User Manual

eosMX

Multiplexer and
eosLink-MX software

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This guide is distributed by EOSENSE INC (“Eosense”) for users of the eosMX Multiplexer instrument in conjunction with the eosLink-MX and eosAnalyze-AC software. Eosense is not liable for special, indirect, incidental, or consequential damages. Eosense’s obligation under this warranty is limited to repairing or replacing (at Eosense’s discretion) defective products. The customer shall assume all costs of removing, reinstalling, and shipping defective products to Eosense where applicable. Eosense will return said products by surface carrier prepaid. This warranty is in lieu of all other warranties, expressed or implied.

REV: January 20, 2016

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1 Introduction

1.1 eosMX User Manual

This manual is intended to help end-users of the Eosense eosMX Multiplexer set-up, deploy and collect data from their equipment. The information provided is intended for first time users of an eosMX, though we highly recommend all users read this document thoroughly before using the equipment, as each of the hardware and software features are explained in detail.

This manual is intended for users of the eosMX with version 1.6.7 of the eosLink-MX interface. Please check the Customer Resources section of the Eosense website for the most up-to-date manuals and software.

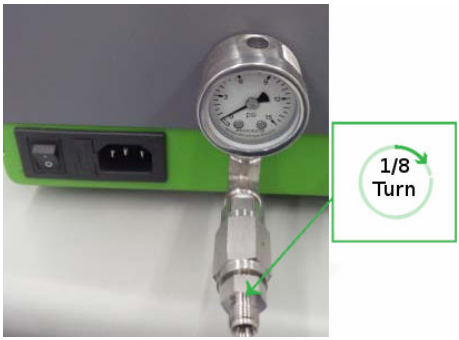
If you have any specific questions or require additional guidance or information, please contact Eosense Technical Support through our website or by email:

support@eosense.com
http://eosense.com/support

Section 2 (Quick Start Guide) provides a short guide to setting up the eosMX multiplexer with a Picarro gas analyzer and collecting data from connected eosAC autochambers, however we **strongly recommended** that all users read the complete manual before use. Section 3 (Hardware and Setup) details the eosMX components and how to connect the equipment to your gas analyzer and eosACs. Section 4 (eosLink-MX) covers how to use the provided software to schedule chamber measurements. Finally, Section 5 (Troubleshooting) briefly covers some possible issues that may arise during operation of the eosMX and related software. For further information or assistance, please contact support@eosense.com.

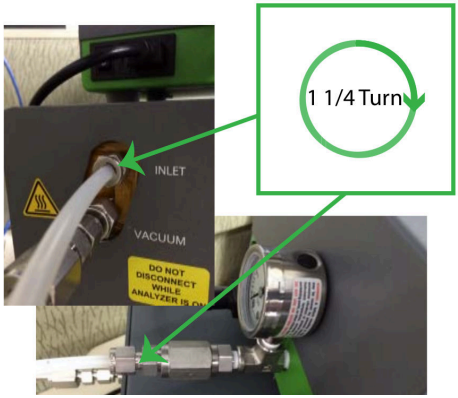
2 Quick Start Guide

(1) Attach the VCR coupling to the outlet port of the pump. Insert the VCR Metal Gasket into the coupling and attach the VCR to Swagelok fitting. Connect the VCR to Swagelok fitting finger tight, plus an additional 1/8th.



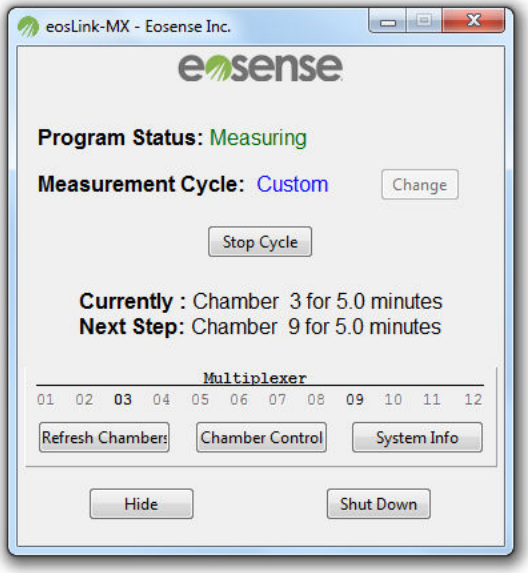
(2) Attach the Vacuum VCR Connection to the Vacuum port of the analyzer. Connect the pump and analyzer vacuum ports using the convoluted metal hose, ensuring that each connection receives a VCR Metal Gasket and is tightened 1/8th of a turn past finger tight.

