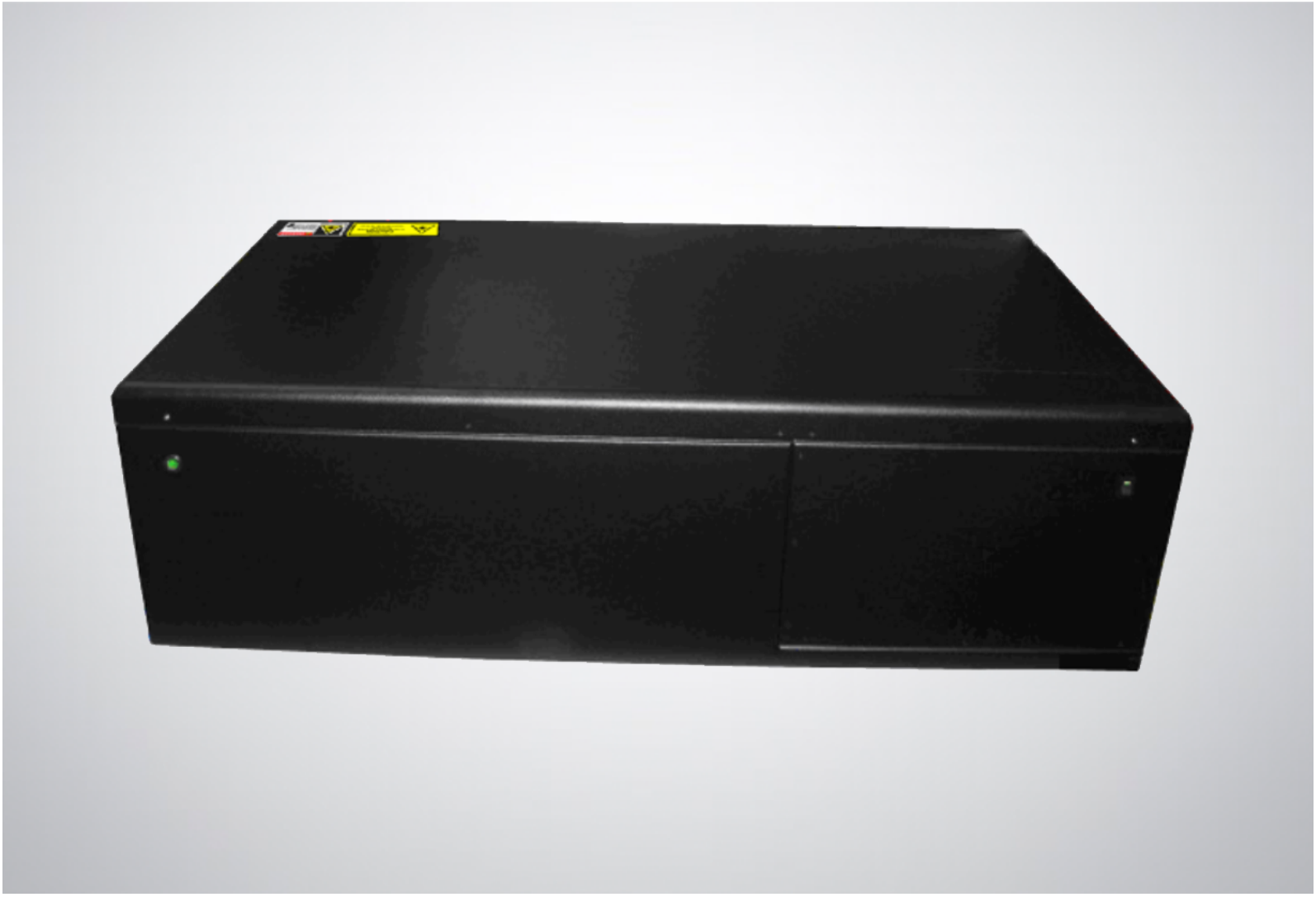
ABB MEASUREMENT & ANALYTICS | USER MANUAL

User Manual | ICOS

GLA431-MCIA Enhanced Performance Benchtop Continuous Flow Analyzer



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Disclaimer

This document contains product specifications and performance statements that may be in conflict with other ABB published literature, such as product flyers and product catalogs. All specifications, product characteristics, and performance statements included in this document are suggested specifications only. In case of conflict between product characteristics in this document and specifications in the official ABB product catalogs, the latter takes precedence.

ABB reserves the right to make changes to the specifications of all equipment and software, and to the contents of this document, without obligation to notify any person or organization of such changes. Every effort has been made to ensure that the information contained in this document is current and accurate. Please contact ABB-LGR if you find any error in this document, so we can make appropriate corrections.

Cyber Security

This product is designed to be connected to and to communicate information and data via a network interface. It is your sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be). You shall establish and maintain any appropriate measures (such as, but not limited to, the installation of firewalls, application of authentication measures, encryption of data, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Patent

The analyzer technology is protected by patents:

- 7,468,797
- 6,839,140
- 6,795,190
- 6,694,067

Copyright

Safety

The following pages provide important safety precautions.

Class of Laser Equipment

The analyzer is a Class 1 laser instrument when the case cover is closed for normal operation, and the lock is installed.

Certification

The analyzer certifications are listed in Table 1.

Table 1: Safety Certifications

Symbols	Standards Tested and Met
CE	2004/108/EU (EMC), EN61326-1
FDA	Title 21 Code of Federal Regulations, chapter 1, sub-chapter J

WEEE Directive

The analyzer is not subject to WEEE Directive 2002/96/EC (Waste Electrical and Electronic Equipment) or relevant national laws (e.g. ElektroG in Germany).

The product must be disposed of at a specialized recycling facility. Do not use municipal garbage collection points. According to the WEEE Directive 2002/96/EC, only products used in private applications may be disposed of at municipal garbage facilities.

Labels

The following labels are at specific locations on or in the analyzer to identify hazardous areas. (Figure 1)

Figure 1: Radiation Labels

These labels are located on the enclosure covering the ICOS cell. The fiber laser is visible only when the insulated enclosure is removed from the ICOS cell.

Operator Safety

When the case cover is closed and locked into position, the analyzer runs safely, without risk to the operator. Modifying the analyzer to operate with the case cover open can injure personnel.

WARNING!

Bypassing the analyzer interlock switch to open the case cover during analyzer operations can cause serious bodily injury. Even though the analyzer provides a second layer of protection, such as a laser cover to prevent the user from the invisible laser beam or any secondary reflection from the laser on a reflective surface, it is not recommended to modify the analyzer to operate in an unsafe condition.

Electrical Hazards

The analyzer poses no electrical hazards. The analyzer components operate at ≤ 6.8 V DC.

Laser Hazards

The analyzer is a Class 1 laser product that complies with:

- 21 CFR 1040.10 and 1040.11
- EN 60825-1:2014

WARNING

The laser is classified as a Class IIIb when exposed.
Only trained service personnel are authorized to open the housing or service the laser.

Using this analyzer in a manner not specified by ABB-LGR may result in damage to the analyzer and render it unsafe to operate.

WARNING

Only authorized persons may open the analyzer cover or perform internal maintenance. Contact ABB-LGR for maintenance instructions and maintenance kits. Make sure the analyzer is unplugged before working with the internal components. Failure to do so may result in damage to the analyzer and electric shock.

Safety Provisions for a Chemical Spill

Follow these precautions when dealing with all chemicals:

- Keep all chemical containers away from heat, sparks, and open flames.
- Use only on grounded equipment and with non-sparking tools.
- Store in a cool, dry, and well-ventilated place, away from incompatible materials.

If a spill occurs:

- Make sure all handling equipment is electrically grounded.
- Mop or wipe up, and then place all chemical-soaked items in containers approved by the US Department of Transportation (DOT) or the appropriate local regulatory agency.

Text Formats and Warning Icons

Text Formats

This section describes text formats and warning icons used in this manual.

- *Italicized* text is used for emphasis in text and also to emphasize the names of screens or text fields.
- **Bold** text is used to show text that you type in fields and also button choices that you enter.

Warning Icons

Table 2 shows and describes the warning icons used in this manual.

Table 2: Warning Icon Descriptions

Icon	Meaning
	Emphasizes facts and conditions important to analyzer operation.
	**General Warning Icon:** gives general safety information that must be followed to avoid hazardous conditions.
	**Electrical Warning Icon:** warns of potential electrical shock hazard.
	**Laser Warning Icon:** warns of potential laser hazard.

Transportation and Storage of Boxed Analyzers

When transporting and storing boxed analyzers:

- Analyzers may be shipped in non-pressurized aircraft.
- Analyzers are fragile: Do not drop or smash boxed analyzers.
- Do not store analyzers outside in wet weather.
- Do not stack boxes more than five high.
- Analyzers may be safely stored at temperatures between -20°C and +60°C.

Save the original shipping materials to use when returning the analyzer to ABB-LGR if factory service or repair is needed.

Table 3 lists and describes the safety icons on ABB-LGR shipping boxes. Follow these instructions when transporting and storing boxed analyzers.

Table 3: Transportation and Storage Icon Descriptions

Icon	Meaning
	Store your analyzer in a sheltered, dry area. Do not let the box get wet.
	Transport and store the analyzer box with the arrows on the box pointing up.
	The analyzer is fragile. Transport carefully. Do not drop the box.

Positioning the analyzer

Positioning the analyzer is a two-person task. With one person on each side, lift the analyzer out of the box and onto a flat surface. Leave four inches of free space on each side of the analyzer for proper ventilation.

Warranty

Warranty terms and conditions are covered by terms and condition agreed upon during the sales process.

Please contact icos.support@ca.abb.com and your local sales representative for more details.

Customer Support

ABB provides product support services worldwide. To receive product support, either in or out of warranty, contact the ABB office that serves your geographical area, or the office indicated below:

ABB Inc. Measurement & Analytics
3400, rue Pierre-Ardouin
Quebec, (Quebec) G1P 0B2 Canada

Tel: 1 800 858 3847 (North America)
Tel: +1 418 877 2944 (Worldwide)
Fax: +1 418 877 2834
Technical Support: Icos.support@ca.abb.com

Please contact icos.support@ca.abb.com and your local sales representative for more details.

Please provide the serial number or sales order number of the analyzer.

1 Analyzer Overview

The ABB-LGR GLA431-MCIA1 Methane Carbon Isotope Analyzer measures gas concentrations in parts per million (PPM), and isotope ratios in parts per thousand (per mil). It provides accurate isotope ratio measurements rapidly and with high precision.

This analyzer is a Class 1 laser product.

Performance Specifications

Ambient Humidity

- <99% relative humidity non-condensing

Operating Temperature

- 0 - 45°C

Maximum Altitude

- 6,000 Feet

Power Requirements

- 115/230 VAC, 50/60 hz
- 150 W (steady state)
- 550 W with the ACC DP3H external pump

Fuse Ratings

- 250 VAC
- 10 Amps

Cable Plugs and Voltage for EC Countries

- See page 109

Always use the power supply cord provided by ABB-LGR. See page 109 for a description of power cords for a specific country.

Standard Components

This section describes the analyzer components. Verify that each of the system components has arrived before installation.

The standard components include:

Basic free-flow system:

- Analyzer
- Analyzer power cord
- User guide (this document)
- USB flash drive
- Serial port connection cable (null modem type)
- Exhaust Muffler
- Pretreatment box:
  - One - 6' x ¼"
  - Two - 6' x 3/8"
- External pump (ACC DP3H)
  - Pump connection kit
  - Pump slave power cord
- Pump orifice for low flow mode.

Optional Components

Multiport Inlet Unit (8 or 16 channels)

- Power Cable for MIU
- 25-pin connection cable for control signal

Batch injection system

- Syringe injection port
- 140mL syringe
- Centering needle
- Septa (box of 50)
- Septum Puller

Dilution Control System (EDDS)

- Control Cable
- Sample Line
- One 6' x ¼" Zero-air (connects to house air supply)
- Line to sample supply
- Tee connector for the analyzer inlet port

This analyzer has been CE certified using data cables three meters long or less. Connecting the analyzer using longer data-cables is not recommended.

If you have not received all of these components, contact ABB-LGR at icos.support@ca.abb.com.

Figure 2 shows the front of the analyzer.

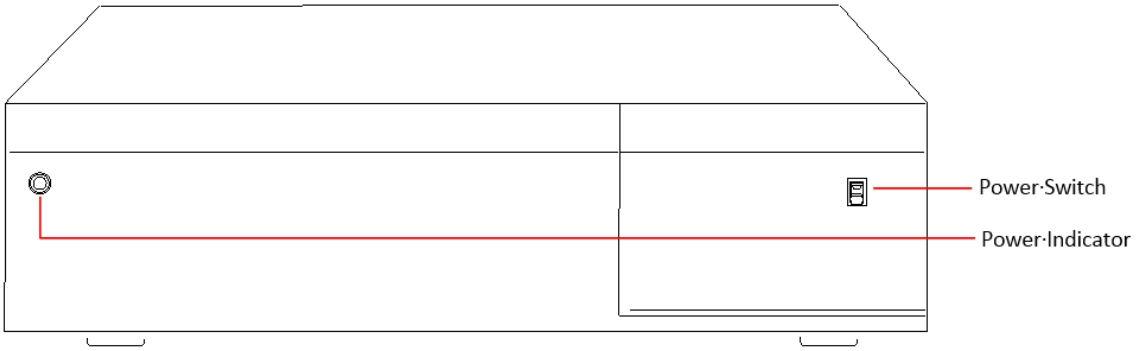

Figure 2: Front Panel

Figure 3 shows the back of the analyzer with connections.

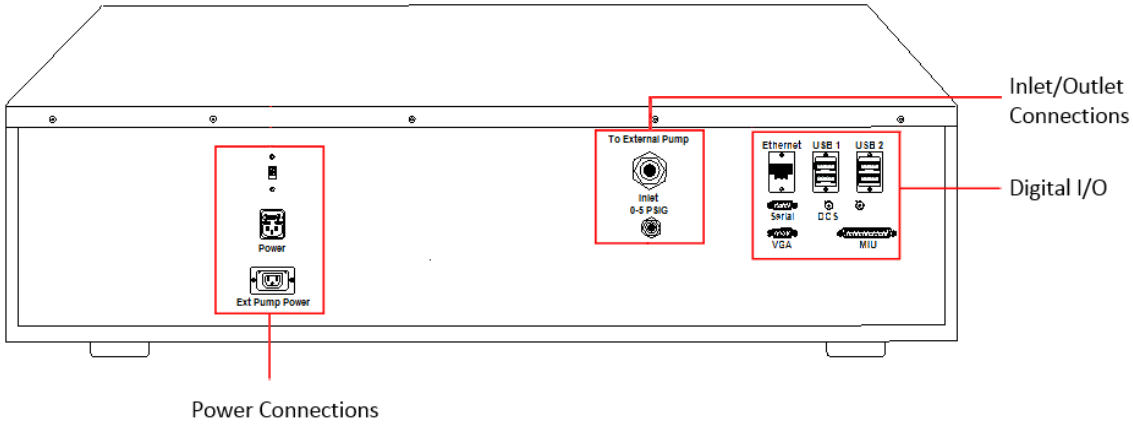

Figure 3: Back Panel

Power Connections

Figure 4 shows the power connections on the back panel, and Table 4 describes the connections.

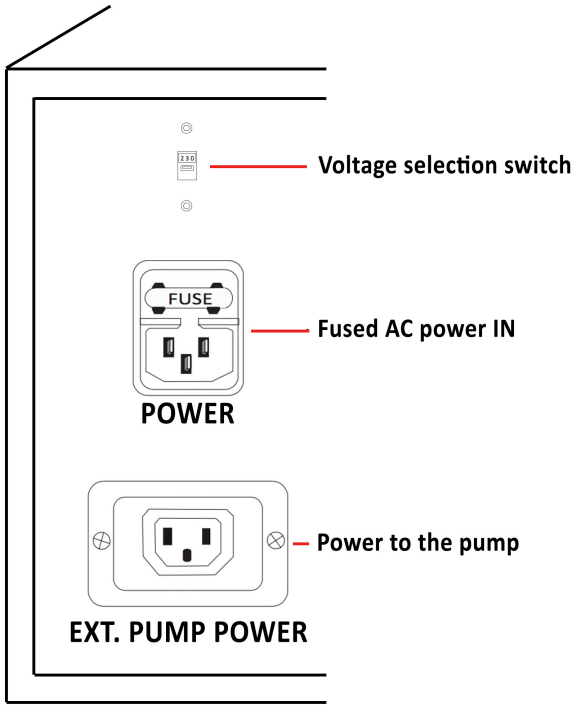

Figure 4: Power Connections and AC Voltage Selection Switch

Table 4: Power Connections and AC Voltage Selection Switch Description

Connector	Description
AC Voltage Selection	Toggles the input voltage to the analyzer's power supply between 115 VAC and 230 VAC, determined by the country where the analyzer is used. Setting an incorrect voltage may damage the analyzer. When changing the supply voltage verify that both the: • Analyzer is powered off or not connected to power. • AC voltage selection on the analyzer matches the AC voltage being supplied from your power supply.
AC Power In	Connects the analyzer to the power supply
EXT. Pump Power	Provides power to an external pump when operating the analyzer.

NOTE **If you require a different power source, please contact ABB-LGR.**

Data Interface Connection Ports

This section describes the data interface connections as shown in Figure 5. These connections may vary depending on analyzer types.

- Ethernet port – Connects the analyzer to a local area network (LAN) and allows access to the data directory using an external computer.
- USB ports – Used for transferring data to a USB memory device, or to connect a USB keyboard and mouse.
- Serial port (9 pin D-sub) – For real-time digital measurement output.
- DCS port (BNC male port) – Used to control the External Dynamic Dilution System (EDDS)
- Video port (15 pin D-sub) – Connects an external monitor to the analyzer.
- MIU (25-pin data port) – For connecting the optional Multiport Inlet Unit (MIU).

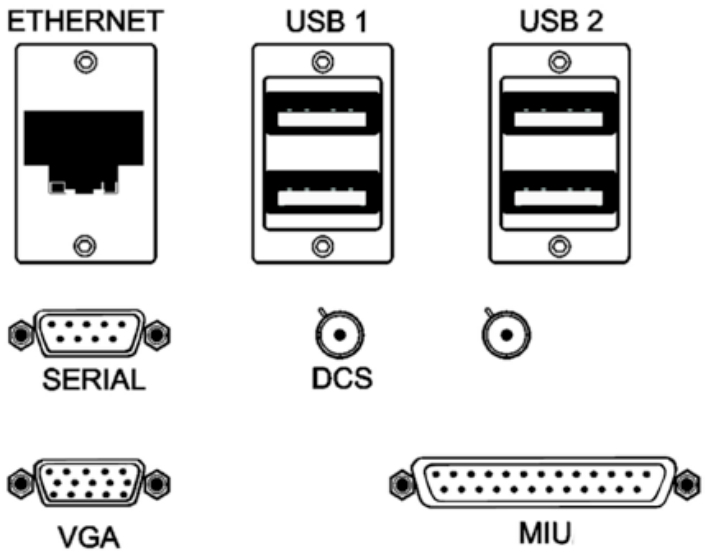

Figure 5: Data Interface Connection Ports

Plumbing Diagram

The plumbing diagram measures the internal flow of gas through the analyzers.

The external pump draws gas through the *Sample Inlet* port (1/4" Swagelok) on the back panel of the analyzer, and the waste is exhausted through the *To External Pump* port (3/8" Swagelok). The inlet gas pressure range is 0 to 5 psig.

Figure 6 shows the plumbing diagram.

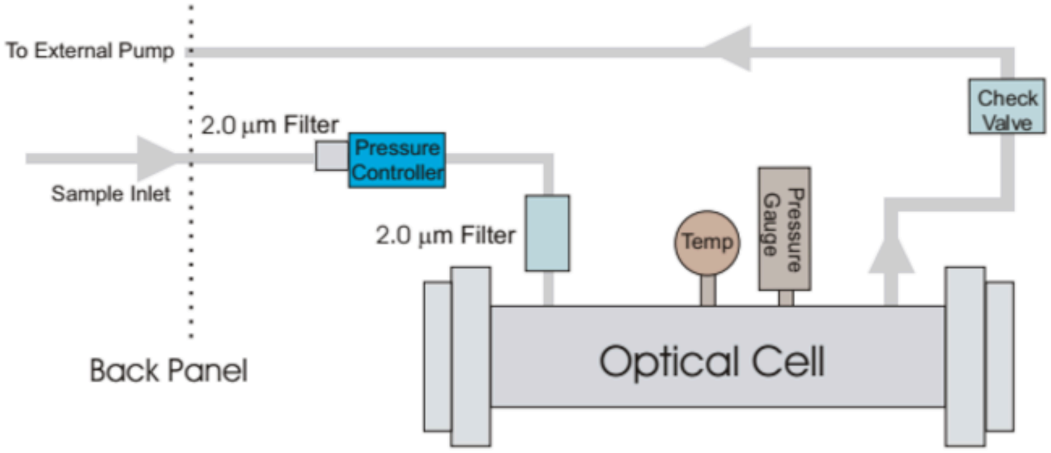

Figure 6: Plumbing Diagram

If the analyzer flow is greater than 200sccm, it must be restricted with an orifice, which is connected in between the pump and the Pretreatment Box. (Figure 7) The provided 450um orifice will throttle the analyzer flow to less than 180 sccm. This is primarily used to switch between the External Dynamic Dilution System (EDDS) and Batch Mode Operation.

Refer to Appendix E: on page 94 for External Dynamic Dilution System (EDDS) details.
Refer to Appendix F: on page 99 for Batch Mode Operation.

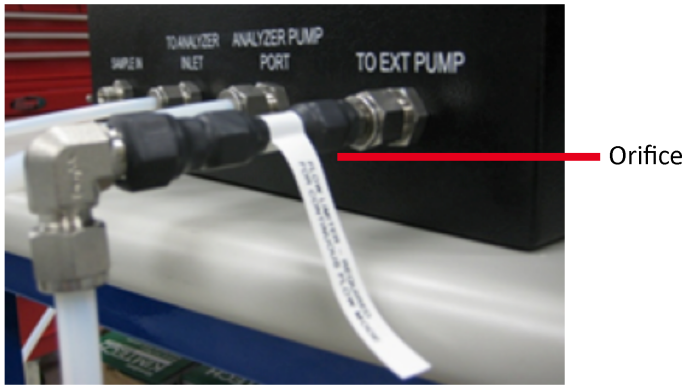

Figure 7: Orifice for decreasing analyzer flow

Inlet/Outlet Connections

The inlet and outlet ports are located on the back panel of the analyzer. (Figure 3) These ports are shown in detail in Figure 8.

The unit ships with inlets and outlets capped for protection. The connections use Swagelok fittings ISO thread size 1/4" and 3/8". (Figure 8)

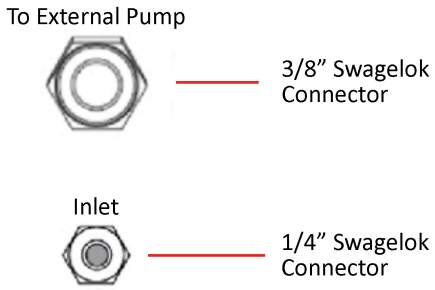

Figure 8: Inlet/Outlets

Exhaust ports:

- The exhaust is located on the external pump. It can either be connected to the provided muffler to expel exhaust into the room air, or the exhaust can be routed to the facility ventilation system.

Warning Labels and Descriptions

This section describes the warning labels shown on the analyzer.

- Table 5 gives a description of the warning labels.
- Figure 9 shows the location of the labels on the analyzer.

Table 5: Warning Labels and Descriptions

Label	Description
	The laser is rated Class 3 (invisible laser radiation) when the housing is open. **Only trained maintenance personnel may open the analyzer housing.**
	General laser warning label.

Figure 9: Warning Label Locations

Specifications

This section provides the weight and dimensions of the analyzer. (Figure 10)

External Dimensions
11” H x 38” W x 22” D

Weight
40 kg

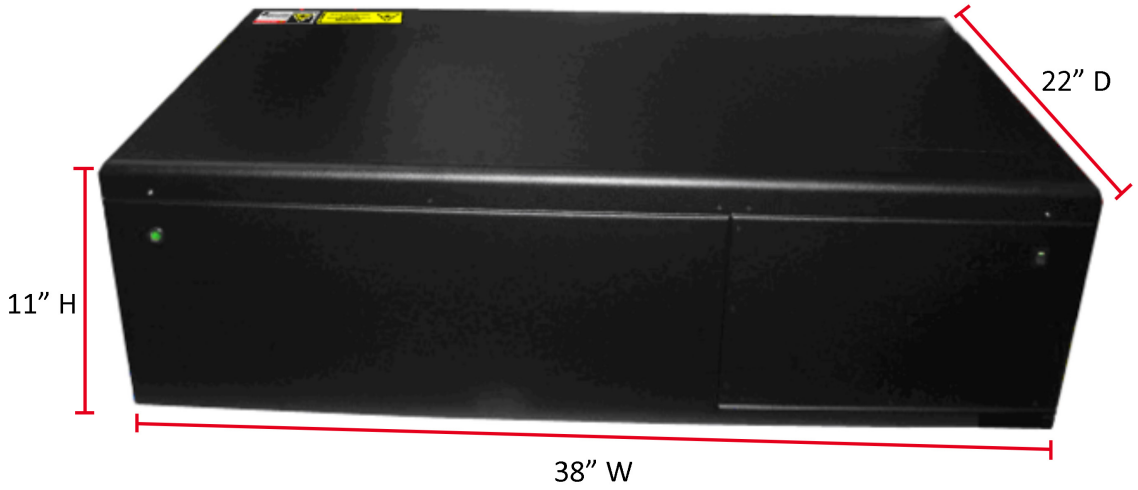

Figure 10: Front Panel Dimensions

2 Analyzer Setup

Connect the Power Cords

1. Connect the analyzer power cord from the AC power port on the back panel to a grounded outlet of your power supply. (Figure 3)
2. Connect the External pump's power cord from the pump to the EXT. PUMP POWER port on the back panel of the analyzer. (Figure 3)

Connect the Data Interface Connections

1. See Figure 5 for a detailed description of the connections.

Connect the Inlet/Outlet Plumbing Connections

1. Uncap the INLET port on the back panel of the analyzer.
    a) If applicable, connect a ¼" sample tube (not provided) from the INLET port to your sample source.
2. Connect the External Pump's 6' x 3/8" Teflon tubing with Swagelok fittings from the external pump to the TO EXT PUMP port on the back panel of the analyzer. (Figure 3)
3. The exhaust port is located on the pump. It can either be connected to the provided muffler to expel exhaust into the room air, or the exhaust can be routed to the facility ventilation system.

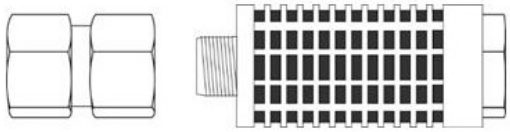

Figure 11: Exhaust Muffler

The Pretreatment Box

The pretreatment box dries the sample, so the water concentration is maintained below 500 ppm. The pretreatment box removes ambient CO_2 and dries the sample, so the water concentration is maintained below 500 ppm.

NOTE

Replace the soda lime filter as needed (normally at six week intervals). When the LithOlyme® in the canister turns purple, it needs to be replaced.

Figure 12 shows LithOlyme® alternated with Soda Lime in both fresh and depleted condition.

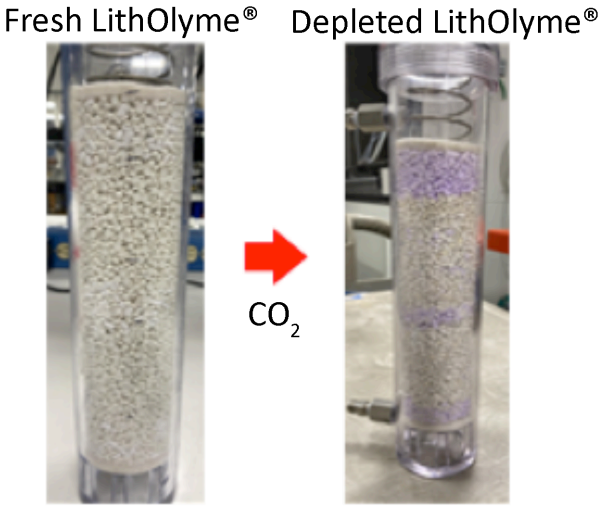

Figure 12: LithOlyme® (Fresh and Depleted)

Connect the Pretreatment Box, Pump, and Analyzer

1. Connect the external pump to the pretreatment box TO EXT. PUMP port using the 6’ x 3/8” Swagelok connector and tubing (provided).
2. Connect the external pump’s power cord from the pump to the EXT. PUMP POWER outlet on the analyzer.
3. Connect the pretreatment box from the ANALYZER EXIT port to the analyzer’s TO EXT. PUMP port using the 6’ x 3/8” Swagelok connector and tubing in the pump connection kit (provided).
4. Connect the pretreatment box ANALYZER INLET port to the INLET port on the analyzer, using the 6’ x 1/4” Swagelok connector and tubing in the pump connection kit (provided).

