ABB MEASUREMENT & ANALYTICS | USER MANUAL

User Manual | ICOS
GLA132 Series Ultraportable Analyzers

Table of Contents

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.

Cybersecurity

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.

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

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.

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

Transportation and Storage of Boxed Analyzers

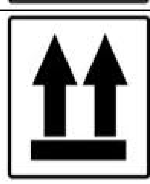
When transporting and storing boxed analyzers:

- 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.

Warranty

Each ABB-LGR analyzer is warranted by ABB-LGR to be free from defects in material and workmanship. However, our sole obligation under this warranty shall be to repair or replace any part of the analyzer, which our examination discloses to have been defective in material or workmanship without charge and only under the following conditions:

1. The defects are called to the attention of ABB-LGR in writing within one year after the shipping date of the analyzer.
2. The analyzer has not been maintained, repaired or altered by anyone who was not approved by ABB-LGR.
3. The analyzer was used in the normal, proper, and ordinary manner and has not been abused, altered, misused, neglected, involved in an accident or damaged by an act of God or other casualty.
4. The purchaser (whether a distributor or direct customer of ABB-LGR, or a distributor's customer), packs and ships or delivers the analyzer to ABB-LGR's main office within 30 days after ABB-LGR has received written notice of the defect. Unless other arrangements have been made in writing, transportation to ABB-LGR is at customer's expense.
5. No-charge repair parts may be sent at ABB-LGR's sole discretion to the purchaser for installation by purchaser.
6. ABB-LGR's liability is limited to repair or replace any part of the analyzer free of charge if ABB-LGR's examination discloses the part to be defective.

The laws of some locations may not allow the exclusion or limitation on implied warranties or on incidental or consequential damages, so the limitations herein may not apply directly. This warranty gives you specific legal rights, and you may already have other rights, which vary from location to location. All warranties that apply, whether included by this contract or by law, are limited to the time period of this warranty, which is a twelve-month period commencing from the analyzer customer ship date or eighteen months from the date of shipment to an ABB-LGR authorized distributor, whichever is earlier.

Further information concerning this warranty may be obtained by writing or telephoning the Warranty Manager at ABB-LGR Customer Service.

ABB-LGR provides direct assistance in the use and application of all of its analyzers through email, telephone, and if necessary, in person.

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

Warranty Returns

If your product is defective, you may return it during its designated warranty period for a prompt exchange or repair. To return a product, please contact your local sales representative and ABB service support to request a Return Material Authorization (RMA) number. Requests for refunds and exchanges cannot be processed without a valid RMA number.

Please have the following information available when requesting an RMA number:

- Part Number
- Serial Number (Located on the side panel of the analyzer)
- Description of the Problem

The company-issued RMA number must be prominently displayed on the return package.

No returns will be accepted collect or C.O.D. On all warranty returns, ABB-LGR will pay the shipping charges on the return of the merchandise to the customer.

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.

NOTE

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

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1 Analyzer Overview

The ABB-LGR GLA132 Series are Ultra-Portable Analyzers that measure concentrations of gas in parts per million (ppm) and parts per billion (ppb).

NOTE

This analyzer is a Class 1 laser product.

Performance Specifications

Ambient Humidity

- <99% relative humidity non-condensing

Operating Temperature

- 5 - 45°C

Maximum Altitude

- 6,000 Feet

Power Requirements

- 60 Watts (typical) – 11-30 VDC (battery power)
- 66 Watts (typical) – 15-230 VAC, 50 / 60hz (AC adaptor)
- 120 Watts maximum

Fuse Ratings

- 32 VAC
- 10 Amps
- Fast-blow fuse

Cable Plugs and Voltage for EC Countries

- See page 129.

WARNING

Always use the power supply cord provided by ABB-LGR. See page 129 for a description of power cords for a specific country.

External Dimensions

- 18.5” W x 14” D x 7” H

Weight

- 16.9 kg

Cell Volume

- 345 cc cavity
- 10 cc tubing
- Total volume = 355 cc

Standard Components

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

The standard components include:

- GLA132 Series analyzer
- Analyzer power cord
- AC/DC power supply
- External in-line filter (push-connect)
- Null modem type serial data cable
- USB flash drive
- User Guide (this document)
- Certificate of compliance

Optional Components

NOTE Available on select analyzers.

- Multiport Inlet Unit, eight or sixteen channels (MIU-8, MIU-16)
  - Power cable
  - 25-pin control signal cable
  - 64GB solid state hard drive
- Water Vapor Isotope Standard Source – Standard range (WVISS)
  - WVISS hand pad
  - Control signal cable
  - BNC cable

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

WARNING The wireless user interface will not work if:

- The analyzer has a system failure
- The hard drive fails or is corrupted
- Battery power to the analyzer is interrupted

If any of these failures occur, you will need a mouse, keyboard and monitor to restart the analyzer. A back up hard drive is recommended.

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

Figure 2 shows the left side of the analyzer.

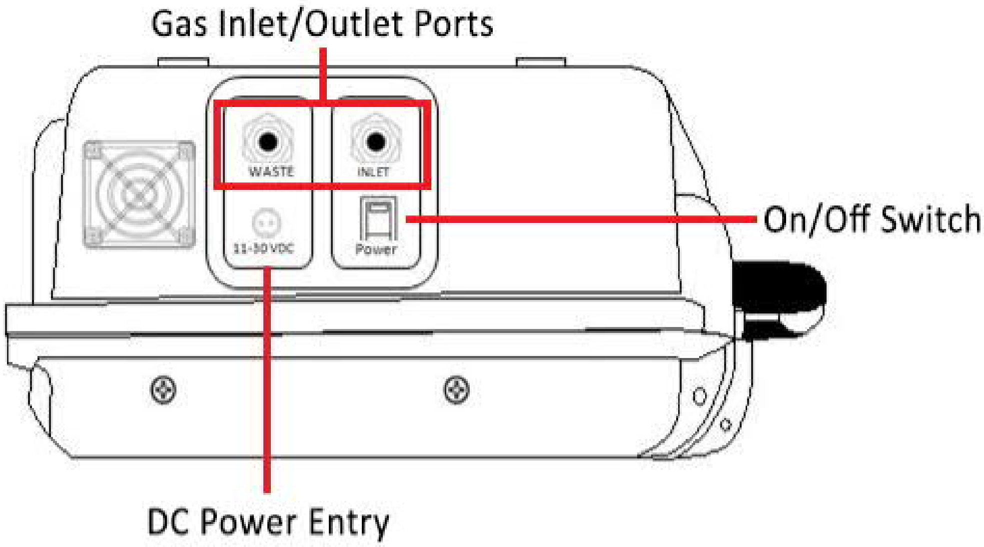

Figure 2: Left Panel

Figure 3 shows the right side of the analyzer.

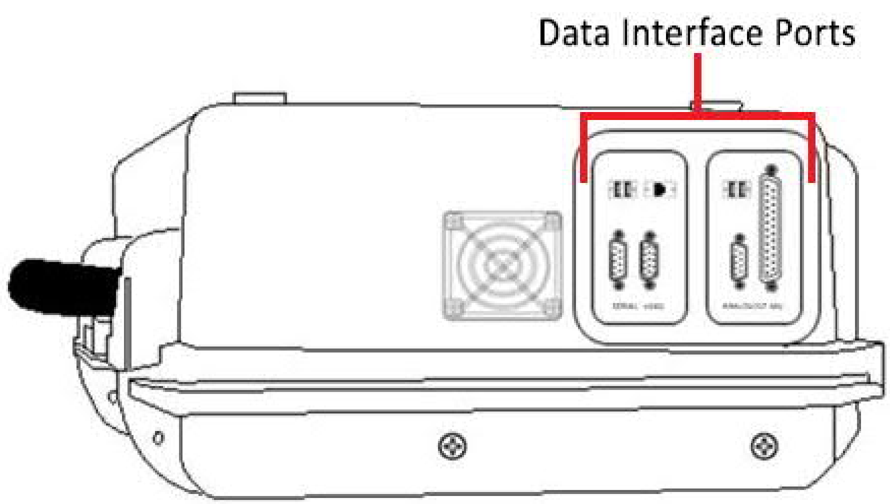

Figure 3: Right Panel

Power Connections

The power connector is on the left side panel of the analyzer. (Figure 4)

The analyzer can be powered two ways:

- Using the AC/DC power supply to the DC power inlet
- Using the battery hook-up kit (Optional)

The battery voltage must be in the range of *11-30 volts DC*. It has a continuous discharge rate to power 80 watts (or higher).

Figure 4 shows the power entry connector and the power switch.

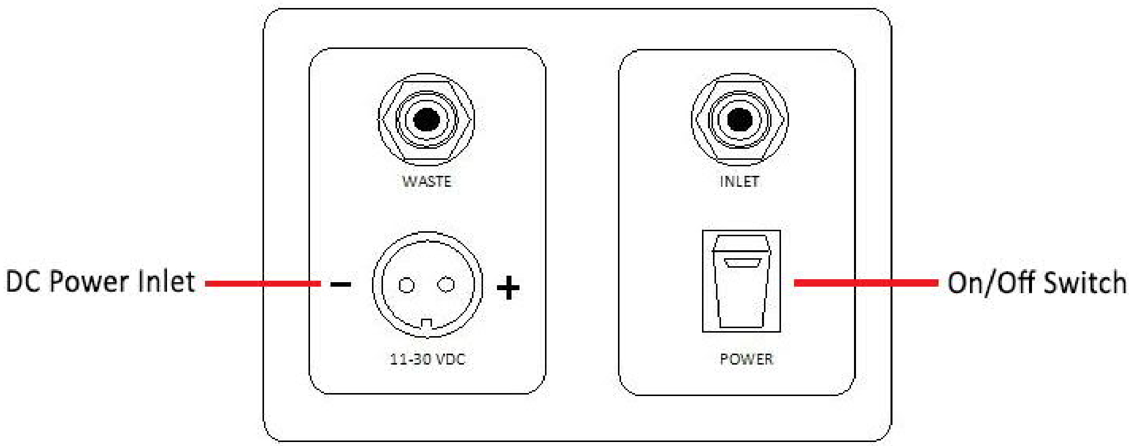

Figure 4: Power Connections and AC Voltage Selection Switch

The analyzer is equipped with a three-prong power plug. The third prong of the facility electrical outlets must be grounded. Failure to ground the third prong may result in electrical damage to the analyzer and electrical shock to the operator.

Emergency Shutdown Procedure

If the analyzer malfunctions and requires emergency shutdown:

1. Turn off the analyzer using the left side panel on/off switch. (Figure 2)
2. Unplug the power cord from the analyzer. (Figure 4)
3. Notify trained service personnel that the analyzer needs repair or servicing.

Data Interface Connection Ports

This section describes the data interface connections as shown in Figure 5. These connections may vary from analyzer to analyzer depending on the ordered configuration.

- USB ports – Used for transferring data to a USB memory device, or to connect a USB keyboard and mouse.
- Ethernet port – Connects the analyzer to a local area network (LAN) and allows access to the data directory using an external computer.
- Serial port (9 pin D-sub) – For real-time digital measurement output.
- Video port (15 pin D-sub) – Connects an external monitor to the analyzer.
- Analog out ports – Provides a DC voltage proportional to the measured gas concentration. If this output is connected to an external device, it must be terminated into a moderate to high impedance (>1 kOhm).
- MIU port (25-pin data port) – For connecting to a Multiport Inlet Unit (optional).
- WVISS- Only applicable for the GLA132-WVIA

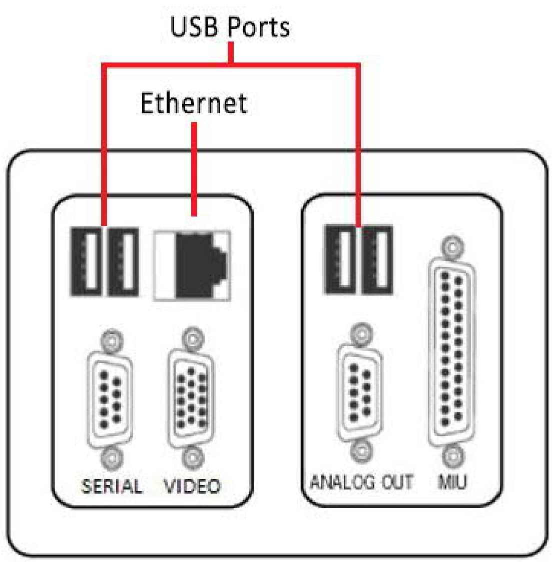

Figure 5: Data Interface Connection Ports

Plumbing Diagram

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

Standard Plumbing

Figure 6 shows an example of the internal flow of gas in an ultraportable analyzer. Plumbing configurations will vary depending on the analyzer type.

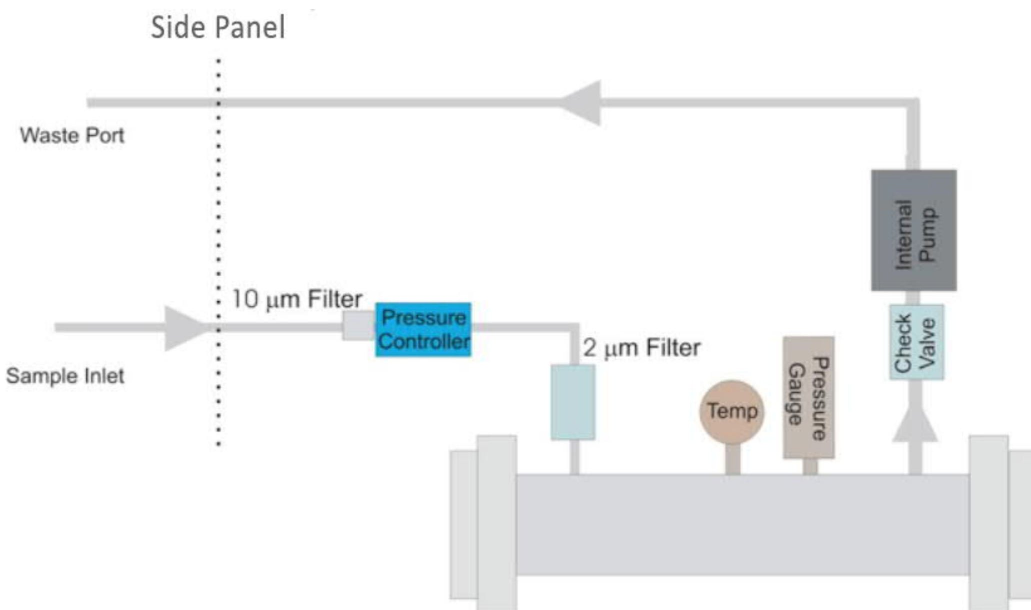

Figure 6: Plumbing Diagram for a GLA132-GGA analyzer

The internal pump draws gas through the SAMPLE INLET on the left side panel of the analyzer. The gas is filtered through a screen filter before entering the pressure controller, which regulates the pressure to maintain a specific set point. The gas travels through the optical cell and out through the WASTE port.

Figure 7 shows the plumbing diagram for a GLA132-CCIA2

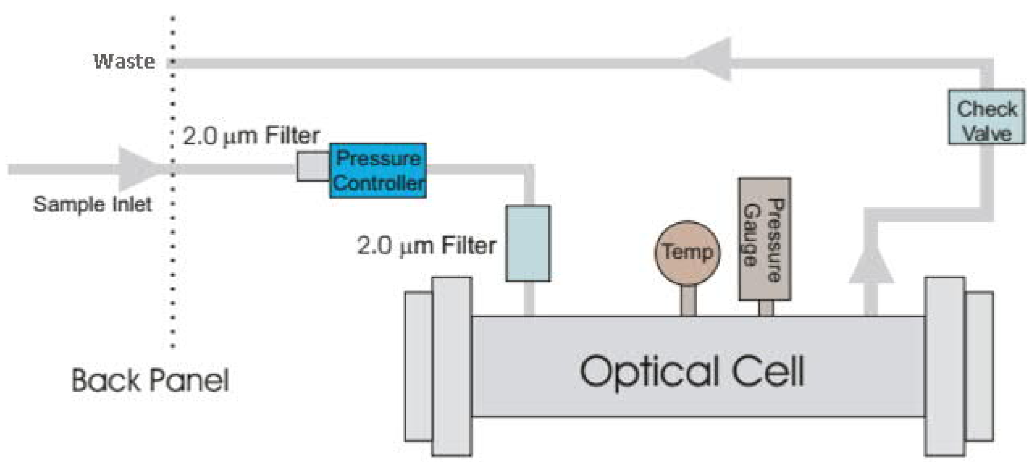

Figure 7: Plumbing diagram for a GLA132-CCIA2

Inlet/Outlet Connections

The inlet and outlet ports are located on the left side panel of the analyzer. (Figure 8)

- Gas to be measured is connected to the ¼" push-connect *INLET* port.
- An External In-Line Filter (Figure 10) is provided and can be attached to the *INLET* port.

During normal operation, the pump draws the sample through the analyzer inlet, and exhausts the sample through the waste port.

The ¼" push-connect *WASTE* port may be:

- Routed to the facility ventilation system, or
- Remain open, expelling non-hazardous gas into the room air.

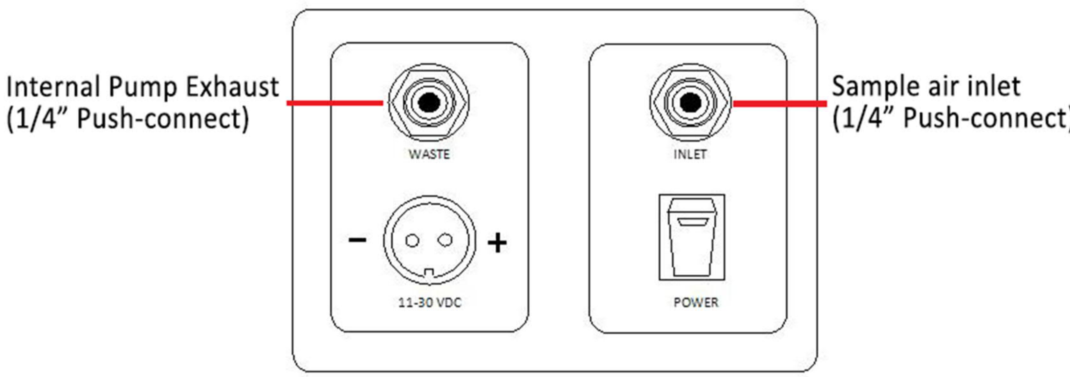

Figure 8: Inlet/Outlet ports

Warning Labels and Descriptions

This section describes the warning labels shown on the analyzer.

- Table 4 gives a description of the warning labels.
- Figure 9 shows the location of the labels on the analyzer.

Table 4: 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

2 Analyzer Setup

The following information describes how to set up the analyzer.

Connect the Power Cords

1. Connect the AC/DC power supply power cord from the power supply to a grounded outlet.
2. Connect the power connector cord on the power supply to the 11-30 VDC port on the left side of the analyzer. (Figure 4)

Connect the Data Interface Connections

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

Connect the Inlet/Outlet Plumbing Connections

1. If applicable, connect a ¼" sample tube (not provided) from the ¼" push connect INLET port on the left panel of the analyzer to your sample source.
2. The provided External In-Line Filter can be used for additional filtering by connecting to the ¼" push connect INLET port on the right panel of the analyzer. (Figure 10)

Figure 10: Portable Analyzer External In-Line Filter

NOTE

To disconnect, push the outer ring around the Inlet and Waste ports to release the 1/4" tubing.

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3 Initialize and Run the Analyzer

To initialize the analyzer:

1. Press the power switch on the left side of the analyzer to the ON position. (0 = OFF / - = ON)
   The internal computer initializes, and a screen (Figure 11) displays as the program loads.
   The *Launch Service* screen displays after initialization. (Figure 13)

NOTE

The wireless interface will not work if:

- The analyzer has a system failure
- The hard drive fails or is corrupted
- Battery power to the analyzer is interrupted

If any of these failures occur, you will need a keyboard, mouse, and monitor to restart the analyzer. A back-up hard drive is recommended.

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2. Click on the launch button to manually launch the analyzer.
   a. The launch button is the abbreviated name of the gas analyzer. For example, the GLA132-GGA button displays GGA. (Figure 13)
   b. If you don't make a selection within 120-seconds, the analyzer automatically defaults to the *Main Panel Numeric* display. (Figure 19)
3. Click on the maintenance SERVICE button (Figure 13) if you need more time or need to choose a maintenance setting. (Figure 14)

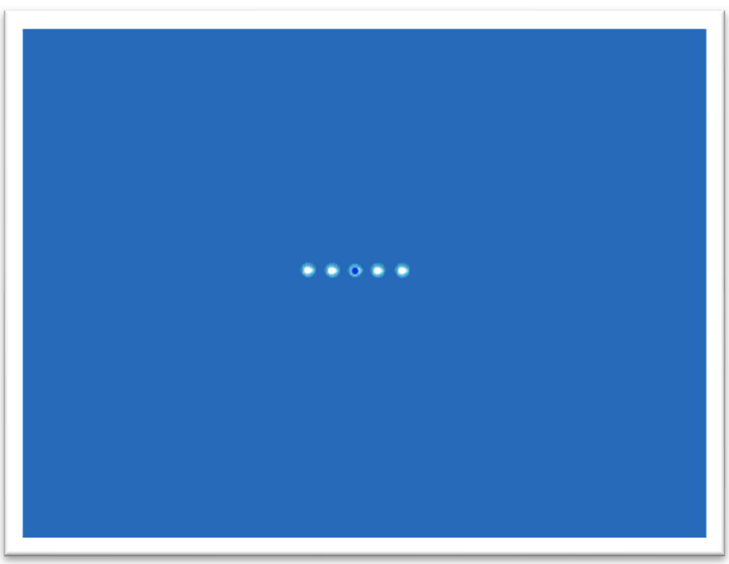

Figure 11: Start-up Screen in Busy Mode

File System Integrity Check

Once a month, the analyzer automatically performs a file system integrity check following initialization. Figure 12 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.

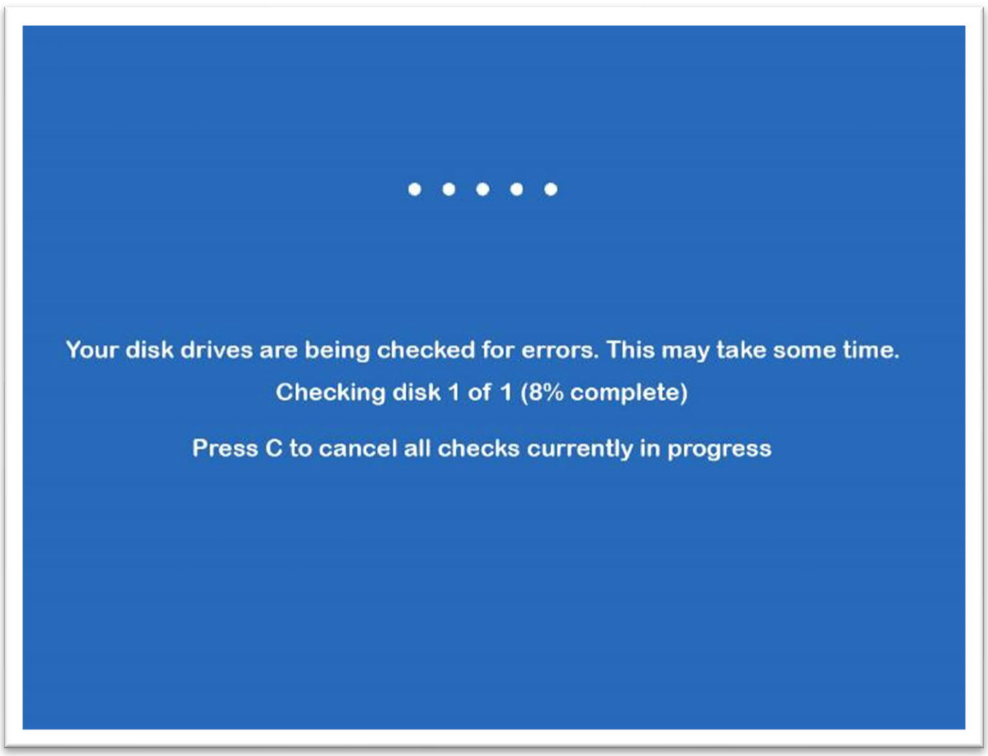

Figure 12: File System Integrity Check Screen

Thermal Stabilization

The exact final cell temperature will be analyzer specific (~25°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 GLA132-GGA launch button displays GGA as shown in Figure 13.
- Open the auto launch window by clicking Service.
- Turn off the analyzer by clicking Shutdown.