(3) Add Swage nuts and ferrules to one end of the tubing and attach them to the analyzer inlet and outlet (hand tight plus an extra 1 1/4 turns). Attach the Picarro Inlet to eosMX Inlet and Picarro Outlet to eosMX Outlet, both using a Swagelok nut and ferrule set (1 1/4 turns past finger tight).



(4) Connect power to the eosMX and turn it on via the power switch on the back. Connect eosAC COMM ports to the front ports of the eosMX, as well as tubing from paired Inlet/Outlet ports (Swagelok fittings on the eosMX ends, no fittings on the eosAC ends).

(5) Run the eosLink-MX software and create a measurement schedule. Start the cycle and wait for it to complete (or cancel when ready, if looping). Use the companion Chamber Data Processor software to import, view, edit and export chamber measurements.



Please note that the eosMX housing is not designed for field deployment where it may be exposed to water or extreme humidity. Leaving the eosMX exposed to excessive moisture may damage the instrument, as well as any connected devices.

3 Hardware and Setup

3.1 Connecting the eosMX to a Gas Analyzer

The eosMX allows the user to coordinate Picarro gas analyzer samples from up to twelve eosAC autochambers (sequentially). The eosMX is constructed of light weight aluminum, and is designed to stack on top of a Picarro gas analyzer, with the external pump resting on top of the eoxMX. The three instruments should be connected in a continuous loop, as shown in **Figure 1**.

Figure 1 Gas tubing connections between the analyzer, eosMX and external pump.

In order to create this loop, a number of components are required:

Picarro Analyzer (e.g. G2508)
Recirculation Pump (A0702)
Eosense eosMX Multiplexer

(A) Convoluted Metal Hose (VCR)
(B) VCR Coupling (SS-4-VCR-CG)
(C) VCR →Swagelok Fitting (SS-4-VCR-6-400)
(D) 1/4 Ferrule x2 (SS-403-1, SS-404-1)
(E) 1/4 Swage Nut x2 (SS-402-1)
(F) Vacuum VCR Connection
(G) VCR Metal Gasket x3 (SS-4-VCR-2)

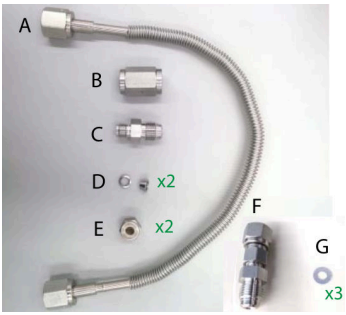


Figure 2 Fittings, hose and other required components.

Carefully set the analyzer, eosMX and external pump on a flat surface and remove the caps from the analyzer (Vacuum and Input) and pump (Vacuum and Exhaust), if still present. There are two ports on the back of the recirculating pump: one provides vacuum to the Picarro analyzer, which is necessary for its operation, while the other port acts as the gas exhaust for the system. To connect the external recirculating pump into the gas sampling loop, begin by attaching the VCR coupling (B) to the outlet port of the pump. Next, insert the VCR Metal Gasket (G) into the coupling and attach the VCR to Swagelok fitting (C). Once the VCR to Swagelok fitting (C) is finger tight, turn the fitting an additional 1/8th turn to compress the gasket.

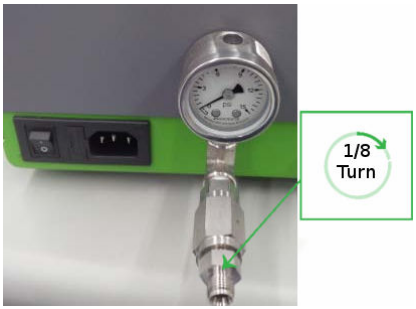


Figure 3 External recirculating pump with VCR coupling and Swagelok fitting attached.