Figure 13 shows the pretreatment box plumbing diagram.

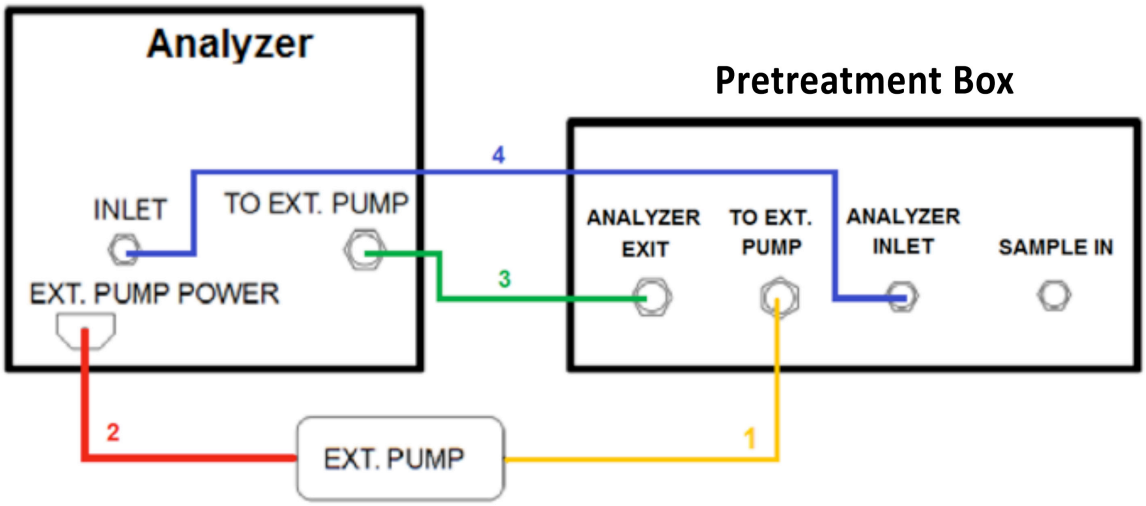

Figure 13: Pretreatment Box Plumbing Diagram

Attach and Tighten the Swagelok Connectors

1. Tighten the Swagelok connections to between 1/4 and 1/2 turn past finger tight. Leave a gap of at least 3.5 mm as shown in Figure 14.
2. Table 6 lists the Swagelok fitting sizes and recommended wrench sizes.

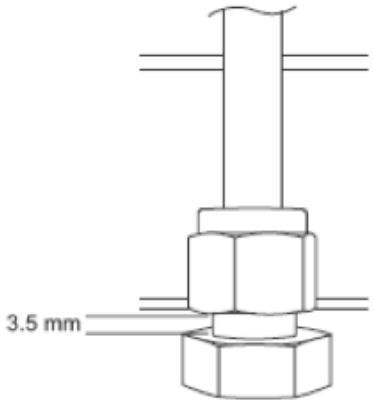

Figure 14: Swagelok Connection Gap

Table 6: Recommended Wrench Sizes for Swagelok Fittings

Swagelok Fitting Size	Recommended Wrench Size
$^{1}/_{4}$”	$^{9}/_{16}$”
$^{3}/_{8}$”	$^{11}/_{16}$”
$^{1}/_{2}$”	$^{7}/_{8}$”

3 Initialize and Run the Analyzer

To initialize the analyzer:

1. Press the power switch on the front of the analyzer to the **ON** position. (0 = OFF / - = ON)
   The internal computer initializes, and a screen (Figure 15) displays as the program loads.
   The *Launch Service* screen displays after initialization. (Figure 17)
2. Click on the **launch button** to manually launch the analyzer.
   a. The launch button is the abbreviated name of the gas analyzer **(MCIA)**. (Figure 17)
   b. If you don't make a selection within 120-seconds, the analyzer automatically defaults to the *Main Panel Numeric* display. (Figure 23)
3. Click on the maintenance **SERVICE** button (Figure 17) if you need more time or need to choose a maintenance setting. (Figure 18)

Once a month, the analyzer automatically performs a thorough file system integrity check during startup. This maintenance takes approximately one to two minutes before it continues to load the software.

Do not turn off the computer during the monthly maintenance!

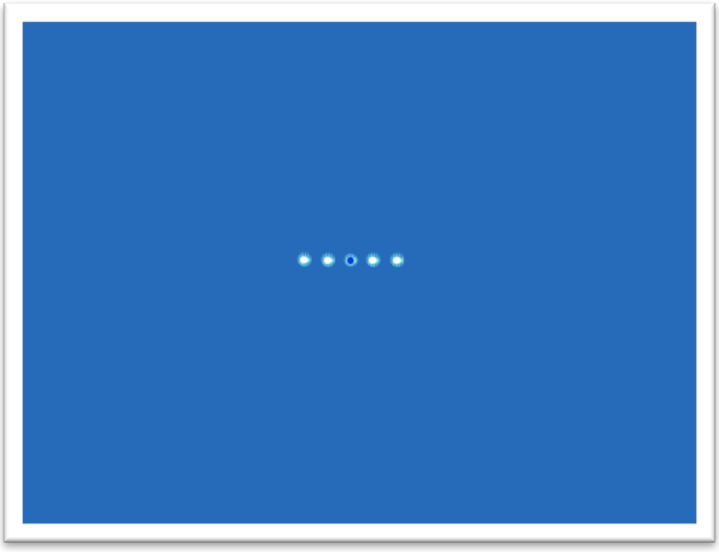

Figure 15: Start-up Screen in Busy Mode

File System Integrity Check

Once a month, the analyzer automatically performs a file system integrity check following initialization. Figure 16 shows the screen you see while the integrity check runs. The integrity check runs for one to two minutes before launching the analyzer's control software.

Do not turn off the computer while the integrity check is running.

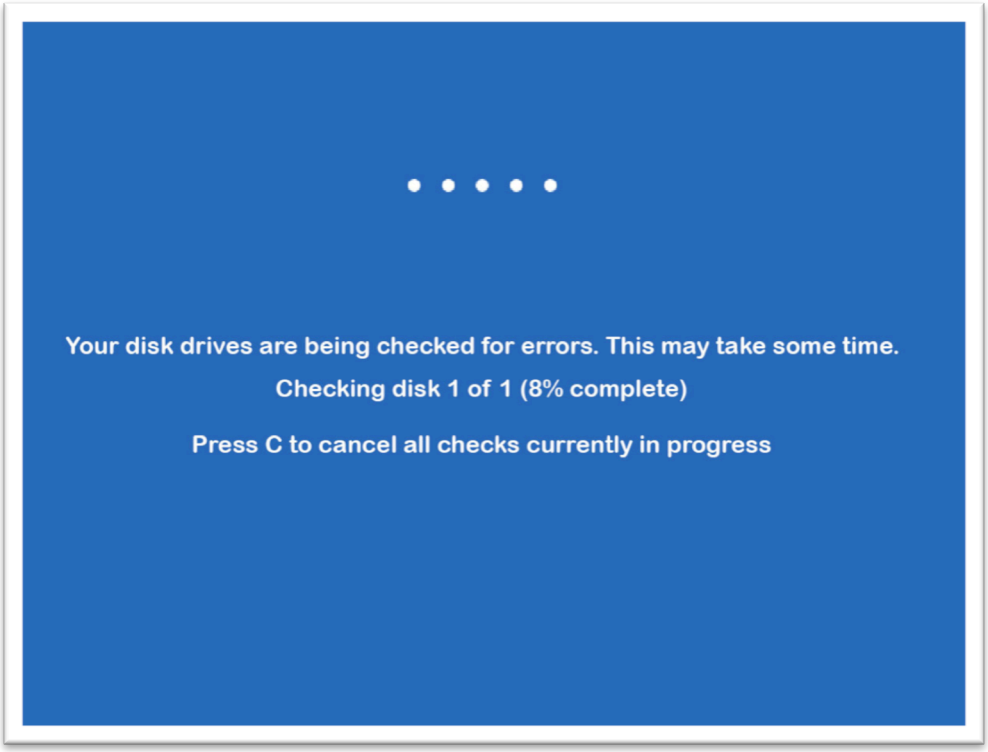

Figure 16: File System Integrity Check Screen

Thermal Stabilization

Run the analyzer for four hours before collecting data. This allows the internal temperature to stabilize. The exact final cell temperature will be analyzer specific (≈45°C).

The Launch Service Screen

The *Launch Service* screen displays when initialization is completed. From this interface you can:

- Bypass the auto launch countdown to manually start recording measurements by clicking the **launch button**.
    - The **launch button** is the abbreviated name of the gas analyzer. For example, the MCIA launch button displays **MCIA** as shown in Figure 17.
- Open the auto launch window by clicking **Service**.
- Turn off the analyzer by clicking **Shutdown**.

Figure 17 shows the *Launch Service* screen.

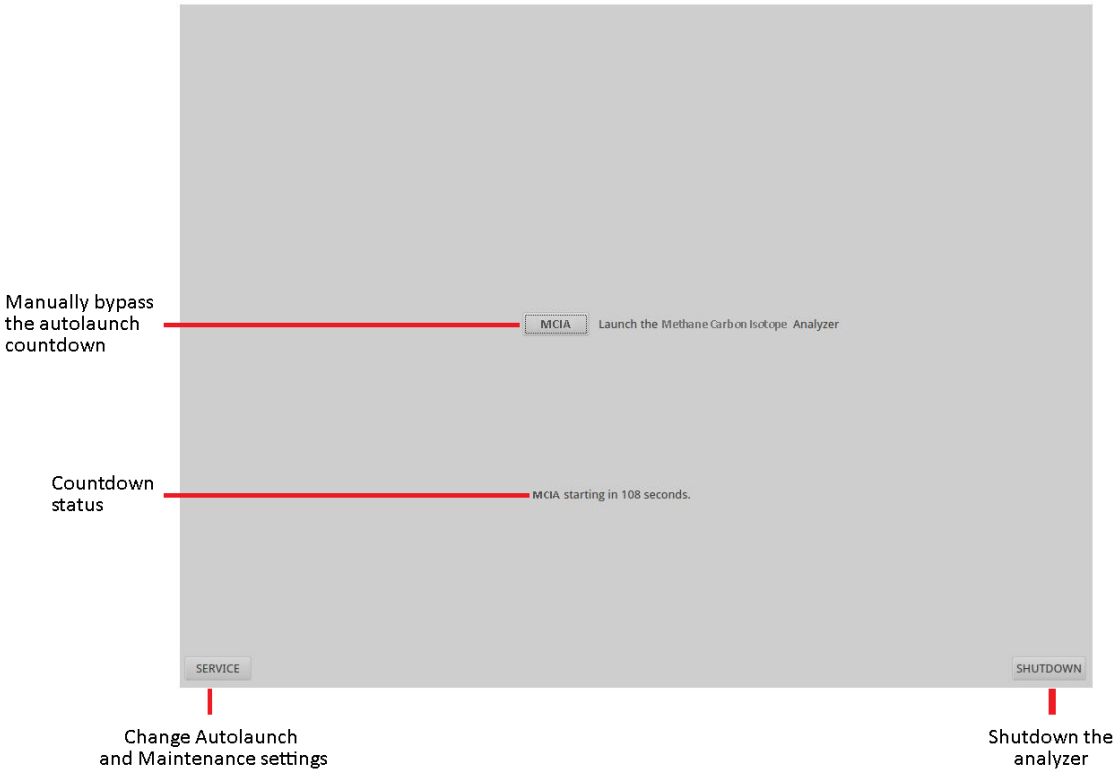

Figure 17: Launch Service Screen

The Auto Launch Screen

The Auto Launch and Maintenance settings are available when you click the **Service** button on the *Launch Service* screen. From this interface, you can:

- Change the auto launch delay timing.
- Transfer files from the internal hard drive to an external storage device connected via USB by clicking **Files**.
- Restore the analyzer's factory settings by clicking **Restore**.

Figure 18 shows the *Auto Launch* screen.

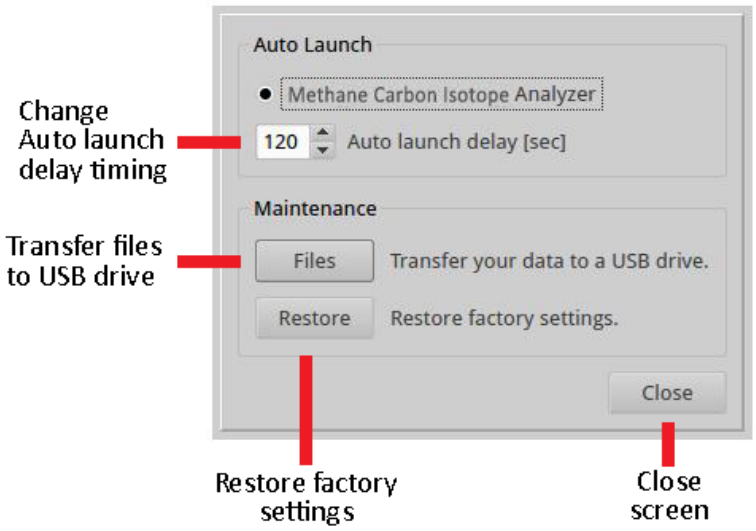

Figure 18: Auto Launch Screen

Login to Access Menu Options

To access the analyzer user interface features, log into the system as follows:

1. Click the **Security** button on the *User Interface Control Bar*. (Figure 19)

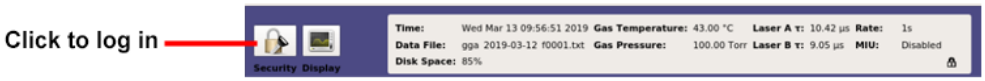

Figure 19: Control Bar Security Button

2. For initial login, use the default Linux credentials for the username and password (Figure 20), as follows:

   User: lgr

   Password: 3456789

WARNING

If you change and forget this password, you will not be able to recover it without a factory restore.

NOTE

There is only one Linux account.

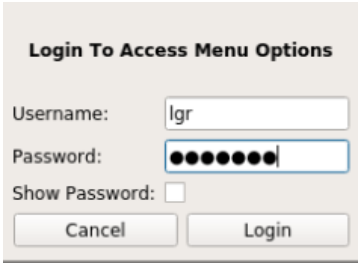

Figure 20: Login Dialog Box

3. Click **Login**.

Main Panel

After the software launches, the *Main Panel* is displayed. Figure 21 shows the *Main Panel*.

The operational status of the analyzer is displayed at the bottom of the main panel:

- Green: The analyzer is functioning properly.
- Yellow: The data may not be reliable, or maintenance is required soon.
- Red: The analyzer requires maintenance to correct an identified fault.

NOTE

Refer to the *Alarm Status Display* section on pages 34 - 36 for detailed Temperature Status and Analyzer Status descriptions.

This panel contains the *User Interface Control Bar* (Figure 22) and *Numeric* Display. (Figure 23)

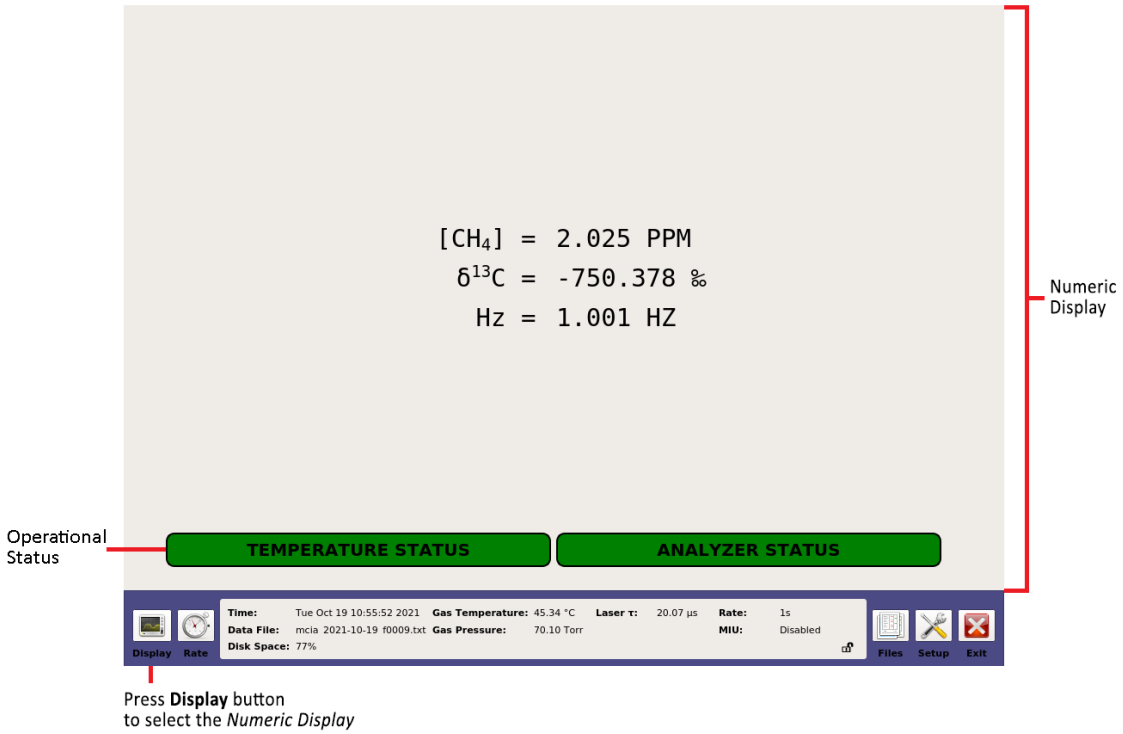

Figure 21: Main Panel

User Interface Control Bar

Use the control bar to operate the analyzer.

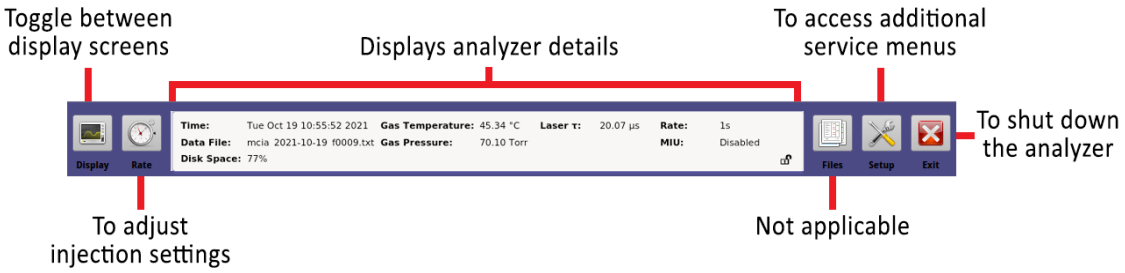

Figure 22: User Interface Control Bar

Display – Toggles through the three *Main Panel* display formats:

- ***Numeric Display*** **–** Default display. Displays the numeric readout of the last measurement. (Figure 23)
- ***Alarm Status Display*** **–** shows the operational status of the analyzer. (Figure 24)
- ***Spectrum Display*** **–** Displays the raw and fitted spectral scans. (Figure 25)
- ***Time Chart Display*** **–** Displays the concentration over time. (Figure 27)

Rate – Adjusts the rate at which data is written to the log file. (Figure 28)

Parameter Window – Displays the:

- Time – Current time
- Data File – Current filename to log data
- Gas Temperature – Temperature in Cell (Celsius - °C)
- Gas Pressure – Pressure in Cell (Torr)
- Laser A τ – Laser A ring-down time (micro-seconds - μs)
- MIU– Multiport Inlet Unit
- Rate – Sampling Frequency
- Disk Space – Remaining hard-drive space

Files – Allows easy transfer of files onto USB storage devices.

Setup – Accesses additional configuration and service menus.

Exit – Exits the application and shuts down the analyzer.

Main Panel Displays

Click the **Display** button to change the display in the *Main Panel*. Clicking the **Display** button multiple times lets you cycle through the three main panel displays. When the analyzer is launched, it defaults to the *Numeric Display*. The three displays within the display function are:

- Numeric
- Alarm Status
- Spectrum
- TimeChart

This section describes the displays.

Numeric Display

The Numeric Display is the default display. It appears when the analyzer is first turned on or re-initialized.

Figure 23 shows the numeric readout of the last measurement of CH_4 in parts per million (PPM), and isotope ratios in parts per thousand (‰).

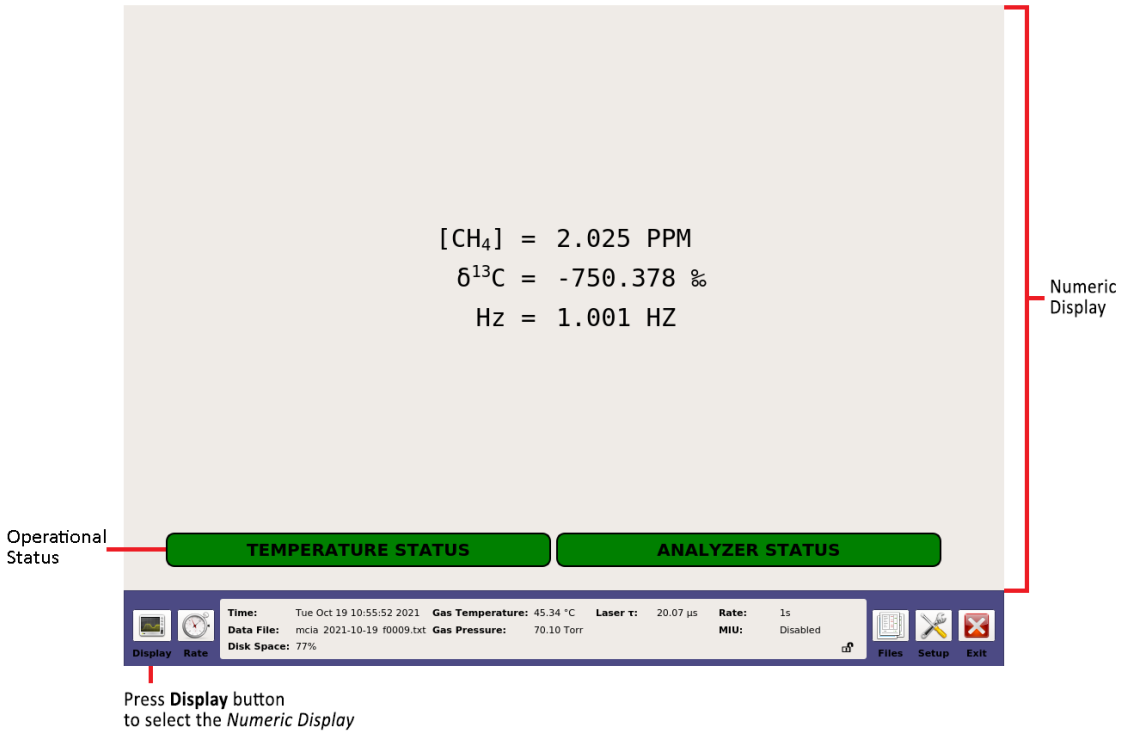

Figure 23: Numeric Display

Alarm Status Display

The *Alarm Status* display (Figure 24) shows the detailed operational status of the analyzer.

The *Alarm Status* is color-coded:

- Green: The analyzer is functioning properly
- Yellow: The data may not reliable, or maintenance is required soon.
- Red: The analyzer requires maintenance to correct an identified fault.

Figure 24 shows the *Alarm Status Display* with all parameters functioning properly.

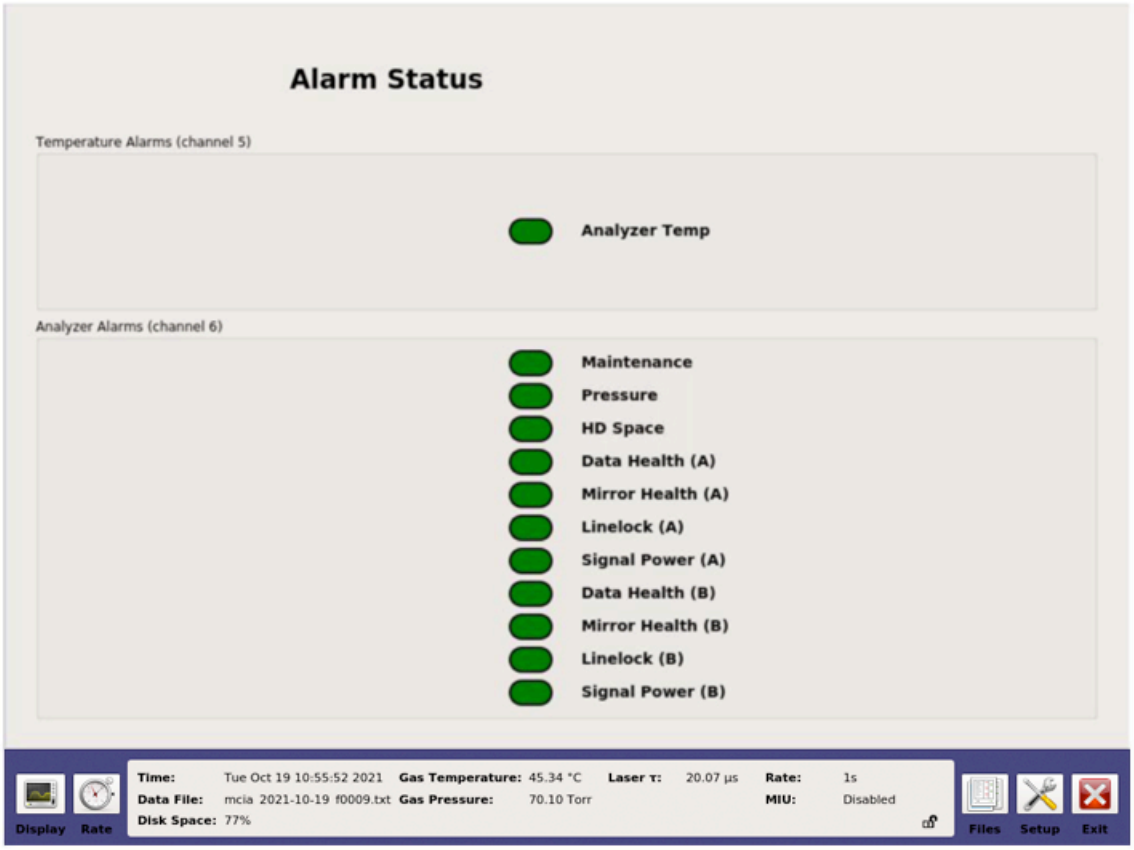

Figure 24: Alarm Status

Table 7 describes fault criteria for the Temperature Alarms.

Table 7: Fault Criteria for Temperature Alarms

Status	Sensor Read	Fault Condition	Description
10	Analyzer Temp	Temperature High/Low Alarm	The temperature exceeds the operating temperature range.
11	**CROSS OVER**		
14	Analyzer Temp	Temperature High/Low Warning	The temperature is > the high warning set point. The temperature is < the low warning set point.
17	Fault	NaN reading	Occurs when there is a false or undefined value. (NaN= not a number)
19	**Dead Band**		
20	Acceptable Range	No warning/alarm	No warning/alarm

NOTE

If the *Alarm Status* is Yellow or Red please refer to the *Maintenance* section on page 60. If issue continues, please contact Support@lgrinc.com.

Table 8 describes fault criteria for the Analyzer Alarms.

