button to reset the status for all *Latched Alarms* and previous alarms to be cleared.

NOTICE Any **Active Alarm** () or **Latched Alarm** () requires attention from the system operator in a timely manner

Alarm History

Even after the alarms have been cleared, the *Alarm History* tab keeps a record of each active alarm in the dataset and its timestamp.



Alarm Name	Gas Id	Start Time	End Time	Active State
Cabinet Temperature	MAX.IAQ.CABINET.TEMP	13:55:58 03/04/2021	13:57:57 03/04/2021	

MAX-OXT Alarm Troubleshooting

Issue	Troubleshooting
Customer supplied computer went to sleep	On computer settings Start> Settings > Power & Sleep set both options to “Never”. Power off the MAX-OXT. Restart Computer Start> Power> Restart. Once the computer has restarted, power on the MAX-OXT.
MAX Acquisition won’t connect to the MAX-OXT	<ol style="list-style-type: none"> 1. Verify that the correct Product Configuration is selected. 2. Unplug the ethernet cable at the MAX-OXT as well as the computer. 3. Reconnect the ethernet cable to both the MAX-OXT as well as the computer. 4. If necessary, close the MAX Acquisition software package then re-open it

Thermal Oxidizer CDA Pressure Alarm	<ol style="list-style-type: none"> 1. If using cylinder bottles, check the bottle pressure on the N2/CDA cylinder regulator and make sure it is > 200 psig. If not consider changing out the cylinder. 2. Check that the outlet pressure on the N2/CDA source is ≥80psig. 3. If the N2/CDA source is ≥80psig, check the EMS-10 pneumatic connections and tighten if loose. 4. If the connections and supply pressure are adequate, check the regulator on the front panel of the MAX-OXT. If the pressure is ≤80psig, increase the pressure by pulling the black housing out slightly and rotating clockwise until the regulator reads 80psig. Then push the black housing back to prevent further changes.
Thermal Oxidizer (MAX-OXT) Thermal Limit Alarm	<p>The Hardware overheat safety switch has been tripped. When this alarm is triggered, the MAX-OXT will automatically switch to bypass mode to divert sample flow away from the catalyst, immediately shut off the sample gas flow to the EMS-10 system to prevent high levels of reactive gases from reaching the MAX-OXT.</p> <ol style="list-style-type: none"> 1. Power cycle the MAX-OXT. 2. If power cycling the MAX-OXT does not resolve the alarm, the system requires immediate maintenance. Immediately power off the MAX-OXT and contact technical support for assistance.
CDA gauge won't adjust	<ol style="list-style-type: none"> 1. Verify that the CDA line is connected to the appropriate inlet port and set to 80psig. 2. To adjust the pressure on the regulator with gauge on the MAX-OXT, gently pull the black housing of the regulator then turn it clockwise to increase pressure or counter-clockwise to decrease the pressure. 3. If the pressure needs to be decreased, close the corresponding CDA cylinder stem and quickly loosen the line fitting to relieve the excess pressure. Make sure to tighten the fitting then check for leaks when complete. <p>When the pressure is set appropriately, gently push the black housing of the regulator toward the MAX-OXT to lock it.</p>
Watlow temperature does not match setpoint	<p>The Watlows are programmed to run at the setpoint specified within the Instrument Method. If the actual temperature varies from the temperature setpoint, contact technical support for assistance.</p>
Sample data yields low concentration for the compound(s) of interest	<ol style="list-style-type: none"> 1. Ensure that the calibration gas is connected without leaks, open, and set to the correct pressure. 2. Verify that the sample data is collected in bypass mode. Collecting sample data in oxidizer mode will result in the destruction of the compound of interest (ex: ethylene oxide would yield ~0ppb if run through the oxidizer at 125C).

**MAX-OXT is not turning on
or running at reduced
capacity**

1. Look at the label located near the power cord on the rear of the MAX-OXT.
 2. Verify that the power source is the same voltage as the voltage listed on the label.
 3. If they match and issues persist, contact [technical support](#) for assistance.
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