Next, attach the Vacuum VCR Connection (F) to the Vacuum port of the gas analyzer. Connect the pump and analyzer vacuum ports using the convoluted metal hose (A). Ensure that each connection receives a VCR Metal Gasket (G) and is tightened 1/8th of a turn past finger tight.

Depending on application, the tubing lengths for the eosMX setup may vary. If the eosMX will rest on top of the analyzer, then two lengths of tubing approximately 60 cm long are sufficient to connect the eosMX and analyzer. Begin by adding Swage nuts (E) and ferrules (D) to one end of the tubing and attaching them to the gas analyzer inlet and outlet by hand tightening and then turning an extra 1 1/4 turns with a wrench. See the diagrams in the top left of the page for this step. The other end of the tube will attach to the rear of the eosMX. This attachment will require two additional Swage nuts (D) and ferrules (E).

Figure 4 External recirculating pump with CVR coupling and Swagelok fitting attached.

Before attaching the tubing between the analyzer and the eosMX unit, ensure that the unit's main power is turned on so that the pressure relief valves are active. Attach the Inlet tube from the Picarro to the Inlet port on the eosMX using a Swagelok nut and ferrule set. Turn 1 1/4 turns past finger tight to compress the ferrules. Next attach the Outlet of the Picarro to the Outlet of the eosMX using the same procedure.

Note: The Inlet port is required in order for the the gas analyzer to draw chamber samples, however the Outlet port need only be connected if you are interested in recirculating the sampled gas back to the chamber. Recirculation is recommended, as this minimizes the impact on the soil system and thus allows for unbiased flux measurements.

3.2 Connecting eosAC autochambers to the eosMX

The front face has connections for up to 12 Eosense eosAC autochambers, which include a combined power / communication port and two Swagelok gas fittings for transporting gases to and from the analyzer. Each connected eosAC will require a power/data cable and two lengths of tubing (Swage fitting on one end only), with a maximum length of 30 m.

Connect each chamber by attaching the bare end of one length of tubing to the Inlet port on the rear of the eosAC by pushing the tubing into the quick connect port until held securely. Repeat this process with the other length of tubing and the eosAC's Outlet port. Connect the Inlet tubing to an Inlet port on the front of the eosMX and the Outlet tubing to the paired Outlet port using the Swage fittings. Depending on the environment in which the analyzer and eosAC are deployed, steps to protect these lines from rodents and other wildlife may be recommended. Attach one end of the eosAC power/data cable to the back of the eosAC, ensuring that it is connected to the top left electrical port, labeled **COMM**. Connect the other end of the cable to one of the power/data ports on the front of the eosMX. Each eosAC should be connected to a power/communication port and the matching Inlet/Outlet fittings. For example, the first eosAC would connect to COMM 1, Inlet 1 and Outlet 1, while the next would connect to COMM 2, Inlet 2 and Outlet 2 and so on. **Each eosAC must be connected to matched gas and data ports.** Connecting the power/data cable or tubing to the wrong ports will result in failed measurements and/or pressure issues with the connected gas analyzer.

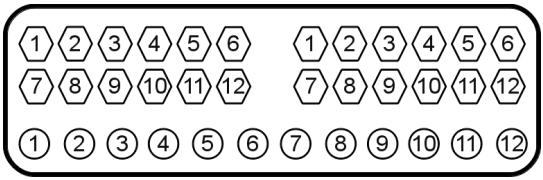


Figure 5 Diagram of the eosMX front face showing the correct matching between power/data, inlet and outlet ports.

3.3 eosMX Power and Communication

The eosMX power cable should be connected to stable 100-240 VAC power (43-67 Hz), and draws a maximum of 430 W. The On/Off switch is located directly under the cable, with **1** indicating that the eosMX is powered, and **0** indicating no power. The two USB cables should be connected to the PC that will be operating the chamber scheduling software and storing measurement logs (often the gas analyzer itself).

Figure 6 The rear face of the eosMX, showing gas analyzer Inlet and Outlet fittings; the eosMX power cable and On/Off switch; and the two USB communication cables.

4 eosLink-MX

4.1 Setup and Connection

The eosLink-MX software is used to collect and store peripheral data from and control the measurement cycle of up to twelve Eosense eosACs. The software requires no installation on the part of the user, and comes bundled with the eosAnalyze-AC software. **Note:** The eosLink-MX executable must remain in the same directory as the eosAnalyze-AC executable and associated resources.