Table 8: Fault Criteria for Analyzer Alarms

Status	Sensor Read	Fault Condition	Description
4	Data Health (A/B)	Fit is not optimal	The laser fitting condition is poor. Occurs when fit is no longer working, peaks have been lost, or spectrum is unknown.
5	Pressure	Not within operating range	Occurs when pressure is outside of the operating range.
6	HD Space	Limited hard drive space	Occurs when the internal hard drive has < 10% of space left. Delete unnecessary data files.
7	Mirror Health (A/B)	Mirrors have declined in reflectivity	Occurs when the ringdown time has degraded by > 20% of the factory value. Mirror cleaning is required.
8	Linelock (A/B)	Peak is outside control range	Occurs when linelock control voltage is no longer able to control.
9	Signal Power (A/B)	Signal power has degraded	Occurs when laser signal power has degraded by > 20% of the factory value.
10	Maintenance	Maintenance needed now	Occurs when the analyzer requires maintenance (every 381 days).
11	**CROSS OVER**		
12	Data Health (A/B)	Fit is not optimal	The laser fitting condition is not optimal. Occurs when residuals of fit go above normal operational values.
13	Pressure	Noisy	Occurs when the specified operational pressure is not optimal.
14	HD Space	Low space	Occurs when the internal hard drive has < 20% space left. Delete unnecessary data files.
15	Mirror Health (A/B)	Mirrors have declined in reflectivity	Occurs when the ringdown time has degraded by > 10% of the factory value.
16	Linelock (A/B)	Peak is drifting	Occurs when linelock control voltage is approaching control range limit.
17	Signal Power (A/B)	Signal power is degrading	Occurs when laser signal power has degraded by > 10% of the factory value.
18	Maintenance	Maintenance needed soon	Analyzer maintenance will be needed soon (every 360 days).
19	**Dead Band**		
20	Performance	No warning/alarm	No warning/alarm

NOTE

If the *Alarm Status* is Yellow or Red please refer to the *Maintenance* section on page 60. If issue continues, please contact Support@lgrinc.com.

Spectrum Display

Click the **Display** button on the *User Interface Control Bar* to switch to *Spectrum Display*.

The top plot shows the voltage from the photo-detector as the laser scans across the absorption features.

The bottom plot shows the corresponding optical absorption displayed as black circles, and the peak fit resulting from signal analysis as a blue line.

The measured concentrations are shown in parts per million (PPM) and ‰ (PP_MIL) on the bottom of the *Spectrum Display*.

Figure 25 shows the *Numeric Display* with 100ppm CH_4 in air.

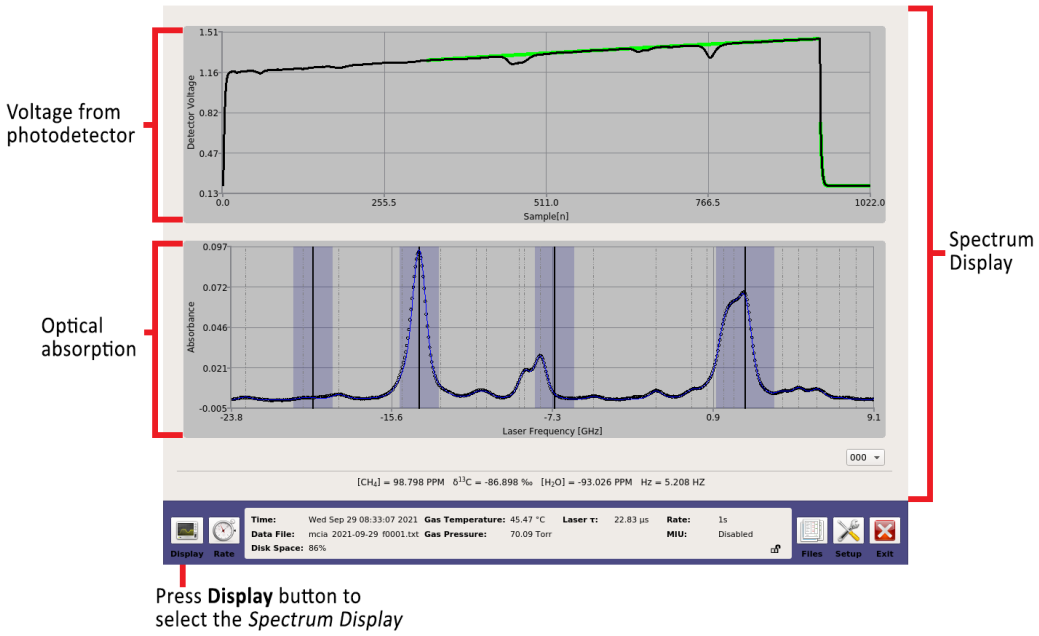

Figure 25: Spectrum Display (100ppm CH_4 in air)

Figure 26 shows the *Numeric Display* in ambient air.

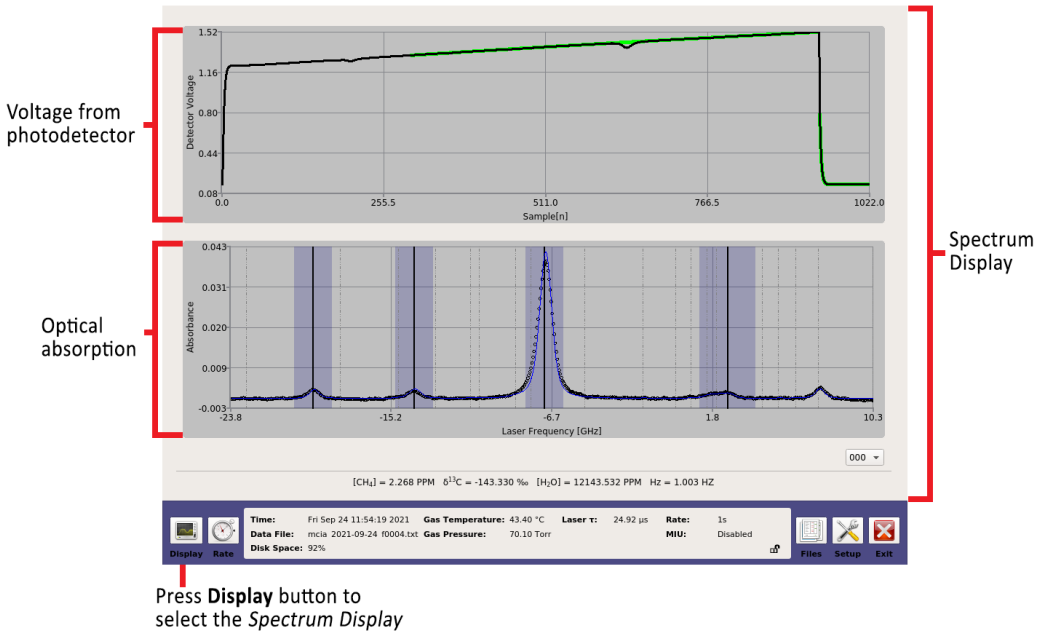

Figure 26: Spectrum Display (ambient air)

TimeChart Display

Click the **Display** button on the *User Interface Control Bar* to switch to *TimeChart* Display.

The *TimeChart* Display is a real-time measurement of concentration vs. time.

Figure 27 shows the *Time Chart* with a continuous flow of gas over time. A 10-point running average (in black) is shown going through the raw data (shown in blue).

Click on the **drop-down box** in the lower-right corner of either window to change displays of water isotope concentrations and to adjust the number of significant figures.

The data is saved to the file indicated in the left corner of the *parameter window*.

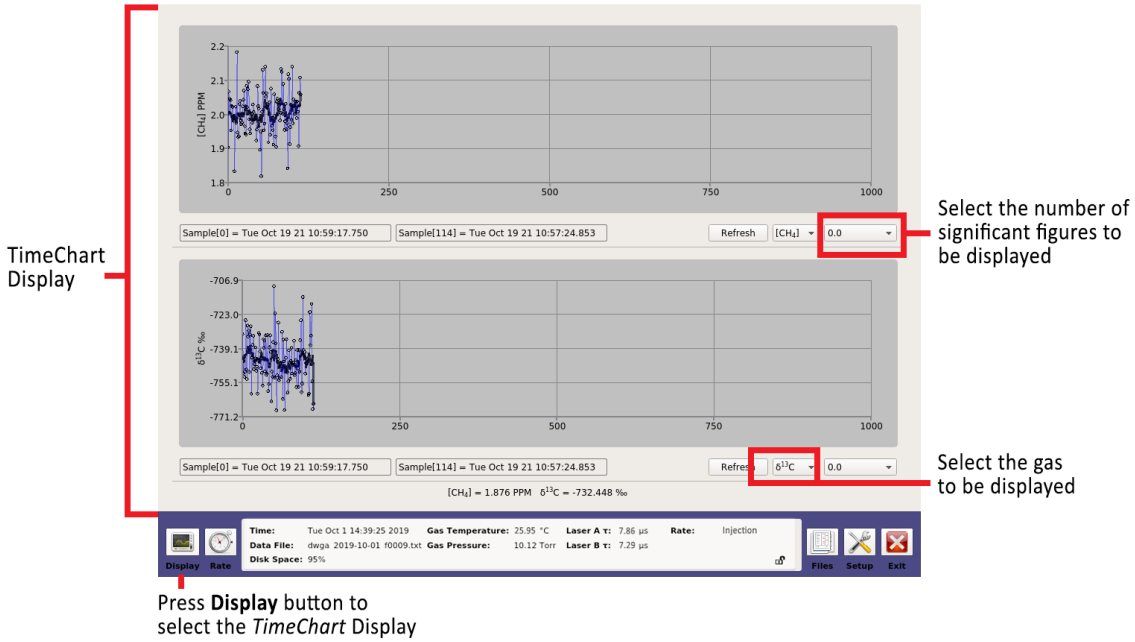

Figure 27: TimeChart Display

Rate Control

Data is acquired at 1 Hz rate and averaged for a selected interval (1 to 100 seconds) before being written to the data file and plotted on the time chart. Longer averaging periods (or equivalently, slower data acquisition rates) will yield better measurement precision than shorter averaging periods.

When the **Rate** button (clock icon) on the *User Interface Control Bar* (Figure 22) is selected, a pop-up box appears to allow rate control adjustments to the operating mode and plot frequency. (Figure 28)

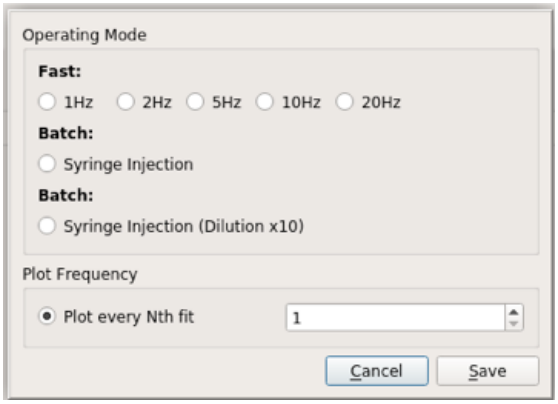

Figure 28: Rate Control Screen

The *Operating Mode* radio buttons allow you to change the rate at which data is written to the log file. To adjust the rate:

1. Click the **Rate** button (clock icon) on the *User Interface Control Bar.* (Figure 22) The *Data Rate Control Adjustment* panel appears. (Figure 28)
2. Click the **Operating Mode** radio buttons to select the rate at which data is acquired.
    a. Fast-flow mode (optional)
        i. The internal pump is powered off.
        ii. The (optional) external pump is powered on.
3. Click **Save**.

The *Plot Frequency* radio buttons allow you to select between manually or automatically plotting the data. (Figure 28)

To adjust the frequency:

1. Click the **Rate** button (clock icon) on the *User Interface Control Bar.* (Figure 22) The *Data Rate Control Adjustment* panel appears. (Figure 28)
2. Click the **Plot on Demand** radio button to manually plot the data.
    a. When selected, the *Refresh Plot* button appears on the *Main Panel* display. When **Refresh Plot** button is selected, (Figure 27), current data is added to the *Main Panel* display.
3. Click the **Plot every Nth fit** radio button to automatically set the rate at which the data is updated on the *Main Panel* display.
    a. For example, if you set the value to 5, a data point will be saved every 5 seconds.
4. Click **Save**.

The analyzer restarts sampling at whatever rate was set last.

File Transfer Menu

Use the *File Transfer* menu to access data collected by the analyzer.

- Each time the analyzer is re-started, the most recent file name is displayed. Example: mcia_2021-02-20_f0001.txt, where the:
  - First characters represent the analyzer model (mcia)
  - Next 10 characters represent the date (yyyy-mm-dd)
  - Last four numbers are a serial number.
- The serial number counts upward to provide up to 10,000 unique file names each day.
- If the analyzer is left in continuous operation, a new data file will automatically be created every 24 hours to keep data file sizes manageable.

Standard Data File

Data files are written in text (ASCII) format and contain labeled columns displaying:

- The time stamp of each recorded measurement
- Gas/Water Vapor concentration
- Del values
- Cell pressure (Torr)
- Cell temperature (Celsius)
- Ambient Temperature (Celsius)
- Ring-Down Time (microseconds)

The format can be changed in the *Time/Files* menu of the Setup panel. (Figure 36)

Figure 29 shows a typical data file.

```
          Time,    [12CH4]_ppm, [12CH4]_ppm_se,    [13CH4]_ppm, [13CH4]_ppm_se,      [CH4]_ppm,   [CH4]_ppm_se,
0000:00:43.307,    1.05640e+02,    0.00000e+00,    1.14791e+00,    0.00000e+00,    1.06788e+02,    0.00000e+00,
0000:00:44.287,    1.04850e+02,    0.00000e+00,    1.14437e+00,    0.00000e+00,    1.05995e+02,    0.00000e+00,
0000:00:45.287,    1.05305e+02,    0.00000e+00,    1.14325e+00,    0.00000e+00,    1.06448e+02,    0.00000e+00,
0000:00:46.270,    1.04823e+02,    0.00000e+00,    1.14103e+00,    0.00000e+00,    1.05964e+02,    0.00000e+00,
0000:00:47.278,    1.04971e+02,    0.00000e+00,    1.14153e+00,    0.00000e+00,    1.06112e+02,    0.00000e+00,
0000:00:48.286,    1.04738e+02,    0.00000e+00,    1.14361e+00,    0.00000e+00,    1.05881e+02,    0.00000e+00,
0000:00:49.292,    1.04920e+02,    0.00000e+00,    1.14200e+00,    0.00000e+00,    1.06062e+02,    0.00000e+00,
```

Figure 29: The Beginning of a Typical Data File

For each measurement there is an adjacent column reporting the standard deviation of the measurement (with sd suffix).

- The standard deviation is zero when the analyzer is running at 1 Hz, as no averaging of data has taken place.
- At speeds slower than 1 Hz, the standard error of the average is reported.
- At the end of each data file are encoded listings of settings used by the analyzer for that data file. Settings are typically stored for diagnostic or troubleshooting purposes.

Transfer Data Files

To transfer data files from the analyzer hard drive to a USB storage device:

1. Click the **Files** button on the *User Interface Control Bar* (Figure 22) to access the *File Transfer Menu*. (Figure 30)
2. Insert a USB storage device into the USB port on the front or back panel of the analyzer.
3. Click on the **Mount USB** button. (Figure 30)

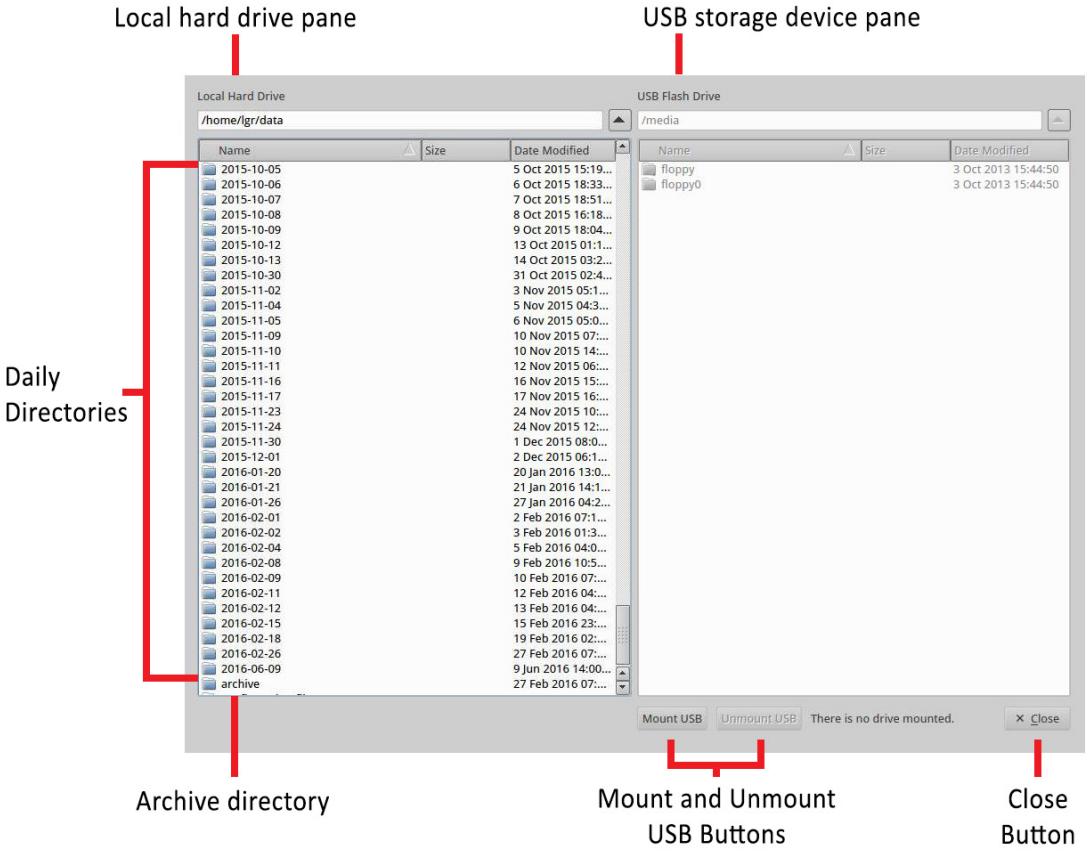

Figure 30: File Transfer Menu: Local Hard Drive (left pane) and USB Flash Drive (right pane)

4. Transfer data files from the analyzer hard drive to a USB storage device by dragging and dropping the files from the hard drive pane to the USB device pane. Use the left mouse button to highlight one or multiple files in the window.
   The directory windows default to the local hard drive on the left screen and the USB memory device on the right.
   Navigate through folders, create new folders, and delete files and folders.

NOTE **USB drives should be no larger than 8GB. They must be FAT32 formatted.**

When you have finished transferring files:

5. Click the **Unmount USB** button.
   Wait for the *Safe to Remove USB Memory Device* message before removing the USB memory device.

6. Click **Close** to exit the *File Transfer Menu*.

Removing the USB memory device before seeing the *Safe to Remove* pop-up message may result in loss of data.

Types of directories in the local hard drive

The analyzer hard drive contains two types of directories:

- Daily Directory
- Archive Directory

Daily Directory

The local hard drive (Figure 30) creates a daily folder containing new data files for each day that the analyzer operates.

To access the data files for a specific date, double-click the folder. Each file from that day is displayed in chronological order. (Figure 31)

Each file is a single zipped .txt file, using the following convention:

- mcia_YYYY-MM-DD_f0000.txt.zip

Examples of files in the daily directory are shown in Figure 31.

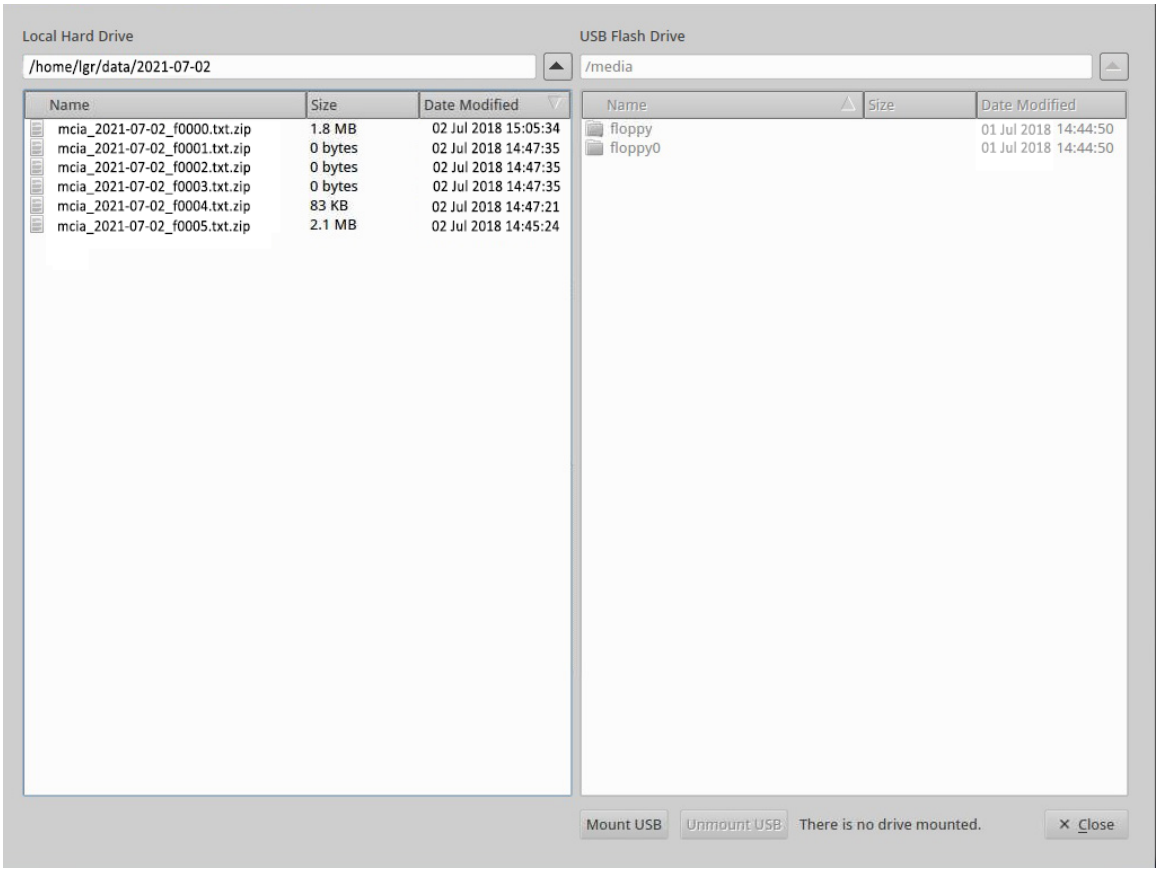

Figure 31: Daily Directory

Archive Directory

The local hard drive (Figure 30) creates an archived folder containing zipped files organized by date. (Figure 32)

To access the archived files, double-click the **Archive** folder. (Figure 30)

Each file is a single zipped .txt file, using the following convention: YYYY-MM-DD.zip. Each zipped file contains the data files for the day that the analyzer operated.

Examples of files in the archive directory are shown in Figure 32.

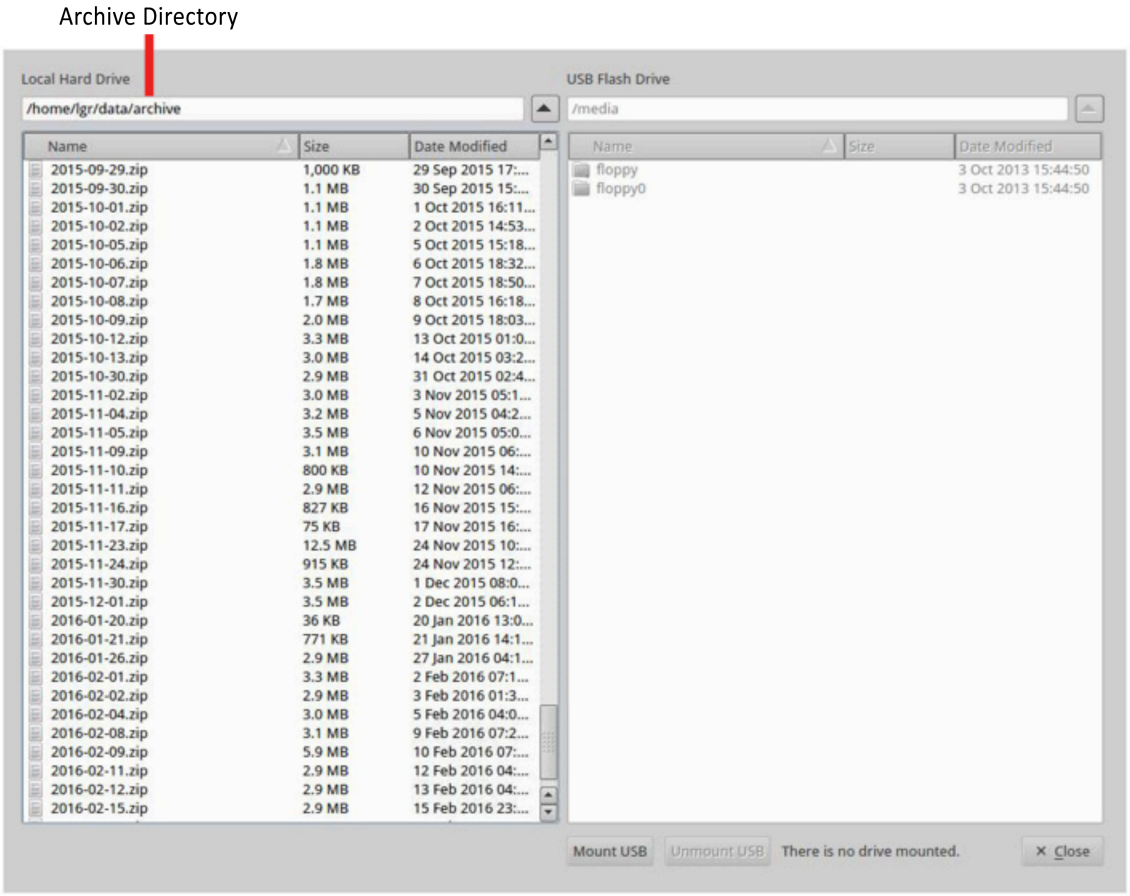

Figure 32: Archive Directory

File Transfer Error Screen

The *File Transfer Error screen* (Figure 33) displays when:

- The USB Key does not have enough storage space.
- The device is not recognized.

Try again with a correctly inserted USB device.

Figure 33: File Transfer Error

Setup Menu

The *Setup* menu allows access to additional configurations and services. The contents of the *Setup* menu will vary depending on the analyzer type.

To enter *Setup* mode:

1. Click the **Setup** button on the *User Interface Control Bar*. (Figure 34)

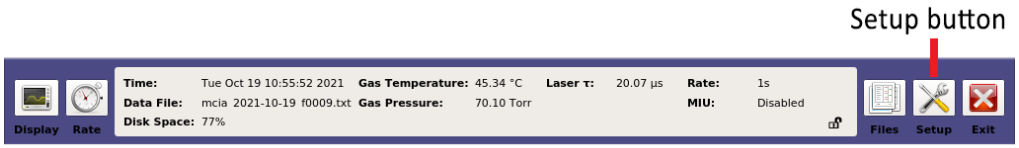

Figure 34: Setup button on the User Interface Control Bar

2. The default *Time/Files* screen is displayed. (Figure 35)

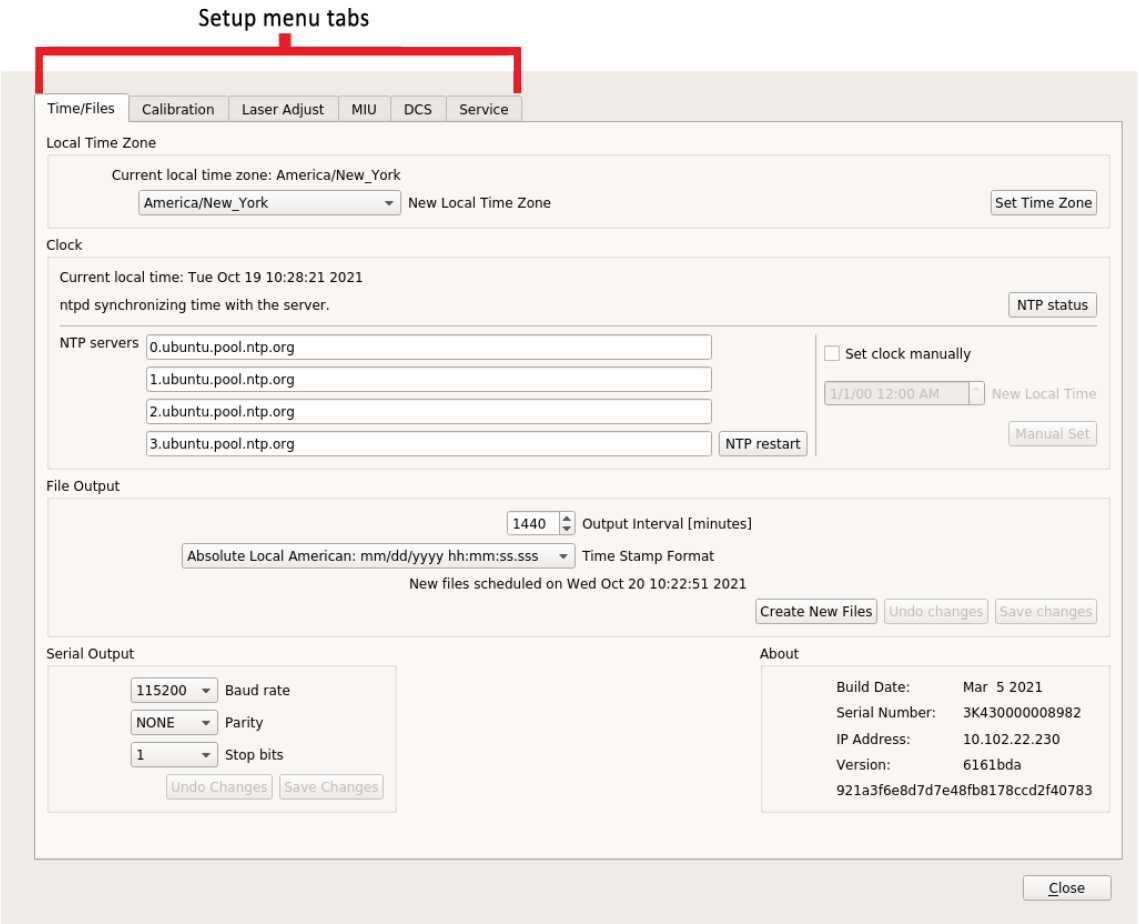

Figure 35: Setup Menu Tabs with Time/Files Screen Selected

The *Setup* menu has function tabs at the top of the screen that allows you to configure the analyzer mode and settings. (Figure 35) These tabs let you:

- Manage file saving settings
- Adjust the current time/date settings
- Configure the Serial Output
- Calibrate the analyzer to a local gas standard
- Enable the laser offset adjustment.
- Configure the optional Multi-Port Inlet Unit
- Configure the optional External Dynamic Dilution System (EDDS)
- Select Service options

Use these function tabs to make adjustments to the analyzer and its' operation.