Figure 13 shows the *Launch Service* screen.

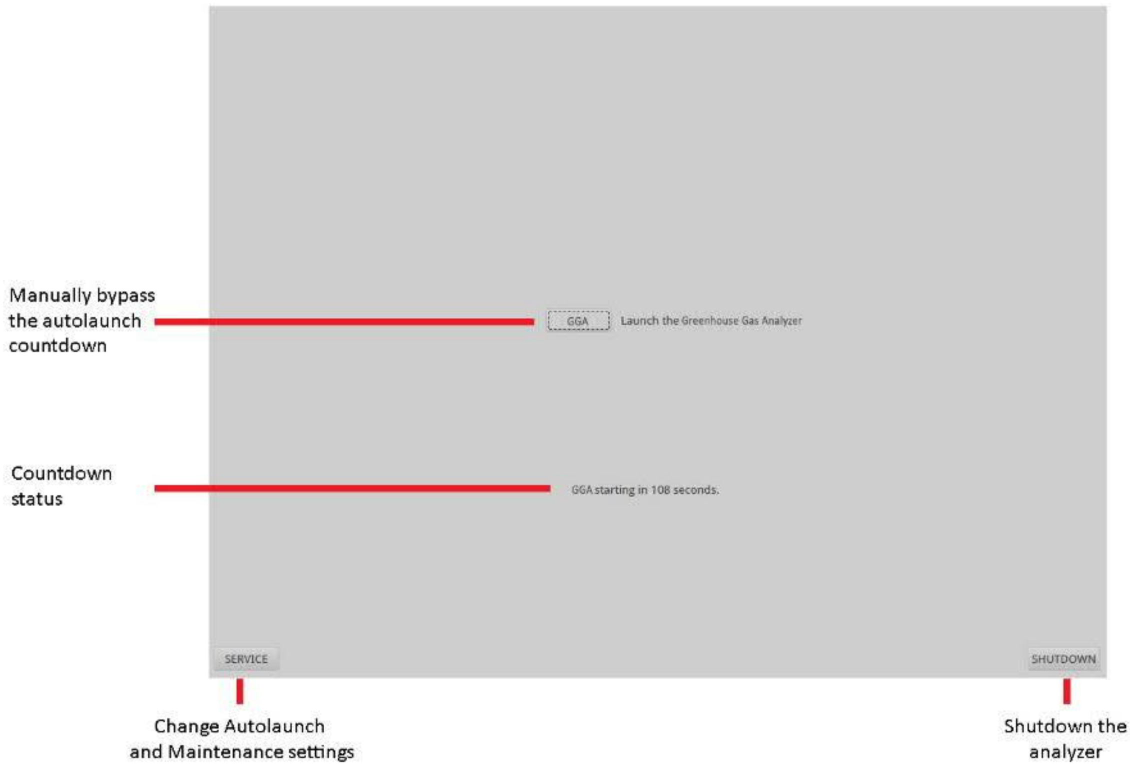

Figure 13: Launch Service Screen

The Auto Launch Screen

The Auto Launch and Maintenance settings are available when you click the Service button on the *Launch Service* screen.

The *Auto Launch* screen displays the type of analyzer.

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 14 shows the *Auto Launch* screen.

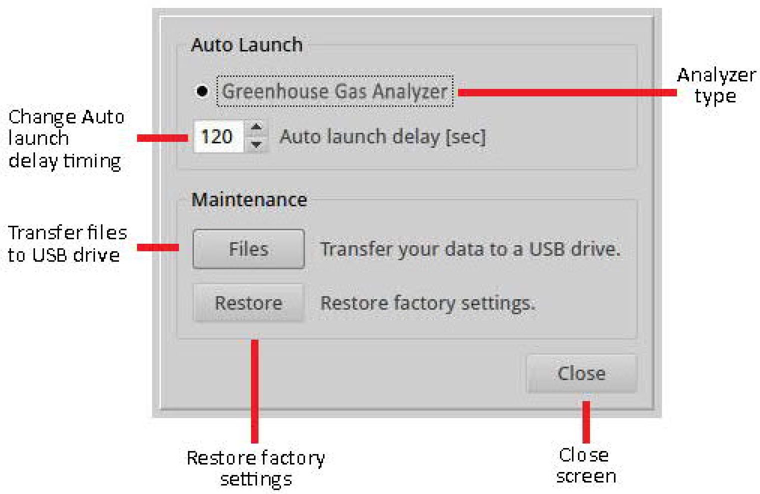

Figure 14: Auto Launch Screen

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 15)

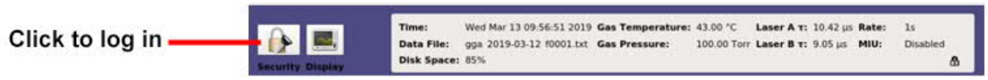

Figure 15: Control Bar Security Button

2. For initial login, use the default Linux credentials for the username and password (Figure 16), 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.

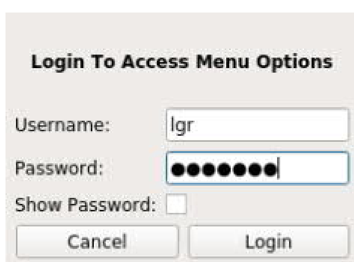

Figure 16: Login Dialog Box

3. Click Login.

Main Panel

After the software launches, the *Main Panel* is displayed. Figure 17 shows the *Main Panel* for the GLA132-GGA. The gases displayed are dependent on the type of analyzer.

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 32 - 34 for detailed Temperature Status and Analyzer Status descriptions.

This panel contains the *User Interface Control Bar* (Figure 18) and *Numeric* Display. (Figure 19)

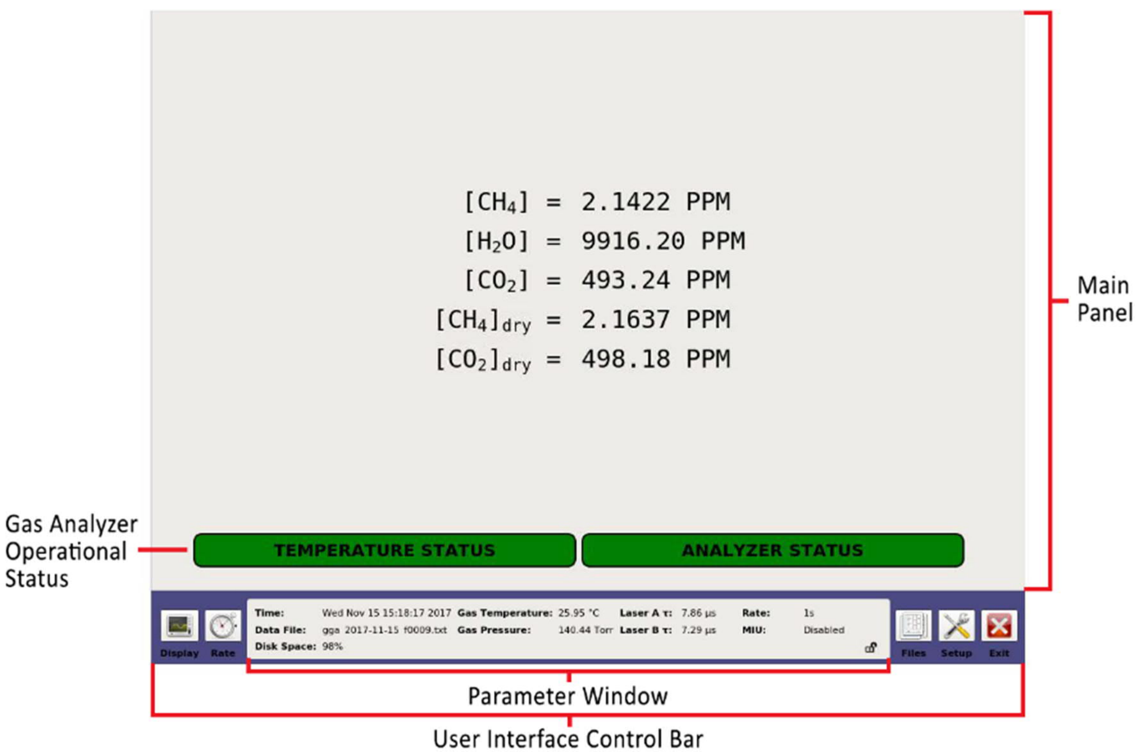

Figure 17: Main Panel

User Interface Control Bar

Use the control bar to operate the analyzer.

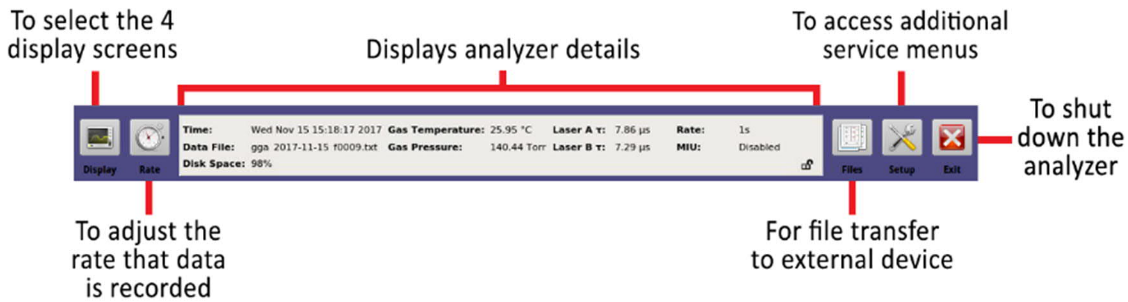

Figure 18: User Interface Control Bar

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

- *Numeric Display* – Default display. Displays the numeric readout of the last measurement. (Figure 19)
- *Alarm Status Display* – shows the operational status of the analyzer. (Figure 20)
- *Spectrum Display* – Displays the raw and fitted spectral scans for one to two lasers, depending on the analyzer type. (Figure 21 and Figure 22)
- *Time Chart Display* – Displays the concentration over time. (Figure 23)

Rate – Adjusts the rate at which data is written to the log file. (Figure 24)

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)
- Laser B τ – Laser B ring-down time (micro-seconds - µs)
    - Only applicable for two laser systems
- MIU– Multiport Inlet Unit
- WVISS– Water Vapor Isotope Standard Source
    - Only applicable for the GLA132-WVIA
- 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*. (Figure 18) Clicking the Display button multiple times lets you cycle through the four main panel displays. When the analyzer is launched, it defaults to the *Numeric Display*. The four 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 19 shows an example of the *Numeric Display* screen for the GLA132-GGA. It displays the numeric readout of the last measurements of gas at a specific concentration. Concentrations vary depending on the type of analyzer.

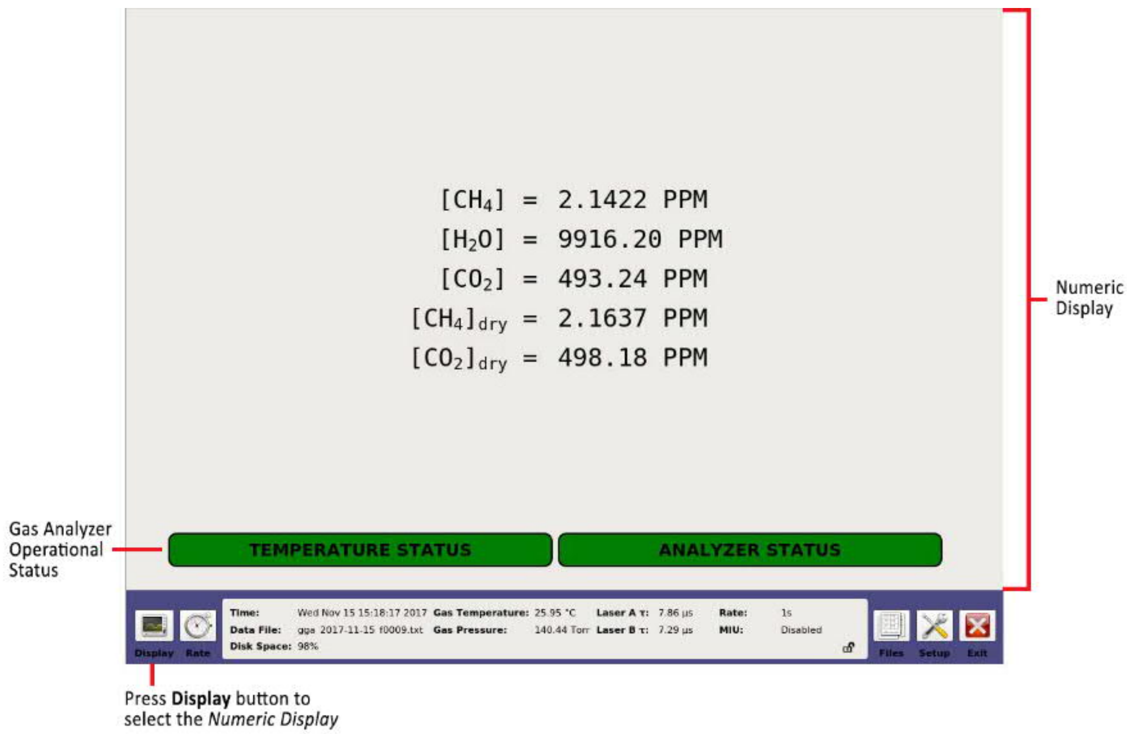

Figure 19: Numeric Display

Alarm Status Display

The *Alarm Status* display (Figure 20) 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 20 shows the *Alarm Status Display* with all parameters functioning properly.

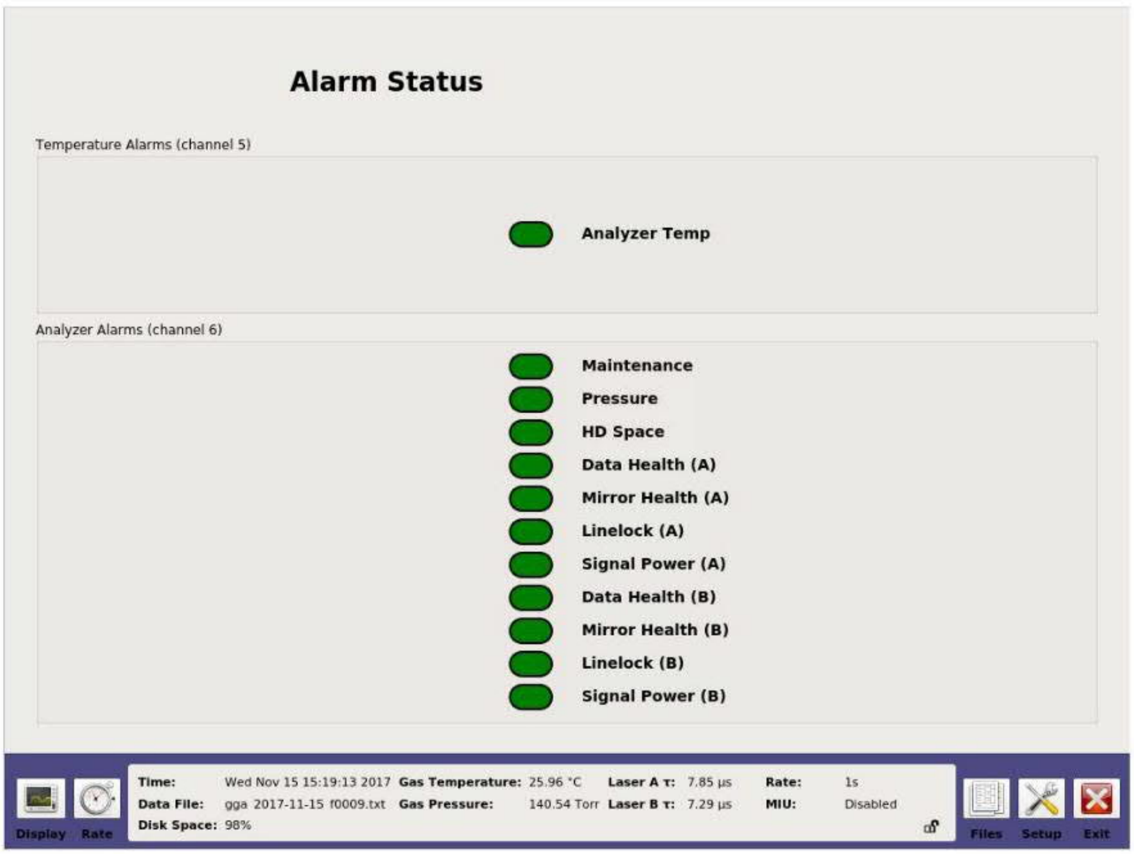

Figure 20: Alarm Status

Table 5 describes fault criteria for the Temperature Alarms.

Table 5: 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 at icos.support@ca.abb.com.

Table 6 describes fault criteria for the Analyzer Alarms.

NOTE

'A' refers to Laser 1 and 'B' refers to Laser 2. Not all analyzers are equipped with 2 lasers.

Table 6: 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 icos.support@ca.abb.com.

Spectrum Display

Click the Display button on the *User Interface Control Bar* to switch to *Spectrum Display*. (Figure 18)

The top plot shows the voltage from the photodetector 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.

Figure 21 and Figure 22 show the *Spectrum Displays* for the GLA132-GGA. The GLA132-GGA is a dual-laser system. The drop-down selector in the lower right portion of the *Spectrum Display* lets you toggle between the two lasers:

- Laser 1 (also referred to as laser A) displays CH_4 and H_2O peaks. (Figure 21)
- Laser 2 (also referred to as laser B) displays the CO_2 peak. (Figure 22)

The measured concentrations are shown in parts per million (ppm) on the bottom of the *Spectrum Display*.

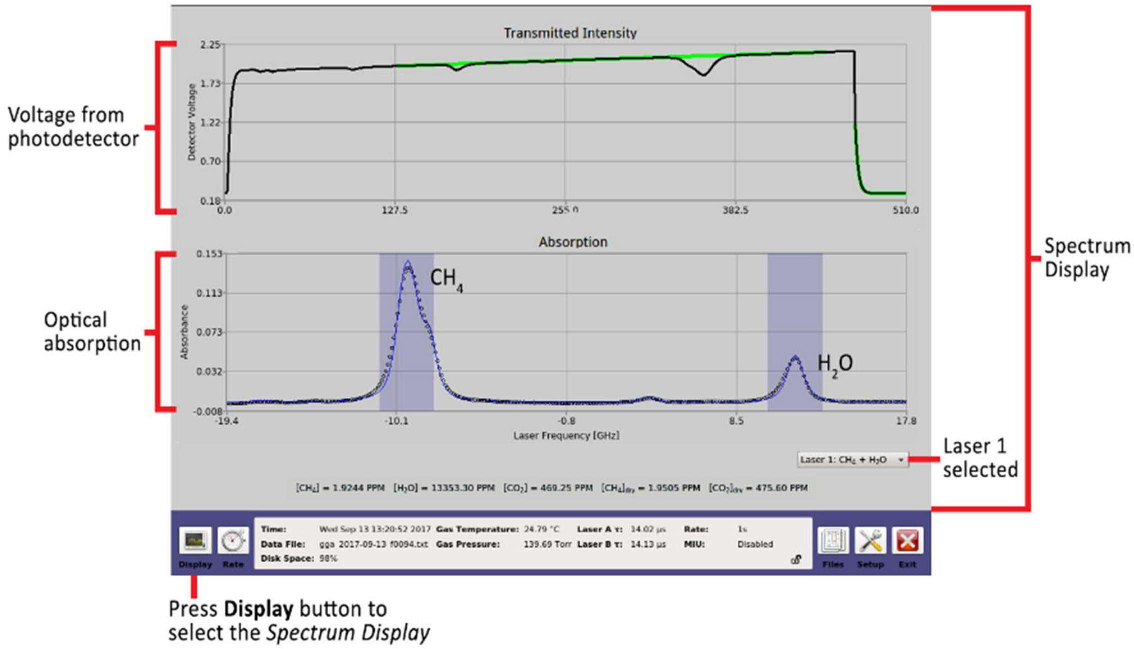

Figure 21: Spectrum Display for Laser 1 (GLA132-GGA)

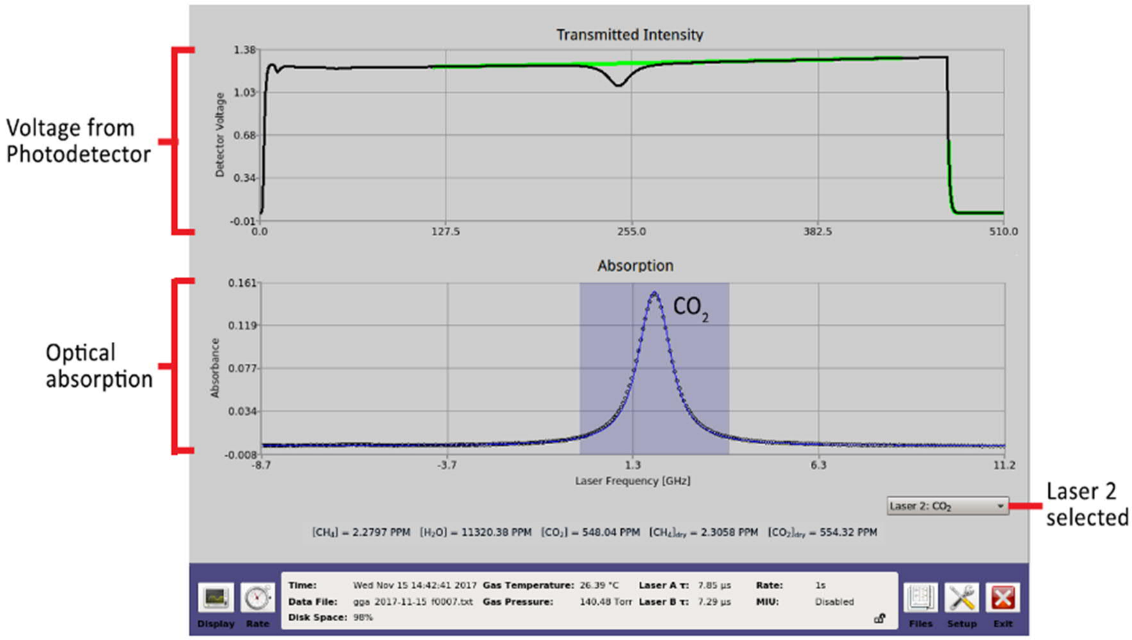

Figure 22: Spectrum Display for Laser 2 (GLA132-GGA)

Refer to Appendix: Spectrum Displays on page 111 to view the *Spectrum Displays* for different analyzer types.