Double clicking the eosLink-MX icon or a Desktop Shortcut will launch the program. It is strongly recommended that you connect both the Control and Data USB cables to your analyzer or PC **prior to launching eosLink-MX**; the program will check for a multiplexer connection periodically, however you will need to manually refresh if Data is connected after start-up. The eosMX will proceed through a 12 step start-up sequence, during which it will detect any connected eosACs. Once the start-up sequence has completed, the main eosLink-MX window will be shown (see Figure 7).

4.2 Scheduling Chamber Measurements

The eosLink-MX software is used to collect and store peripheral data from and control the measurement cycle of up to twelve Eosense eosAC autochambers. Similar to eosLink-AC, eosLink-MX logs temperature/peripheral data from connected eosACs, but it also serves as the control panel for the eosMX. The main window shows the current connection status (Idle, Searching, or Measuring), the type of measurement schedule (Default or Custom), the current and next steps in the current cycle, and the detected eosACs. Once a schedule has been selected, clicking the **Start** button will begin the cycle, with a new option to **Stop** measuring at any point.

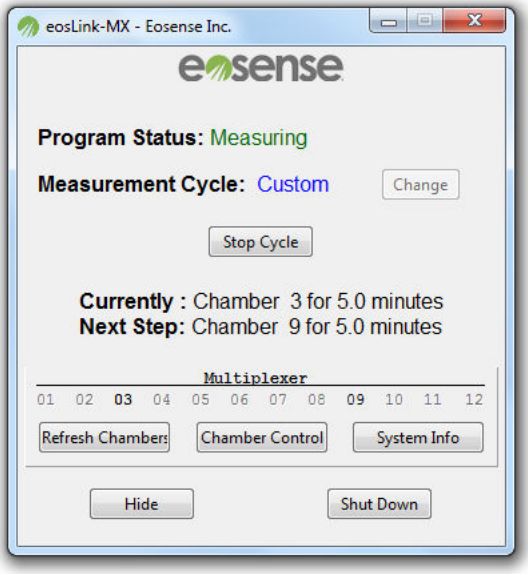


Figure 7 The eosLink-MX main window, showing an active cycle with two detected eosACs.

As each step in the cycle completes, the main window will be updated to show the new current step (with time remaining) and the next step in the cycle (with duration). The numbers underneath the “Multiplexer” heading will also update, with unused eosMX ports grayed out, and currently closed chambers in bold. If the cycle is set to loop, it will continue until manually stopped, otherwise the program will return to an idle status when the cycle is complete.

A number of chamber specific notifications can be viewed by clicking on the **System Info** button. This window contains a tab for each of the twelve possible eosACs, showing the most recently collected temperature and pressure data, as well as the current status of the chamber and any related warnings or messages.

The measurement cycle can be customized by clicking the **Change** button on the main window. This brings up a window that allows the user to choose the number and type of measurement steps, as well as save or load custom cycles. As the number of measurements is increased, steps will be added to the