Time/Files Tab

The *Time/Files* menu allows you to adjust the time zone, manually set the clock, adjust the format of data files, and adjust the Serial Configuration.

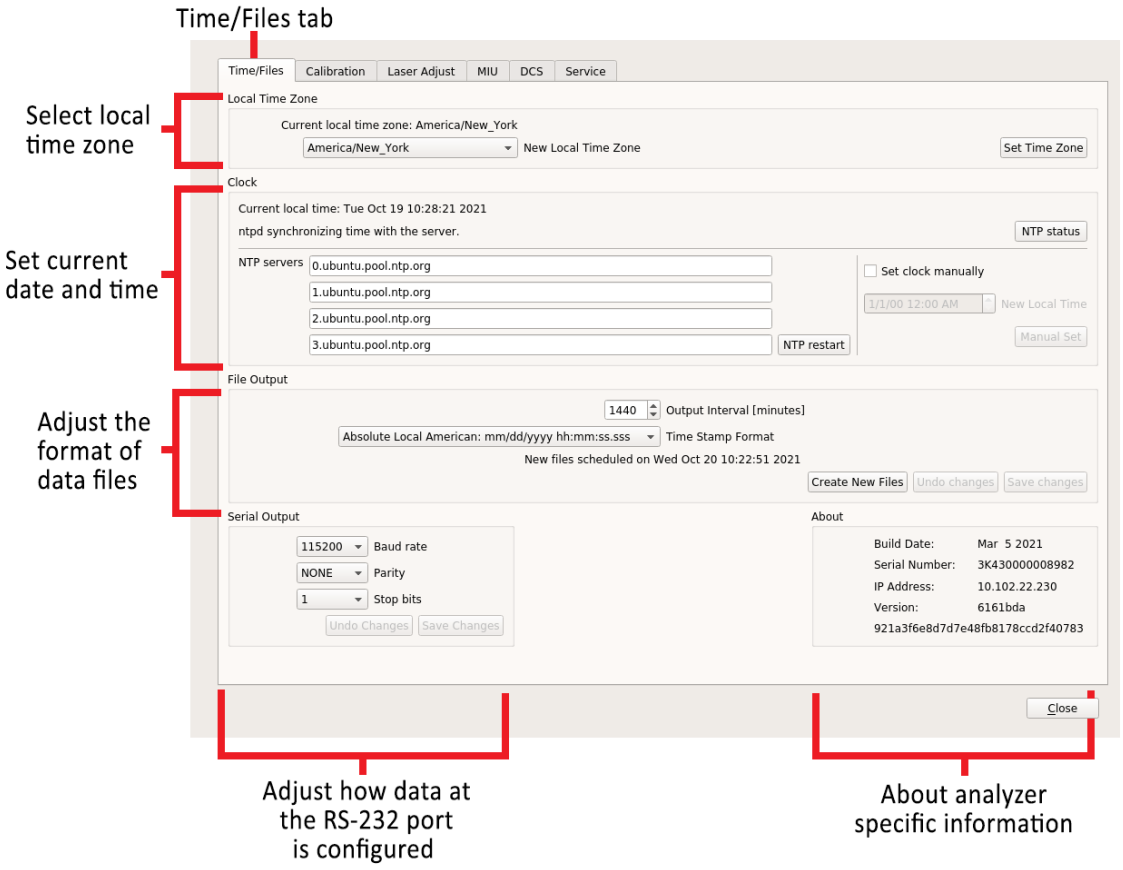

Figure 36: Functions of the Time/Files Menu

Local Time Zone
The *Local Time Zone* menu lets you adjust the current local time zone by selecting an option from the drop-down selection box.

Clock
The *Clock* menu lets you manually adjust the current time and date settings.

File Output
The *File Output* menu lets you adjust the timestamp format of the data files. The available timestamp formats are shown in Table 9.

New file creation intervals (when running continuously) can be set by adjusting the value in the **Output Interval [minutes]** spinner control box.

Table 9: Available Time Stamp Formats

Time Stamp Name	Format
Absolute Local American	mm/dd/yyyy, hh:mm:ss.sss
Absolute Local European	dd/mm/yyyy, hh:mm:ss.sss
Absolute GMT American	mm/dd/yyyy, hh:mm:ss.sss
Absolute GMT European	dd/mm/yyyy, hh:mm:ss.sss
Relative Seconds After Power On	ssssss.sss
Relative Seconds in Hours, Minutes, Seconds	hh:mm:ss.sss

Serial Output

The *Serial Output* menu lets you change how the data reported at the RS-232 port is configured. Standard settings are provided for:

- Baud Rate
- Parity
- Stop Bits

The actual rate of the serial output is equal to the Logged File Rate (i.e. 1 Hz) divided by the Rate specified in the *Time/Files* menu.

Use a null modem serial cable to connect the analyzer serial port to an external computer.

About

The *About* section displays analyzer specific information, such as the:

- Build Date of the current software
- Version of the code
- IP Address
- Serial Number of the analyzer

Calibration Tab

ABB-LGR recommends periodic referencing rather than calibration to ensure measurement accuracy and consistency. When calibration is necessary, follow the procedure detailed below.

Calibration Procedure:

1. Click the **Setup** button on the *User Interface Control Bar*. (Figure 22)
2. Select the **Calibration tab** at the top of the screen to enter the *Calibration* menu. (Figure 37)

Figure 37 shows the *Calibration Setup* screen.

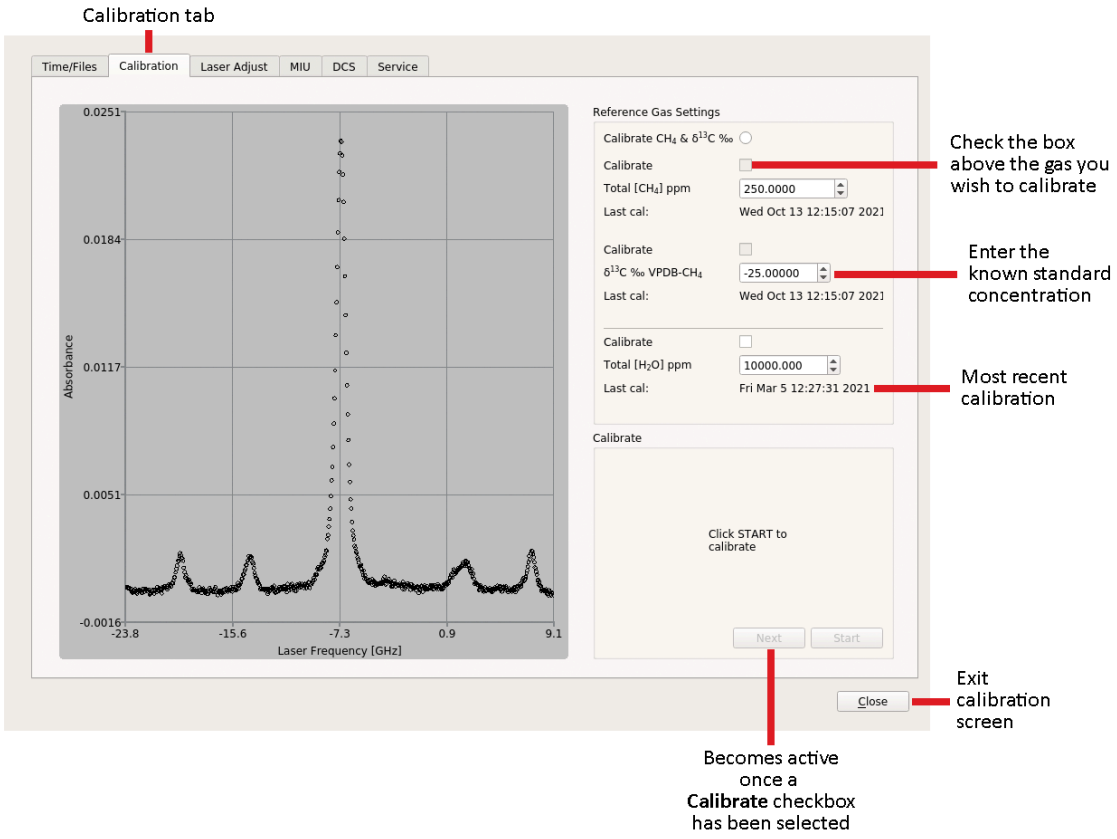

Figure 37: Calibration Setup Screen

3. On the top, right panel of the screen under *Reference Gas Settings*, select the checkbox next to the gas you wish to calibrate.
4. Enter the known concentration for your local standard.
5. Connect your reference supply to the ¼" Swagelok inlet port on the back panel of the analyzer. (Figure 3)
6. Open the valve on your gas supply.
7. Click the **NEXT** button on the lower, right panel of the screen to begin calibration.

8. Each step is displayed in the lower-right panel of the calibration screen as the analyzer performs the calibration. Figure 38 shows the calibration process as a flow chart.

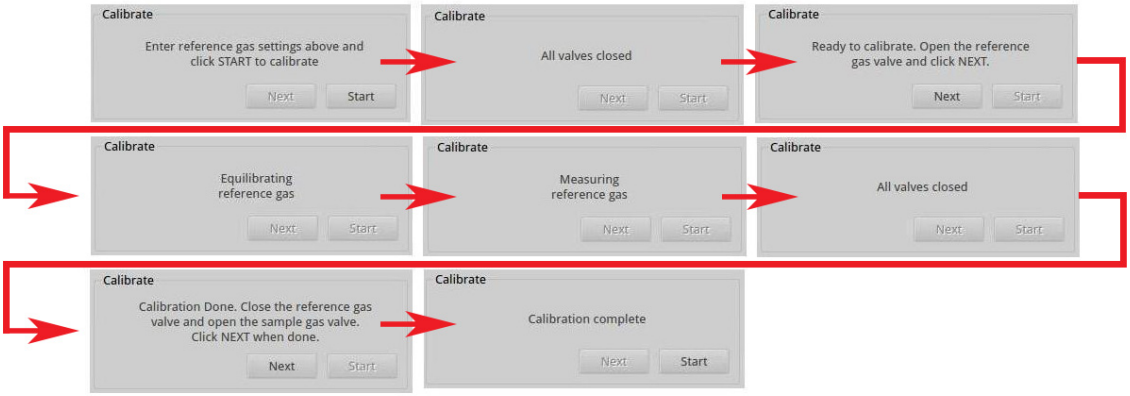

Figure 38: Calibration Flow

9. When the *Calibration Complete* message is displayed, click the **CLOSE** button.
10. Enter *TimeChart* by selecting the **Display** button on the *User Interface Control Bar*, and verify that the displayed concentration correctly corresponds to your local gas standard.
11. Repeat steps 1-10 for each gas you wish to calibrate.

NOTE

The time of latest calibration is stored in *Reference Gas Settings* within the *Calibration* menu for future reference.

Laser Adjust Tab

Use the *Laser Adjust* tab to manually adjust the laser's wavelength to compensate for any cumulative drift. (Figure 39)

Laser adjustment may be needed for the following reasons:

- The laser's wavelength has drifted beyond the target range of the analyzer.
- The analyzer is operated outside the recommended temperature range.

Figure 39 shows the offset between absorption peaks and target lines.

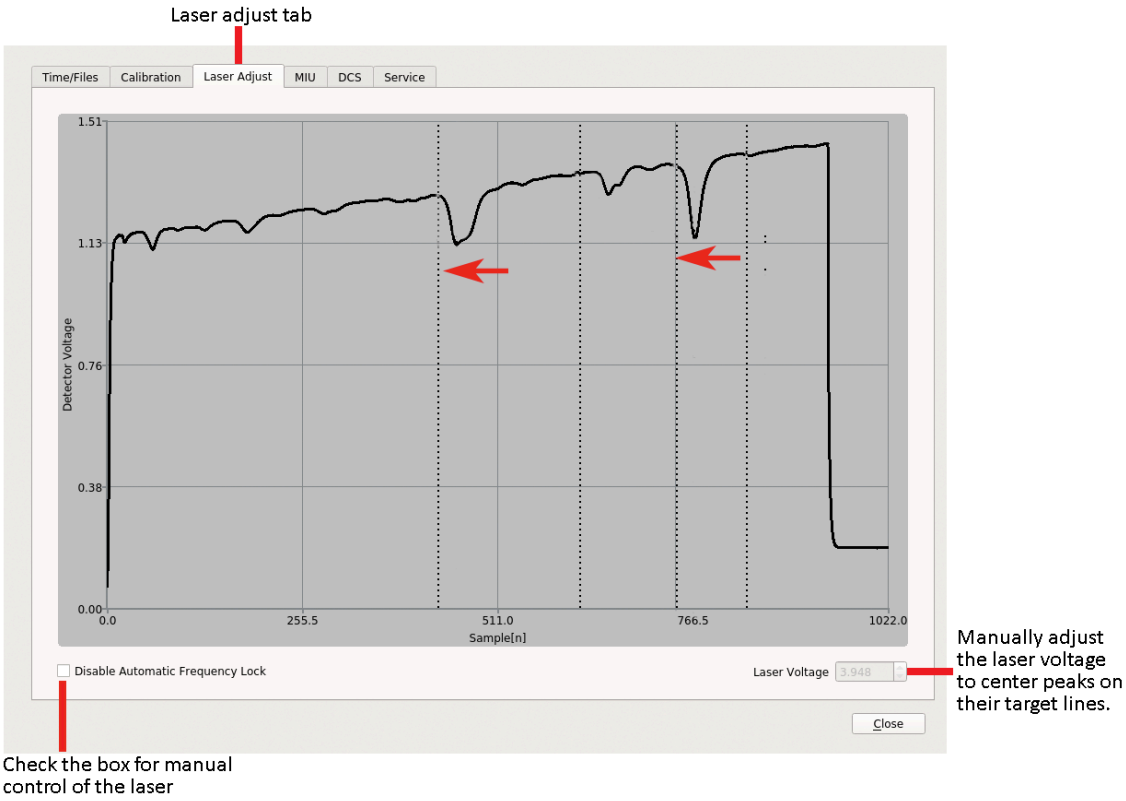

Figure 39: Absorption peaks off of target lines. Laser voltage adjustment needed.

Manually Adjust the Laser Offset

1. Click the **Setup** button on the *User Interface Control Bar*. (Figure 22)
2. Select the **Laser Adjust** tab at the top of the screen. (Figure 39)
3. Select the **Disable Laser Frequency Lock** check box to allow manual control of the laser.
4. Adjust the **Laser A Voltage** using the arrow buttons to shift the peaks until they are centered on their respective target lines.
    a. Up Arrow: Peaks adjust to the right
    b. Down Arrow: Peaks adjust to the left
5. Deselect the **Disable Laser Frequency Lock** check box. The software resumes automatic tracking and control of the laser wavelength.
6. Click **Close** to exit the menu and return to the *Main panel*.

Figure 40 shows an example of the laser voltage adjusted so that the absorption peaks are centered on the target lines.

Figure 40: Absorption Peaks Centered Correctly on Target Lines (250ppm CH_4 in air)

MIU tab

The (optional) Multi-Port Inlet Unit (MIU) is an ABB-LGR accessory that allows automated control of 8 or 16 inlet ports (depending on the ordered configuration). These ports are directed to the inlet port of the analyzer for sampling unknown gases and reference gases.

The *MIU* menu can be configured to control which gases are introduced to the analyzer, and for how long. (Figure 41)

See the *MIU Appendix* on page 64 for detailed instructions on configuring and controlling the MIU. Figure 41 shows the MIU screen.

Figure 41: Control Menu for the (Optional) Multi-Port Inlet Unit (MIU)

DCS Tab (Optional)

The External Dynamic Dilution System (EDDS), formally known as DCS, is an optional accessory.

The EDDS is an ABB accessory that dilutes sample gas with zero-air whenever the concentration rises above the target. It extends the upper range up to 100x through automated dilution and maintains the target concentration at that level.

The EDDS can be enabled/disabled using the radio buttons; and the dilution factor can be set using the drop-down selection box on the DCS screen. (Figure 42)

See the *External Dynamic Dilution System (EDDS) Appendix* on page 94 for detailed instructions on enabling and controlling the EDDS.

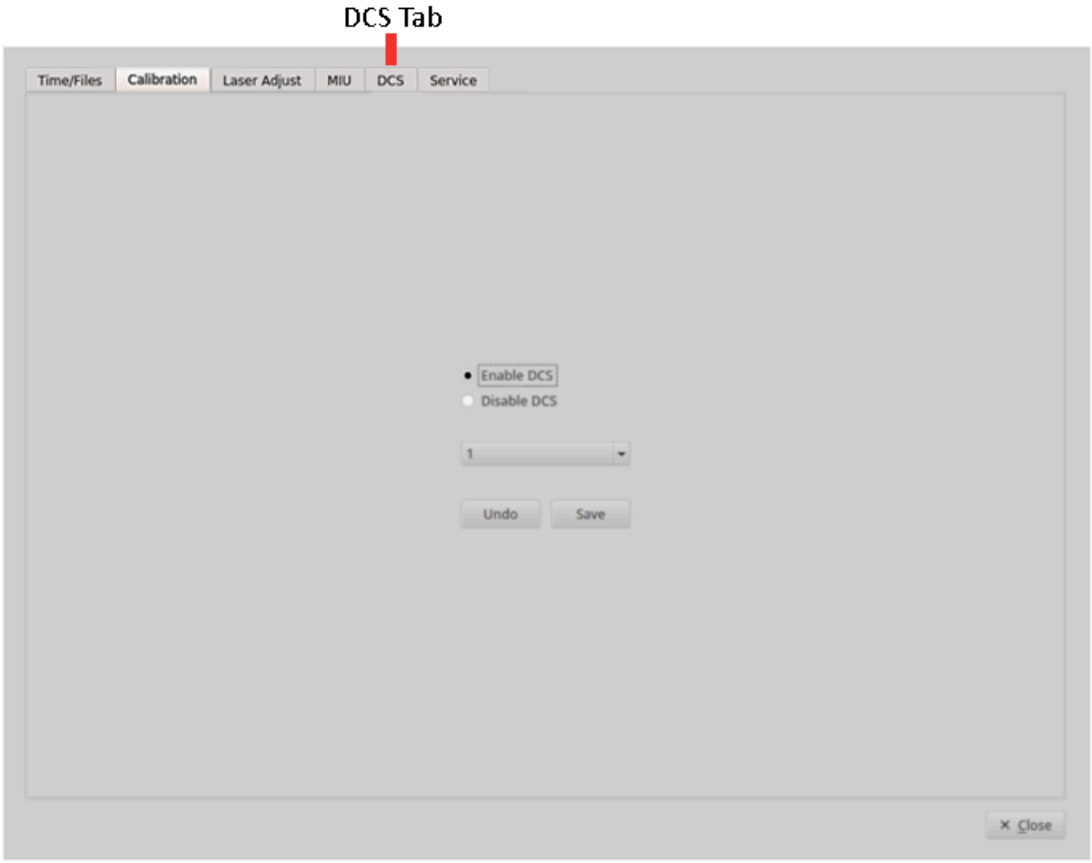

Figure 42: DCS Screen for the EDDS

Service

ABB-trained field service engineers monitor the performance of the analyzer via the *Service* screen. (Figure 43)

- These settings determine the level of change that could affect measurement performance.
- The alarm threshold levels are analyzer-dependent and are set based upon the last fixed setting.

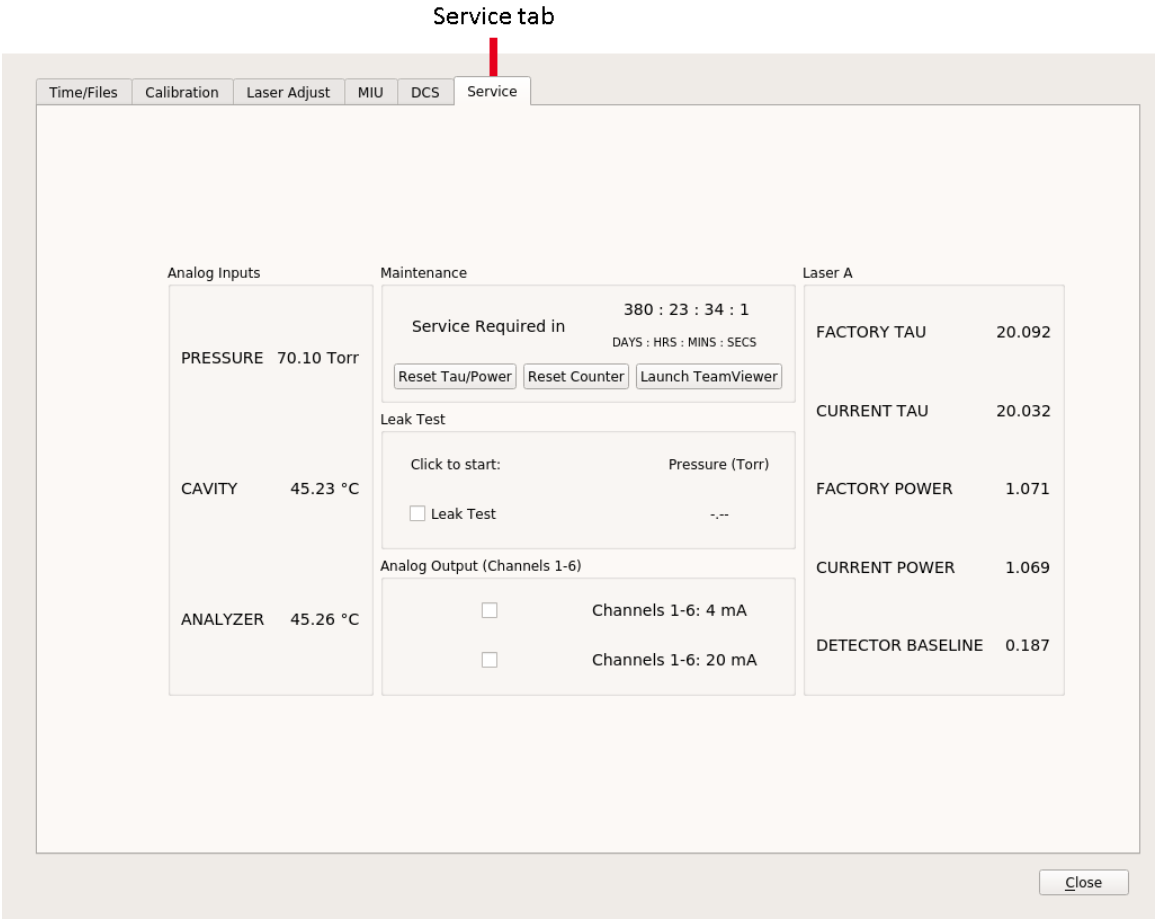

Figure 43: Service Screen

The *Service* tab contains 3 Service buttons:

- **Reset Tau/Power** button – resets the mirror ringdown time and laser power to current settings. This is typically done after mirrors have been cleaned.

- **Reset Counter** button – resets the # of days that maintenance is required. This is typically done after yearly maintenance.

- **Launch TeamViewer** button – TeamViewer allows service engineers to remotely access the analyzer if service needs are required.

Shutting Down the Analyzer

To shut down the analyzer:

1. Click the **Exit** button on the *User Interface Control Bar*. (Figure 44)
2. A pop-up box appears on the *Main Panel* and prompts you to verify that you want to shut down the analyzer to prevent accidental button presses from causing interruption in data acquisition. (Figure 45)

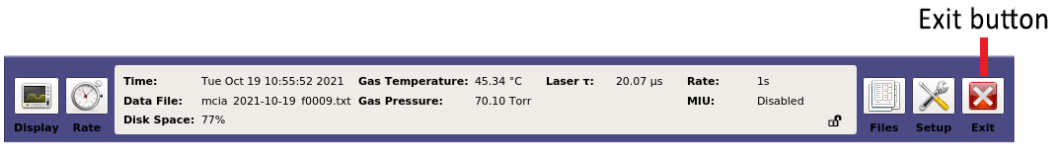

Figure 44: User Interface Control Bar Exit Button

3. Click the **OK** button to halt data acquisition, close the current data file, and display the shutdown screen. (Figure 45)

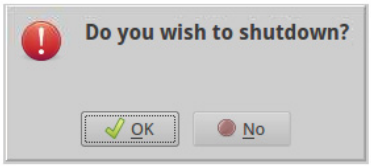

Figure 45: Analyzer Shutdown Prompt

4. When the *"You may turn off the instrument"* message displays (Figure 46), you can safely shut off power to the analyzer by pushing the **OFF** switch on the front of the analyzer. (Figure 2)

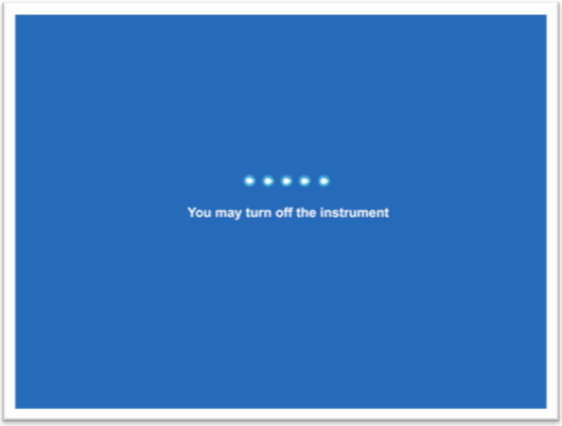

Figure 46: Final Shutdown Screen

NOTE

Failure to wait for the power down command to display before shutting off power to the analyzer may result in file system instability.

4 Maintenance

Daily Operation Checklist

Table 10 describes routine maintenance tasks that keep your analyzer operating smoothly.

Table 10: Maintenance Checklist

Frequency	Task
Every 1-2 days	• On the *Spectrum Display*, verify that the spectrum is correct. The spectrum should appear as shown in Figure 25. Become familiar with the normal appearance of the spectrum (the best way of diagnosing analyzer performance). Any deviations from normal could indicate a problem with the analyzer. • Log the transmitted intensity displayed in the upper panel of the spectrum screen. Any decrease in transmitted intensity could be indicative of dirty mirrors. • Log the analyzer pressure. Any decrease in pressure could be indicative of an obstruction in the flow system. An increase in pressure could be indicative of a leak in the system, or a pump failure.
Every 3-6 days	• Check the Laser Offset and adjust if necessary. (Figure 39)

Mirror Ring-Down Time and Maintenance

Measurement cell mirrors are protected from contamination by an internal inlet filter. With continued use the mirrors may gradually decline in reflectivity.