Table 7: Spectrum Display for different analyzer types

Analyzer Type	Figure for Reference
GLA132-AMA	Figure 111, Figure 112
GLA132-CCIA2	Figure 113
GLA132-EAA	Figure 114
GLA132-GGA	Figure 115 and Figure 116
GLA132-H2SN	Figure 117
GLA132-HCL	Figure 118
GLA132-HF	Figure 119
GLA132-HFHC	Figure 120 and Figure 121
GLA132-MCEA1	Figure 122 and Figure 123
GLA132-OXCC	Figure 124 and Figure 125
GLA132-SAM	Figure 126, Figure 127, Figure 128, Figure 129
GLA132-SOFX1	Figure 130 and Figure 131
GLA132-SOFX2	Figure 132 and Figure 133
GLA132-WVIA	Figure 134

TimeChart Display

Click the Display button on the *User Interface Control Bar* to switch to *TimeChart* Display. (Figure 23)

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

Figure 23 shows the *Time Chart* with a continuous flow of gas. 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 toggle between available gases, and to adjust the number of significant figures.

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

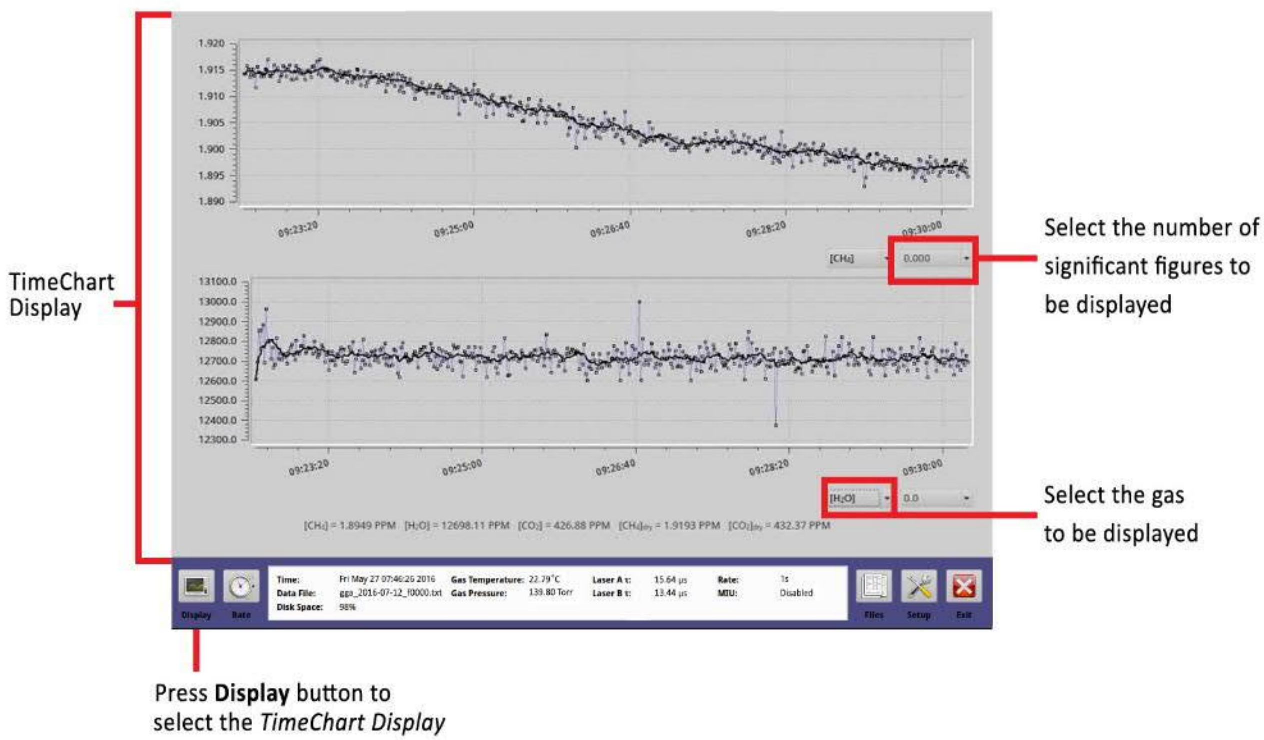

Figure 23: TimeChart Display (GLA132-GGA)

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 18) is selected, a pop-up box appears to allow rate control adjustments to the operating mode and plot frequency. (Figure 24) Selections in this window may vary, depending on analyzer configurations.

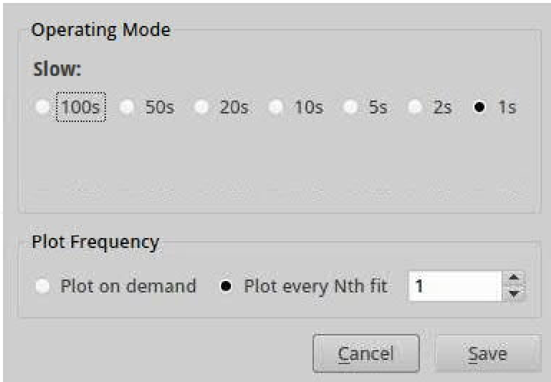

Figure 24: Rate Control Screen

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 18)
   The *Data Rate Control Adjustment* panel appears. (Figure 24)
2. Click the Operating Mode radio buttons to select the rate at which data is acquired.
   a. Slow-flow mode
      i. The internal pump is powered on.
3. Click Save.

The *Plot Frequency* radio buttons allow you to select between manually or automatically plotting the data. (Figure 24)

To adjust the frequency:

1. Click the Rate button (clock icon) on the *User Interface Control Bar.* (Figure 18) The *Data Rate Control Adjustment* panel appears. (Figure 24)
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 23), 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.

NOTE

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 in the form:
  xxx_2020-12-29_f0001.txt
  - First characters represent the analyzer model (Example: gga)
  - 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 concentration
- 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 32)

Figure 25 shows a typical data file for the GLA132-GGA.

Time,	[CH4]_ppm,	[CH4]_ppm_sd,	[H2O]_ppm,	[H2O]_ppm_sd,	[CO2]_ppm,
11/16/2017 14:32:17.025,	1.899413e+00,	0.000000e+00,	3.951746e+02,	0.000000e+00,	3.909035e+02,
11/16/2017 14:32:17.226,	1.886235e+00,	0.000000e+00,	3.750896e+02,	0.000000e+00,	3.895215e+02,
11/16/2017 14:32:18.204,	1.897474e+00,	0.000000e+00,	2.705034e+02,	0.000000e+00,	3.915712e+02,
11/16/2017 14:32:19.189,	1.898177e+00,	0.000000e+00,	4.005718e+02,	0.000000e+00,	3.908344e+02,
11/16/2017 14:32:20.156,	1.895078e+00,	0.000000e+00,	4.120824e+02,	0.000000e+00,	3.915692e+02,
11/16/2017 14:32:21.136,	1.894028e+00,	0.000000e+00,	4.269311e+02,	0.000000e+00,	3.908023e+02,
11/16/2017 14:32:22.111,	1.897651e+00,	0.000000e+00,	3.892464e+02,	0.000000e+00,	3.913812e+02,
11/16/2017 14:32:23.085,	1.896892e+00,	0.000000e+00,	3.465505e+02,	0.000000e+00,	3.911982e+02,
11/16/2017 14:32:24.066,	1.898895e+00,	0.000000e+00,	3.562836e+02,	0.000000e+00,	3.913012e+02,
11/16/2017 14:32:25.041,	1.894560e+00,	0.000000e+00,	3.325825e+02,	0.000000e+00,	3.918638e+02,
11/16/2017 14:32:26.018,	1.898246e+00,	0.000000e+00,	3.428583e+02,	0.000000e+00,	3.915302e+02,
11/16/2017 14:32:26.998,	1.895619e+00,	0.000000e+00,	4.100324e+02,	0.000000e+00,	3.912913e+02,
11/16/2017 14:32:27.971,	1.895556e+00,	0.000000e+00,	2.666621e+02,	0.000000e+00,	3.909508e+02,
11/16/2017 14:32:28.951,	1.896705e+00,	0.000000e+00,	3.193251e+02,	0.000000e+00,	3.905767e+02,

Figure 25: The Beginning of a Typical Data File (GGA)

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 18) to access the *File Transfer Menu*. (Figure 26)
2. Insert a USB storage device into the USB port on the side panel of the analyzer.
3. Click on the Mount USB button. (Figure 26)

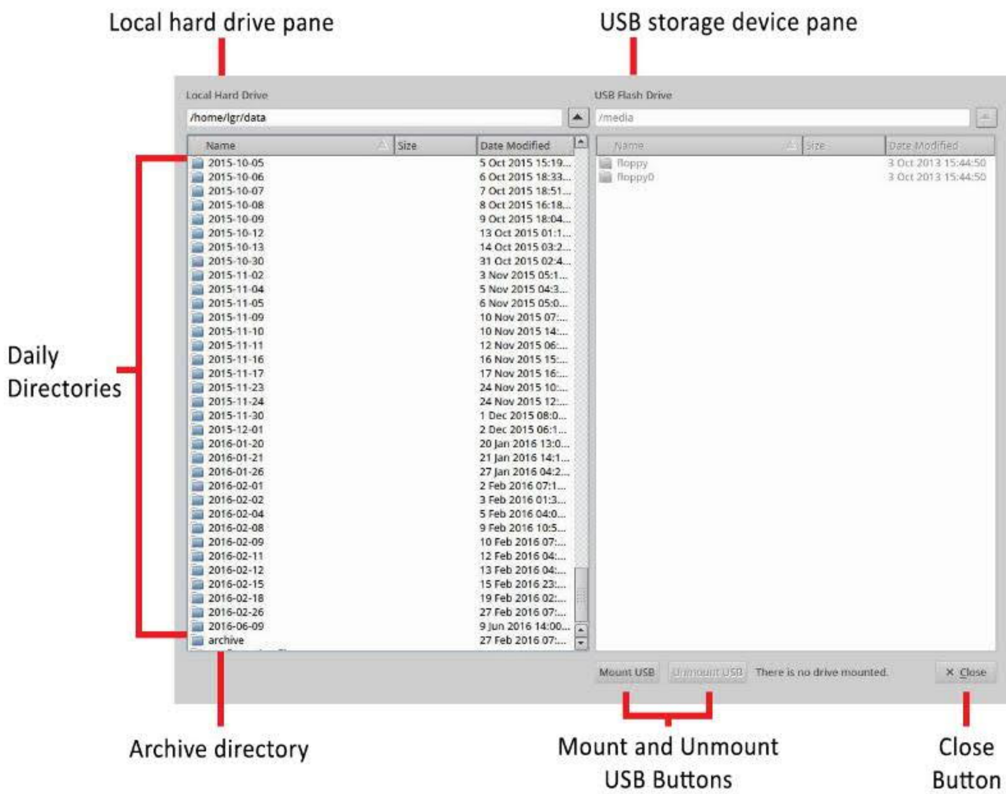

Figure 26: File Transfer Menu: Local Hard Drive (left pane) and USB Flash Drive (right pane)

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*.

NOTE

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 26) 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 27)

Each file is a single zipped .txt file, using the following convention:
XXX_YYYY-MM-DD_f0000.txt.zip

Examples of files in the daily directory are shown in Figure 27.

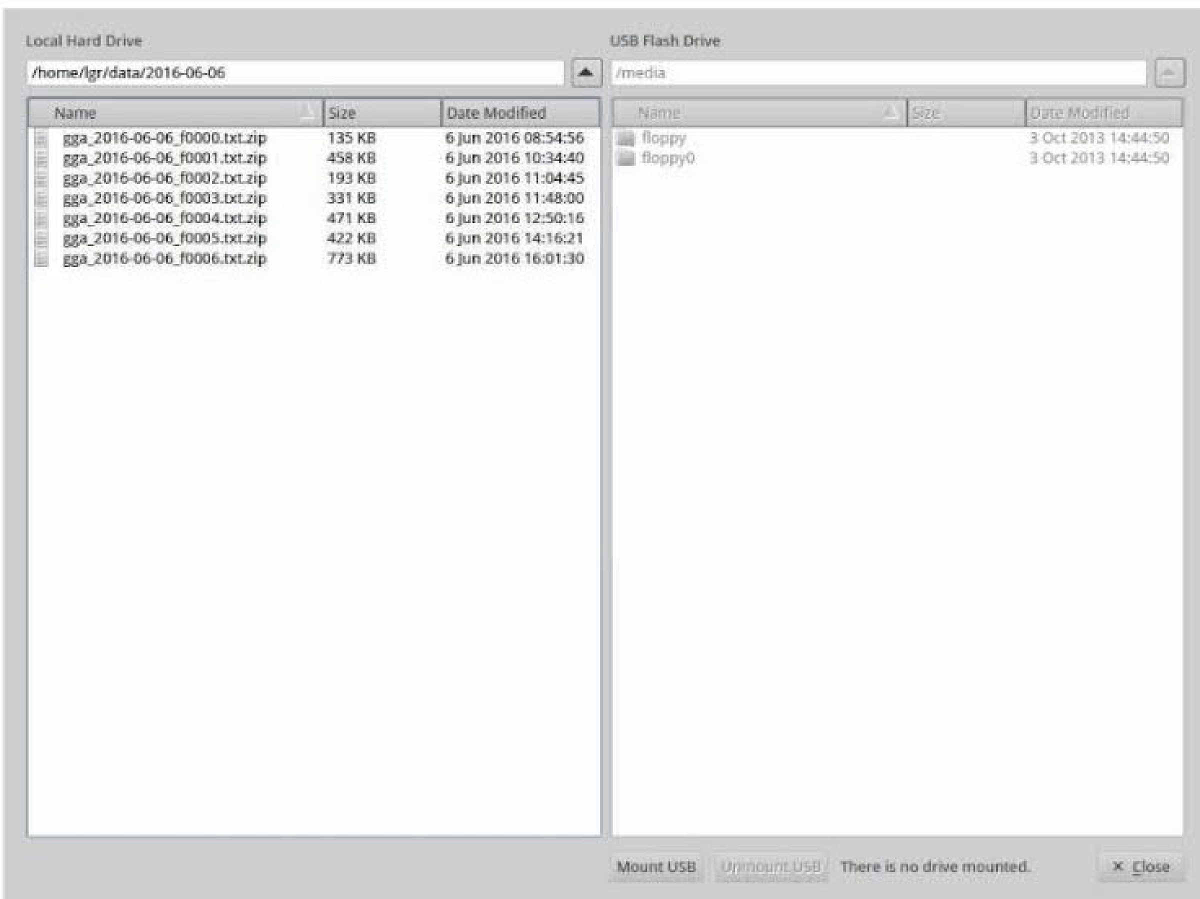

Figure 27: Daily Directory

Archive Directory

The local hard drive (Figure 26) creates an archived folder containing zipped files organized by date. (Figure 28)

To access the archived files, double-click the Archive folder. (Figure 26)

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 28.

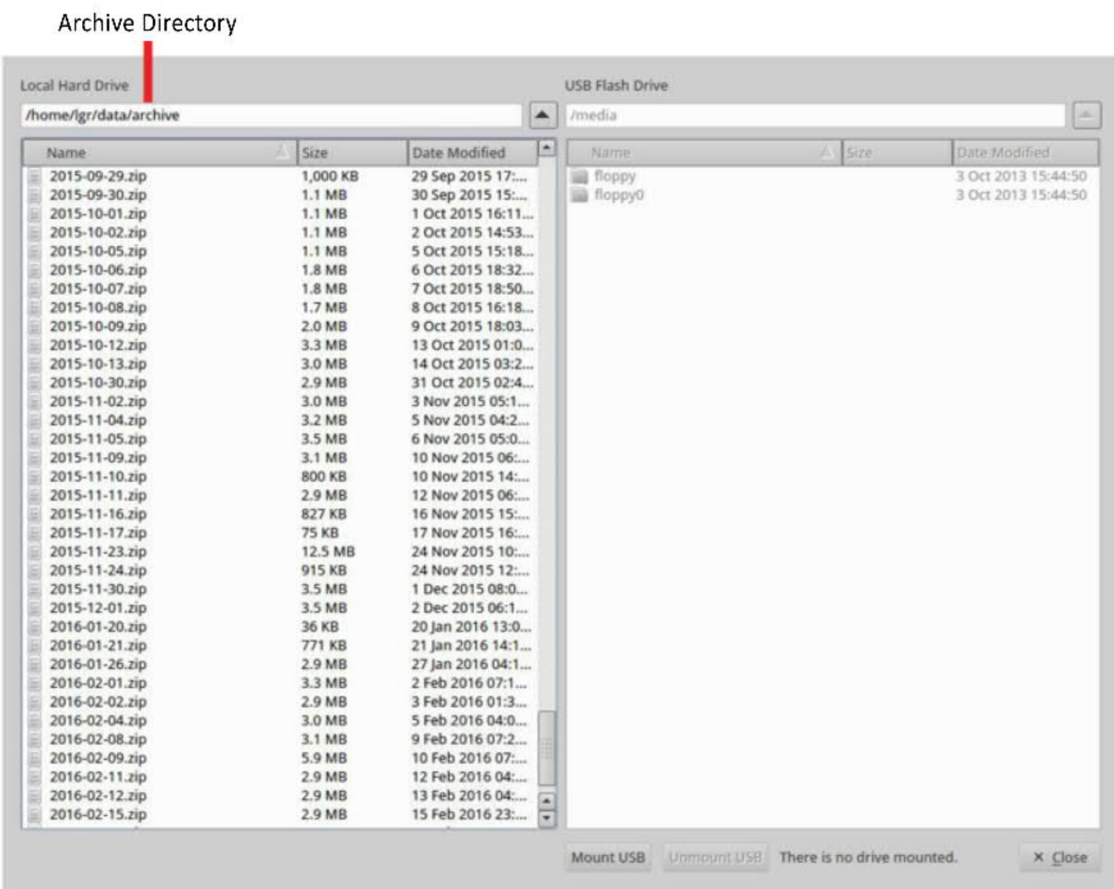

Figure 28: Archive Directory

File Transfer Error Screen

The *File Transfer Error screen* (Figure 29) 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 29: File Transfer Error

Setup Menu

The *Setup* menu allows access to additional configurations and services. Configurations will vary among analyzer types.

To enter *Setup* mode:

1. Click the Setup button on the *User Interface Control Bar*. (Figure 30)

Figure 30: Setup button on the User Interface Control Bar

2. The default *Time/Files* screen is displayed. (Figure 31)

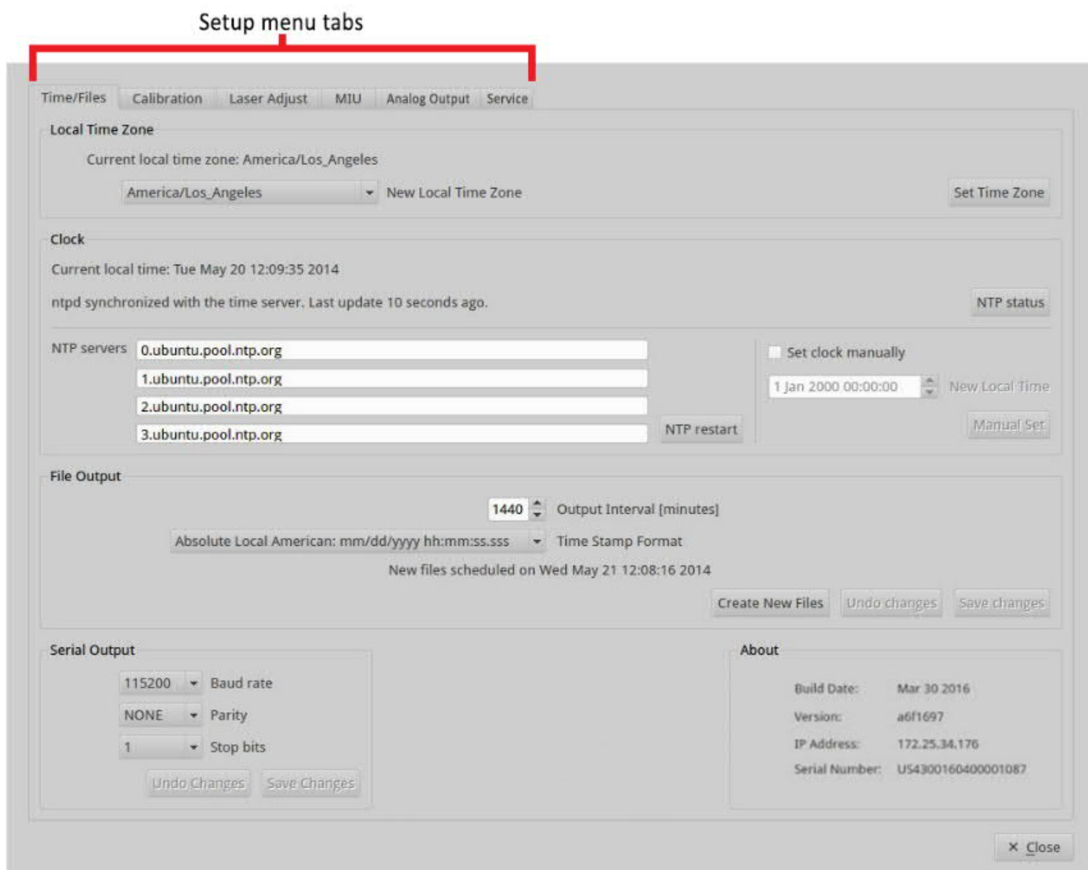

Figure 31: Setup Menu Tabs with Time/Files Screen Selected

The *Setup* menu has function tabs at the top of the screen that allows you to configure the analyzer mode and settings. (Figure 31) These tabs will vary among analyzer types.

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 Analog Output
- Configure the optional Water Vapor Isotope Standard Source
    - o Applicable only for GLA132-WVIA
- Service screen for technicians to check on the status of the analyzer

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. Contents may vary, depending on the type of analyzer. Figure 32 shows the *Time/Files* menu for the GLA132-GGA.

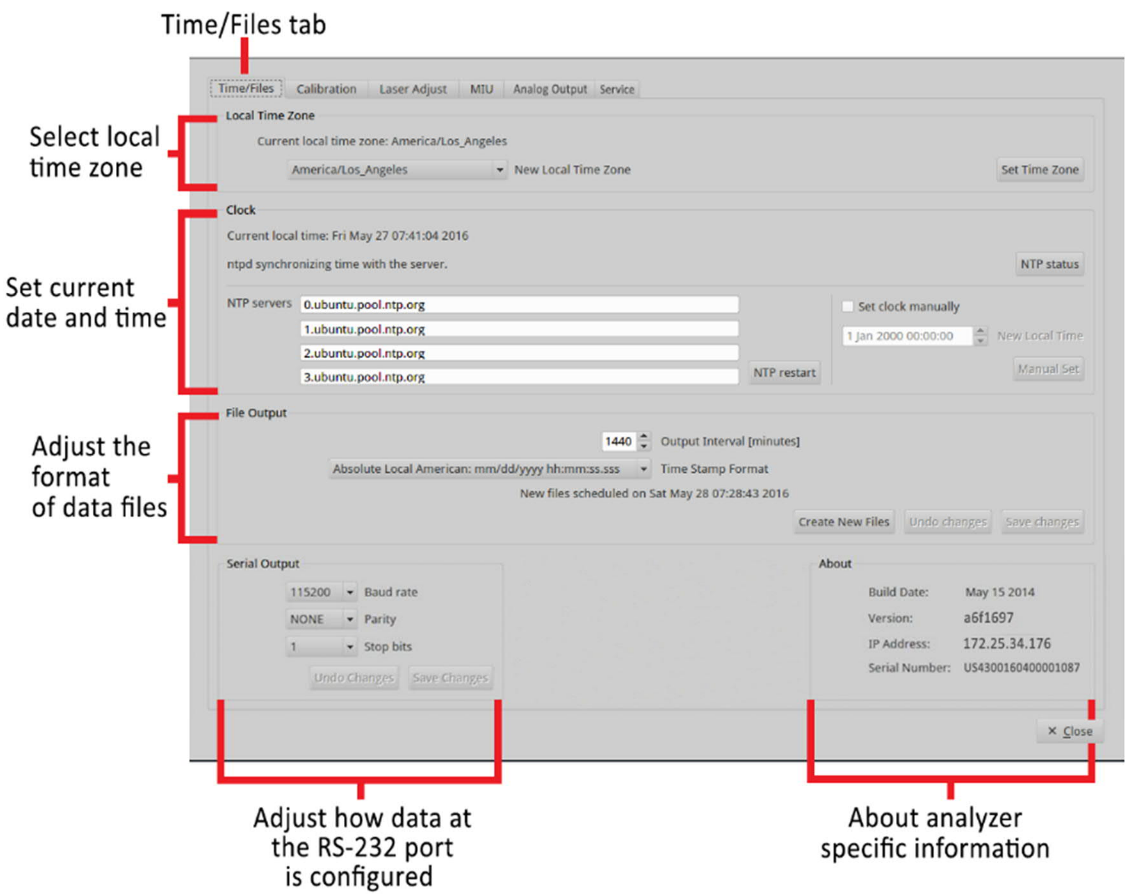

Figure 32: Functions of the Time/Files Menu (GLA132-GGA)

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 8.