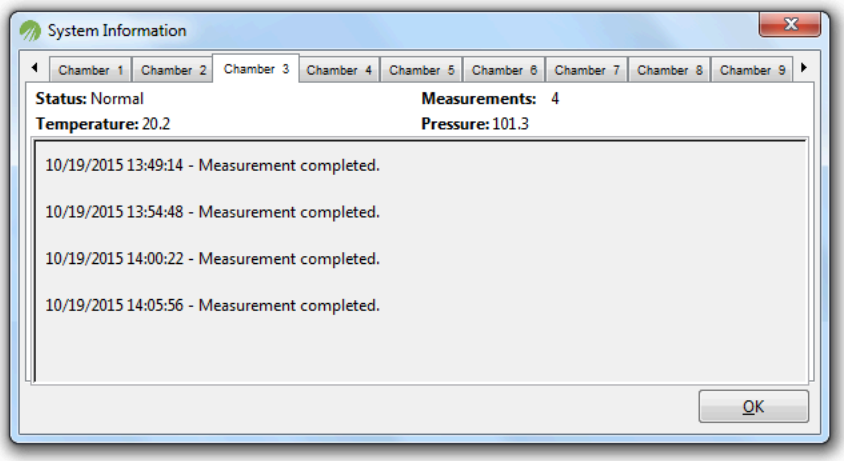
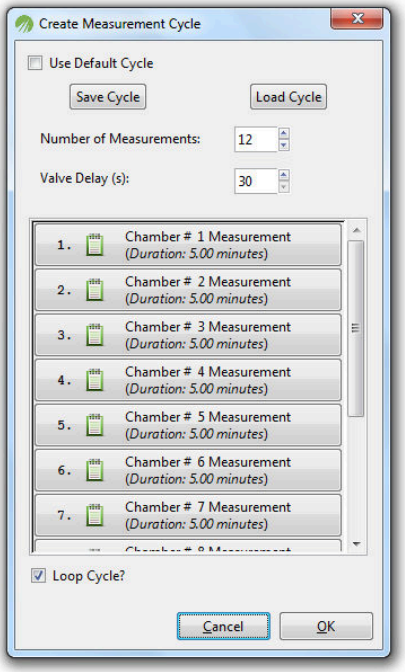


Figure 8 The System Information window, showing notifications for each chamber as well as recent peripheral data collected.

scrolling window. These steps can be set to either Idle or a Chamber measurement by clicking on them, then setting the measurement type and duration.



Checking **Loop Cycle** will cause the specified measurement cycle to begin from the first step each time the cycle completes. Checking the **Use Default** box will reset the measurement cycle to a simple loop through each detected eosAC. Finally, the **Valve Delay** option specifies the amount of time to wait between starting to draw gas from the chamber and the chamber closing (typically increased with tubing length).

Figure 9 The Create Measurement Cycle window, showing a custom chamber cycle.

4.3 Logged Datafiles

The eosMX stores received eosAC data in a series of files named FRMonitor_####.log. These files are simply space separated data, however they must remain unaltered in order for the Chamber Data Processor to use them. Users wishing to view chamber peripheral data should do so through the Chamber Data Processor software.

The data files consist of an epoch timestamp 10 columns for each of the 12 eosACs. Those fields are:

Chamber_ID	A short numerical ID used to distinguish eosACs.
Valve_State	Reserved binary value.
Chamber_State	Indicates whether an eosAC has a Close signal (1) or an Open signal (0).
Voltage_1	The voltage reading from the Peripheral Voltage Input One (0-5 V).
Voltage_2	The voltage reading from the Peripheral Voltage Input Two (0-5 V).
Voltage_3	The voltage reading from the Peripheral Voltage Input Three (0-5 V).
Current_1	The current reading from the Peripheral Current Input One (unconverted; 0-5 V).
Current_2	The current reading from the Peripheral Current Input Two (unconverted; 0-5 V).
V_Thermistor	The temperature reading from the eosAC thermistor (unconverted; 0-5 V).
Pressure	The pressure reading from the eosAC pressure sensor (KPa).

5 Troubleshooting

This section provides a few example problems that may occur during use, and the appropriate action that should be taken to resolve the issue. For these issues as well as any others that arise, please contact Eosense through email at support@eosense.com with subject “eosMX Support”, or through the support section of our website (http://www.eosense.com/support/).

- ***eosLink-MX is not detecting the eosMX multiplexer***

  Please ensure that the power supplied to the eosMX and that the power switch is set to on. Check that the ACOM1 USB cable is connected to your analyzer or PC. If the problem persists, check the Device Manager to see whether or not the device has been correctly detected by the computer.

- ***eosLink-MX is unable to find one or more connected eosAC autochambers***

  Check which eosMX port the eosAC is connected to. Click the “Refresh Chambers” button if the eosAC was connected after the start-up routine completed. Check that the ACOM1 USB cable is connected to your analyzer or PC. If the problem persists, check the Device Manager to see whether or not 13+ serial connections are present.

- ***Running the software gives an error: ”libgdk-win32-2.0-0.dll is missing from the computer”***

  This error indicates that the executable is missing the (hidden) system files. This happens when the .exe is moved from its original position in the software folder. To resolve this problem, keep the executable in the same folder as it was downloaded in (or re-extract the .zip file and use that as the new software folder).

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