If a significant change occurs in the mirror ring-down time (for example, greater than 20% reduction), the precision of the measurements may be reduced.

Periodically note the ring-down time. If a significant reduction in ring-down time occurs:

- Request a mirror cleaning kit from ABB-LGR.
- If further maintenance is required, contact ABB-LGR for service.
    - Technical Support: icos.support@ca.abb.com

WARNING!

Only authorized persons may open the analyzer cover or perform internal maintenance. Make sure the analyzer is unplugged before working with the internal components. Failure to do so may result in damage to the analyzer and electric shock.

Replace the Power Inlet Fuse

If the fuse on the power inlet blows or is otherwise damaged, the analyzer shuts down. To replace the fuse:

1. Unplug the analyzer.
2. On the back panel of the analyzer, locate the fuse above the power inlet. (Figure 47)

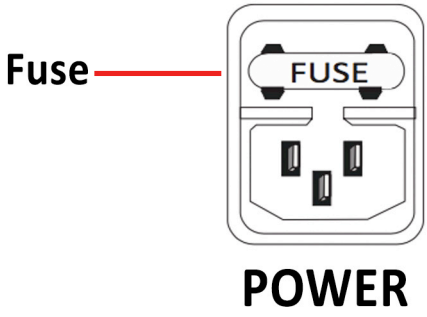

Figure 47: Analyzer Fused Inlet

3. Use a flathead screwdriver to remove the fuse.
   a. Insert the head of the screwdriver into the slot below the fuse. (Figure 48)

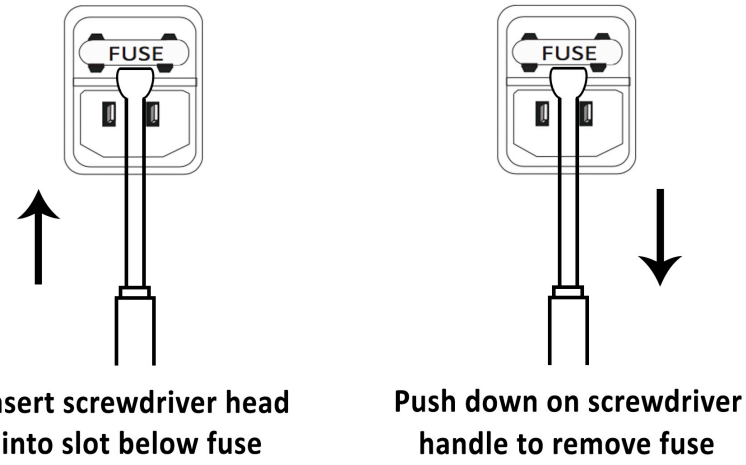

Figure 48: Remove the Fuse

   b. Push down on the screwdriver handle to remove the fuse holder from the power inlet.
   c. Remove the fuse from the fuse holder. (Figure 49)

Figure 49: Remove the Fuse from the Fuse Holder

4. Insert a new fuse into the fuse holder.
5. Re-insert the holder into the power inlet. Push it in until you hear a click.
6. Plug the power cord into the back panel of the analyzer.
7. Resume analyzer operation.

Appendix A: Accessing Data Using the Ethernet

Appendix B explains how to access the analyzer data directory as a Windows Share using an Ethernet connection on a local area network (LAN).

The data files stored on the internal hard disk drive of the analyzer can be accessed as a Windows Share over a Local Area Network (LAN) Ethernet connection. For this function to operate, the analyzer must:

- Be connected to a Local Area Network (LAN) via the RJ-45 Ethernet connection on the back panel of the analyzer.
- Receive a response to a DHCP (Dynamic Host Configuration Protocol) request when the analyzer is initialized.

If the analyzer does not receive a reply, the analyzer:

- Disables the Ethernet port.
- Does not attempt another DHCP request until the analyzer is restarted.

When both conditions are met, the data directory can be accessed using a Windows computer on the same LAN.

To access the data directory:

1. Click **Start > Run**, and enter the IP address of the analyzer:
   Example: *172.25.34.29*

   Refer to the *Time/Files menu* (Figure 36) for the location of the analyzers' IP address.

2. Click **OK**.

3. Within 10 to 60 seconds, the *Windows Share* directory displays the subdirectory **lgrdata**.

   Double-click on the **lgrdata** directory to see a listing of the data files stored on the internal hard drive of the analyzer.

   Open or transfer any of the data files, as you would with any Windows share drive.

Additional Notes

The analyzer shared data directory is in the LGR workgroup. If it is not visible, browse for it in the Windows Network Neighborhood by entering the IP address of the analyzer. Figure 36 shows the location of the IP address.

The current data file of the analyzer can be open while measurement is in progress without interrupting the analyzer operation. The current data file is updated after every fourth KB, so a new data file will appear empty until enough data is collected to be written to the disk.

If a Local Area Network (LAN) is not available, plug the analyzer into a standalone broadband router (example: Netgear Model RP614) to enable the analyzer to obtain a Dynamic Host Configuration Protocol (DHCP) address from the router when the analyzer is started. Then, plug any Windows computer into the same broadband router to access the data directory.

A crossover Ethernet cable will NOT allow an external computer to access the shared data directory, as the analyzer will not obtain a DHCP address on initialization and will shut down its Ethernet interface.

It is possible to access the shared analyzer data directory from operating systems other than Windows. The analyzer uses a Samba server to share the data directory, which could be accessed by any appropriate Samba client application.

Appendix B: Wireless Router Setup

A GL-MT300N-V2 Mini Smart Router is provided for use when the Local Area Network (LAN) is not available. When Wi-Fi is **ON**, the analyzer will obtain a Dynamic Host Configuration Protocol (DHCP) address from the router. The user can plug any Windows computer into the same broadband router to access the data directory.

The router is pre-configured and assigns an IP address to its' specific analyzer.

To use the wireless router:

1. Connect the provided GL-MT300N-V2 Mini Smart Router:
   a. Connect the white cable from the Power port of the router to a USB port on the analyzer. (Figure below)
   b. Connect the provided Ethernet cable from the analyzer to the LAN port on the wireless router. (Figure below)

Figure 50: GL-MT300N-V2 Mini Smart Router

2. Reboot the analyzer.
3. The analyzer IP address will be in the format *192.168.8.XXX,* and will be displayed on the *Time/Files* screen. (Figure 52) To access this screen, press the **Setup** button on the *User Interface Control Bar*. (Figure 51)

Figure 51: Setup button on the User Interface Control Bar

4. The default *Time/Files* screen is displayed. (Figure 52)

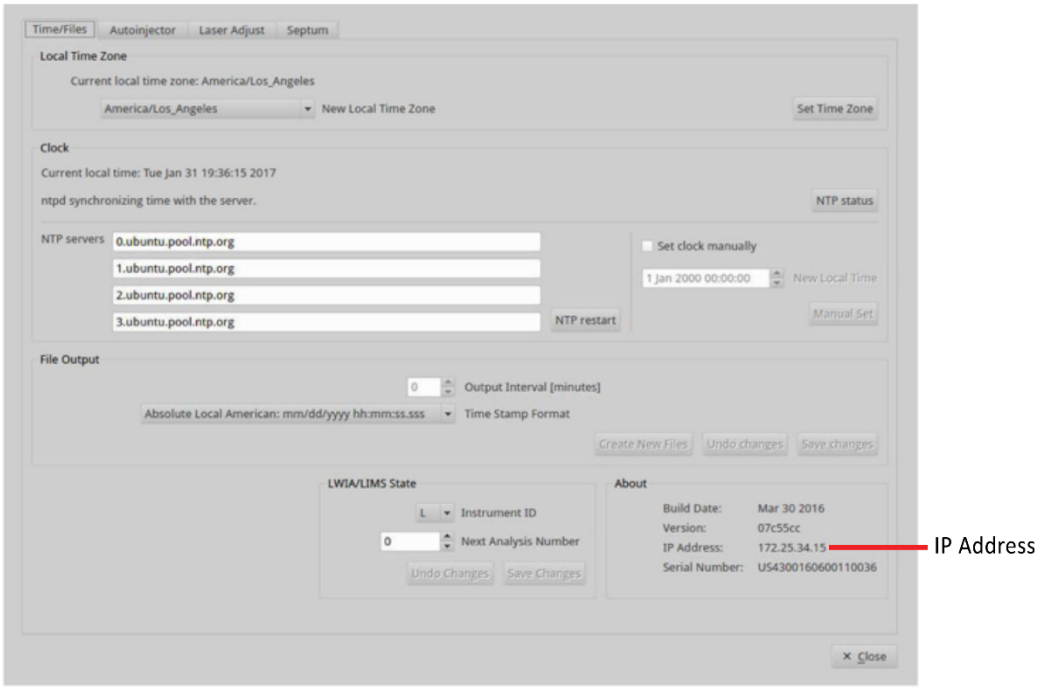

Figure 52: Time/Files Menu

Connect to a Windows Computer

On your personal Windows computer:

1. Click on the **network icon** at the bottom right corner of the screen. (Figure 53)

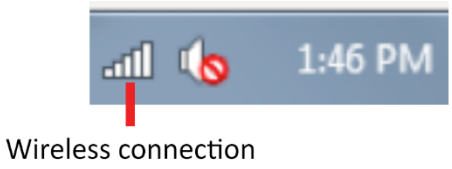

Figure 53: Wireless connection

2. From the list of wireless networks on the *Windows Wireless Networks* dialog-box (Figure 54) select the router. The name of the router is labeled on the front of the router. (example: SSID: **GLMT300N-V2-3a4**)

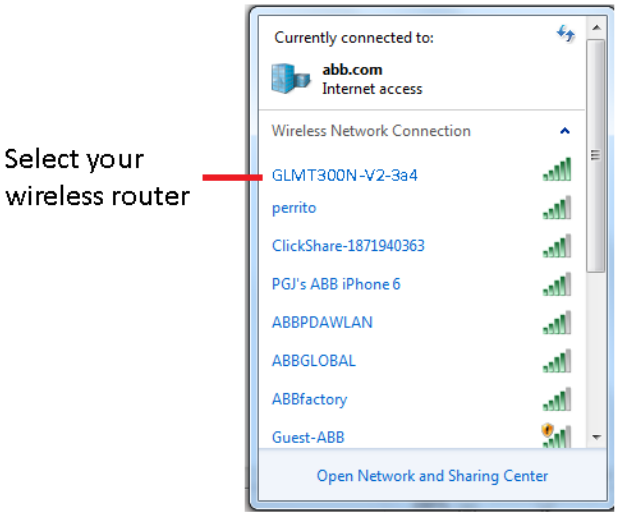

Figure 54: Windows Wireless Networks dialog-box

3. Press **Connect**. (Figure 55)

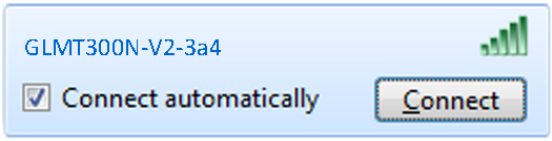

Figure 55: Connect

5. Type the password listed on the router into the Security key box: The password is **goodlife.** (Figure 56)

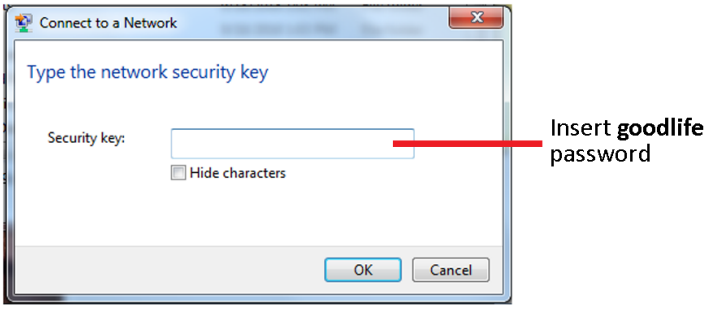

Figure 56: Security key box

6. Press **OK.** (Figure 56)

Reconfiguring the Wireless Router

If the router is to be used with a different analyzer, a new IP address will need to be assigned.

To setup the wireless router:

1. When the analyzer software is active, hover the mouse in the top, left corner of the screen and click on the  icon.
2. A window will pop up. Select **Web Browser**. (Figure 57)

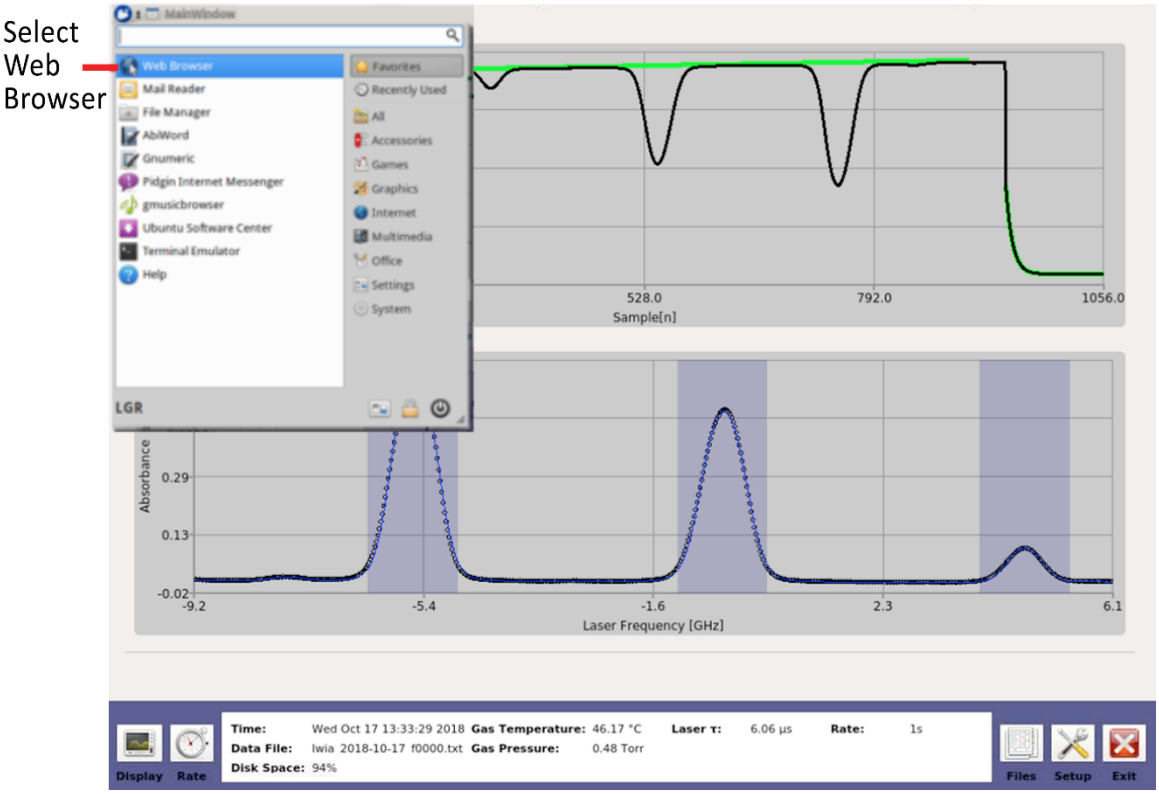

Figure 57: Select Web Browser from menu

3. Mozilla Firefox will open. Type **192.168.8.1**. Press **ENTER**. (Figure 58)

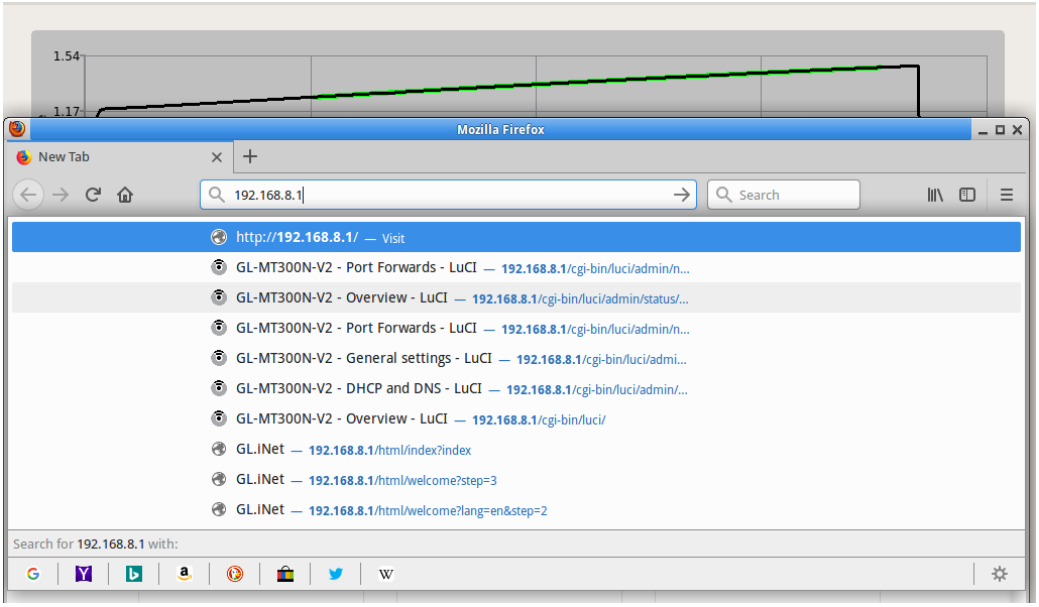

Figure 58: Mozilla Firefox screen

4. Type the password into the box: Password: **123456789** (Figure 59)

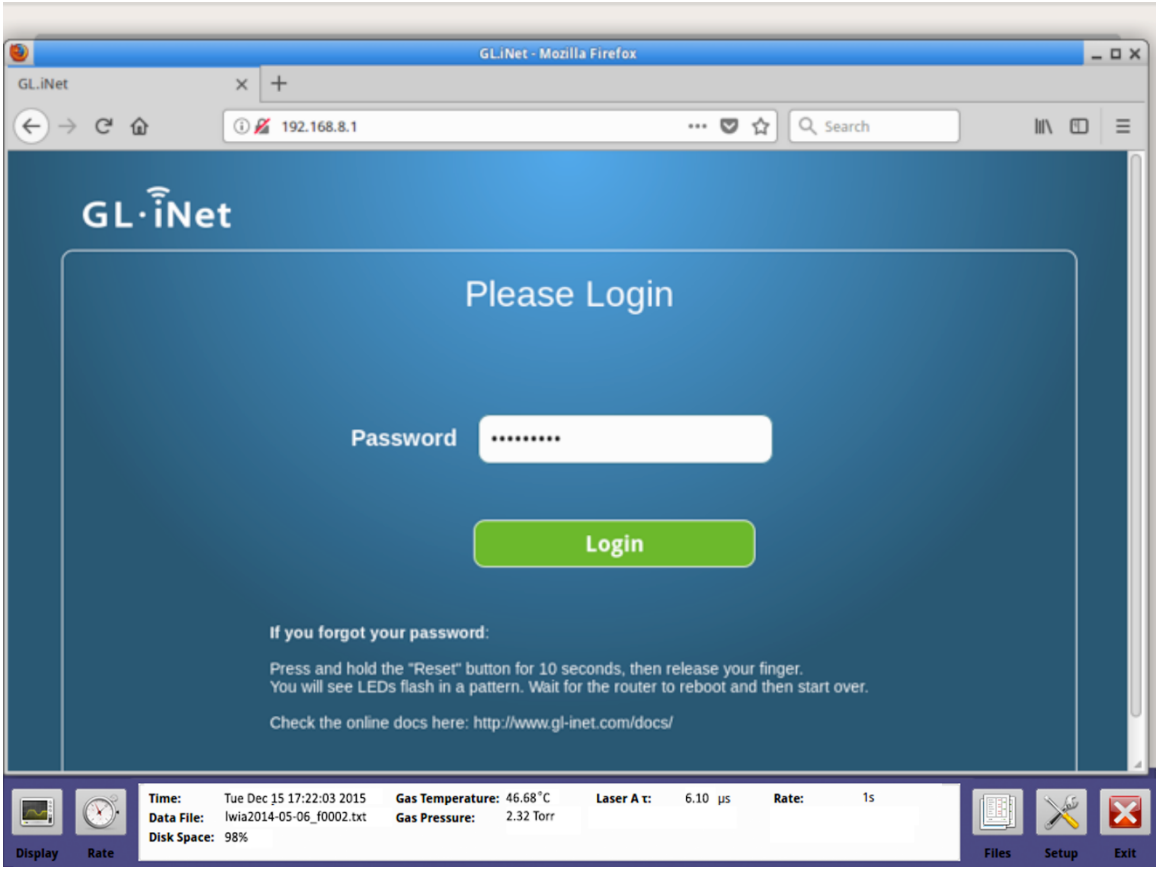

Figure 59: Enter password

5. Click **Advanced Settings** in the top right corner. (Figure 60)

Figure 60: Advanced settings

6. Re-enter the password, and click **Reset**. Password: **123456789** (Figure 61)

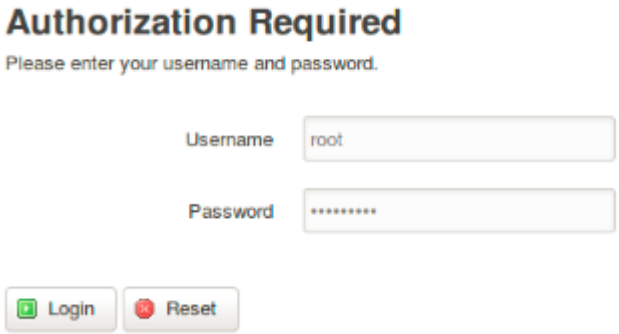

Figure 61: Enter password

7. Select the *Network* tab. (Figure 62)

Figure 62: Network tab

8. In the dropdown menu, select **DHCP and DNS**. (Figure 63)

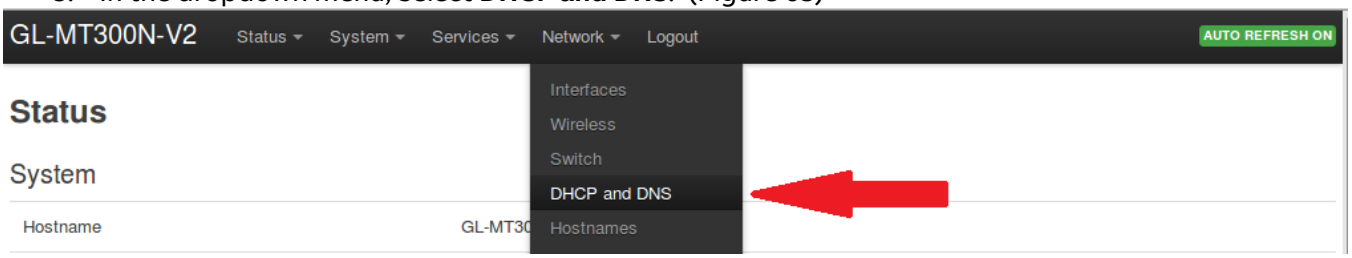

Figure 63: DHCP and DNS

9. Scroll down to *Static Leases* to set up the MAC-Address and IPv4 address for the analyzer.
   a. Click **Add**. (Figure 64)

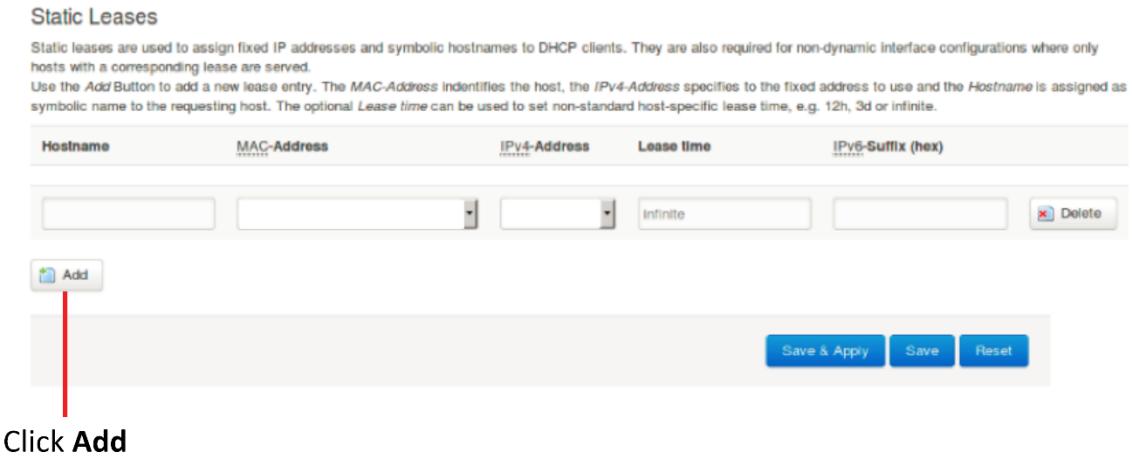

Figure 64: Static Leases

   b. Right click on the analyzer *home screen* to open a *Terminal Window.* Type: **ifconfig** and press **ENTER. (**Figure 65**)**

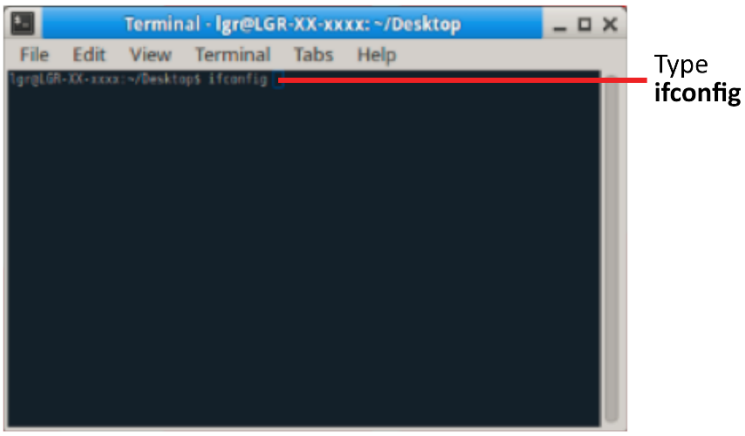

Figure 65: Type ifconfig in Terminal window

c. The terminal window will display the *MAC address* of the analyzer. (Figure 66)

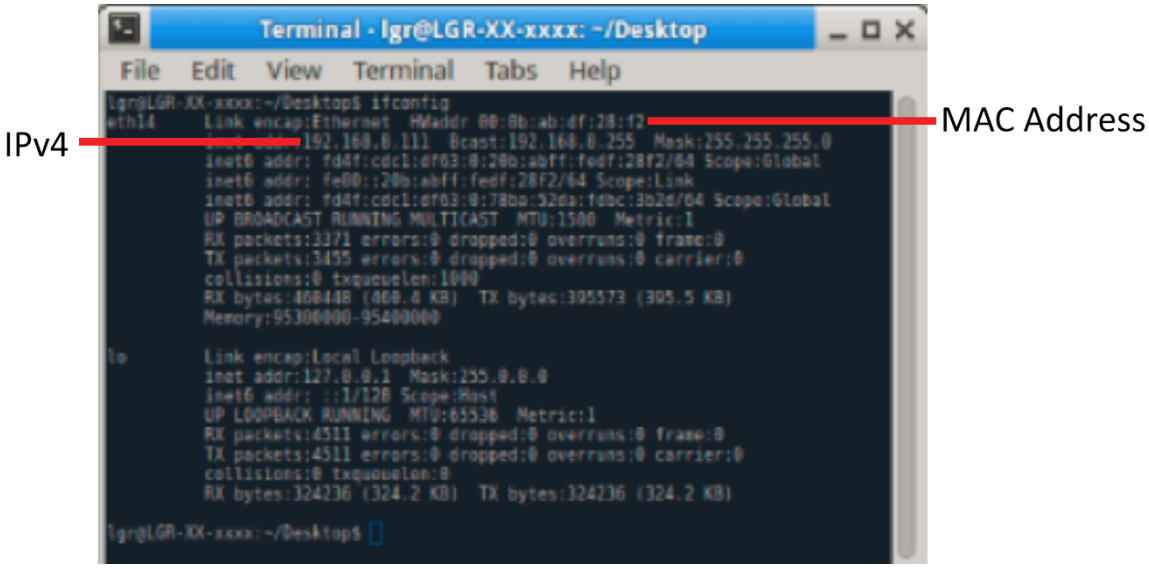

Figure 66: MAC address

d. Return to the *Static Leases* section in the Web Brower (Figure 67). Click on the **Mac-Address drop-down selection box** and choose the same address that is listed in the *Terminal Window.* (Figure 66)