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

Table 8: 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.

The output format is in the form of: comma delimited ascii with the order of columns equivalent to the data file.

NOTE

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.

NOTE

Water vapor analyzers are calibrated differently, and users must refer to the Appendix: Calibration of WVIA and TWVIA analyzers on page 93.

Calibration Procedure:

1. Click the Setup button on the *User Interface Control Bar*. (Figure 18)
2. Select the Calibration tab at the top of the screen to enter the *Calibration* menu. (Figure 33)

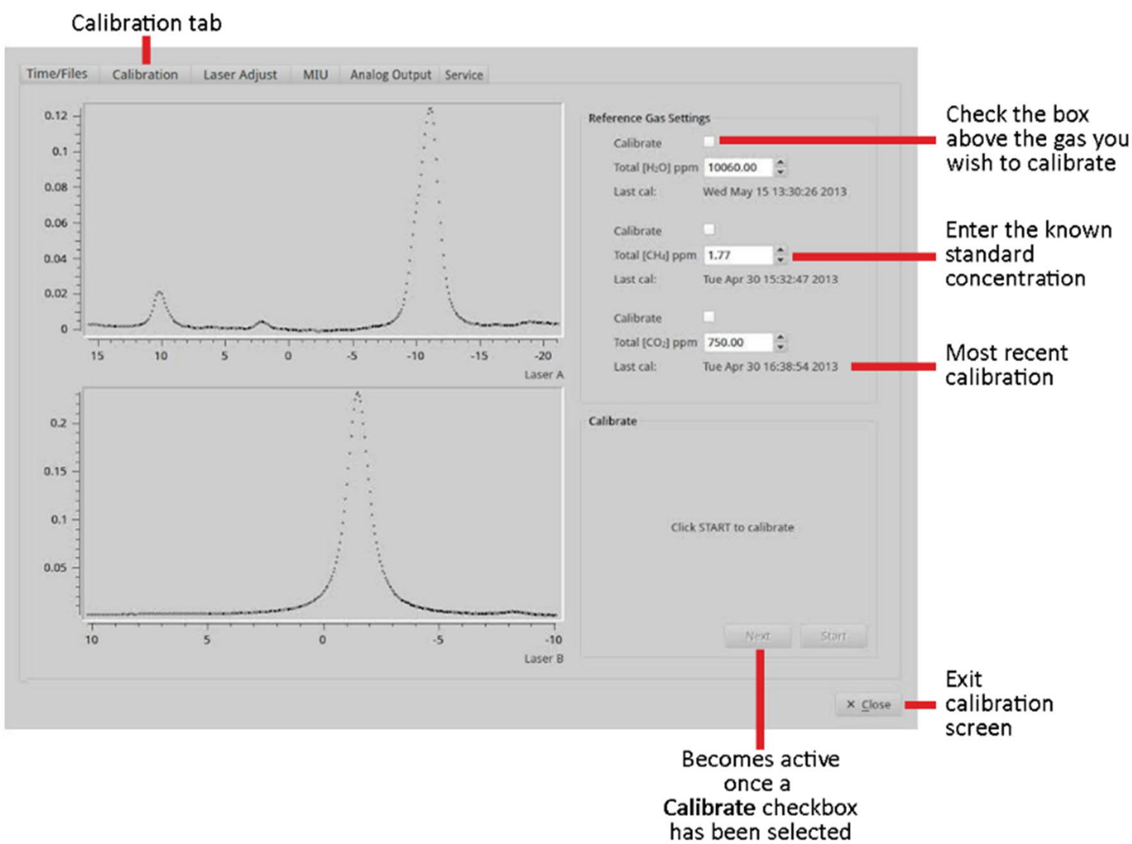

Figure 33: Calibration Setup Screen

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 gas standard.
5. Connect your reference gas supply to the ¼" push-connect inlet port on the left side 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 34 shows the calibration process as a flow chart.

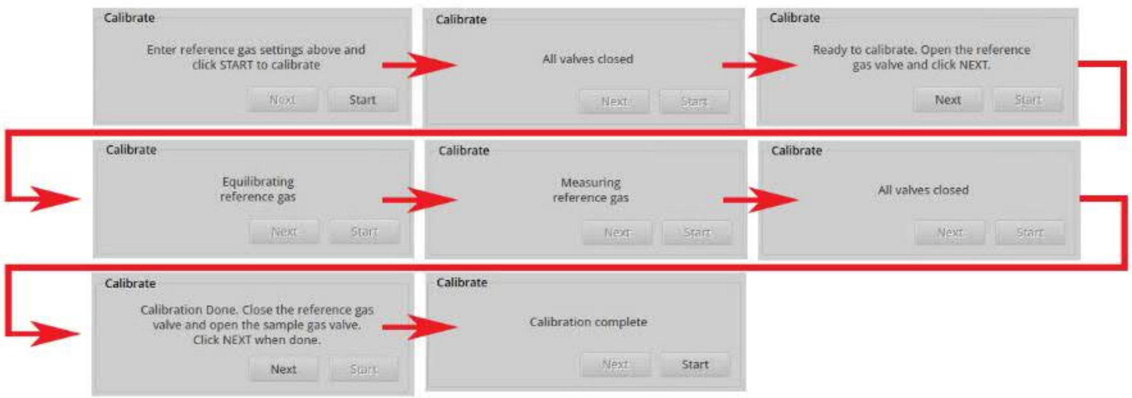

Figure 34: Calibration Flow

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 35)

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 35 shows the offset between absorption peaks and target lines. For a 2-laser system, both lasers need adjustment. Figure 35 shows an example for the GLA132-GGA, which has 2 lasers. Laser A is the top plot and laser B is the bottom plot.

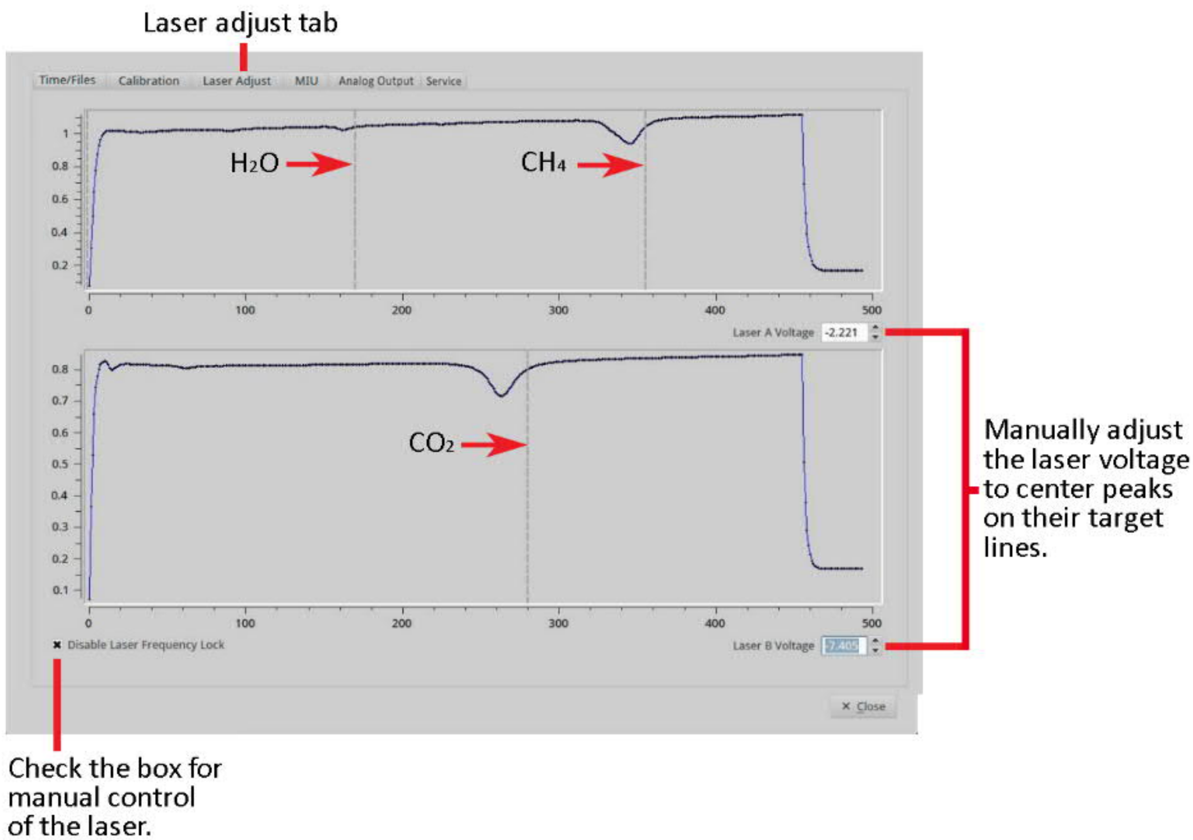

Figure 35: Absorption peaks off of target lines. Laser voltage adjustment needed.

Manually Adjust the Laser Offset

1. Click the Setup button on the *User Interface Control Bar*. (Figure 18)
2. Select the Laser Adjust tab at the top of the screen. (Figure 35)
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. If applicable, adjust the Laser B Voltage (bottom plot) 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
6. Deselect the Disable Laser Frequency Lock check box. The software resumes automatic tracking and control of the laser wavelength.
7. Click Close to exit the menu and return to the *Main Panel*.

Figure 36 shows an example of the laser voltage adjusted so that the absorption peaks are centered on the target lines.

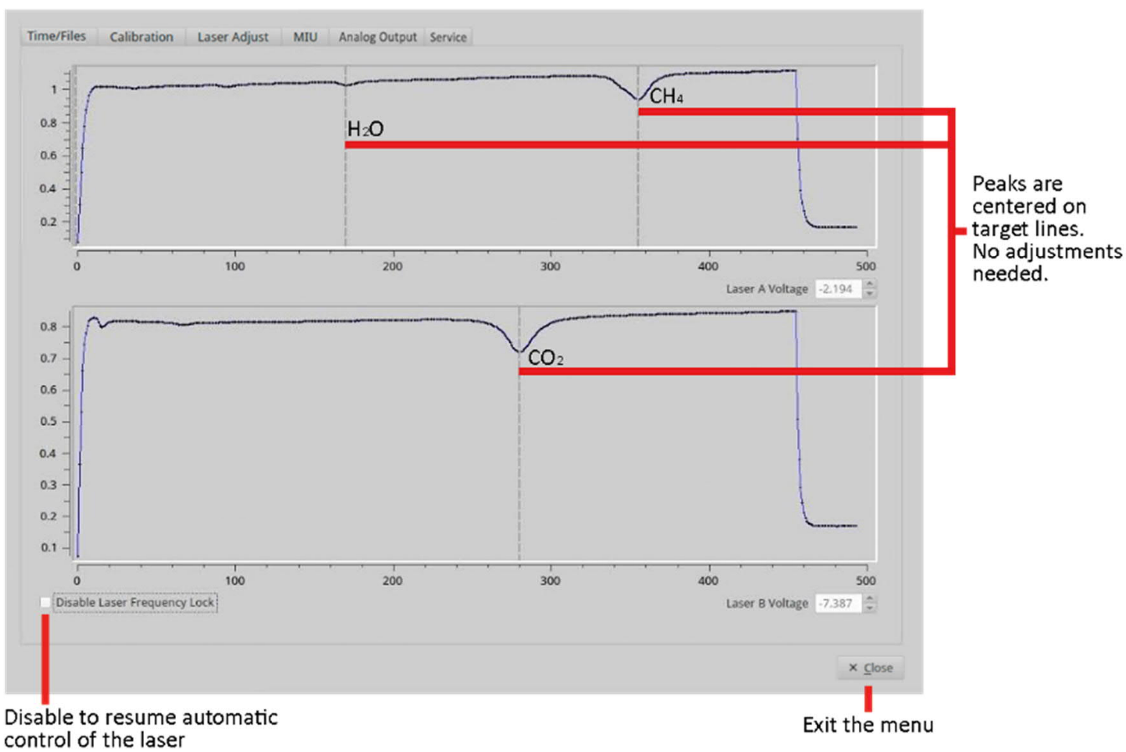

Figure 36: Absorption Peaks Centered Correctly on Target Lines

MIU Tab

The optional Multi-Port Inlet Unit (MIU-8 or MIU-16) 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 37)

See the *MIU Appendix* on page 88 for detailed instructions on configuring and controlling the MIU.

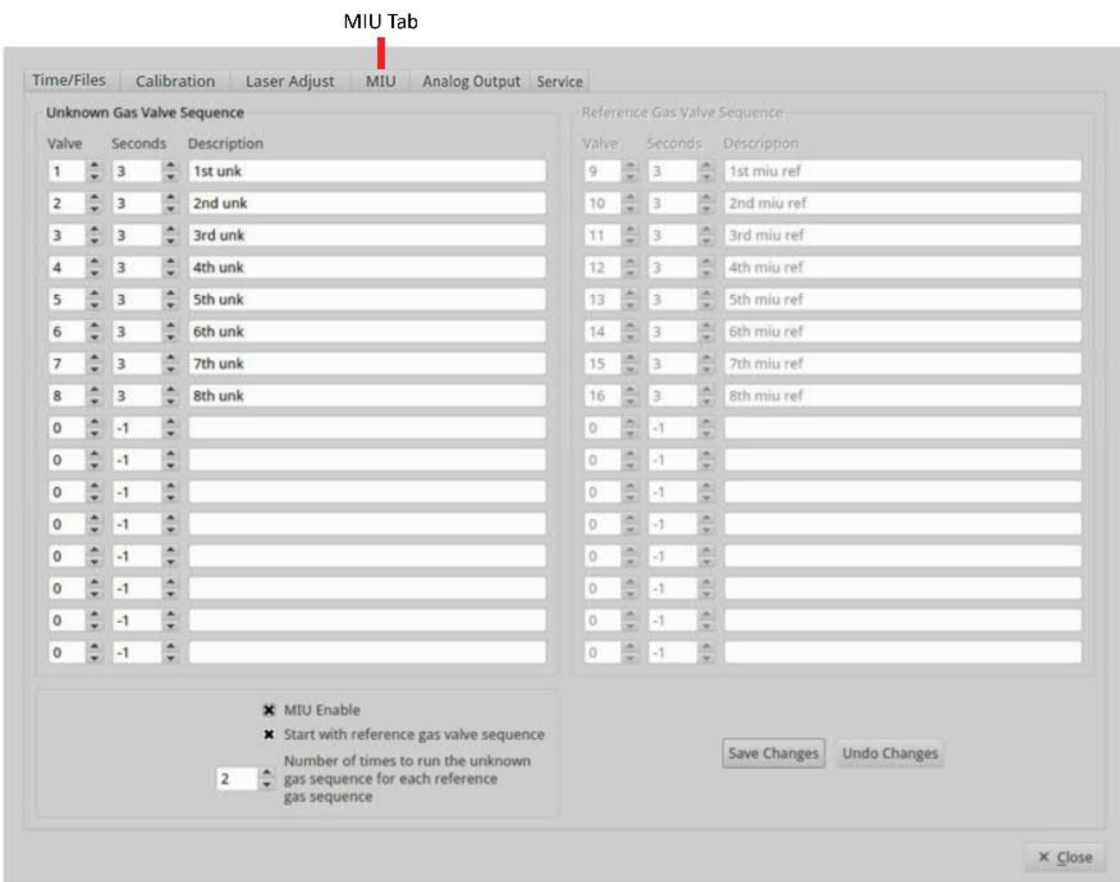

Figure 37: Control Menu for the (Optional) Multi-Port Inlet Unit (MIU)

Analog Output Tab

The *Analog Output* port has a 16-bit voltage range from 0 to 5 volts.

The user can specify a conversion between gas concentration and the analog output voltage, using the spinner controls, or by manually typing a number into the field. (Figure 38) The dropdown spinner controls let you select the concentration value that will correspond to the maximum 5 VDC analog output.

For example:

- Set 5 Volts = 10 ppm on the expectation that the gases measured will be in the range near 2 ppm, with occasional bursts up to almost 10 ppm.
- Set 5 Volts = 5 ppm to get exactly two times greater sensitivity on the analog output, with the expectation that the concentration will not go above 5 ppm.

NOTE If the measured concentration goes above the maximum expected value for the Analog Output, the on-screen displays and data files continue to record the correct measured concentration, but the Analog Output will saturate at its maximum value of 5.0 volts until the concentration drops back into the expected range.

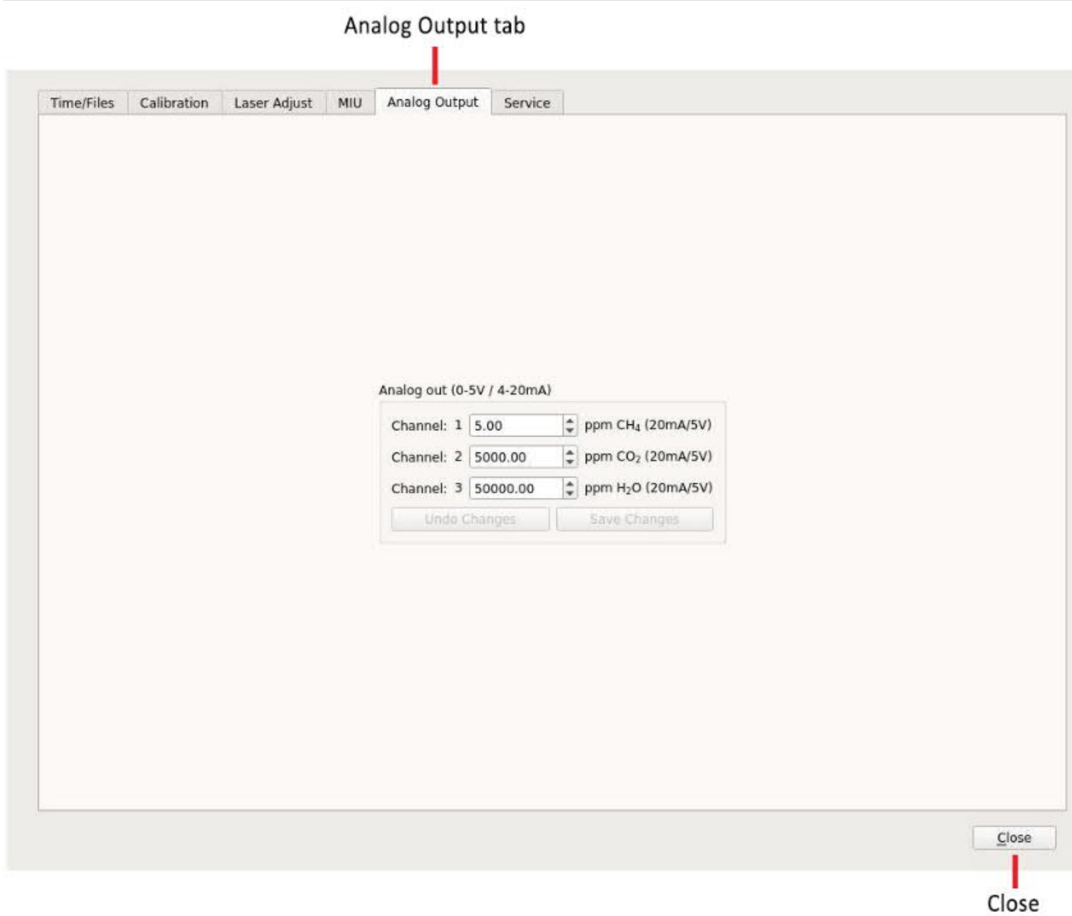

Figure 38: Analog Output Screen

Figure 39 shows the analog output connector.

Figure 39: Analog Output Connector

Water Vapor Isotope Standard Source Tab – WVISS Tab (Optional)

The optional WVISS accessory (WVISS) provides a controllable flow of water vapor at known humidity and isotope ratios for automated calibration of water vapor isotope analyzers (GLA132-WVIA).

Use this panel to configure the control of the WVISS. (Figure 40)

- Select the WVISS tab at the top of the *Setup* Screen.
- To Enable the WVISS, click the WVISS Enabled selection from the drop-down box.

For details on setup and functionality, see the *Configuring the Analyzer for the Optional WVISS Accessory Appendix* on page 98.

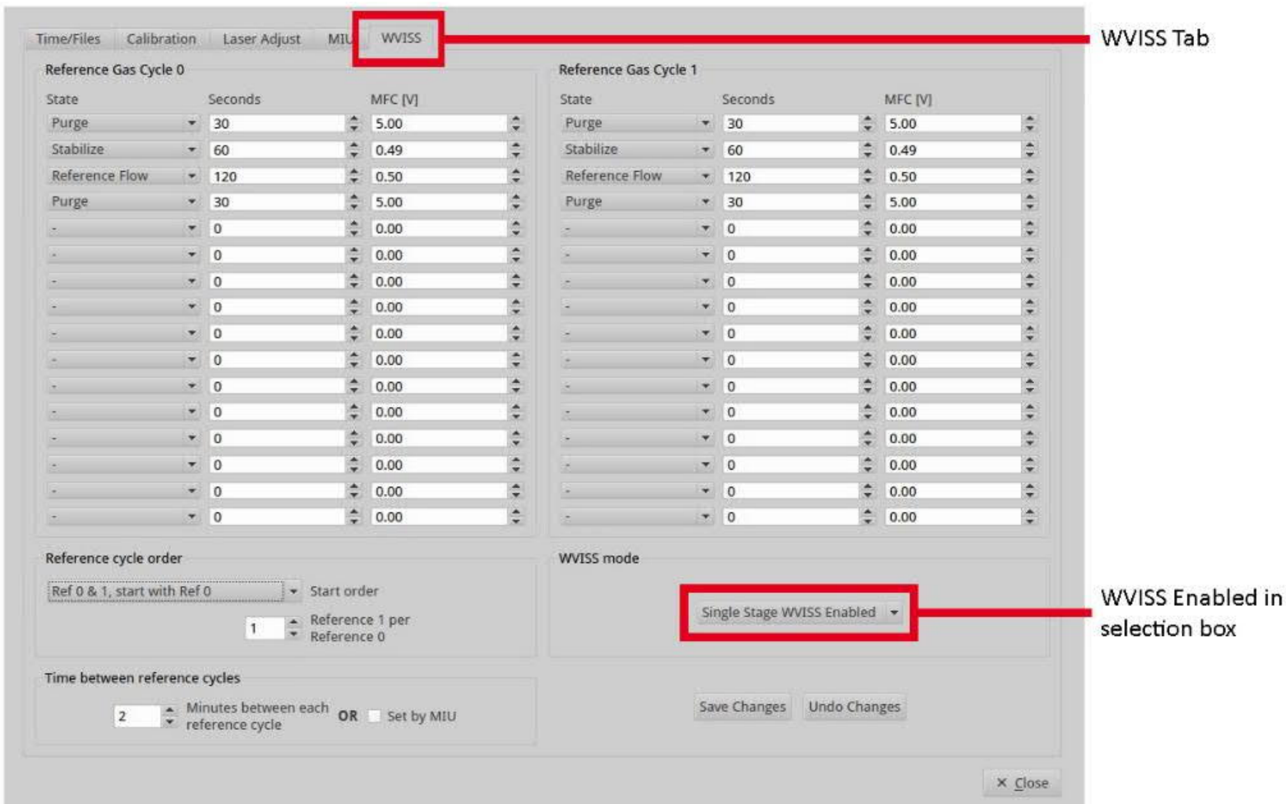

Figure 40: WVISS Tab

Service Tab

ABB-trained field service engineers monitor the performance of the analyzer via the *Service* screen. (Figure 41)

- 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.

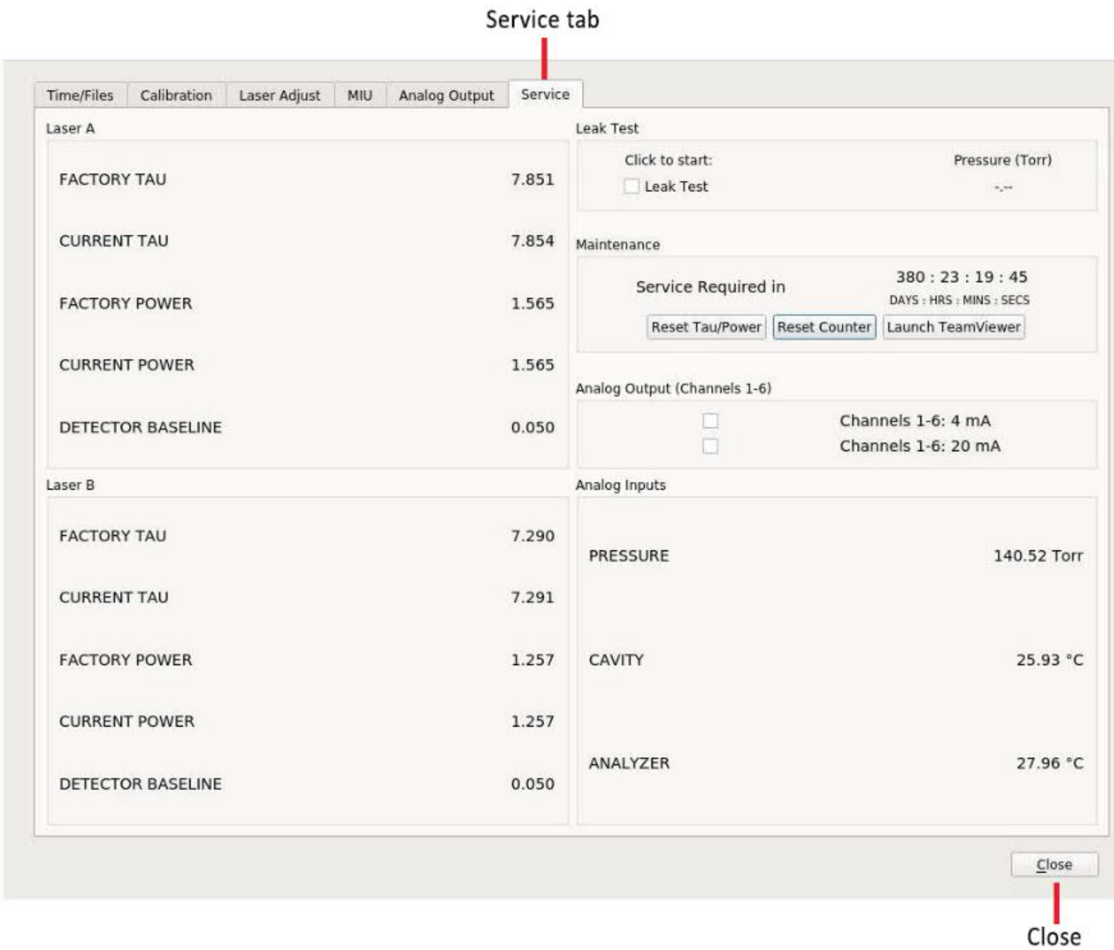

Figure 41: Service Screen

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 42)
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 43)

Figure 42: 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 43)

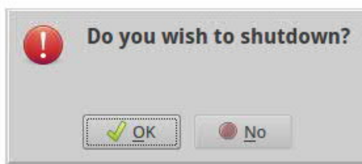

Figure 43: Analyzer Shutdown Prompt

4. When the *"You may turn off the instrument"* message displays (Figure 44), you can safely shut off power to the analyzer by pushing the OFF switch on the left panel of the analyzer. (Figure 2)

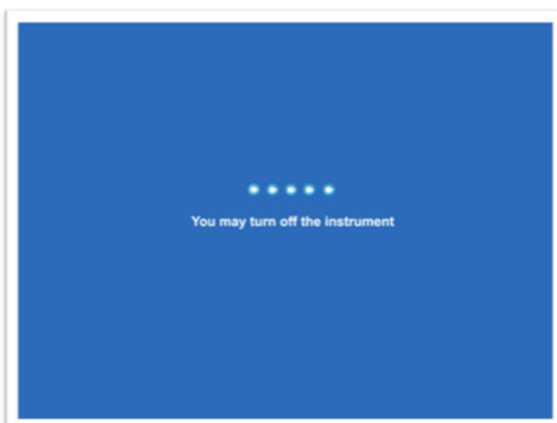

Figure 44: Final Shutdown Screen

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 9 describes routine maintenance tasks that keep your analyzer operating smoothly.

Table 9: Maintenance Checklist

Frequency	Task
Every 1-2 days	• On the *Spectrum Display*, verify that the spectrum is correct for each laser. The spectrum should appear as shown in Figure 21 and Figure 22. 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 35)

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

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 Fuse

If the fuse blows or is otherwise damaged, the analyzer automatically turns off.

To replace the fuse:

1. Flip the Power switch to OFF on the left side of the analyzer. (Figure 4)
2. Unplug the 11-30 VDC power connector from the left side of the analyzer. (Figure 4)
3. Unlatch the Case Securing Latches. (Figure 45)
    a. Push the latch button.
    b. Pull down on the latch.

Figure 45: Case Securing Latches

4. Open the case top. (Figure 46)

Figure 46: Open the Case Top

5. The fuse is located on the upper portion of the analyzer on the left side above the internal pump. (Figure 47)

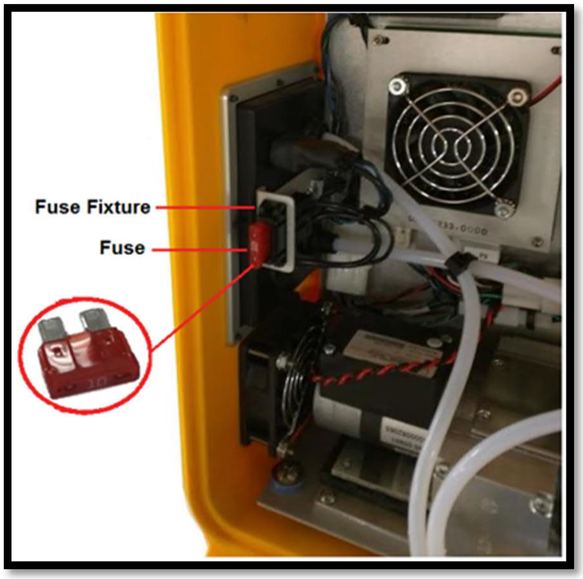

Figure 47: Analyzer Fused Inlet

6. Pull the fuse out of the fuse fixture. (Figure 48)

Figure 48: Remove the Fuse

7. Push the new fuse into the fuse fixture. (Figure 49)

Figure 49: Install the New Fuse in the Fuse Holder

8. Carefully close the case top and push the latches to lock the case.
9. Re-attach the 11-30 VDC power connector into the left side of the analyzer. (Figure 4)
10. Flip the Power switch to the ON position on the left side of the analyzer. (Figure 4)

Appendix A: About Gas Analyzers and Laser Absorption Spectroscopy

Conventional Laser Absorption Spectroscopy

For gas measurements based on conventional laser-absorption spectroscopy (Figure 50), a laser beam is directed through a sample, and the mixing ratio (or mole fraction) of a gas is determined from the measured absorption using Beer's Law, which may be expressed:

$$\frac{I_\upsilon}{I_o} = e^{-SL\chi P \phi_\upsilon}$$

Where:

- I_V is the transmitted intensity through the sample at frequency
- I_O is the (reference) laser intensity prior to entering the cell
- S is the absorption line strength of the probed transition
- L is the optical path length of the laser beam through the sample
- χ is the mole fraction
- P is the gas pressure
- Φ_V is the line-shape function of the transition at frequency $\boldsymbol{\upsilon}$

In this case,

$$\int \phi(\upsilon) d\upsilon = 1$$

If the laser line width is much narrower than the width of the absorption feature, high-resolution absorption spectra may be recorded by tuning the laser wavelength over the probed feature.

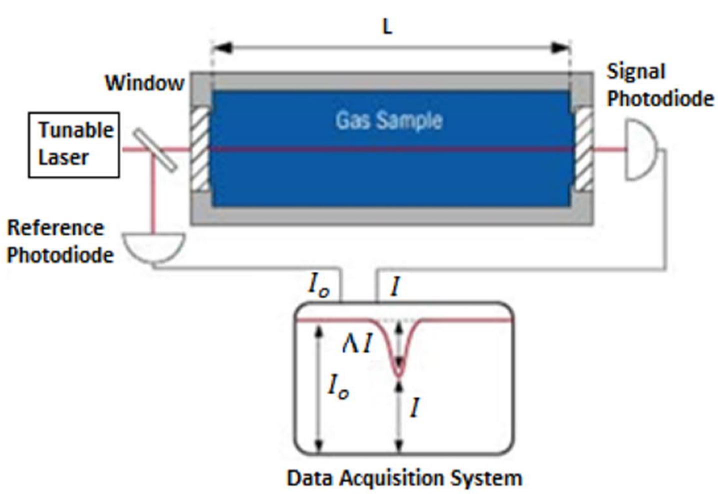

Figure 50: Typical Laser Absorption Spectroscopy Setup

Integration of the measured spectra with the measured values of:

- Gas temperature
- Gas pressure
- Path length
- Line strength of the probed transition

Enables you to determine the mole fraction directly from the relation:

$$\chi = \frac{-1}{SLP}\int_{v} ln\left(\frac{I_v}{I_o}\right)dv$$

Use this equation to determine gas concentrations, even in hostile environments without using calibration gases or reference standards. These values are measured:

- Mixtures containing several species
- Flows at elevated temperatures and pressures

ABB-LGR's Off-Axis Integrated-Cavity Output Spectroscopy (Off-Axis ICOS)

Off-Axis ICOS uses a high-finesse optical cavity as an absorption cell as shown in Figure 51. Unlike multi-pass detectors, which are typically limited to path lengths of less than two hundred meters, an Off-Axis ICOS absorption cell effectively traps the laser photon so that, on average, they make thousands of passes before leaving the cell.

As a result, the effective optical path length may be several thousands of meters using high-reflectivity mirrors and thus the measured absorption of light after it passes through the optical cavity is significantly enhanced. For example, for a cell composed of two 99.99% reflectivity mirrors spaced by 25 cm, the effective optical path length is 2500 meters.

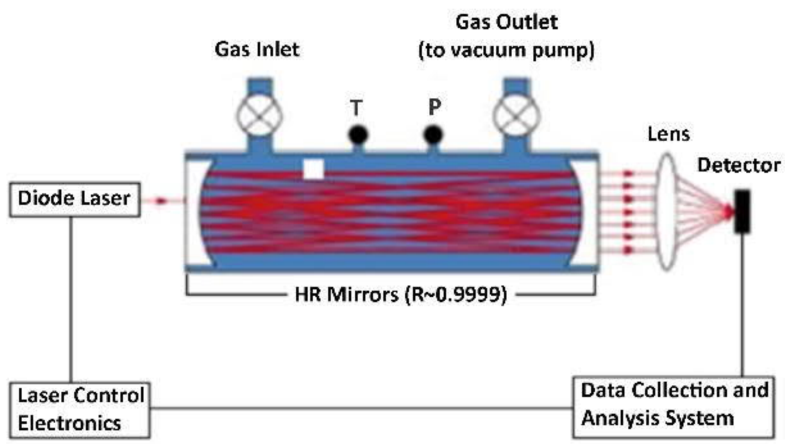

Figure 51: Schematic Diagram of an Off-Axis ICOS Analyzer

Because the path length depends only on optical losses in the cavity and not on a unique beam trajectory (like conventional multi-pass cells or cavity-ring-down systems), the optical alignment is very robust allowing for reliable operation in the field. The effective optical path length is determined routinely by simply switching the laser off and measuring the necessary time for light to leave the cavity (typically tens of microseconds).

As with conventional tunable-laser absorption-spectroscopy methods:

- The wavelength of the laser is turned over a selected absorption feature of the target species.
- The measured absorption spectra is recorded and used to determine a quantitative measurement of mixing ratio directly and without external calibration when combined with the recorded:
    - Measured gas temperature and pressure in the cell
    - Effective path length
    - Known line strength

Appendix B: 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 side 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: *\\192.168.100.29*

   Refer to the *Time/Files menu* (Figure 32) 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 32 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 C: Wireless Router Setup (Optional)

The analyzer can be ordered with an optional wireless router (OPT-WIFI). If you ordered the wireless router option, it will be factory installed inside, or on the side of, the analyzer.

Configuration Options

Access-Point Mode

The router is shipped in Access-Point mode, by default. This appendix provides instructions on setting up the router in Access-Point mode. For information on other possible modes, refer to the TP-Link website at www.tp-link.com/support and enter the TP-Link model number (TL-WR802N).

NOTE

You must restart the analyzer whenever you change router modes for the mode change to take effect.

Local Connection

You can also bypass the wireless router if you want to connect the analyzer to a local network. Refer to the *Connect Analyzer to Local Network* section on page 74 for instructions on this configuration.

Wireless Control Using Remote Device

For wireless control of the analyzer using a remote device, install the appropriate Virtual Network Client (VNC) software on your remote device. Refer to page 75 (Appendix D: Set Up Devices for Remote Access Using VNC Software) for details on setting up devices for remote access using VNC software (optional).

Configure Router for Access-Point Mode

1. Using a phone, tablet, or laptop, connect to the router using the SSID and password on the router. (Figure 52)

Figure 52: Router SSID and Password Location

2. On the same device, launch a Web browser, then type http://tplinkwifi.net in the address bar. (Figure 53)

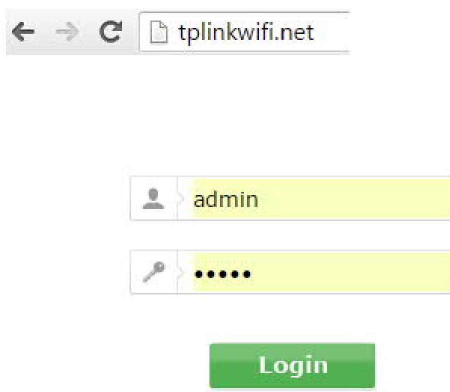

Figure 53: Logging In

3. Enter admin (in lowercase) for both the username and password.

4. Click Login.

5. On the left panel, click Quick Setup. (Figure 54)

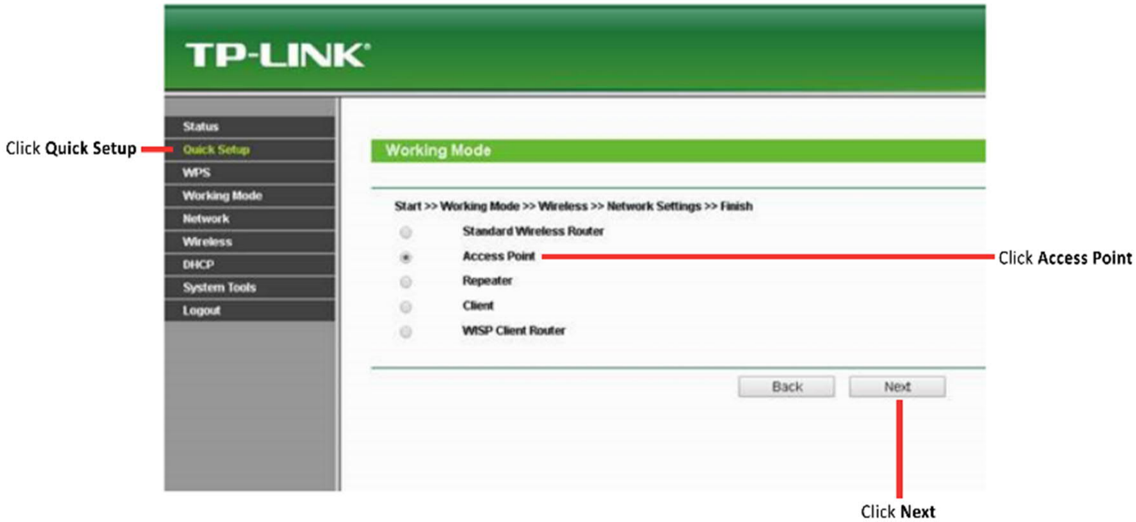

Figure 54: Start Router Configuration

6. Click Next.

7. In the *Main Panel*, select the Access Point button. (Figure 54)

8. Click Next.

9. In the *Wireless Setting* screen, do one of the following: (Figure 55)

   - To keep the default *Wireless Network Name* and / or *AP Wireless Password*, click Next.
   - To change the default *Wireless Network Name* and / or *AP Wireless Password*, change the names in the *Wireless Network Name* and / or *AP Wireless Password* fields, then click Next.

Figure 55: Wireless Setting Screen

10. In the *Network Setting* screen, click Next. (Figure 56)

Figure 56: Network Setting Screen

11. Click Finish.

12. Restart the analyzer.

Connect Analyzer to Local Network

1. Unplug the black cable from the router *LAN/WAN* port. (Figure 57)

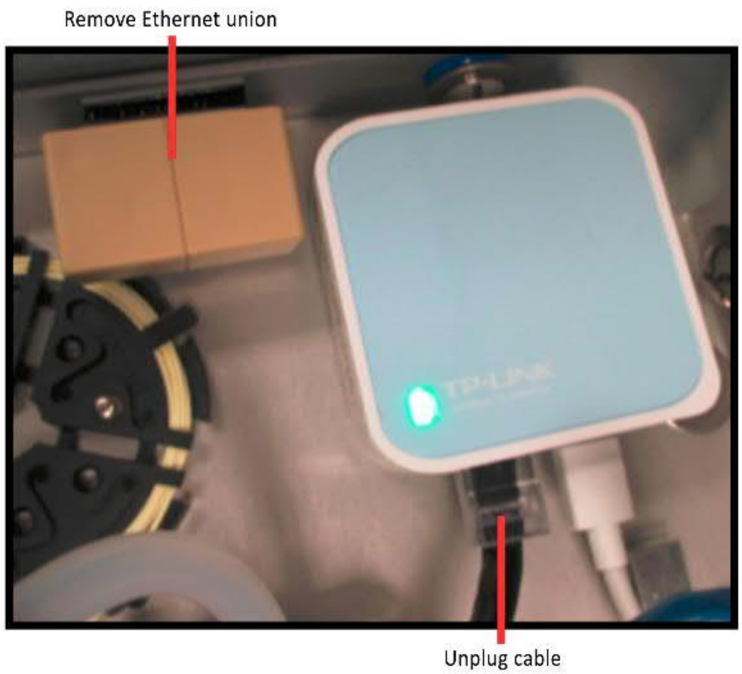

Figure 57: Unplug Cable and Remove Ethernet Union

2. Remove the Ethernet union (next to the router). (Figure 57)
3. Plug the black cable into either port of the Ethernet union. (Figure 58)

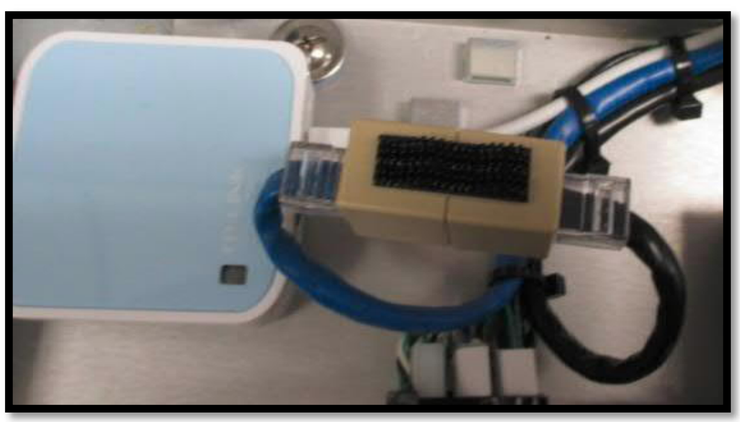

Figure 58: Plug Cables into Ethernet Union

4. Plug the blue cable into the other port of the Ethernet union. (Figure 58)
5. Connect a local area network (LAN) cable from an external computer to the analyzer Ethernet port, located on the external side panel.

Appendix D: 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 listed on the router sticker. Enter the TP-Link wireless router (example: TP-LINK-775C) as shown in Figure 52.
    - 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 SSID.

4. Enter the wireless password printed on the router sticker. (Figure 52) Every router has a different, unique SSID number, and wireless password.