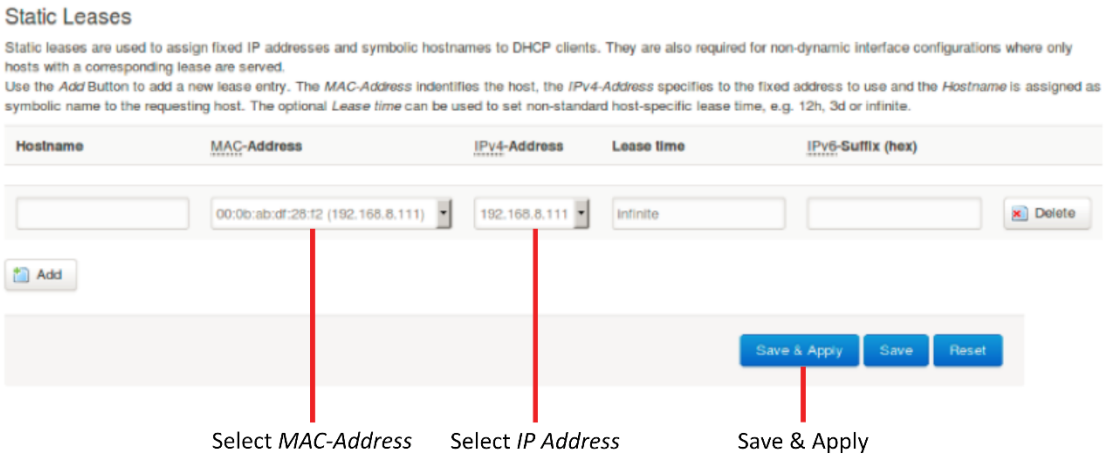

Figure 67: Static Leases

e. Click on the **IPv4-Address drop-down selection box** (Figure 67) and choose the same address that is listed in the *Terminal Window* (Figure 66)

f. Click **Save & Apply**. (Figure 67)

10. Select the **Network** tab at the top of the web browser. (Figure 68)
    a. Scroll to **Firewall** and press **ENTER.**

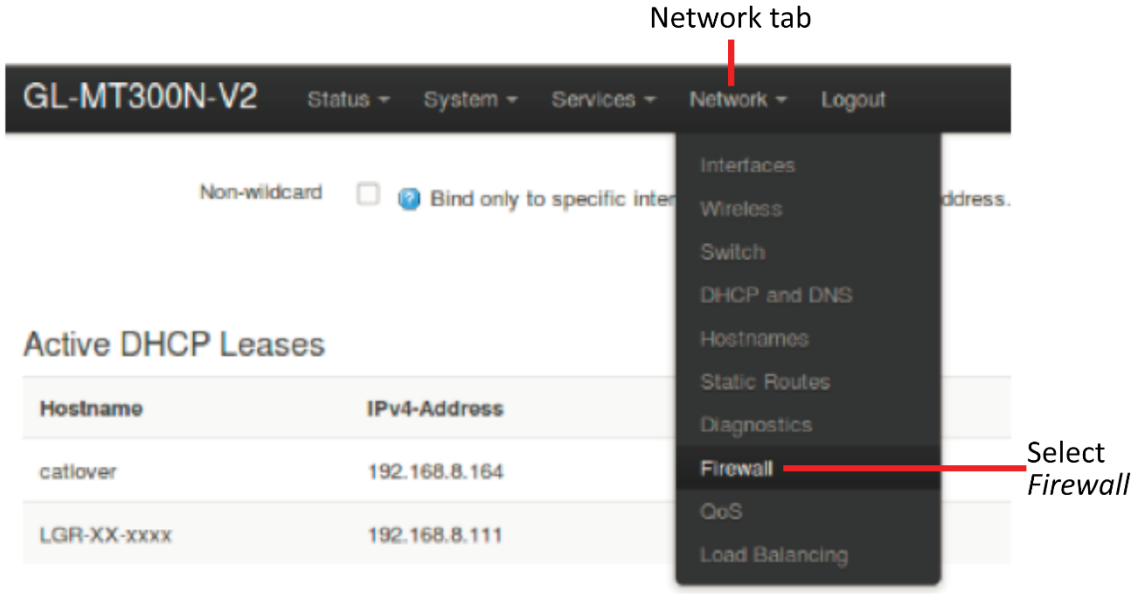

Figure 68: Network tab

11. Set Port Forwards for VNC, SSH, MODBUS, and SMB:
    a. Click the **Port Forwards** tab at the top of the screen. (Figure 69)

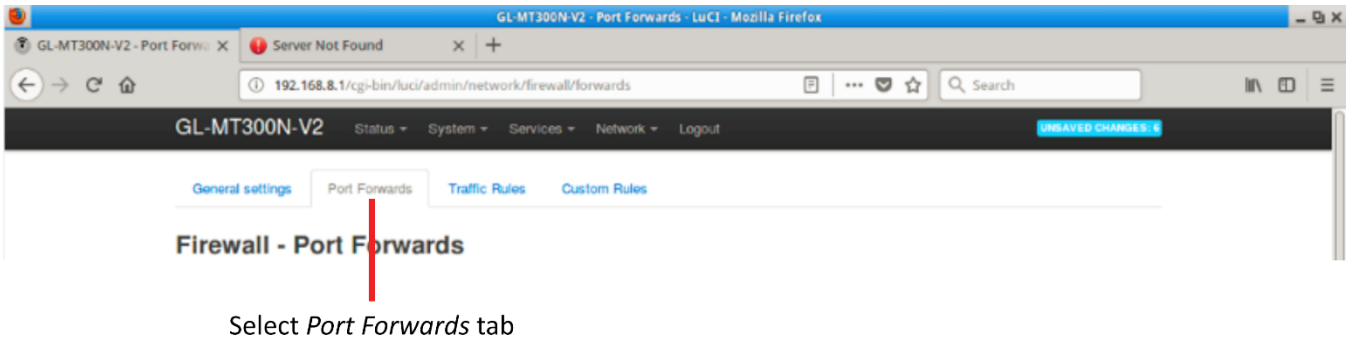

Figure 69: Port Forwards

b. Scroll to *New port forward* and set VNC: (Figure 70)
   i. Type Name: **VNC**
   ii. Set External port to **5900**
   iii. Set Internal port to **5900**
   iv. Select the *Internal IP address* drop down box and select the analyzer's IP address.
   v. Press **Add**

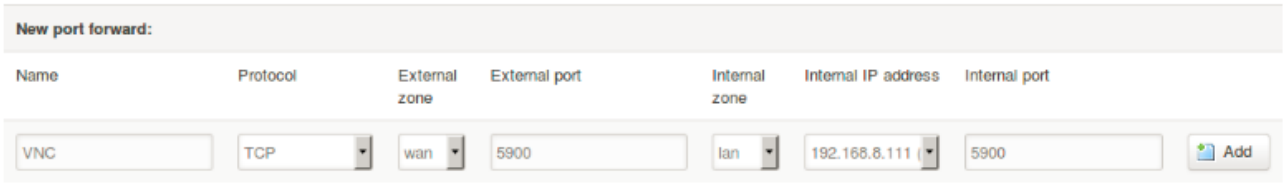

Figure 70: New port forward - VNC

c. Set SSH: (Figure 71)
   i. Type Name: **SSH**
   ii. Set External port to **22**
   iii. Set Internal port to **22**
   iv. Select the *Internal IP address* drop down box and select the analyzer's IP address.
   v. Press **Add**

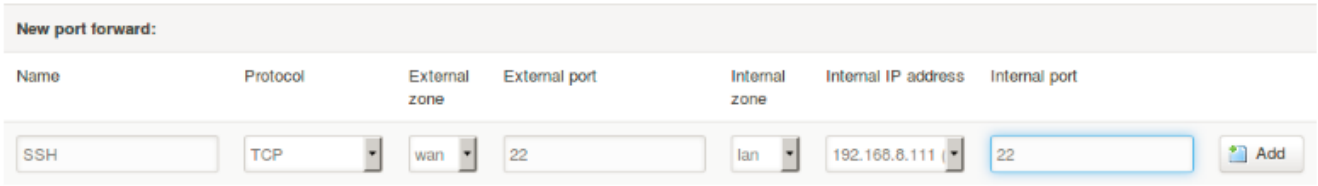

Figure 71: SSH

d. Set MODBUS: (Figure 72)
   vi. Type Name: **MODBUS**
   vii. Set External port to **2222**
   viii. Set Internal port to **2222**
   ix. Select the *Internal IP address* drop down box and select the analyzer's IP address.
   x. Press **Add**

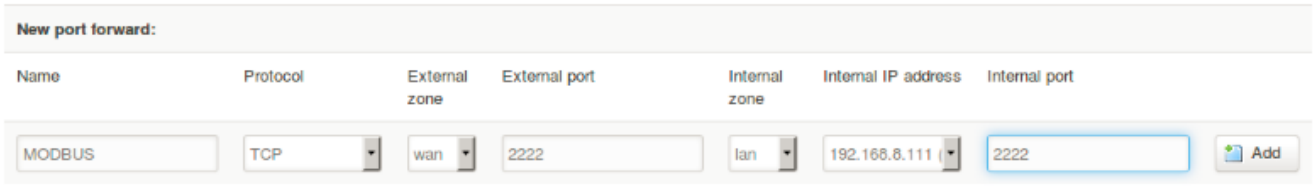

Figure 72: MODBUS

e. Set SMB: (Figure 73)
   xi. Type Name: **SSH**
   xii. Set External port to **445**
   xiii. Set Internal port to **445**
   xiv. Select the *Internal IP address* drop down box and select the analyzer's IP address.
   xv. Press **ADD**.

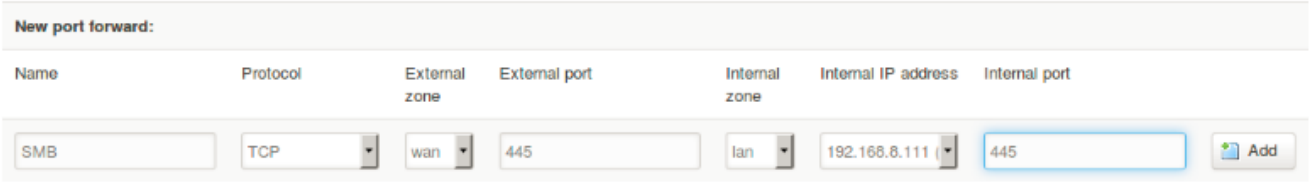

Figure 73: SMB

f. Click **Save and Apply.**
   xvi. Figure 74 shows all configured Port Forwards.

1.

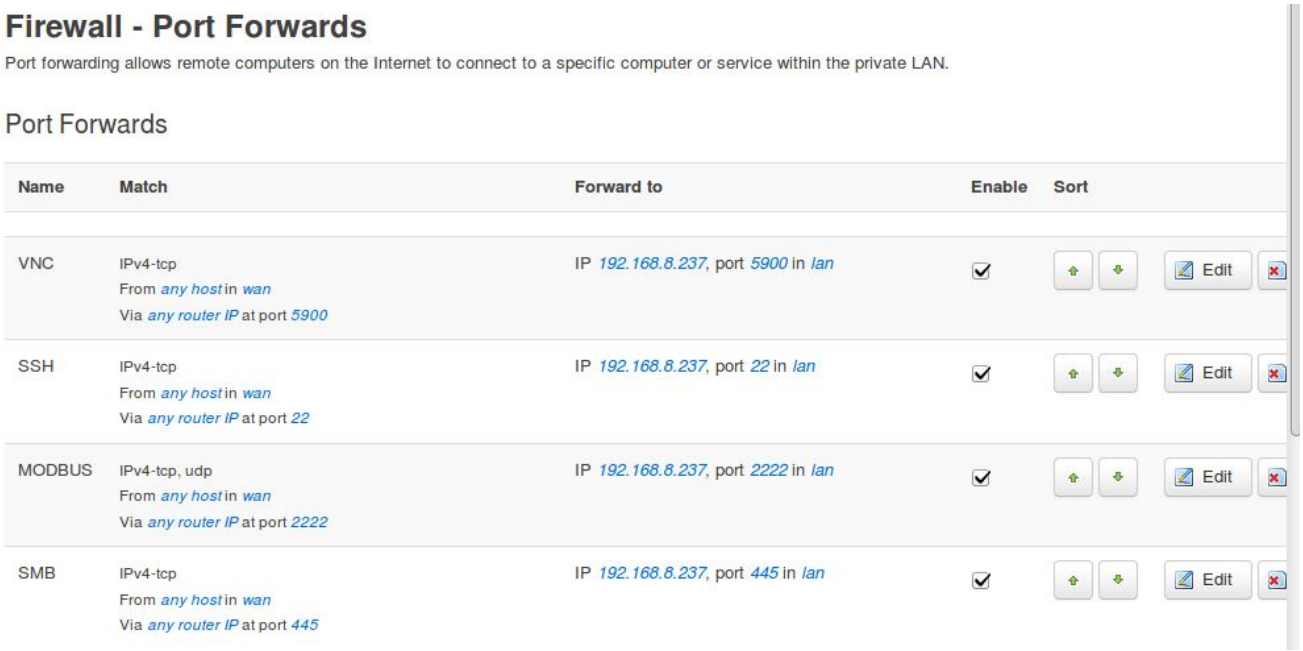

Figure 74: Configured Port Forwards

12. Re-type **192.168.8.1** and press **ENTER** to return to the *Main Window*. (Figure 75)

Figure 75: Main Window

13. The SSID written on the router should match the SSID within *Settings*. (Figure 75)
14. The analyzer serial number should match the serial number located in DEVICES within settings. (Figure 75)
15. Refer to **Connect to a Windows Computer** on page 65 to access the analyzer.

Appendix C: Set Up Devices for Remote Access Using VNC Software

Listed below are three types of devices that can be connected to the analyzer through the wireless router to access information:

- Android OS based devices (smart phones and tablets)
- iOS based devices (smart phones, tablets, and laptops)
- Windows based devices (smart phones, tablets, and laptops)

Each of these devices uses Virtual Network Client (VNC) software to connect the analyzer through the router. Follow the instructions below to install and set up VNC software on the device you are connecting to the analyzer.

Set up VNC Software on Android Devices

1. On the Android device, go to **Settings > WiFi > Connect to Wireless Network**.

2. Connect to the wireless SSID network printed on the front of the router. Enter the TP-Link wireless router (example: **TP-LINK-775C**).
    a. For ultraportable analyzers, the TP-Link wireless router is installed inside the analyzer and may be accessed by opening the case.
    b. For all other analyzers, the optional TP-Link wireless router is attached to the outside of the case.

3. Select **SSID**.

4. Enter the wireless password printed on the front of the router. Every router has a different, unique SSID number, and wireless password.

5. Select **Connect.** (Figure 76)

Figure 76: Password Connection Screen

6. A verification message appears, showing that the Android device is connected to the router. (Figure 77)

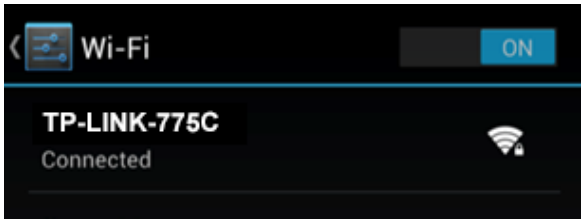

Figure 77: Connectivity Confirmation Screen

7. Ensure that the IP address of the Android device is correct by holding your finger down on the network connection icon. The IP address of the Android device is either 192.168.100.100 or 192.168.100.101.
    a. Wireless devices can compete for dynamic addresses. If the 192.168.100.100 address does not connect, then use 192.168.100.101.

8. Record the IP address of the Android device because it will be necessary to refer to it in Step 12.

9. Install the VNC software by searching and installing from the Google Play store. Search for *Android-vnc-viewer* and install the application by tapping on the **Install** button. (Figure 78)

NOTE

An Internet connection is required for this step.

NOTE

Complete instructions for installing the Android-vnc-viewer can be found online at: http://code.google.com/p/android-vnc-viewer/wiki/Documentation

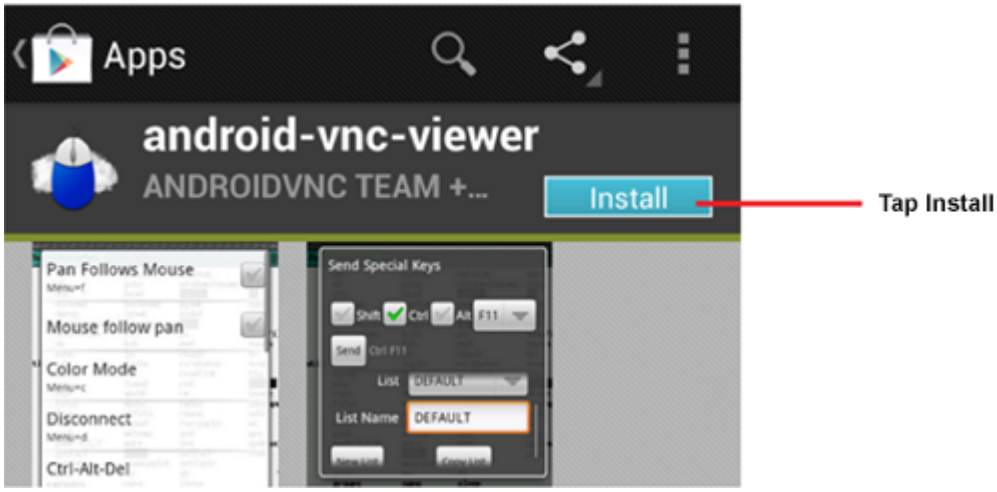

Figure 78: Android-vnc-viewer Install Screen

10. Open the VNC application on the Android device by selecting the **VNC** application icon. (Figure 79)

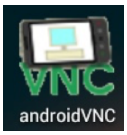

Figure 79: VNC Application Icon

11. The Android VNC screen appears. (Figure 80)

Figure 80: VNC Application Installation Setup Screen

12. In the *Address* field, enter the address of the analyzer (**192.168.100.100** or **192.168.100.101**) that you recorded in Step 8.

    The IP address of the analyzer will be whichever address the Android device is not. For example, if the IP address of the Android device that was displayed in Step 8 is **192.168.100.101**, then the IP address of the analyzer will be **192.168.100.100**.

13. In the Password field, enter **lgrvnc**.

14. Tap the **Connect** button to connect the Android device to the analyzer. The analyzer software interface screen displays on the device. The screen size is adjustable to fit the screen of the device. (Figure 81)

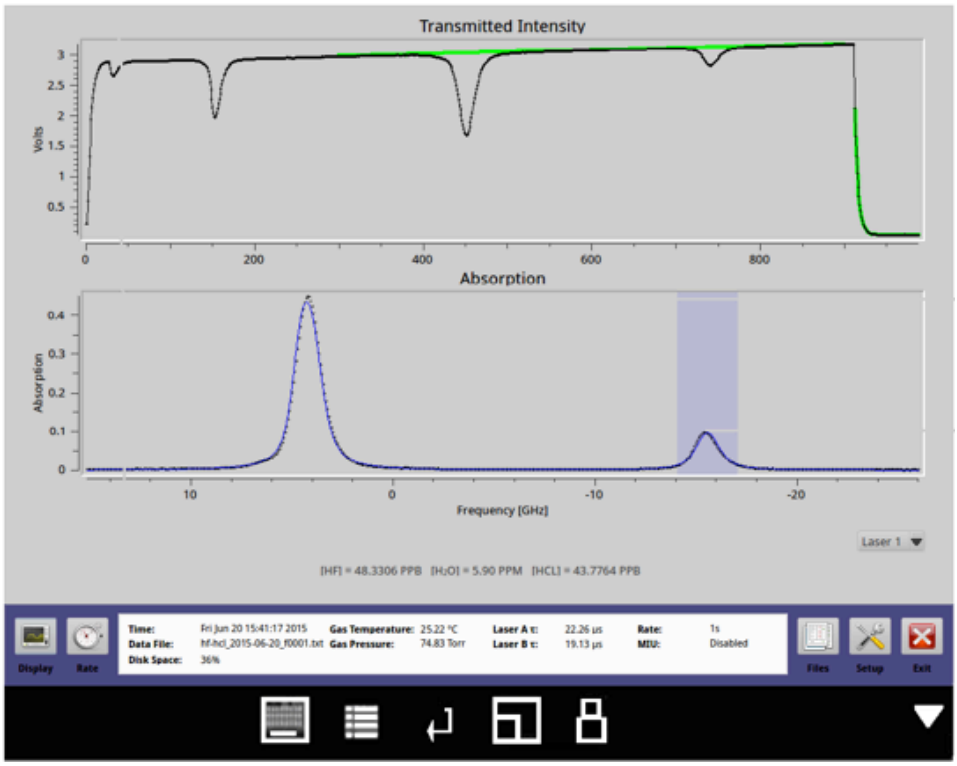

Figure 81: Analyzer Software Interface Display with Size Adjustment for Android Devices

Set up VNC Software on iOS Devices

1. On the iOS device, go to **Settings > WiFi**, then select the network from the list.

2. Connect to the wireless SSID network. Enter the TP-Link wireless router. (example: **TP-LINK-775C**)
    - For ultraportable analyzers, the TP-Link wireless router is installed inside the analyzer and may be accessed by opening the case.
    - For all other analyzers, the optional TP-Link wireless router is attached to the outside of the case.

3. Select your SSID network. For example, **TP-LINK-D036**. (Figure 82)

Figure 82: Network Connections Screen

4. The *Enter Password* screen appears. (Figure 83) In the Password field, enter the wireless password printed on the front of the router.

5. Select **Join**.

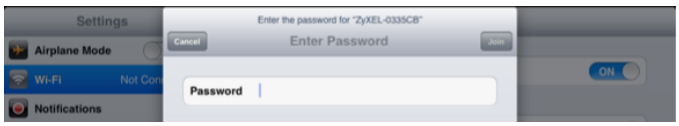

Figure 83: Router Connection Screen

6. The *Network Connections* screen confirms that the iOS device is connected to the router. (Figure 84)

Figure 84: Router Connection Confirmation Screen

7. Select the network to check the IP address (**192.168.100.100** or **192.168.100.101**) of the device as shown in Figure 85.
    a. Wireless devices can compete for dynamic addresses. If the 192.168.100.100 address does not connect, then use 192.168.100.101.

8. Record the IP address of the iOS device because it will be necessary to refer to it in Step 12.

Figure 85: Device IP Address Confirmation Screen

9. Install the VNC software by searching and installing it from the App store.
    a. *Mocha VNC Lite for iOS* is the software used in this example. (Figure 86)
    b. An Internet connection is required for this step.

NOTE

Complete instructions for installing *Mocha VNC Lite for iOS* can be found online at: http://www.mochasoft.dk/iphone_vnc_help2/help.htm.

Figure 86: VNC Selection Screen

10. Open the application and select **Configure**. (Figure 87)

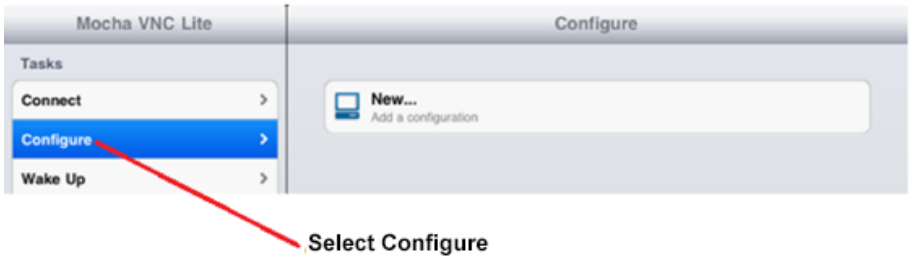

Figure 87: Mocha VNC Lite Configure (New) Screen

11. The *Configure Screen* prompts you for the server IP address and password. (Figure 88)

Figure 88: Mocha VNC Lite Configure Screen

12. Enter the analyzer's address in the *VNC server address* field (**192.168.100.100** or **192.168.100.101**), from Step 8.

    The IP address of the analyzer will be whichever address the iOS device is not.

    For example, if the IP address of the iOS device that was displayed in Step 8 is **192.168.100.101**, then the IP address of the analyzer will be **192.168.100.100**.

13. In the *VNC Password field*, enter **lgrvnc**.

14. Select **Connect**.
    The *Setup Configuration* screen displays the IP address. (Figure 89)

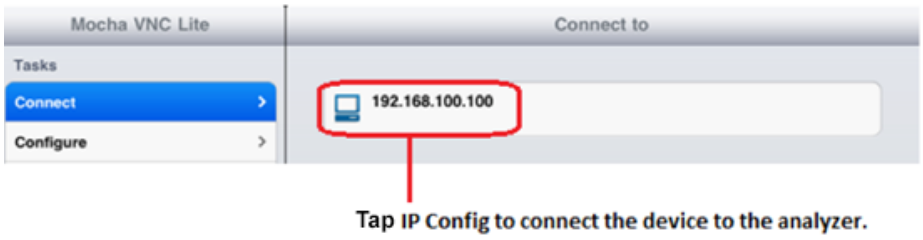

Figure 89: Setup Configurations Screen

15. To connect the iOS device to the analyzer, tap the **IP Config** you set up. The analyzer software will display on the device. (Figure 90) The screen size is adjustable to fit the screen of the device.