5. Select Connect. (Figure 59)

Figure 59: Password Connection Screen

6. A verification message appears, showing that the Android device is connected to the router. (Figure 60)

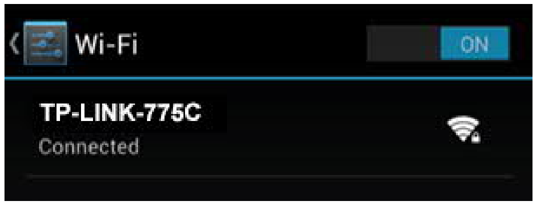

Figure 60: Connectivity Confirmation Screen

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 61)

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

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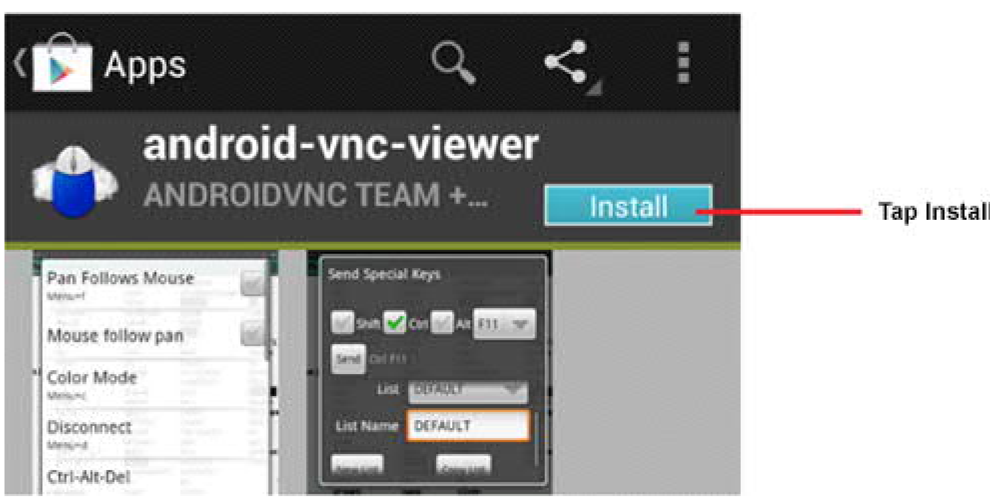

Figure 61: Android-vnc-viewer Install Screen

10. Open the VNC application on the Android device by selecting the VNC application icon. (Figure 62)

Figure 62: VNC Application Icon

11. The Android VNC screen appears. (Figure 63)

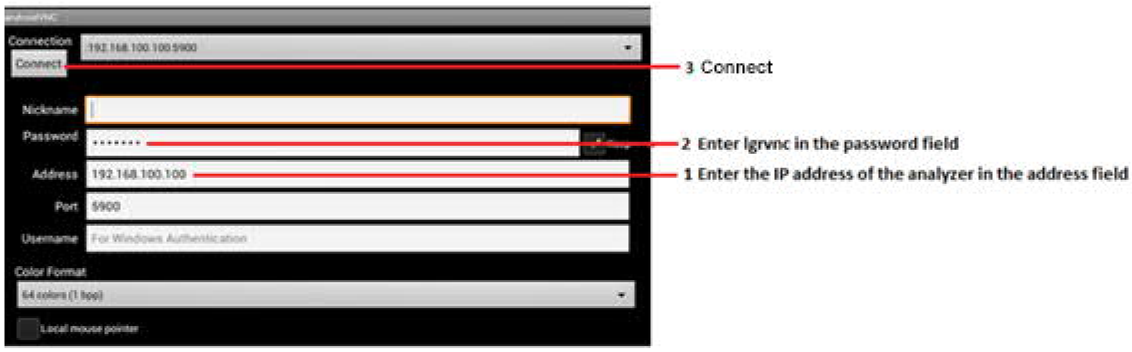

Figure 63: VNC Application Installation Setup Screen

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 64)

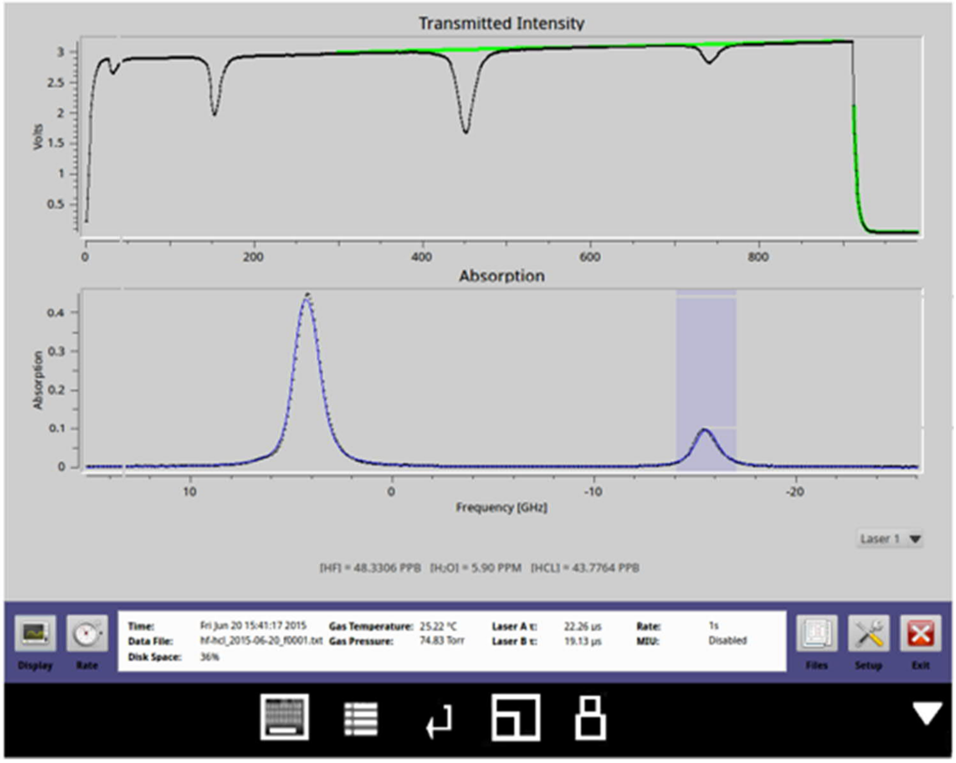

Figure 64: Analyzer Software Interface Display with Size Adjustment for Android Devices

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 listed on the router sticker. (Figure 52) 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 65)

Figure 65: Network Connections Screen

4. The *Enter Password* screen appears. (Figure 66) In the Password field, enter the wireless password on the router sticker. (Figure 52)

5. Select Join.

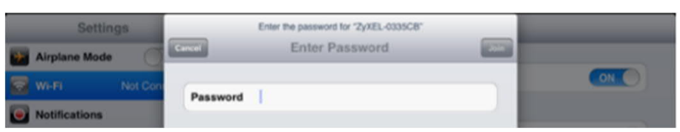

Figure 66: Router Connection Screen

6. The *Network Connections* screen confirms that the iOS device is connected to the router. (Figure 67)

Figure 67: 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 68.
    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 68: Device IP Address Confirmation Screen

9. Install the VNC software by searching and installing it from the App store.
    - *Mocha VNC Lite for iOS* is the software used in this example. (Figure 69)
    - 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.

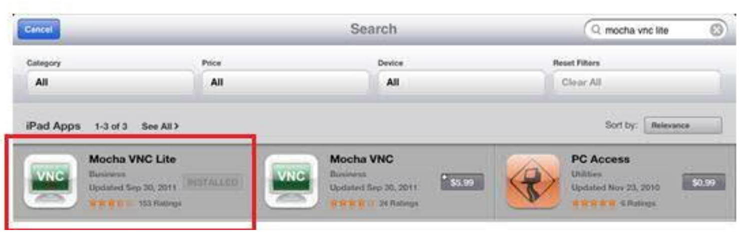

Figure 69: VNC Selection Screen

10. Open the application and select Configure. (Figure 70)

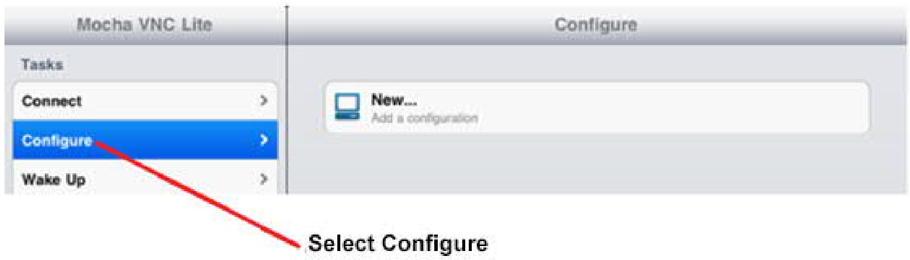

Figure 70: Mocha VNC Lite Configure (New) Screen

11. The *Configure Screen* prompts you for the server IP address and password. (Figure 71)

Figure 71: 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 72)

Figure 72: 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 73) The screen size is adjustable to fit the screen of the device.

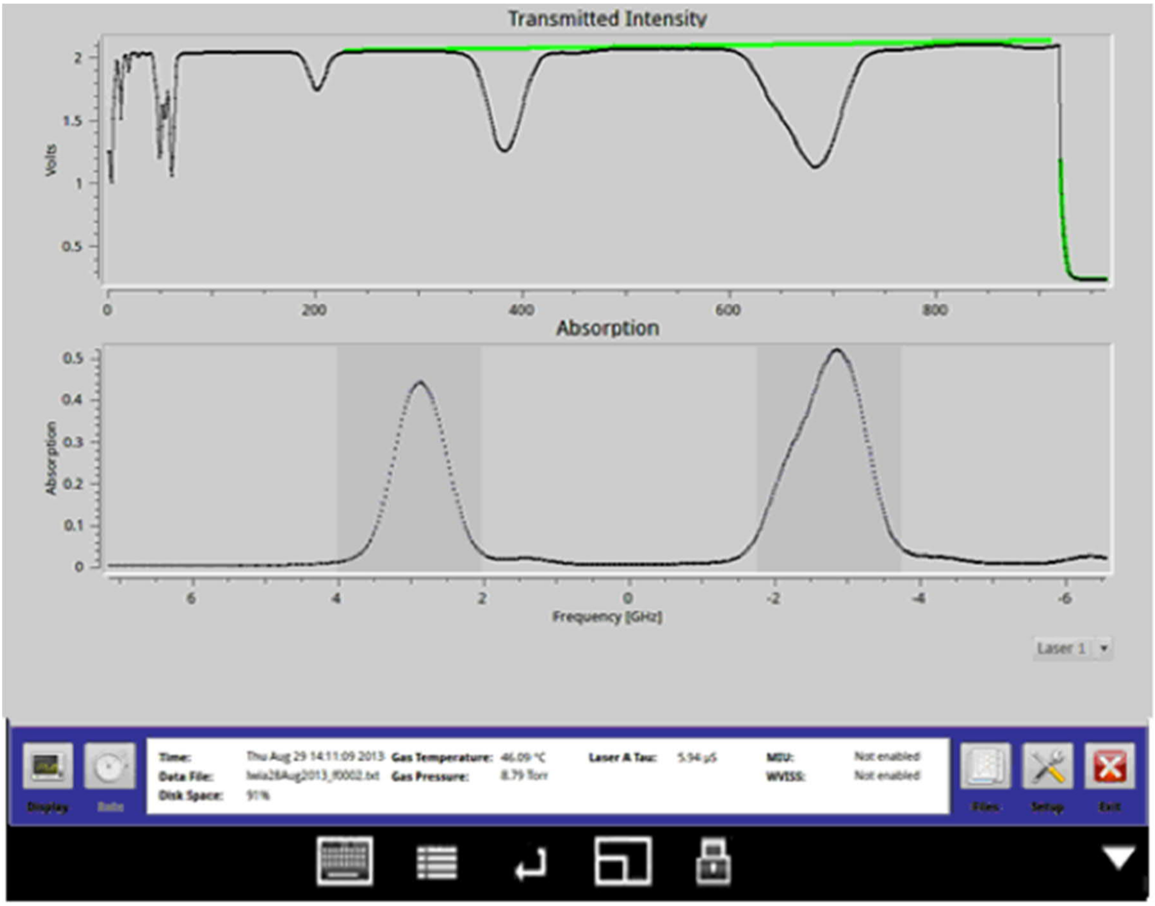

Figure 73: Analyzer Software Interface Screen (Size Adjustment for iOS Devices)

Set up VNC Software on Windows Devices

1. On the Windows device, open *Wireless Router* options.
2. Locate the sticker on the router. (Figure 52)
3. Click on the Wireless Network Connections icon in the bottom left of the screen (Figure 74) to open the *Windows Wireless Networks* dialog-box. (Figure 75)

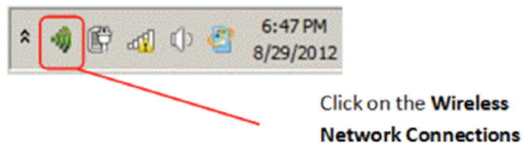

Figure 74: Wireless Connections Icon

Figure 75: 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 76)

5. In the *Security key* field, enter the wireless password located on the router sticker. (Figure 52)

6. Click OK.

Figure 76: Network Connections Security Screen

7. The *Connection Status* dialog-box displays. (Figure 77)

Figure 77: Current Connectivity Screen

8. Check the connection to make sure the device is connected through the wireless router by selecting the router. (Figure 78)

Figure 78: 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 79)

Figure 79: Current Connectivity Screen

10. The *Wireless Network Connection Status* dialog-box displays. (Figure 80)

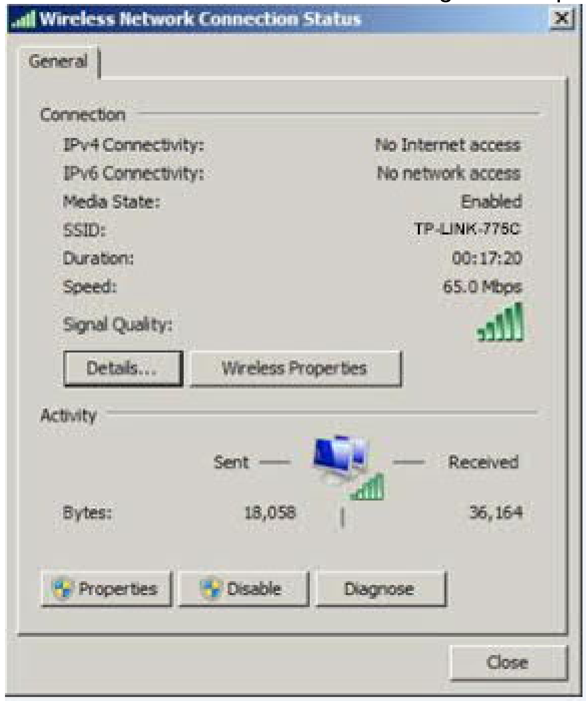

Figure 80: Wireless Network Connection Status Window

11. Click the Details button to display the *Network Connection Details* window. (Figure 81)

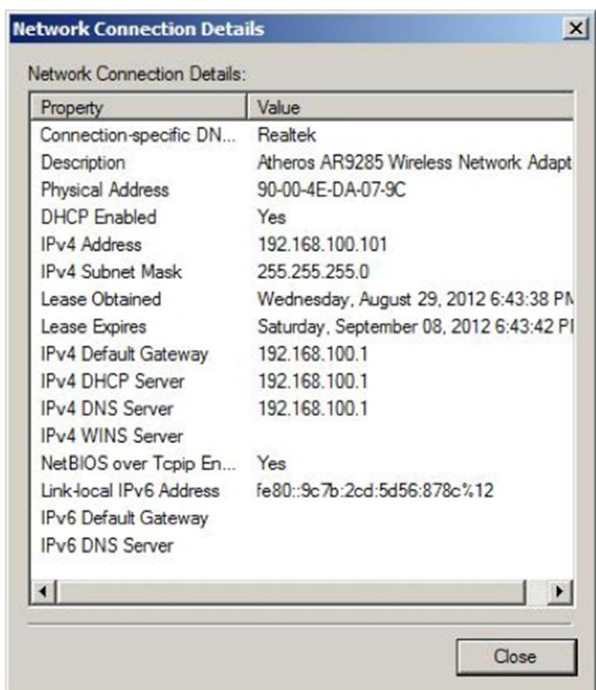

Figure 81: Network Connection Details Window

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 81)

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 82)

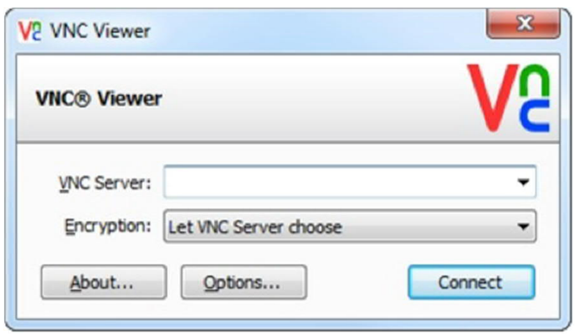

Figure 82: Real VNC Viewer Installation Screen

15. Enter the analyzer's address in the VNC server address field (192.168.100.100 or 192.168.100.101), from Figure 81.

    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 E: Multi-Port Inlet Unit (Optional)

The optional Multiport Inlet Unit 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 83) 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 (MIU-8)
- 16 port (MIU-16)

Figure 83 shows the front panel of a 16 port MIU.

Figure 83: 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 84 shows the back panel of a 16 port MIU (MIU-16). 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)

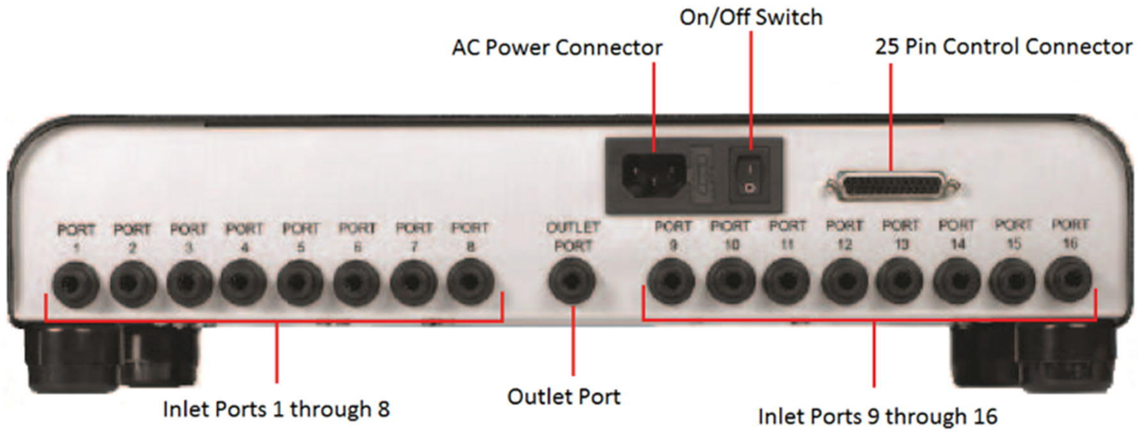

Figure 84: MIU Back Panel

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 87)
2. Click on the MIU tab at the top of the *Setup* menu selection bar. (Figure 85)
    a. The *MIU setup* menu becomes active. Use the menu to specify what ports are sampled and for how long.

Figure 85 shows the *Gas Manifold Control* Screen for the MIU not yet enabled.

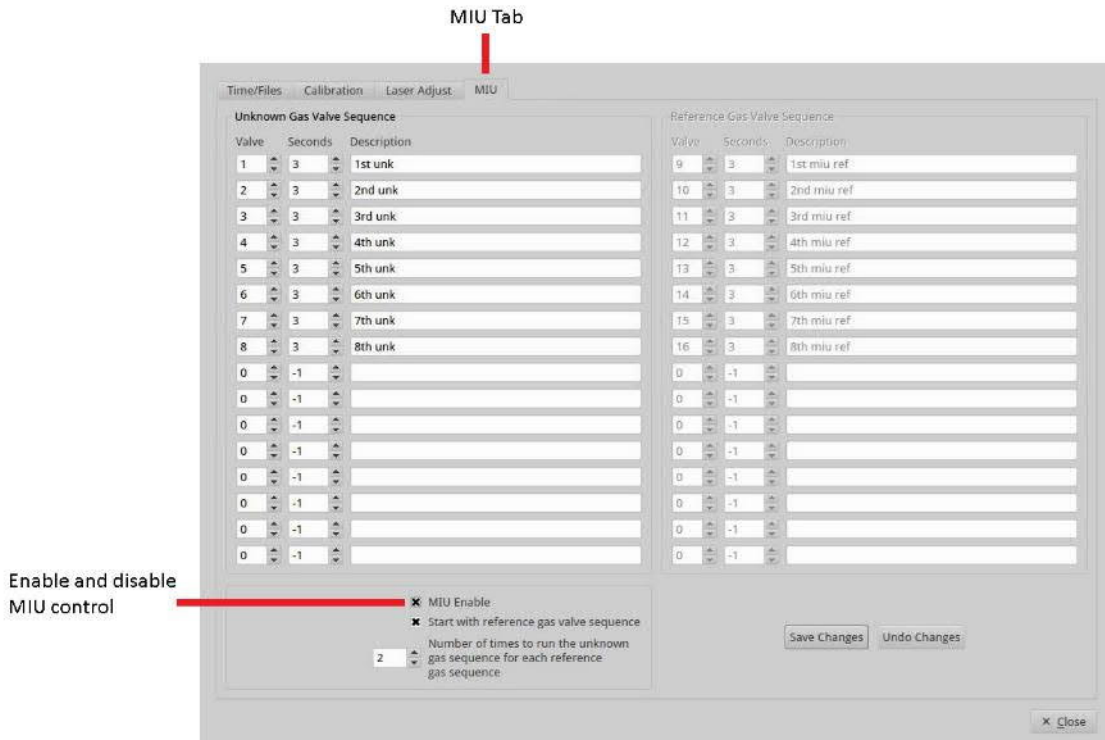

Figure 85: Gas Manifold Control Screen for the MIU, not yet enabled

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 86: 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).

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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 86)
7. Select Save Changes to save your current configuration.
8. To begin sampling, click Close. (Figure 86)

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 87)

The description is:

- Displayed on the parameter window of the *User Interface Control Bar* during analysis. (Figure 87)
- Saved to a data file

Figure 87: 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 86)

Appendix F: Calibration of WVIA and TWVIA analyzers

ABB-LGR recommends periodic referencing rather than calibration to ensure measurement accuracy and consistency.

Water concentration and isotopes are calibrated separately; however, the correct isotope values must be entered when performing a concentration calibration and vice versa. When calibration is necessary, follow the procedure detailed below.

To Calibrate the Water Concentration

1. Connect a Dew Point Generator (Licor LI-610, or similar) to the inlet of the water vapor isotope analyzer.

2. Set the dew point generator to 7V, which is equivalent to 10,060ppm H_2O.

3. Once the water concentration is stable at 7V, create a new data file and run the analyzer for 5 minutes to get an average value of the δD, $\delta^{18}O$ and $\delta^{17}O$ isotope ratios in PP_MIL (‰).

4. Open the Standard Data File (F file) and determine the average values of each isotope:
    a. D_del vs Time
    b. O18_del vs Time
    c. O17_del vs Time (if applicable)

5. Click the Setup button on the *User Interface Control Bar*. (Figure 88)

Figure 88: User Interface Control Bar

6. Select the Calibration tab at the top of the screen to enter the *Calibration* menu. (Figure 89)

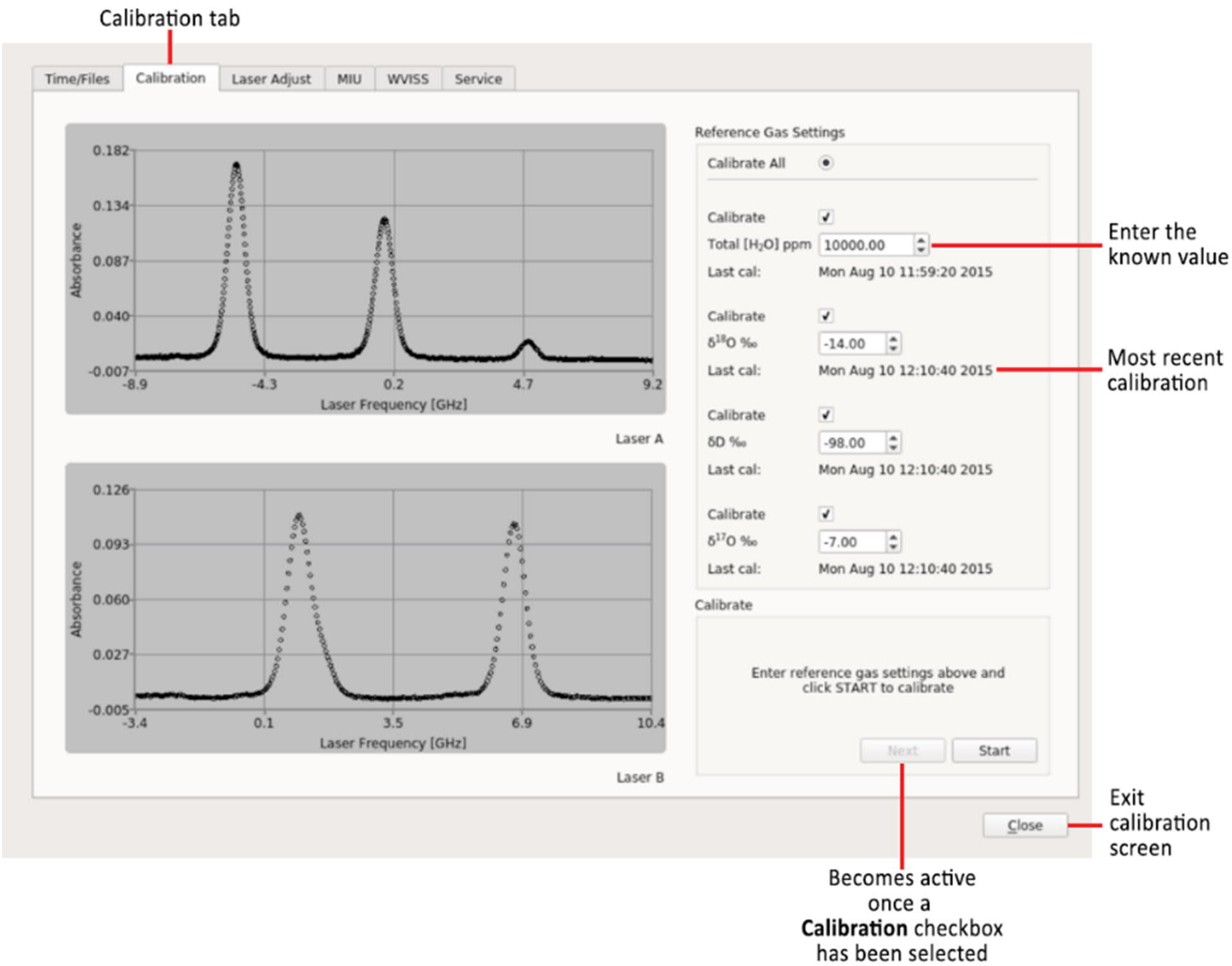

Figure 89: Calibration menu

7. Enter the known concentration of water vapor (example: 10,060ppm if the Dew Point Generator is set to 7 Volts). (Figure 89)

8. Enter the averaged values of δD, δ^{18}O and δ^{17}O in PP_MIL (‰). (Figure 89)

9. Click the NEXT button on the lower, right panel of the screen to begin calibration. (Figure 89)

10. Each step is displayed in the lower-right panel of the calibration screen as the analyzer performs the calibration. Figure 90 shows the calibration process as a flow chart.

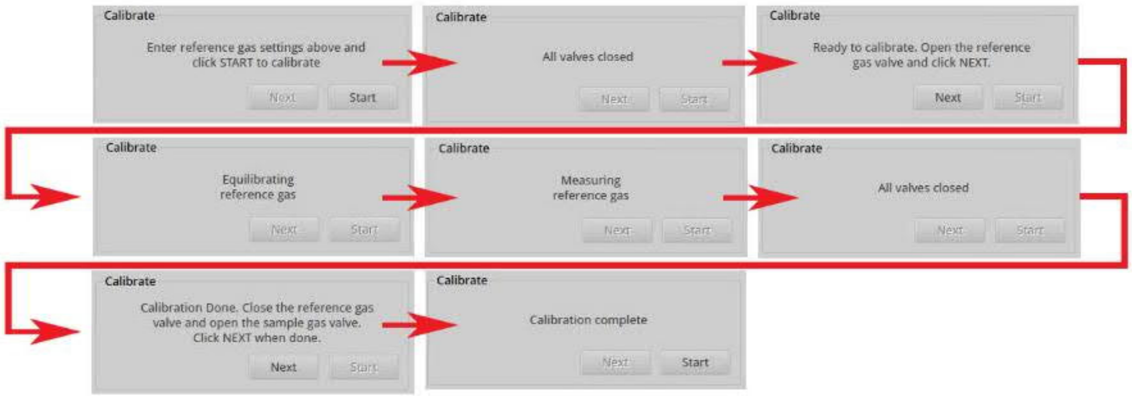

Figure 90: Calibration Flow

11. When the *Calibration Complete* message is displayed, click the CLOSE button.

12. Enter *TimeChart* by selecting the Display button on the *User Interface Control Bar* (Figure 88) and verify that the displayed concentration is reporting the expected value.

NOTE

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

To Calibrate the Isotope Values

1. Connect the WVISS to the inlet of the analyzer.
2. Use a Water Standard with known isotopic values.
3. If the WVISS is labeled with a Calibration Voltage Sticker (example 2.2V = 10,000ppm), set the manual hand pad to that voltage.
    a. If the WVISS is not labeled with a Calibration Voltage, set the hand pad between 2.2-2.4 Volts and adjust accordingly until the analyzer is reporting 10,000ppm.
4. Allow the analyzer to stabilize at 10,000ppm before calibrating.
5. Click the Setup button on the *User Interface Control Bar*. (Figure 91)

Figure 91: User Interface Control Bar

6. Select the Calibration tab at the top of the screen to enter the *Calibration* menu. (Figure 92)

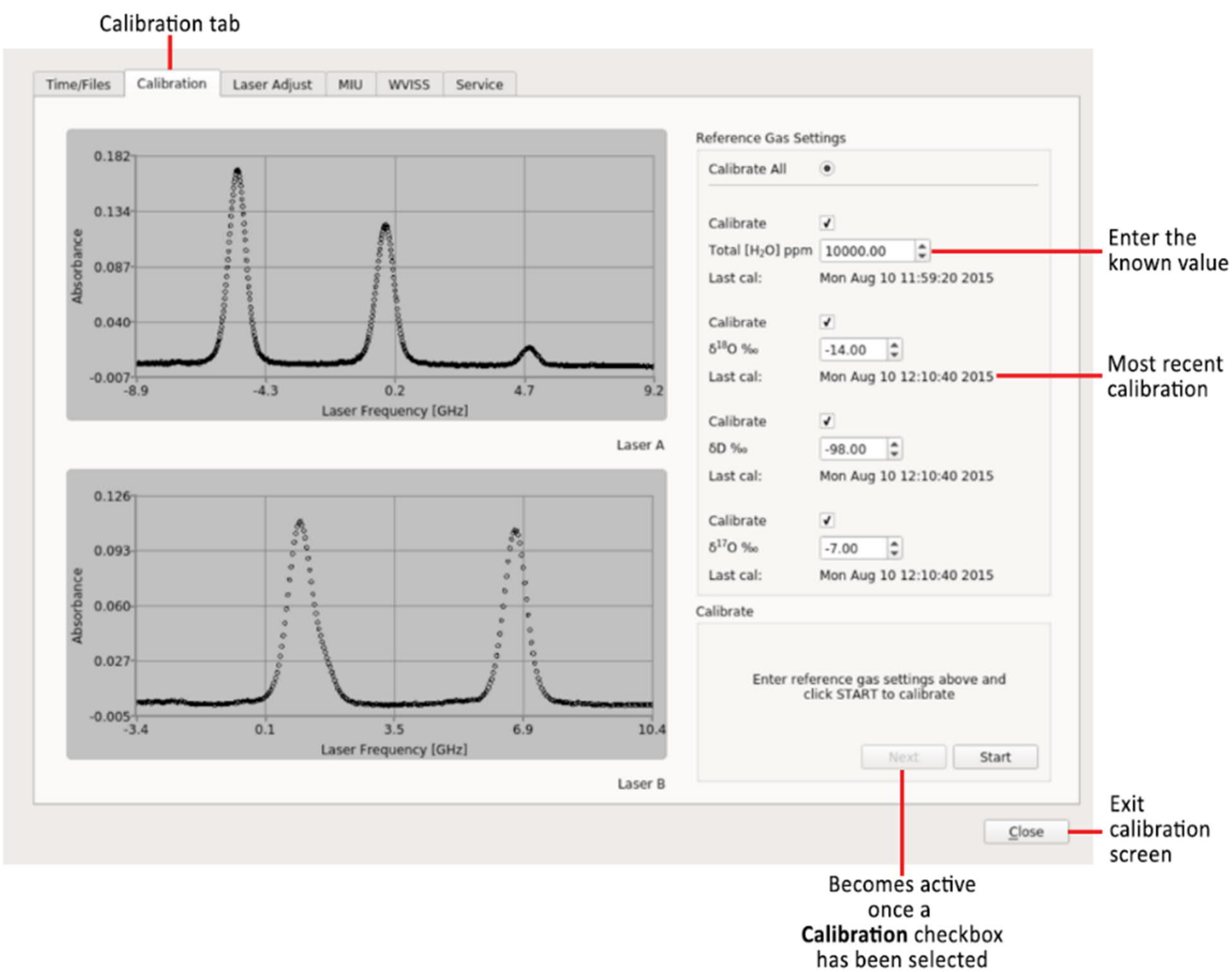

Figure 92: Calibration menu

7. Enter 10,000ppm into the Total [H_2O] ppm field. (Figure 92)
8. Enter the values of δD, $\delta^{18}O$ and $\delta^{17}O$ in PP_MIL (‰) that are labeled on the Water Standard Bottle. (Figure 92)
9. Click the NEXT button on the lower, right panel of the screen to begin calibration. (Figure 92)
10. Each step is displayed in the lower-right panel of the calibration screen as the analyzer performs the calibration. Figure 93 shows the calibration process as a flow chart.

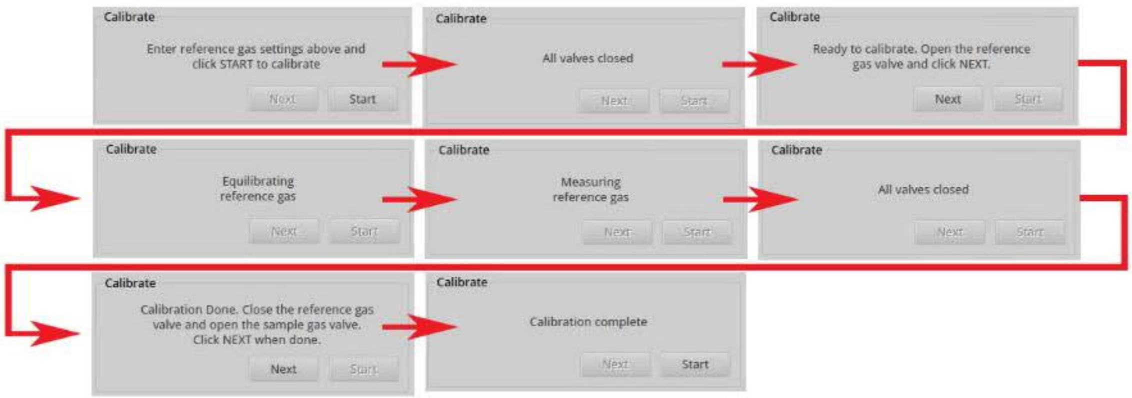

Figure 93: Calibration Flow

11. When the *Calibration Complete* message is displayed, click the CLOSE button. (Figure 92)
12. Enter *TimeChart* by selecting the Display button on the *User Interface Control Bar* (Figure 91), and verify that the displayed isotope values correctly correspond to the values listed on the bottle.

NOTE

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

Appendix G: Configuring the Analyzer for the Optional WVISS Accessory

The Water Vapor Isotope Standard Source (WVISS) is an ABB-LGR accessory that provides a consistent, automated flow of water vapor to the GLA132-WVIA analyzer over a wide range of H_2O concentrations. The WVISS setup screen on the analyzer (Figure 96) allows for configuration and control of water vapor references that are introduced into the inlet port of the analyzer.

Figure 94 shows the front panel of the WVISS accessory:

Figure 94: Front Panel of the WVISS Accessory

The Standard Range WVISS is compatible with the GLA132-WVIA analyzer

- Range: 3000 – 30,000 ppm H2O
- Dimensions: 19" × 17" × 10½"
- Weight: 60 pounds (27 kg)

Power Requirements:

- 115/230 VAC, 50/60Hz
- Average in normal operation: 30 watts
- Idle: 10 watts
- Full operation: 300 watts

NOTE

For WVISS installation, operation, and maintenance, refer to the WVISS User Manual.

Control the WVISS Using the Analyzer Setup Panel

Configure the analyzer to control the WVISS:

1. Click Setup on the *User Interface Control bar*. (Figure 95)

Figure 95: Setup Button on the User Interface Control Bar

2. Click on the WVISS tab at the top of the *Setup menu* selection bar. (Figure 96)

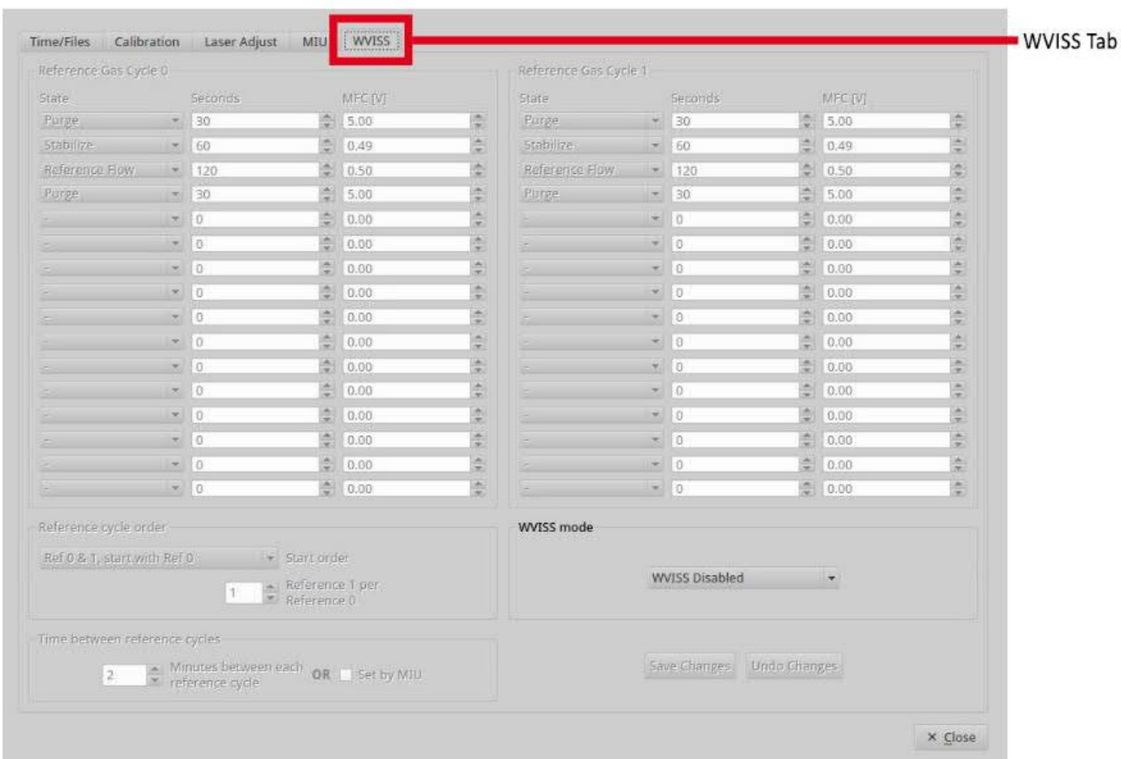

Figure 96: WVISS Setup Screen

3. The *WVISS Control Panel* is displayed. Figure 97 shows the WVISS Control Screen and identifies the panes to make adjustments to the WVISS operation.

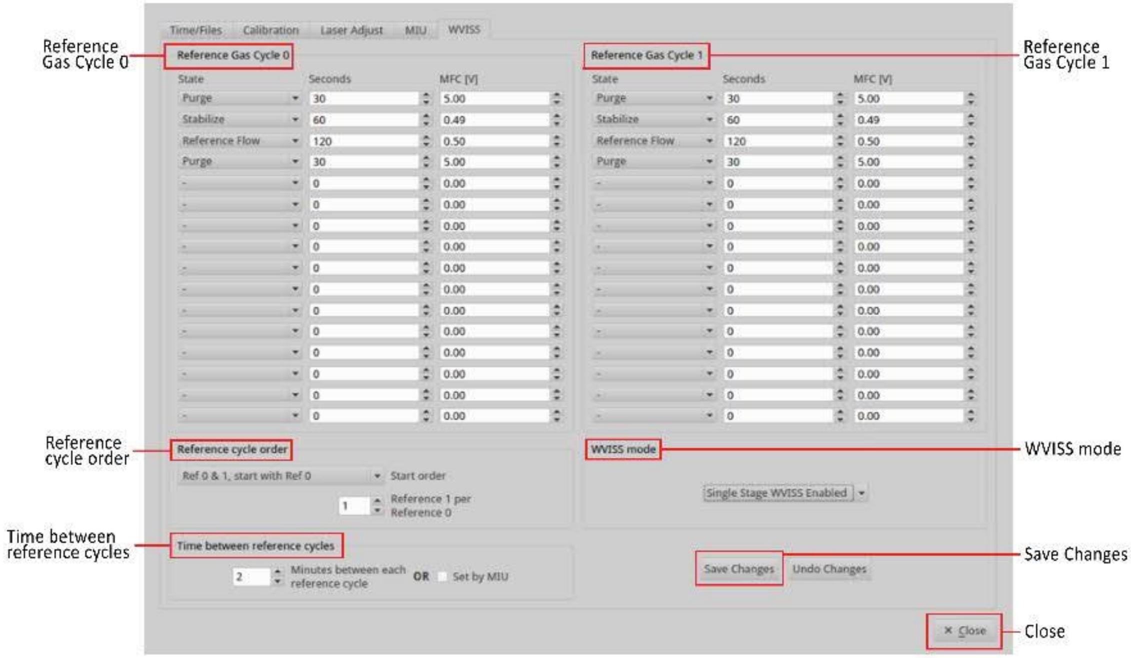

Figure 97: Adjustment Panel for the WVISS operation

4. In the *WVISS mode pane*, use the drop-down selection box to enable control of the WVISS. (Figure 98)

   Options include:
   - WVISS disabled
   - Single Stage WVISS Enabled
   - Dual Stage WVISS Enabled (not compatible with the GLA132-WVIA)

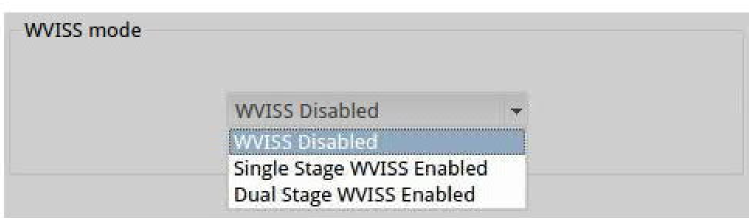

Figure 98: WVISS Mode Drop Down Menu

NOTE

Once WVISS Enabled is selected, the screen becomes active to allow for user configuration.

5. In the Reference Gas Cycle 0 and Reference Gas Cycle 1 panes:
   a. Set the state of the WVISS by using the drop-down selector in the *State columns*. (Figure 99)

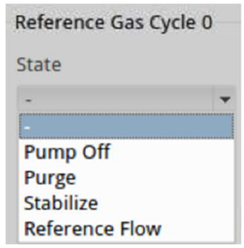

Figure 99: Select the State of the WVISS

The *States* include:

- Pump Off
- Purge
    - This default setting is at the beginning and the end of each cycle, but additional purging steps can be added before stabilizing and after the last reference flow.
    - Purge the nebulizer before and after each sample to avoid clogging the nebulizer.
- Stabilize
    - During stabilization, the analyzer will not record measurements of the reference flow.
- Reference Flow
    - The reference sample is measured and recorded by the analyzer. The settings are recorded and saved in the last column of the data file, (ex: … ,REF1 MFC: 1.00V)

NOTE

The default setting for the analyzer is a single reference flow. This is usually enough for post referencing.

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b. Set the duration of the sample by adjusting the timing in the Seconds columns. (Figure 100)

c. Set the dilution of the sample by adjusting the voltage in the MFC mV columns. (Figure 100)

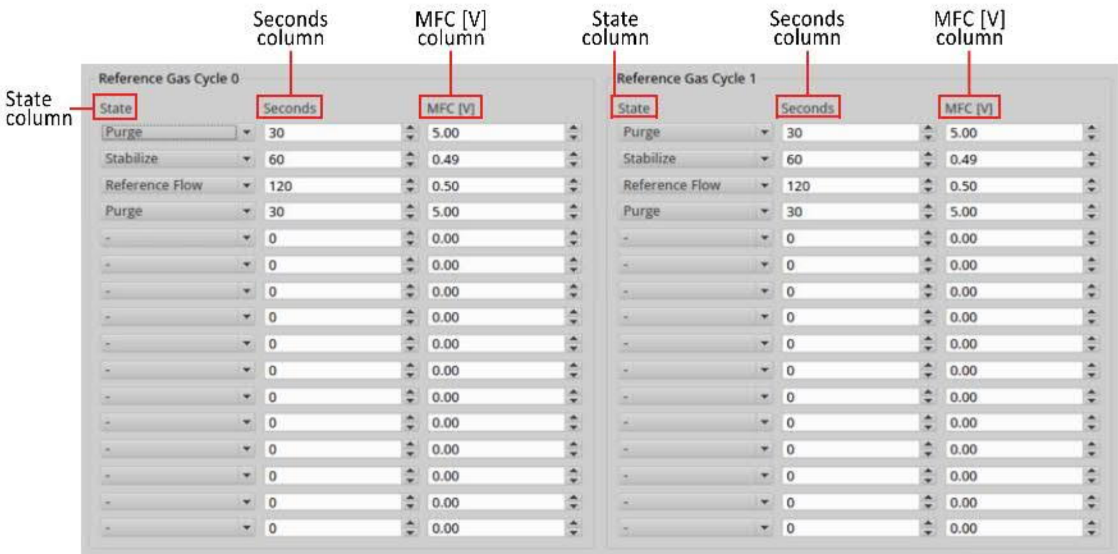

Figure 100: Adjustment of the States

6. Listed below is an example of a Reference Gas Cycle Configuration. (Figure 101)

Reference Gas Cycle 1 (single reference),
Purge for 30-seconds @ 4.99V (automatic function (hidden))
Stabilize for 30-seconds @ 1.00 V
Reference flow for 60-seconds @ 1.00V
Purge for 30-seconds @ 4.99V (automatic function (hidden))

Reference Gas Cycle 0 (6-references):
Purge for 30-seconds @ 4.99V (automatic function (hidden))
Stabilize for 30-seconds @ 4.99 V
Reference flow for 60-seconds @ 4.99V
Reference flow for 60-seconds @ 4.00V
Reference flow for 60-seconds @ 3.00V
Reference flow for 60-seconds @ 2.00V
Reference flow for 60-seconds @ 1.00V
Reference flow for 60-seconds @ 0.50V
Purge for 30-seconds @ 4.99V (automatic function (hidden))

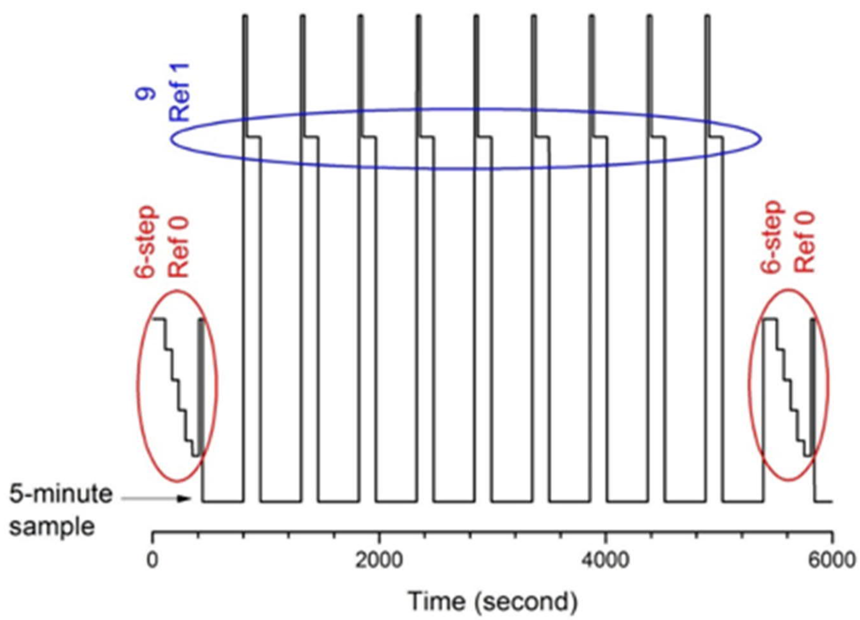

Figure 101: Two Types of WVISS Reference Cycles

7. In the *Reference cycle order pane*, use the drop down selection box to setup the Start order. (Figure 102)

   The options include:
   a. Ref 0 & 1, start with Ref 0
   b. Ref 0 & 1, start with Ref 1
   c. Ref 0 & 1, start with MIU/Sample in
   d. Ref 0 only, start with Ref
   e. Ref 1 only, start with Ref
   f. Ref 0 only, start with MIU/Sample in
   g. Ref 1 only, start with MIU/Sample in

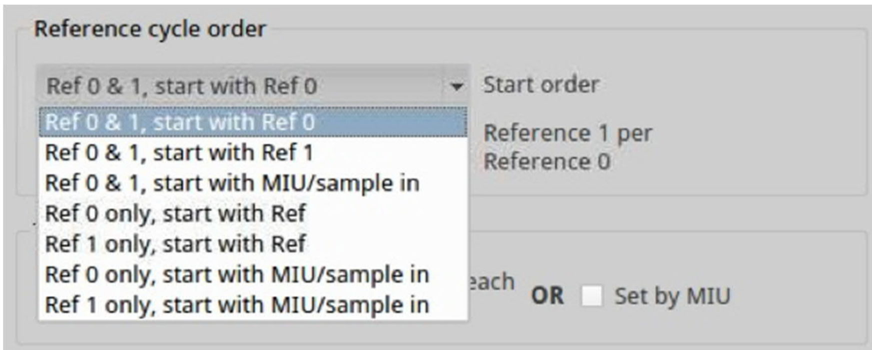

Figure 102: Reference Cycle Order Pane

8. In the *Reference cycle order pane*, use the arrow scroll bar to set the number of times to run Reference 1 for each Reference 0. (Figure 103)

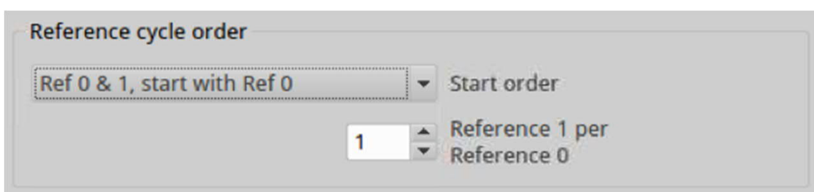

Figure 103: Reference Cycle Order Pane

9. In the *Time between reference cycles pane*, use the arrow scroll bar to set the number of minutes between each reference cycle. (Figure 104)

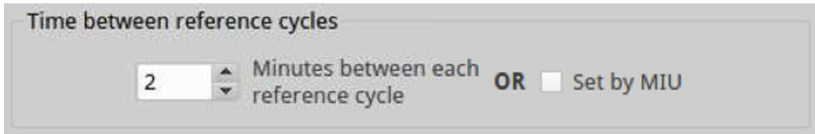

Figure 104: Time Between Reference Cycles Pane

   a. If running the MIU simultaneously with the WVISS, click on the Set by MIU check box. See the Configuring the WVISS and MIU to run simultaneously section on page 108 of this appendix for details.