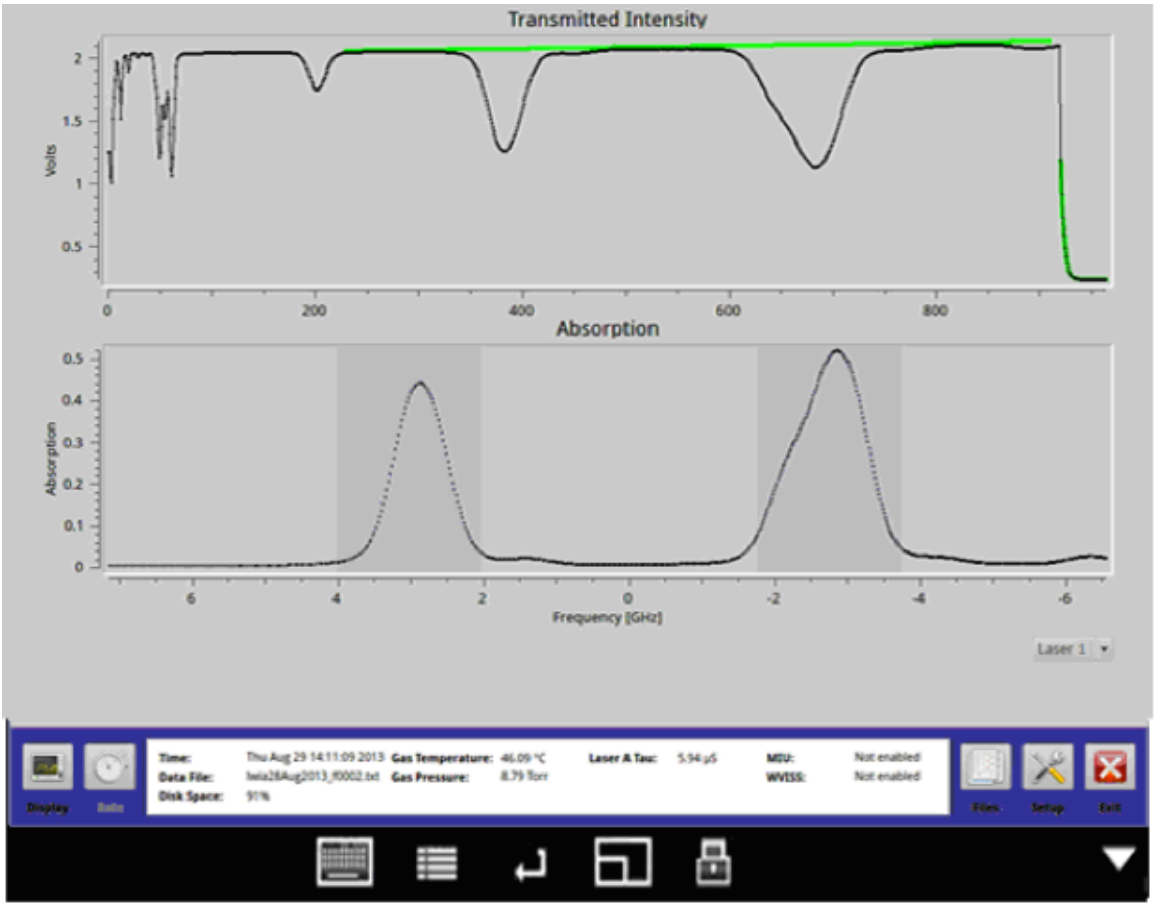

Figure 90: Analyzer Software Interface Screen (Size Adjustment for iOS Devices)

Set up VNC Software on Windows Devices

1. On the Windows device, open *Wireless Router* options.
2. Locate the router number printed on the front of the router.
3. Click on the **Wireless Network Connections** icon in the bottom left of the screen (Figure 91) to open the *Windows Wireless Networks* dialog-box. (Figure 92)

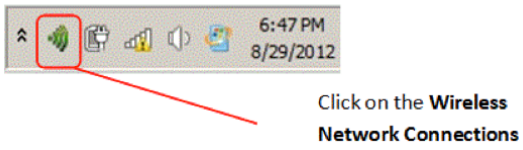

Figure 91: Wireless Connections Icon

Figure 92: Windows Wireless Networks

4. Select the SSID network name listed on the router sticker, (Example: **TP-LINK-775C**), to display the *Connect to a Network* dialog-box. (Figure 93)

5. In the *Security key* field, enter the wireless password printed on the front of the router.
6. Click **OK**.

Figure 93: Network Connections Security Screen

7. The *Connection Status* dialog-box displays. (Figure 94)

Figure 94: Current Connectivity Screen

8. Check the connection to make sure the device is connected through the wireless router by selecting the router. (Figure 95)

Figure 95: Wireless Network Connection Screen

9. Verify the IP address of the Windows device:
    a. Right-click on the **TP-LINK-775C** network connection.
    b. Click **Status**. (Figure 96)

Figure 96: Current Connectivity Screen

10. The *Wireless Network Connection Status* dialog-box displays. (Figure 97)

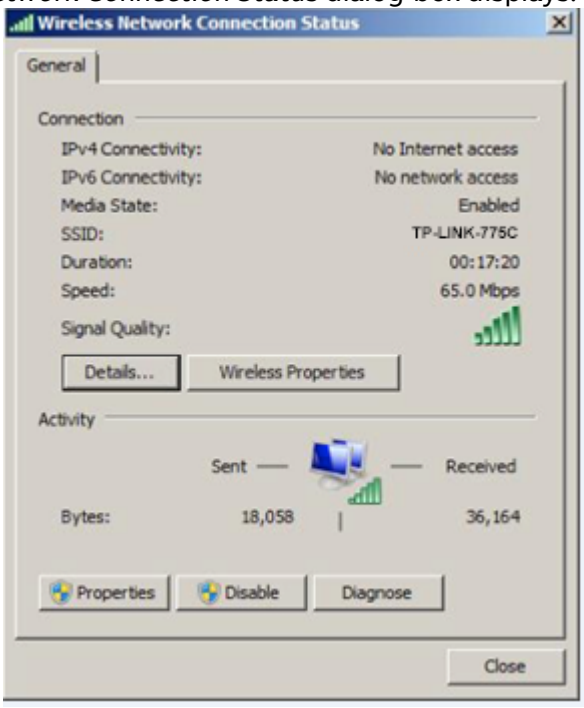

Figure 97: Wireless Network Connection Status Window

11. Click the **Details** button to display the *Network Connection Details* window. (Figure 98)

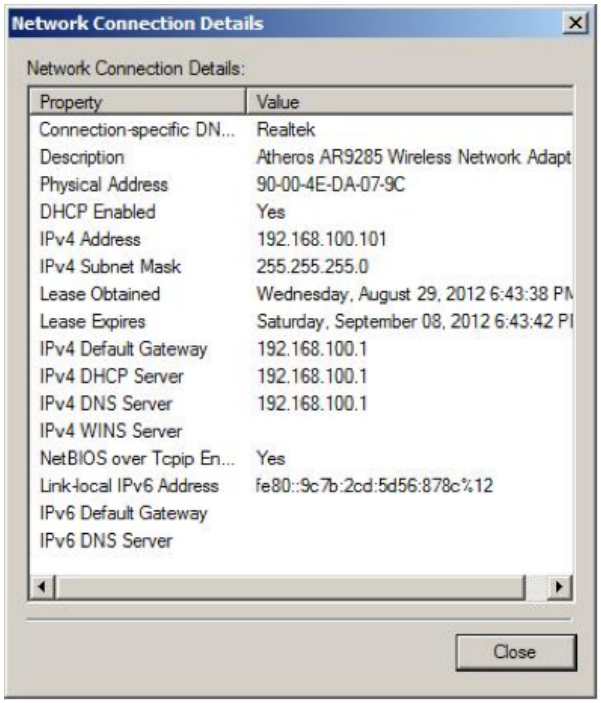

Figure 98: Network Connection Details Window

12. Verify the *Ipv4 Address* of the Windows device, which should be either **192.168.100.100** or **192.168.100.101**. For example, the Windows device IP address is **192.168.100.101.** (Figure 98)

13. Install the VNC software by going to the *RealVNC* website and downloading the RealVNC Viewer "EXE" file from http://www.realvnc.com/download/.

NOTE

Detailed instructions for installing Real VNC Viewer for Windows can be found online at:
http://www.realvnc.com/products/vnc/documentation/5.0/guides/user/Chapter1.html

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14. Open the program by clicking the **Connect** button. (Figure 99)

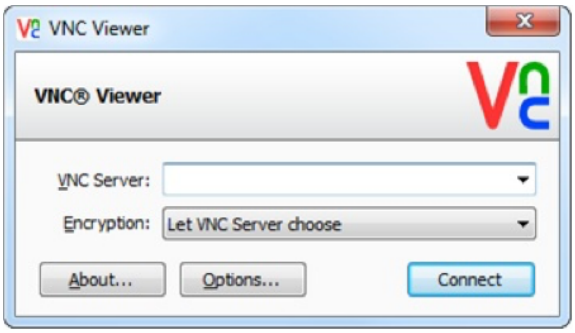


Figure 99: Real VNC Viewer Installation Screen

15. Enter the analyzer's address in the VNC server address field (**192.168.100.100** or **192.168.100.101**), from Figure 98.

    The IP address of the analyzer will be whichever address the Windows device is not. For example, if the IP address of the Windows device that was displayed in Step 12 is **192.168.100.101**, then the IP address of the analyzer will be **192.168.100.100**.

    Wireless devices can compete for dynamic addresses. If the 192.168.100.100 address does not connect, then use 192.168.100.101.

Appendix D: Multi-Port Inlet Unit (Optional)

The Multiport Inlet Unit (MIU) directs samples of multiple unknown gases and multiple reference gases through a series of inlet ports and digitally controlled valves directly into the inlet port of the analyzer. The gas manifold control screen (Figure 100) controls which gases are introduced into the inlet port of the analyzer in what order and for how long.

By sampling references periodically during an ongoing data run, you can post-correct the data for long-term drift when active calibration cannot be done.

ABB-LGR offers two versions of the MIU:

- 8 port
- 16 port

Figure 100 shows the front panel of a 16 port MIU.

Figure 100: 16 Port MIU Front Panel

NOTE

Control of the MIU is unidirectional. The analyzer does not receive feedback on the MIU state. If the MIU is enabled in the analyzer Setup Panel, the data file is tagged with MIU valve descriptions whether or not the MIU is properly connected. The data file simply logs the condition of the control signal to the MIU.

Figure 101 shows the back panel of a 16 port MIU. The MIU inlet ports are labeled numerically on the back panel of the MIU. The outlet port connects to the gas inlet on the analyzer. The MIU is shipped with these accessories:

- A 25-pin control cable (connects the analyzer to the MIU)
- A power cable (Powers the MIU)
- A 1/4" x 6' Teflon tube (connects the outlet port of the MIU to the inlet port of the analyzer)

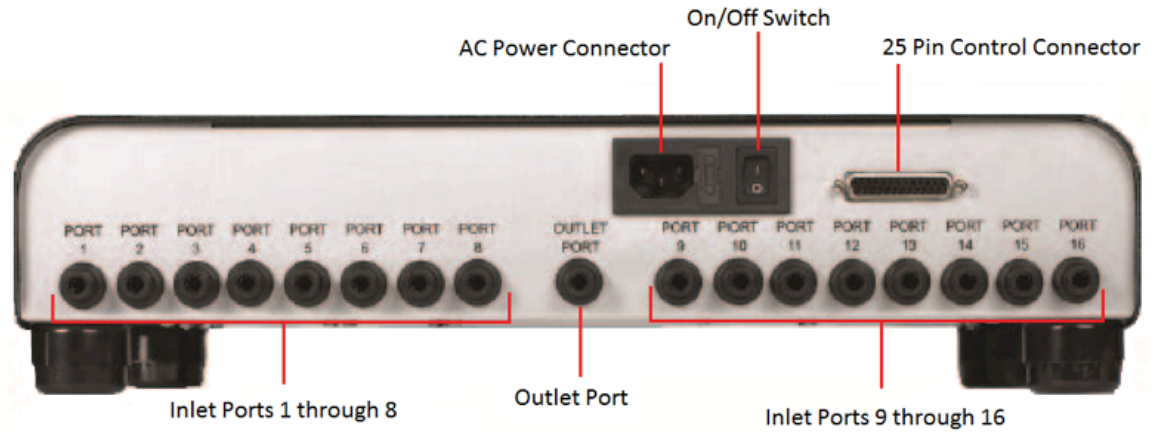


Figure 101: MIU Back Panel

Set Up the MIU

Connect the Components

1. Connect the provided power cable into the fused power-entry module on the back panel.
2. Connect the 25-pin control cable from the MIU to the TO MIU port on the back panel of the analyzer.
3. Connect a 1/4" Teflon tube from your gas source into one of the numbered inlet ports. Repeat for multiple gases.
4. When connecting the tubing, push the tube into the port until you feel a click in order to avoid leaks in the seal.
5. Connect the provided 1/4" x 6' Teflon tube from the MIU outlet port to the Inlet port of the analyzer.
6. Turn on the power switch on the back panel of the MIU.

Disconnect the MIU

1. Push the outer ring around the inlet and outlet connectors on the MIU to release the 1/4" tubing.

Control the MIU Using the Analyzer Setup Panel

1. Click **Setup** on the *User Interface Control Bar.* (Figure 104)
2. Click on the **MIU tab** at the top of the *Setup* menu selection bar. (Figure 102)
    a. The *MIU setup* menu becomes active. Use the menu to specify what ports are sampled and for how long.

Figure 102 shows the *Gas Manifold Control* Screen for the MIU not yet enabled.

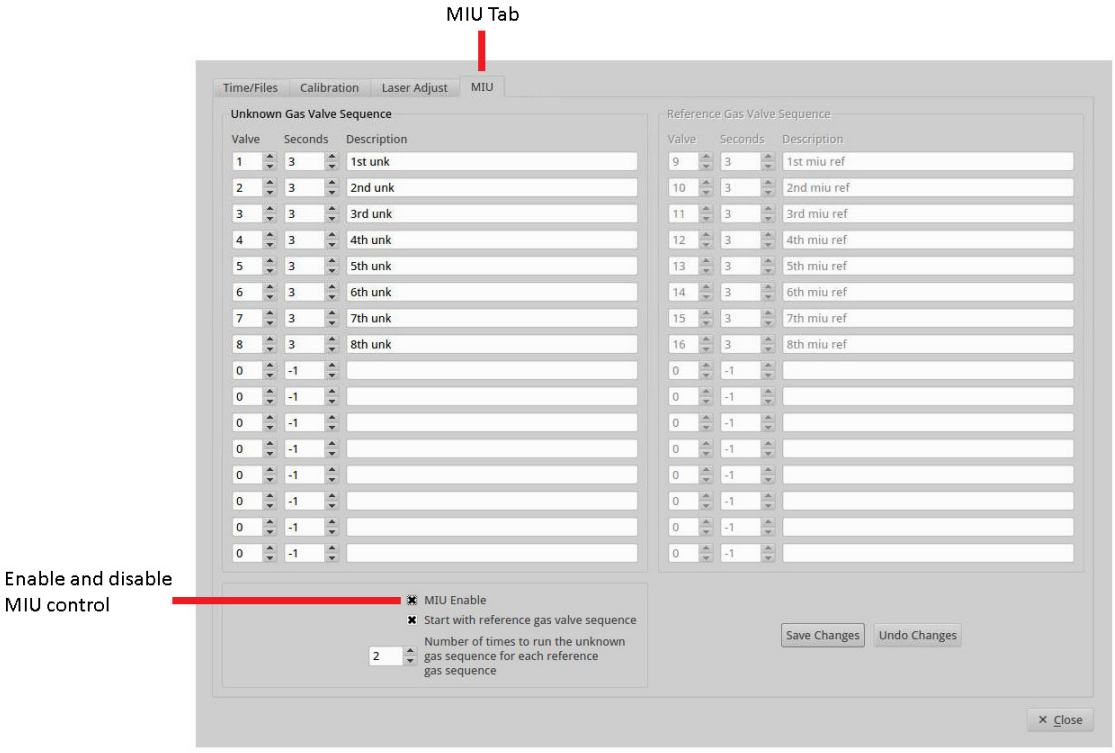


Figure 102: Gas Manifold Control Screen for the MIU, not yet enabled

3. Populate the unknown gas valve sequence:
    a. Valve - The current valve being sampled (corresponds to the port number on the MIU).
    b. Seconds - How long the analyzer should sample the gas (in seconds).
    c. Description - Input a short text description associated with the gas connected to that valve.

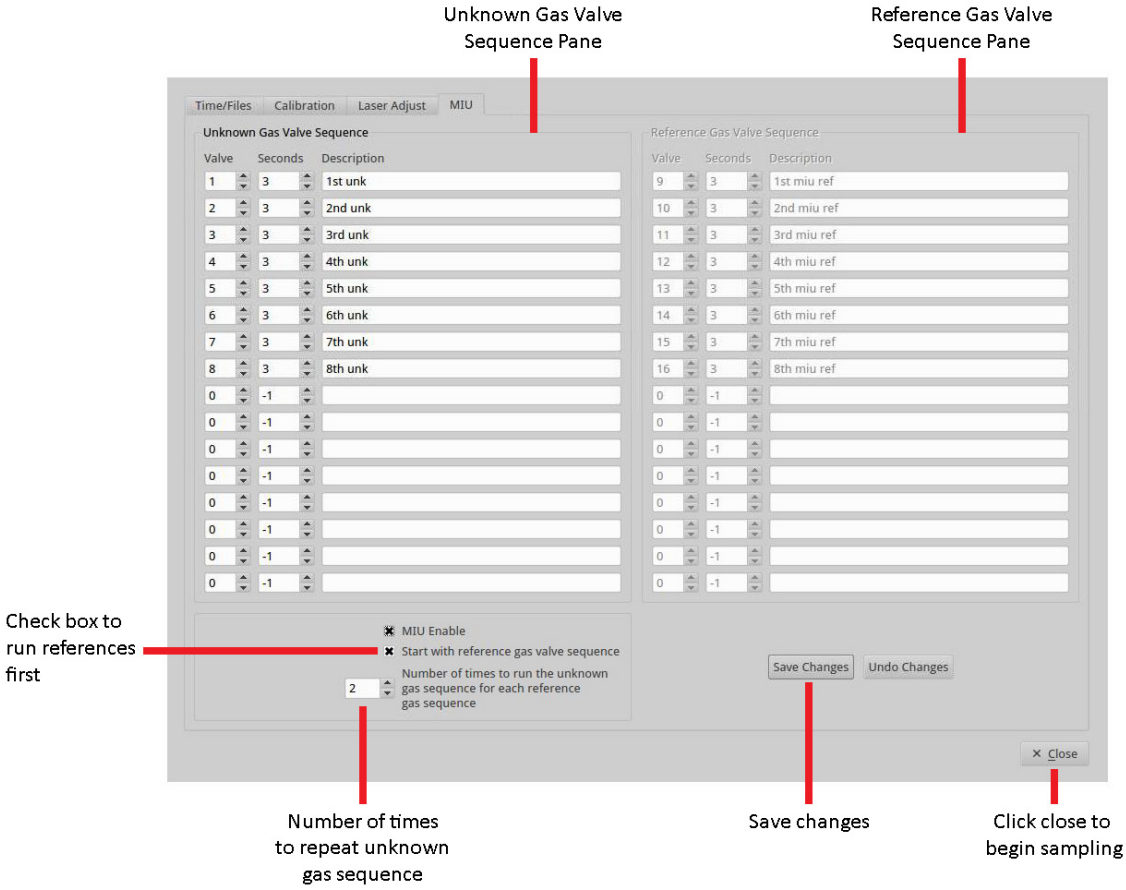


Figure 103: Gas Manifold Control Screen for the MIU, Enabled

NOTE

If a valve is set to 0, the entry is ignored. Each defined gas is sampled sequentially in its respective group (unknown or reference).

4. Populate the reference gas valve sequence:
   a. Valve - The current valve being referenced. Corresponds to the port number on the MIU.
   b. Seconds - How long the analyzer should reference the gas (in seconds).
   c. Description- Input a short text description associated with the reference gas connected to that valve.

5. Click on the **Start with reference gas valve sequence** check box if you wish to run your reference gases first.
6. Use the **arrow scroll bar** to select the number of times to run the unknown gas sequence for each reference gas sequence. (Figure 103)
7. Select **Save Changes** to save your current configuration.
8. To begin sampling, click **Close**. (Figure 103)

The MIU outlet port is:

- Open when the MIU is powered on
- Open at initialization
- Open and closes as specified on the *MIU tab* when the analyzer software has properly initialized

While the MIU is operating, the current valve being sampled/referenced and its text description is shown in the parameter window of the *User Interface Control Bar.* (Figure 104)

The description is:

- Displayed on the parameter window of the *User Interface Control Bar* during analysis. (Figure 104)
- Saved to a data file

Figure 104: User Interface Control Bar (showing MIU information)

9. When sampling is complete, disable the MIU by returning to the *MIU screen*, and uncheck the **MIU Enable** check box. (Figure 103)

Appendix E: External Dynamic Dilution System (Optional)

The External Dynamic Dilution System (EDDS), also known as the DCS, is an optional accessory. This section describes the EDDS and explains setup and operation.

Figure 105: EDDS Front & Back Panel

The EDDS:

- Automatically dilutes the sample stream with zero-air whenever the concentration rises above the target (50, 100, 250, or 500 ppm). It maintains the target concentration at that level.
- Has a response time constant of approximately 2 minutes, so a sudden rise in concentration will cause the concentration to over-range for up to 2 minutes while the EDDS adjusts the concentration to target.

The sample and the zero-air flow in through the gas inlets and are mixed in the EDDS. Both the sample and the zero-air must:

- Be pressurized to between 15 and 50 PSIG
- Have a sample gas flow capability of 200 SCCM
- Have a zero-air flow capability of 2.2 SLPM

NOTE

When transitioning from a large concentration to a lower concentration of gases, a memory effect may result from residual gas in the analyzer. Verify that the gas from the previous sample has had time to exit the system. Residual gas can also be removed by switching inlet lines, using shorter line lengths, or flushing lines with zero-air.

For the EDDS to work properly, the analyzer flow must be <200 sccm since that is the maximum flow of the sample gas. A 450μm orifice is provided with the analyzer to restrict the flow rate of the analyzer when the EDDS is used. The orifice is connected between the pretreatment box and the pump. (Figure 106) The orifice is optional for continuous mode without the EDDS and must be removed for Batch Mode Operation.

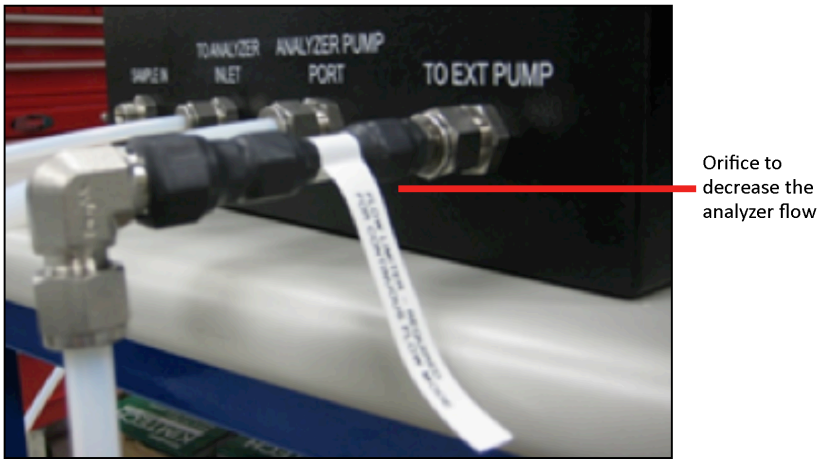


Figure 106: Orifice to decrease analyzer flow

Refer to *Appendix F:* Batch Mode Operation (Optional) on page 99 for Batch Mode Operation details.

Connect the EDDS

This section describes the EDDS hardware and how to connect it. (Figure 107)

1. Control cable – Connect the BNC cable between:
    a. The CONTROL IN port on the EDDS
    b. The DCS port on the analyzer
2. Sample line – Use a 9/16” wrench to connect the 6’ x 1/4” Teflon tubing between:
    a. The OUTPUT TO ANALYZER INLET port on the EDDS
    b. The sample inlet tee connector on the SAMPLE INLET port on the analyzer
3. Zero-air line - Use a 9/16” wrench to connect the 6’ x 1/4” Teflon tubing between:
    a. The ZERO AIR 15-50 psig port on the EDDS
    b. Your house air supply
4. Line to sample supply - Use a 9/16” wrench to connect the 6’ x 1/4” Teflon tubing between:
    a. The SAMPLE 15-50 psig port on the EDDS
    b. Your sample supply
5. Power cord – Connect the EDDS power cord from the port on the back panel to a grounded outlet of your power supply

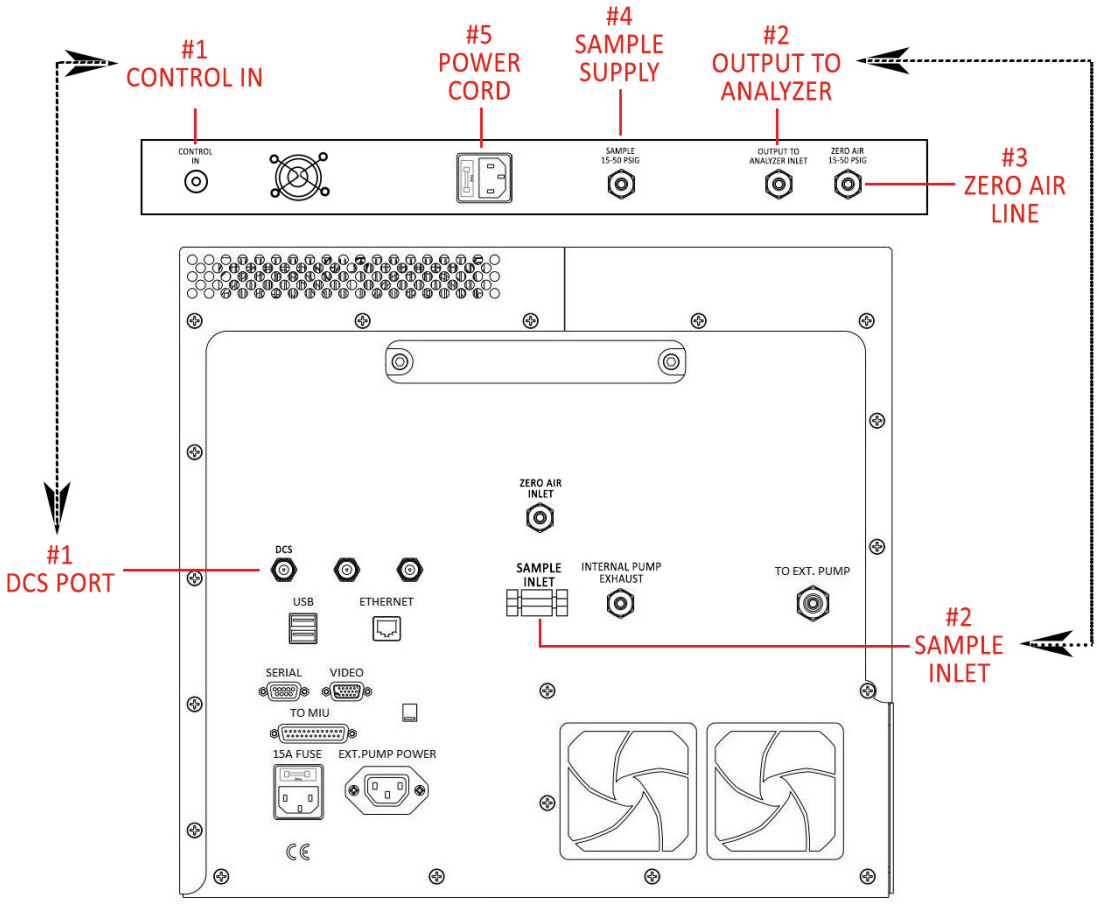


Figure 107: EDDS Connection System

Sample Inlet Tee Connector

The diluted gas flows into analyzer through a T-connector that allows for steady flow past the inlet to the analyzer. (Figure 108)

ABB-LGR recommends these T-connectors:
1/4” inlet: Swagelok SS-400-3
3/8” inlet: Swagelok SS-600-3

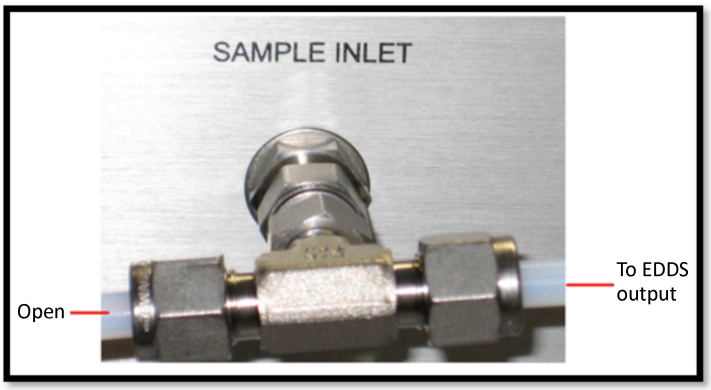


Figure 108: Inlet T-Configuration for the EDDS

WARNING

If you do not use the inlet tee, and connect the gases directly to the analyzer, the mass flow controllers will not maintain proper dilution.

Depending on the sample concentration the mass flow controllers adjust the amount of dilution:

- Sample flow can vary from 0 to 200 SCCM
- Zero-air flow can vary from 0 to 2.2 SLPM

Flow through the measurement cell should remain steady at approximately 180 SCCM or less, with the excess flow vented out through the inlet tee.

Enable the EDDS

1. Click **Setup** on the *User Interface Control Bar*. (Figure 109)

Figure 109: Setup button on the User Interface Control Bar

2. Click on the **DCS tab** at the top of the *Setup* menu selection bar. (Figure 110)
3. Use the radio buttons to Enable or Disable the EDDS.
4. Use the drop down selection box to set the dilution factor.
5. Click **Save**.
6. Click **Close** to begin the dilution.

Figure 110 shows the DCS Screen for the EDDS enabled.

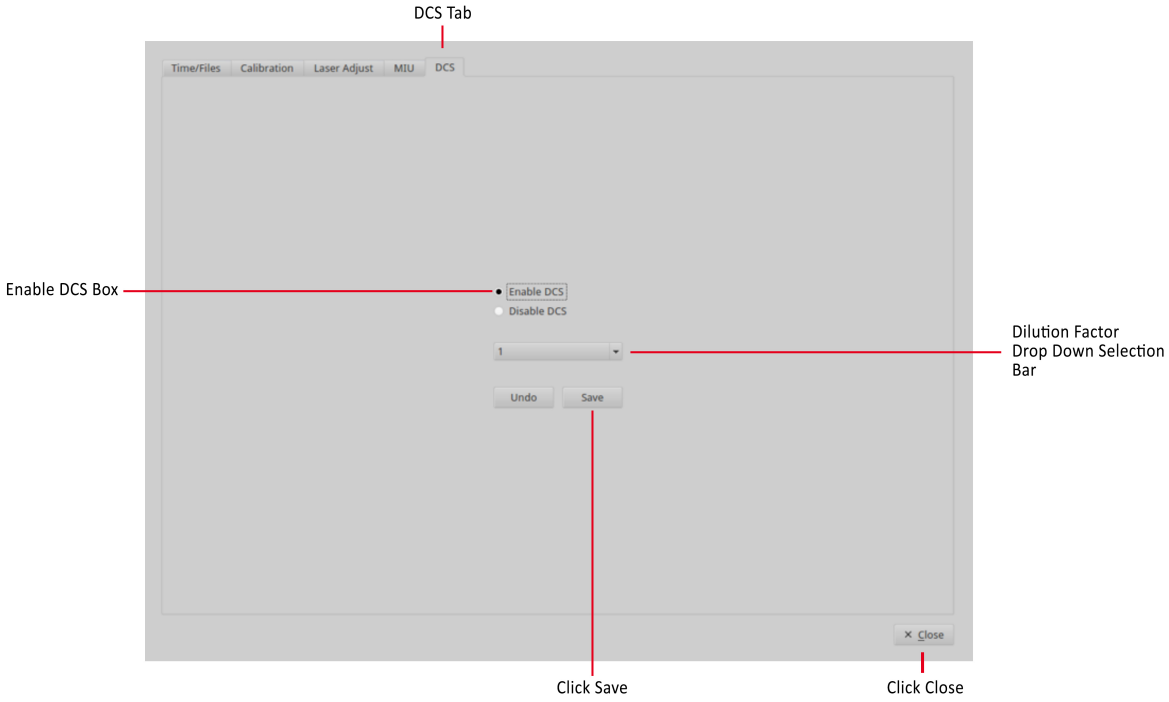


Figure 110: Enable EDDS

Appendix F: Batch Mode Operation (Optional)

The analyzer can be factory equipped to include a batch injection system. The batch system allows the user to manually introduce individual samples to the analyzer, using syringe injection.

Figure 111 shows the plumbing configuration for the optional batch mode.

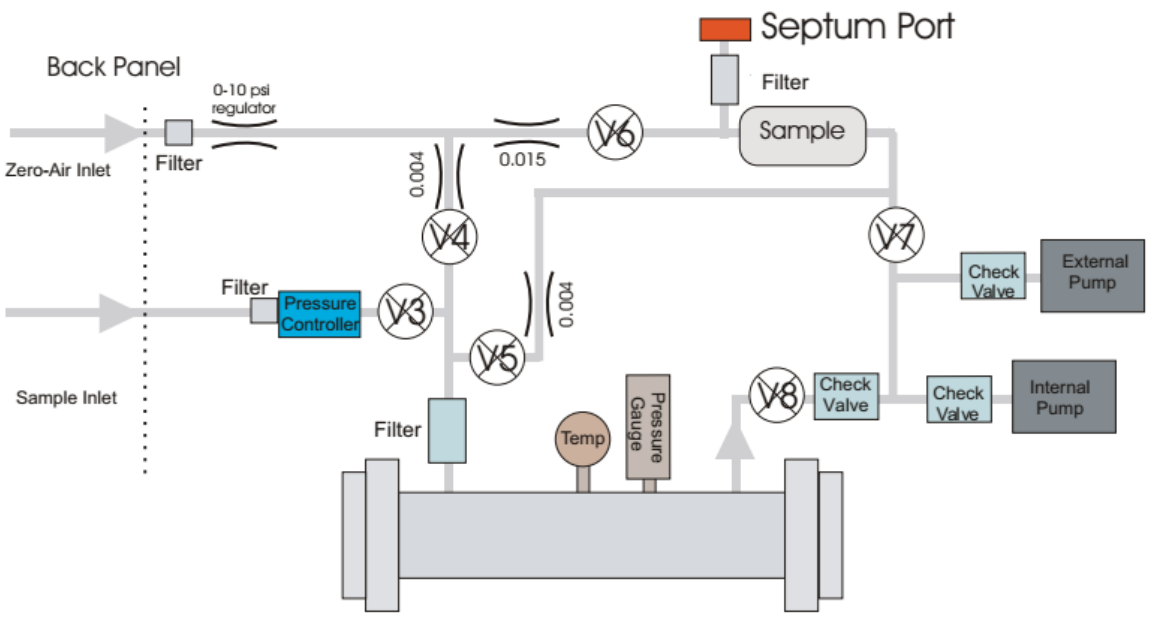


Figure 111: Batch Injection Plumbing Diagram

NOTE

Plumbing configurations may vary depending on analyzer type.

Accessories Required for Batch Injection

The necessary hardware and supplies for batch mode operation include:

- An external pump (ACC DP3H)
  - Pump slave power cord
  - Pump connection kit
- Additional ports on the front and back panels of the analyzer. (Figure 112)
  - Syringe injection port (front panel)
  - Zero-air inlet 1/4" Swagelok port (back panel)
- A 140mL Syringe with needle
- A 22-gauge centering needle

- Septa (Box of 50)
- A septum puller

Hardware Setup

Setup the External Connections:

1. Connect the External Pump:
    a. Connect the pump's power cord from the pump to the *EXT. PUMP POWER* port on the back panel of the analyzer.
    b. Connect the provided 6' x 3/8" Teflon tubing with Swagelok fittings from the external pump to the *TO EXT PUMP* port on the back panel of the analyzer.
    c. Connect the provided exhaust muffler to the exhaust port of the pump to exhaust into the room air, or route to your facility ventilation system.
2. Connect your Zero-Air source to the ¼" Swagelok Zero-Air Inlet port on the back panel of the analyzer. (Figure 112)
    a. Zero-Air flow should be set between 5 and 10 psig.

NOTE

The pretreatment box is not used for batch operation.

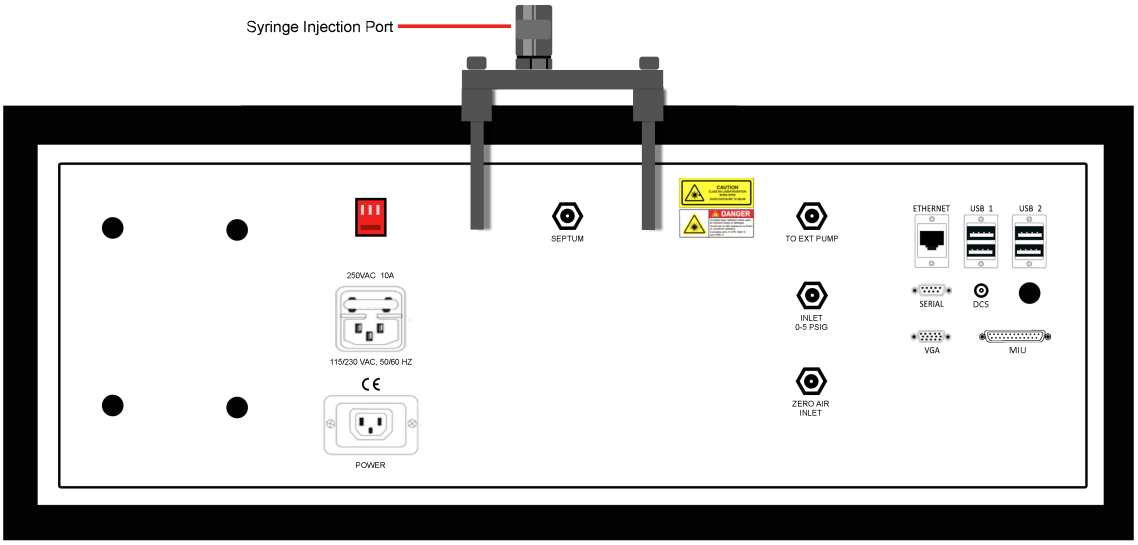


Figure 112: External Batch Connections

Software Setup

1. If applicable, in the parameter window of the *User Interface Control Bar*, verify that the optional MIU is not enabled. (Figure 113)
    a. Disable the *Multi-Port Inlet Unit (MIU)* if your analyzer is configured with this optional accessory. To disable the MIU:
        i. Click **Setup** on the *User Interface Control Bar*. (Figure 113)

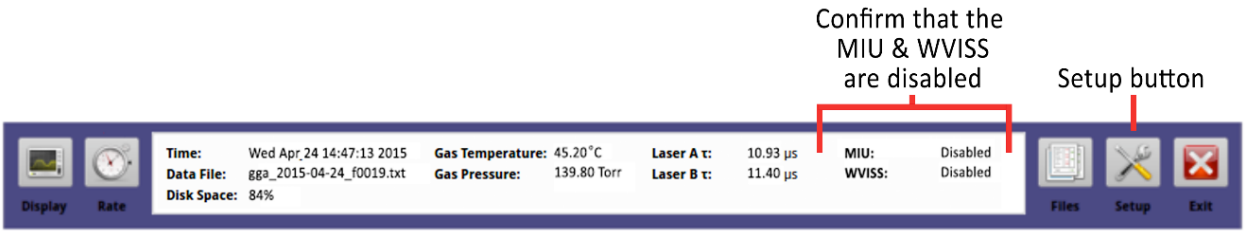


Figure 113: Setup Button on the User Interface Control Bar

ii. Click on the **MIU tab** at the top of the *Setup* screen. (Figure 114)
iii. Uncheck the checkbox at the bottom of the screen to disable the MIU. (Figure 114)
iv. Click **Save Changes**. (Figure 114)
v. Click **Close** to exit the *Setup* menu. (Figure 114)

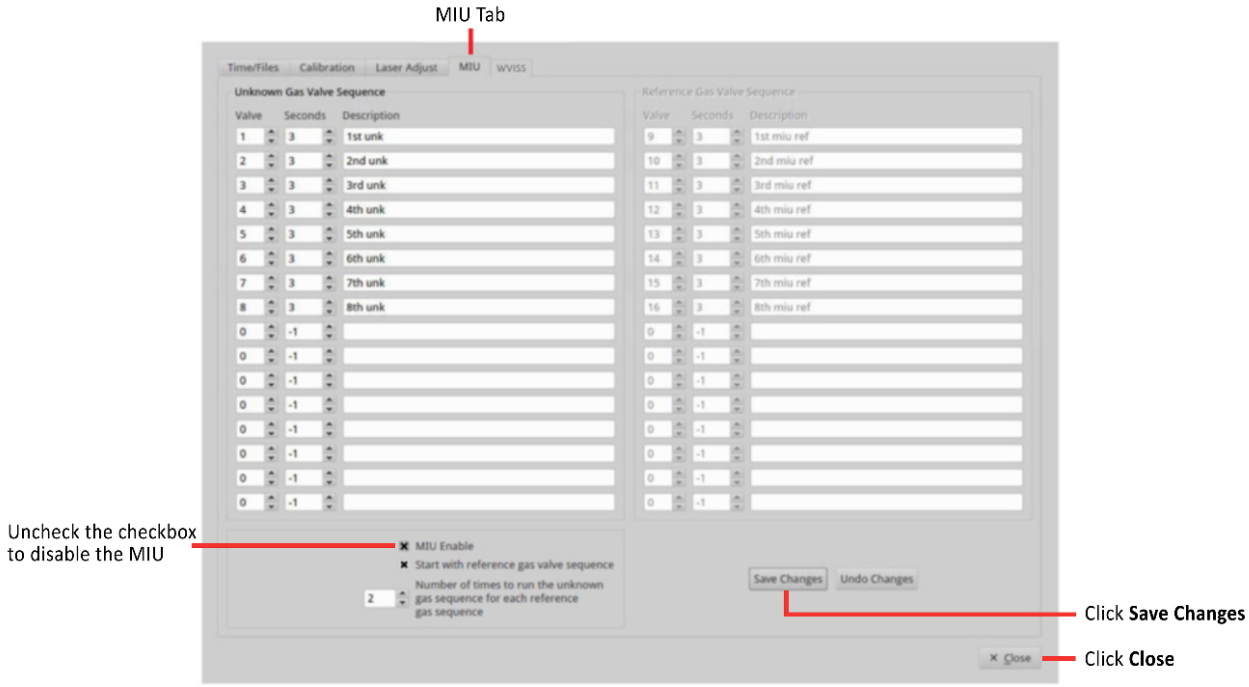


Figure 114: Control Menu for the (Optional) Multi-Port Inlet Unit (MIU)

2. Select Batch Injection mode in the analyzer software:
    a. Click the **RATE** button (clock icon) in the *User Interface Control Bar*. (Figure 115)

Figure 115: Click the Rate Button

3. The *Operating Mode* pop-up menu displays. (Figure 116)
    a. Select either:
        - Syringe Injection
        - Syringe Injection (Dilution x10), if applicable
            - The sample will be diluted x10 by filling the cavity with zero air before measurement.

4. Click **Save**.

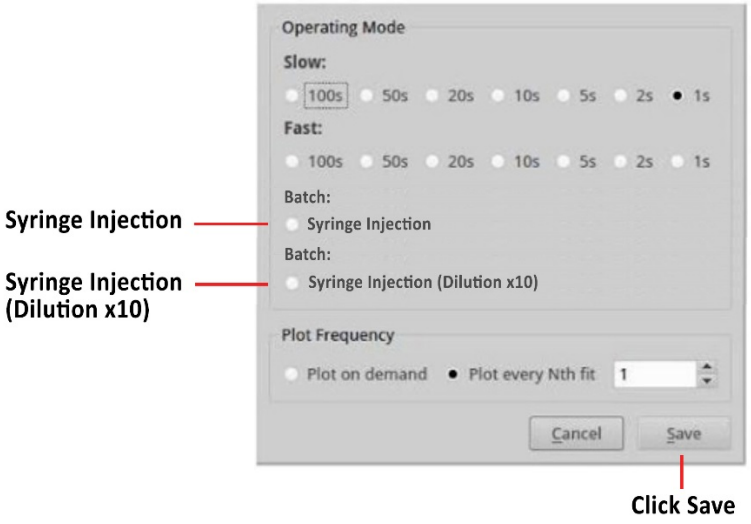


Figure 116: Rate Selection Menu

5. The *Batch Injection Measurement* screen displays. (Figure 117)
    a. This screen combines the three *Main Panel* display modes on one screen:
        - Numeric Display
        - Spectrum Display
        - TimeChart Display
    b. The *Batch Mode Status* display box in the lower right screen shows the status of the current injection. (Figure 117)

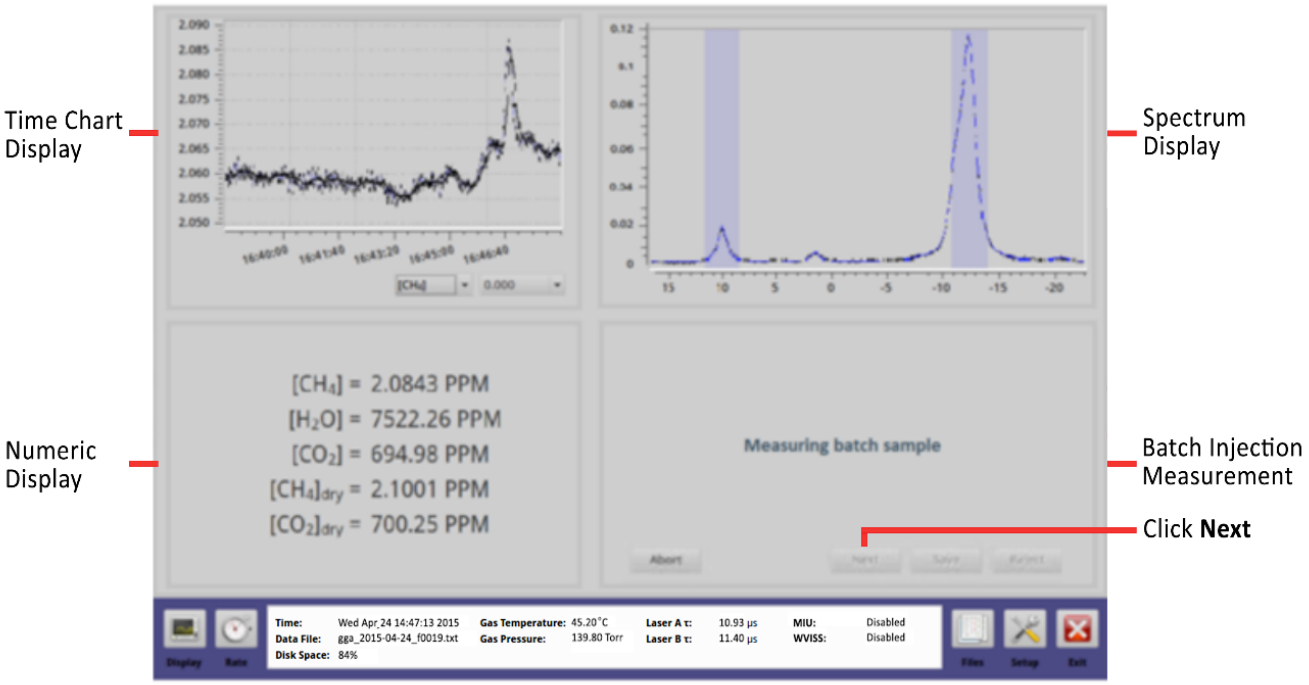


Figure 117: Batch Injection Measurement Screen

Batch Mode Processing

In *batch processing mode,* the analyzer:

1. Initiates the batch injection procedure.
2. Evacuates the cavity.
3. Flushes the cavity with zero air twice before requesting the sample.
4. Prompts you to inject sample (of >60 ml) gas into the syringe port.
    a. You have 120 seconds to inject the sample.

NOTE

If you take longer than 120 seconds to complete the injection, the *Failed Injection* message displays and instructs you to restart the injection process.

Figure 118 shows the *Batch Injection Measurement* screen displayed as a flow diagram to show the batch measurement procedure.

Figure 118: Batch Injection Flow

To begin batch mode processing:

a. Click **NEXT** in the *Batch Mode Status* display box. (Figure 117)
    i. Each step is displayed in the lower-right panel of the screen as the analyzer prepares for the injection.
b. The ICOS cavity is pumped out.
c. The ICOS cavity is flushed with Zero Air twice before requesting the sample.
d. The analyzer Prompts you to inject >140mL of Sample Gas into the syringe port on the front panel of the analyzer.
e. Fill the 140mL syringe with your sample, and insert the needle into the syringe port on the front of the analyzer.
    ii. The suction from the cavity should automatically draw your sample into the cavity. Light pressure on the syringe will help to introduce the sample.
    iii. You have 120 seconds to inject the sample.

If you take longer than 120 seconds to complete the injection, the *Failed Injection* message displays and instructs you to restart the injection process.

Changing the Septa on the Syringe Injection Port

The septum on the syringe injection port requires periodic replacement. Depending on use, a septum should last a minimum of 100 injections.

To replace the septum:

1. Click the **Rate** button on the *User Interface Control Bar*. (Figure 115)
2. The Operating Mode pop-up menu displays. (Figure 119)

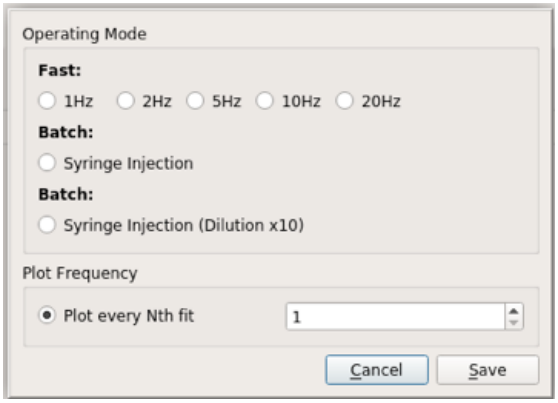


Figure 119: Rate Control Screen

3. Unscrew the septum nut from the injection port as shown in Figure 120.

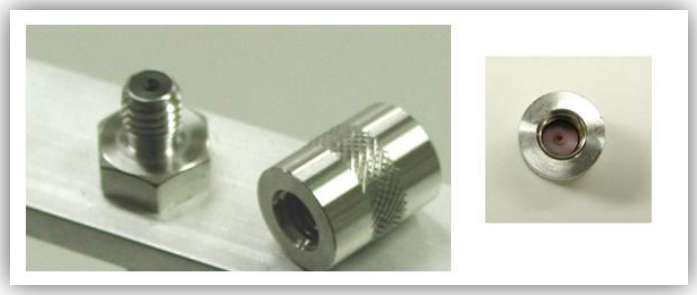


Figure 120: Septum Nut with used septum

4. Remove the red septum with white Teflon coating from the inside of the septum nut, using the provided septum puller. Discard the used septum.
5. Obtain a new septum from the provided package.
6. Slide the septum nut and new septum onto the provided blunt 22-gauge needle. The Teflon-coated side of the septum must face away from the septum nut. (Figure 121)

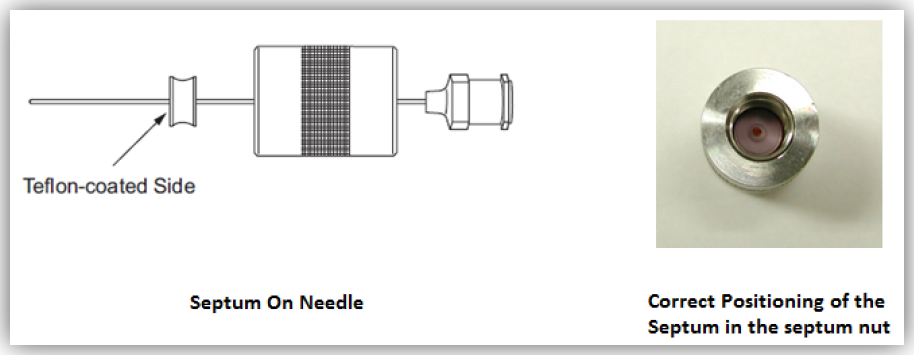


Figure 121: Septum inserted on needle with Teflon coating facing away from the septum nut

7. Slide the needle with septum assembly onto the injection port on the front panel of the analyzer. (Figure 122)

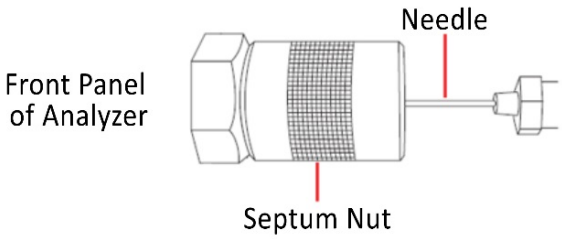


Figure 122: Needle and Septum assembly attached to the injection port

8. Hand-tighten the septum-nut firmly.
9. Manually actuate the needle five times to confirm that the septum is adequately pre-drilled.
10. Remove the needle from the septum nut.

Appendix G: Isotope Definitions

The GLA431-MCIA1 measures the concentration of $^{12}CH_4$ and $^{13}CH_4$. These concentrations are used to calculate the total CH_4 and the isotope ratio that are reported on the display screens. The data file output includes the concentrations as well. The terms and their respective data file name are listed below:

CH_4	[CH4]__ppm
$\delta^{13}C$	d13C
$[^{12}C^1H_4]$	[12CH4]__ppm
$[^{13}C^1H_4]$	[13CH4]__ppm

The isotope ratios are reported in ‰ relative to Vienna Pee Dee Belemnite. The standard listed below were taken from IAEA-TECDOC-825.

(R_{13}) VPDB	0.0112372

Total CH_4 is defined as the sum of all the isotopes:

$$CH_4=[^{12}C^1H_4] + [^{13}C^1H_4]$$

The isotope ratio is defined according to:

$$\delta^{13C} = \left[\frac{(R_{13})_{Meas}}{(R_{13})_{VPDB}} - 1\right] \times 1000$$

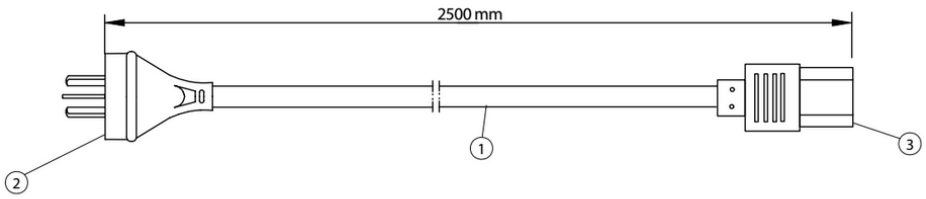
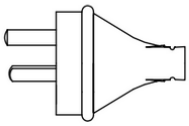
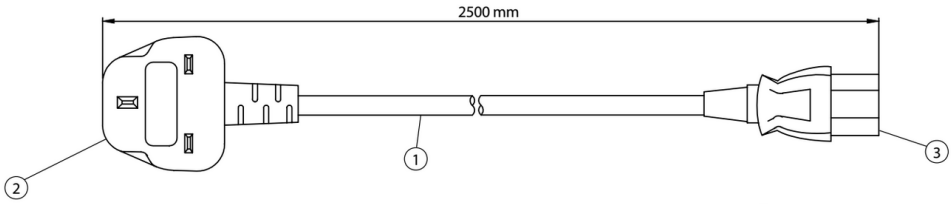
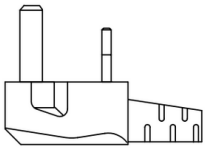
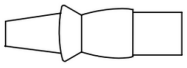
Where the measured ratio is calculated from the measured concentrations:

$$(R_{13})_{Meas} = \frac{^{13}C}{^{12}C} = \frac{[^{13}C^1H_4]}{[^{12}C^1H_4]}$$

Appendix H: Cables

Table 11 describes the power cables shipped with your analyzer.

Table 11: Power Cables

Region	Cable Specifications
Australia and New Zealand	    1. CORDAGE: SAA, 3 x 1.0mm, UNSHIELDED, CEE COLOR CODE, TEMP. RATING 70°C, RATING: 250V 10A, JACKET COLOR: BLACK 2. PLUG: AS 3112/AUSTRALIAN 3. CONNECTOR: IEC 60320 C-13 APPROVALS: AUSTRALIA, NEW ZEALAND ROHS COMPLIANT
United Kingdom	    1. CORDAGE: HO5VV-F, 3x1.00mm, CEE COLOR CODE, TEMP. RATING: 70˚C, RATING: 250V, 10A, JACKET COLOR: BLACK 2. PLUG: UK PLUG BS1363A (SUPPLIED WITH 13A FUSE) 3. CONNECTOR: IEC 60320 C13 APPROVALS: UNITED KINGDOM, CE ROHS COMPLIANT

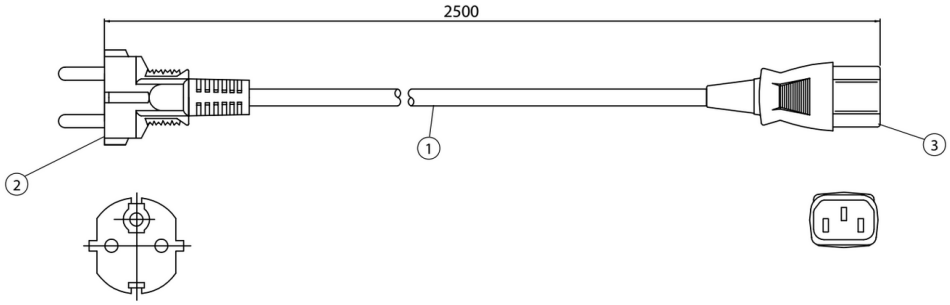
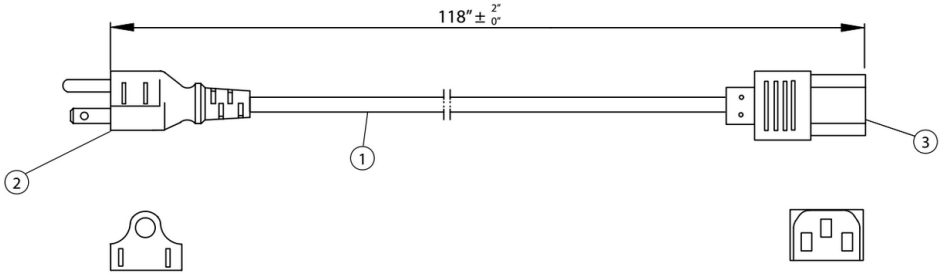
Europe	 1. CORDAGE: H05VV-F, 3 x 1.0mm, UNSHIELDED, CEE COLOR CODE, TEMP. RATING 60°C, RATING: 250V 10A, JACKET COLOR: BLACK 2. PLUG: IEC 884/CEE7-VII 3. CONNECTOR: IEC 60320 C13 APPROVALS: CB, GERMANY, DENMARK, NORWAY, FINLAND, BELGIUM, NETHERLANDS, SWEDEN, AUSTRIA, ROHS COMPLIANT
United States	 1. CORDAGE: SJT, 16AWG / 3C, UNSHIELDED, CEE COLOR CODE, TEMP. RATING 60°C, RATING: 125V 13A, JACKET COLOR: BLACK 2. PLUG: NEMA 5-15P 3. CONNECTOR: IEC 60320 C-13 APPROVALS: UL, cUL ROHS COMPLIANT

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ABB Measurement & Analytics

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abb.com/contacts

For more product information, visit:
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