10. Click Save Changes. (Figure 97)
11. Click Close to begin the WVISS configured run. (Figure 97)
    a. While the WVISS is operating, the current status of the WVISS is displayed in the parameter window of the *User Interface Control Bar*. (Figure 105)
    b. The data is saved to the Data File listed in the parameter window of the *User Interface Control Bar*. (Figure 105)

Figure 105: WVISS Status

12. When sampling is complete, disable the WVISS by returning to the *WVISS screen* in the *Setup panel*. (Figure 96) Within the *WVISS mode pane*, use the drop-down selection box to disable control of the WVISS. (Figure 106)

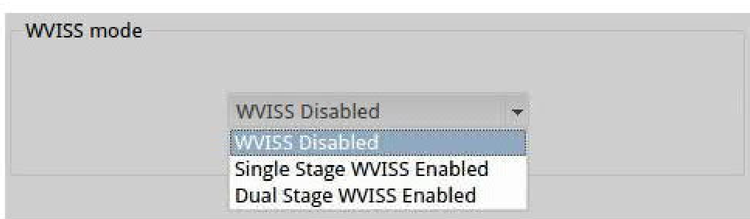

Figure 106: WVISS Mode Drop Down Menu

13. Click Save Changes. (Figure 97)

Figure 107 shows the WVISS Disabled.

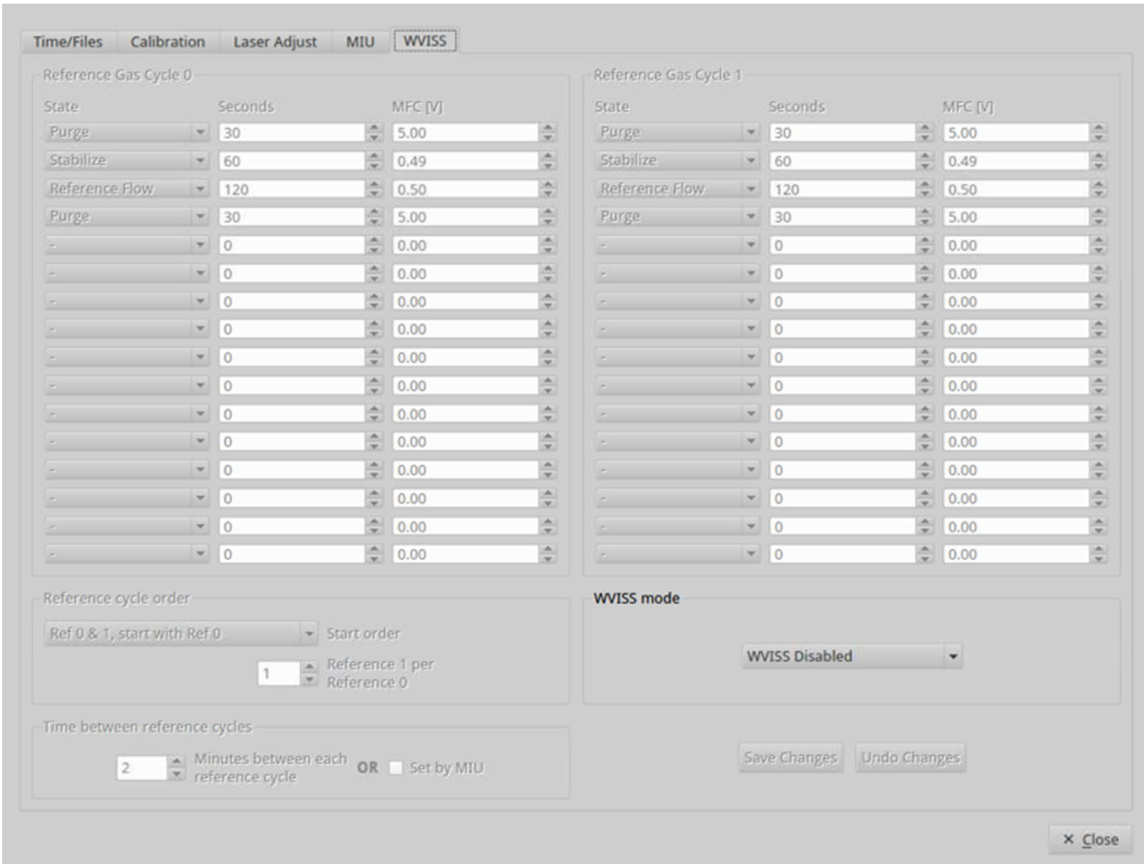

Figure 107: WVISS Disabled

Configuring the WVISS and MIU to run simultaneously

The MIU and WVISS accessories can be configured together to sample multi-channel measurements along with automatic water vapor isotope references.

Connect the Components

Connect the accessories to the analyzer in this order: Samples → MIU → WVISS → Analyzer

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NOTE

The tubing connecting the components should be as short as possible to minimize the response time when switching channels.

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1. Connect your samples to the MIU inlet ports. Refer to the *MIU Appendix* for setup.
2. Connect a ¼” tube from the MIU Outlet push-connect port to the WVISS Sample In push-connect port on the front panel of the WVISS.
3. Connect the WVISS Outlet port to the analyzer Inlet port.

Configure the WVISS and MIU Setup Panels

1. Setup the MIU screen. Refer to the *MIU Appendix* for details.
    a. Click on the MIU tab at the top of the *Setup* menu selection bar to access the *MIU Setup Panel*.

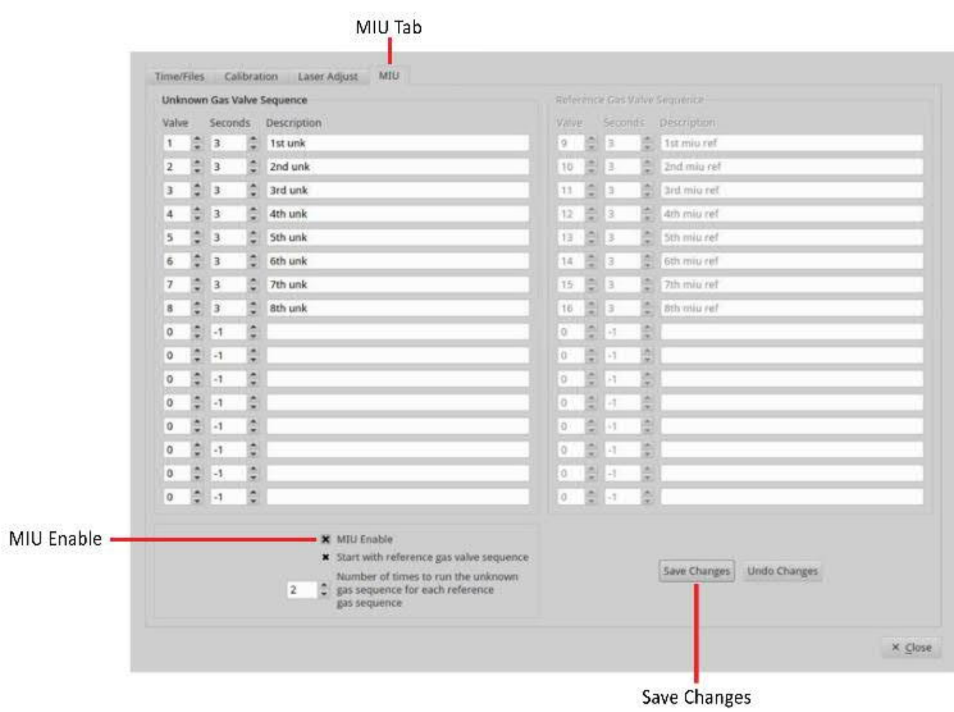


Figure 108: MIU Setup Panel

b. Program the MIU channels for your samples.
c. Check the MIU Enable checkbox. (Figure 108)
d. Select Save Changes. (Figure 108)

2. Setup the WVISS screen. Refer to the *Configure the WVISS section* of this appendix for details.

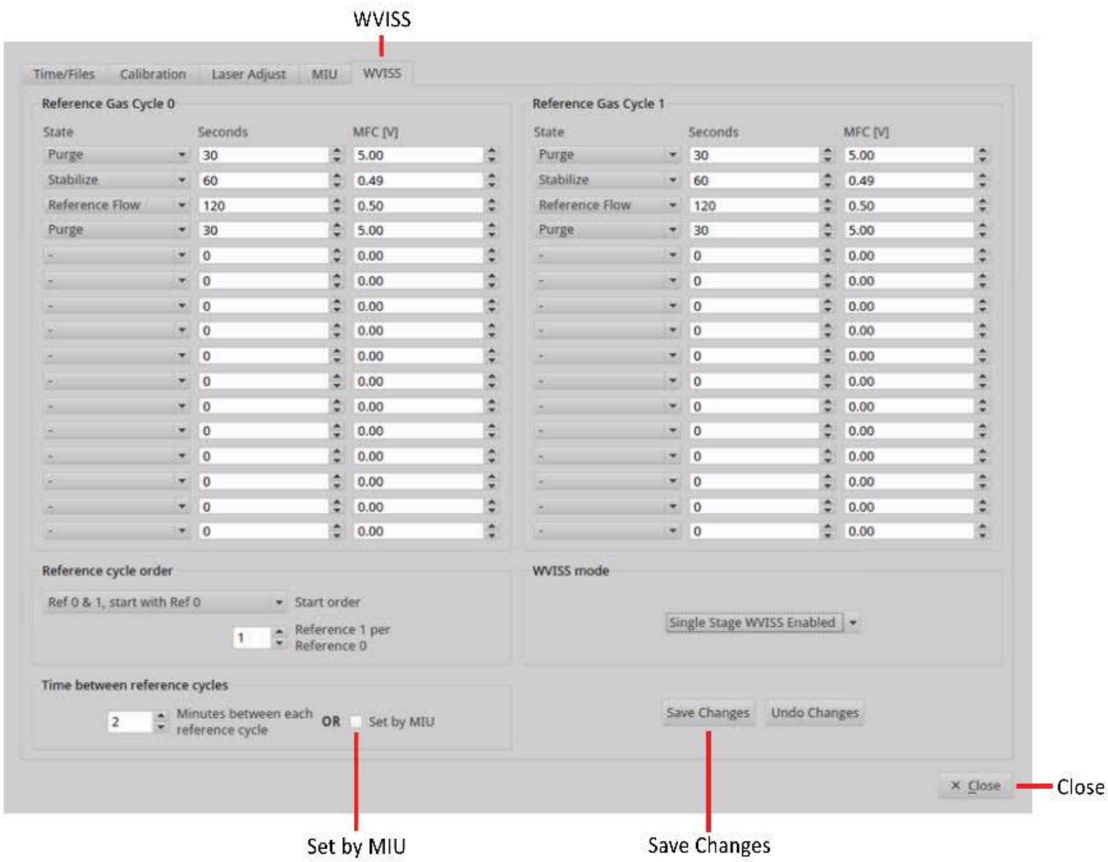


Figure 109: WVISS Setup Panel

a. Click on the WVISS tab at the top of the Setup menu selection bar to access the *WVISS Setup Panel*. (Figure 109)
b. Program the WVISS screen for the references.
c. Check the Set by MIU checkbox. (Figure 109)
    i. If the MIU tab has not been enabled, the WVISS screen becomes grayed out, and a Message Box will appear, informing you to Enable the MIU. (Figure 110)

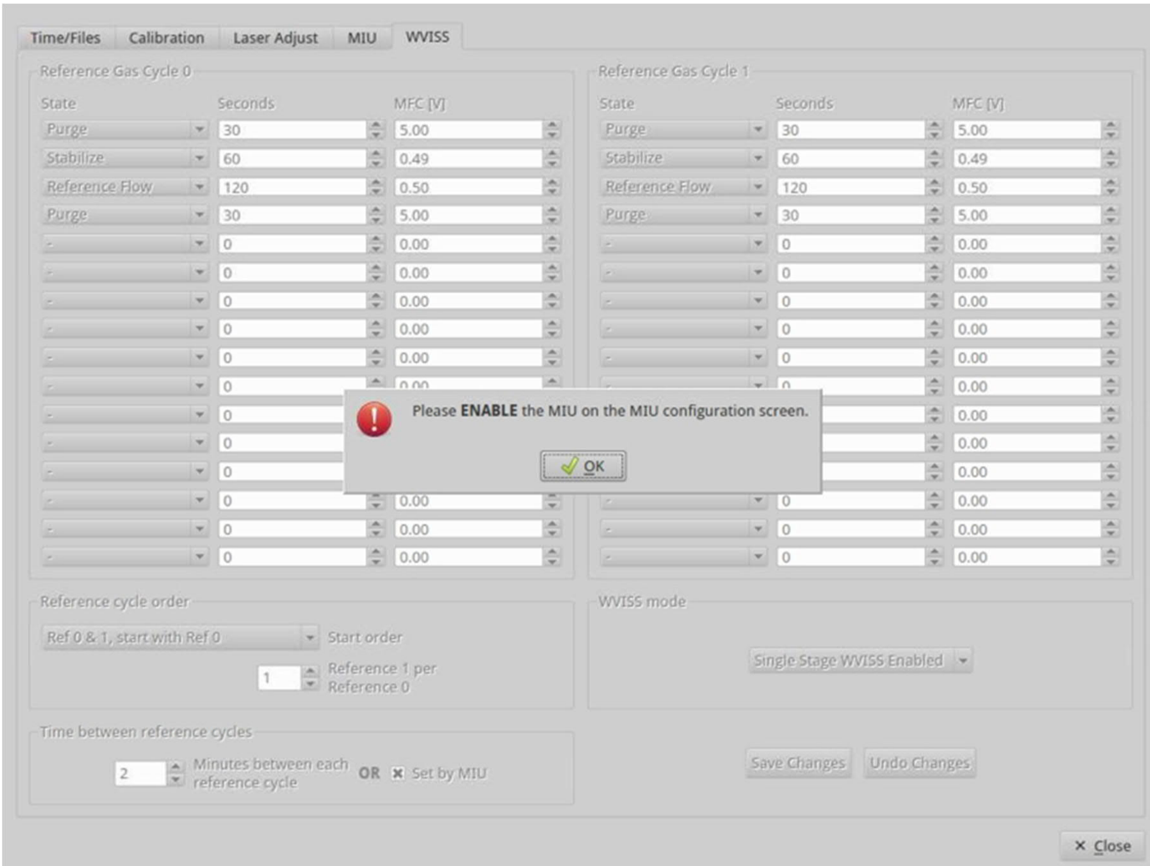


Figure 110: Enable the MIU message screen

d. Select Save Changes. (Figure 110)
e. Click Close to begin the configured run. (Figure 110)

Appendix H: Spectrum Displays

The following images show the *Spectrum Displays* for different analyzer types.

Table 10: Plumbing Diagram for different analyzer types

Analyzer Type	Figure for Reference
GLA132-AMA	Figure 111, Figure 112
GLA132-CCIA2	Figure 113
GLA132-EAA	Figure 114
GLA132-GGA	Figure 115 and Figure 116
GLA132-H2SN	Figure 117
GLA132-HCL	Figure 118
GLA132-HF	Figure 119
GLA132-HFHC	Figure 120 and Figure 121
GLA132-MCEA1	Figure 122 and Figure 123
GLA132-OXCC	Figure 124 and Figure 125
GLA132-SAM	Figure 126, Figure 127, Figure 128, Figure 129
GLA132-SOFX1	Figure 130 and Figure 131
GLA132-SOFX2	Figure 132 and Figure 133
GLA132-WVIA	Figure 134

GLA132-AMA Methane / Acetylene Analyzer

Figure 111 and Figure 112 show the *Spectrum Display* for the GLA132-AMA.

Laser 1 (also referred to as laser A) displays CH_4 and H_2O peaks.

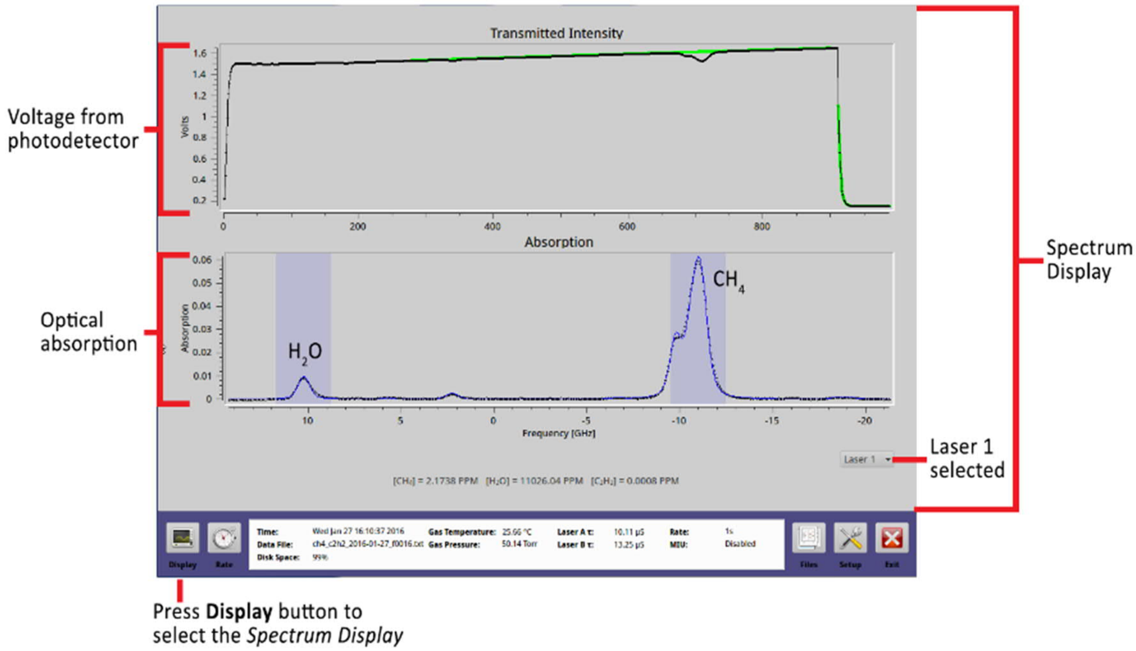


Figure 111: Spectrum Display for Laser 1 (GLA132-AMA)

Laser 2 (also referred to as laser B) displays the C_2H_2 peak.

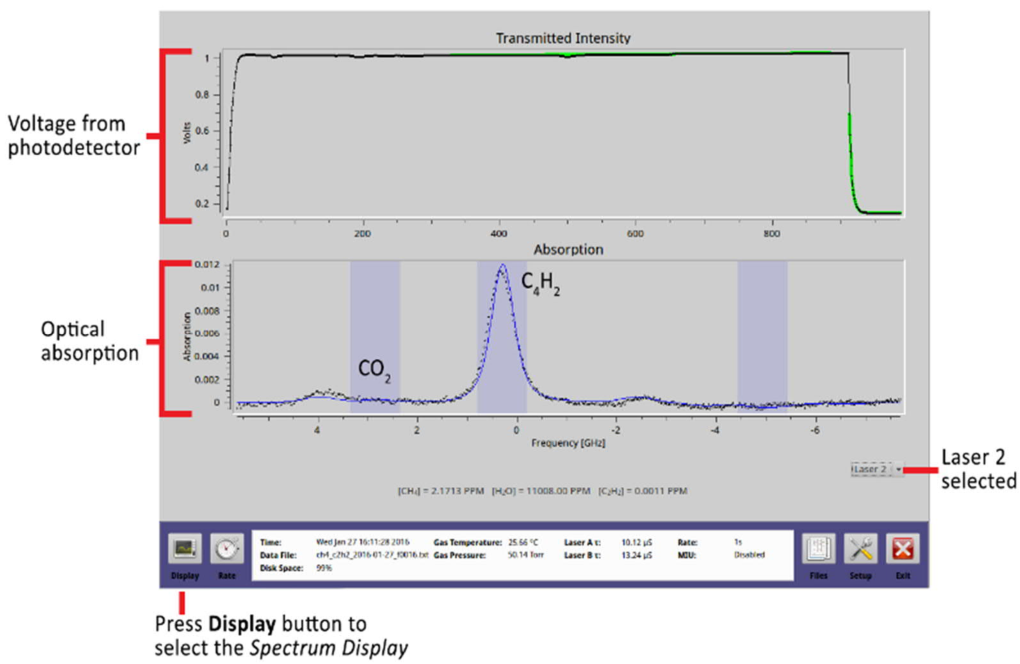


Figure 112: Spectrum Display for Laser 2 (GLA132-AMA)

GLA431-CCIA2 Carbon Dioxide Isotopic Analyzer

Figure 113 shows the *Spectrum Display* for the GLA132-CCIA2.

Laser 1 (also referred to as laser A) displays the $^{12}CO_2$, $OC^{18}O$, $^{13}CO_2$, and H_2O peaks.

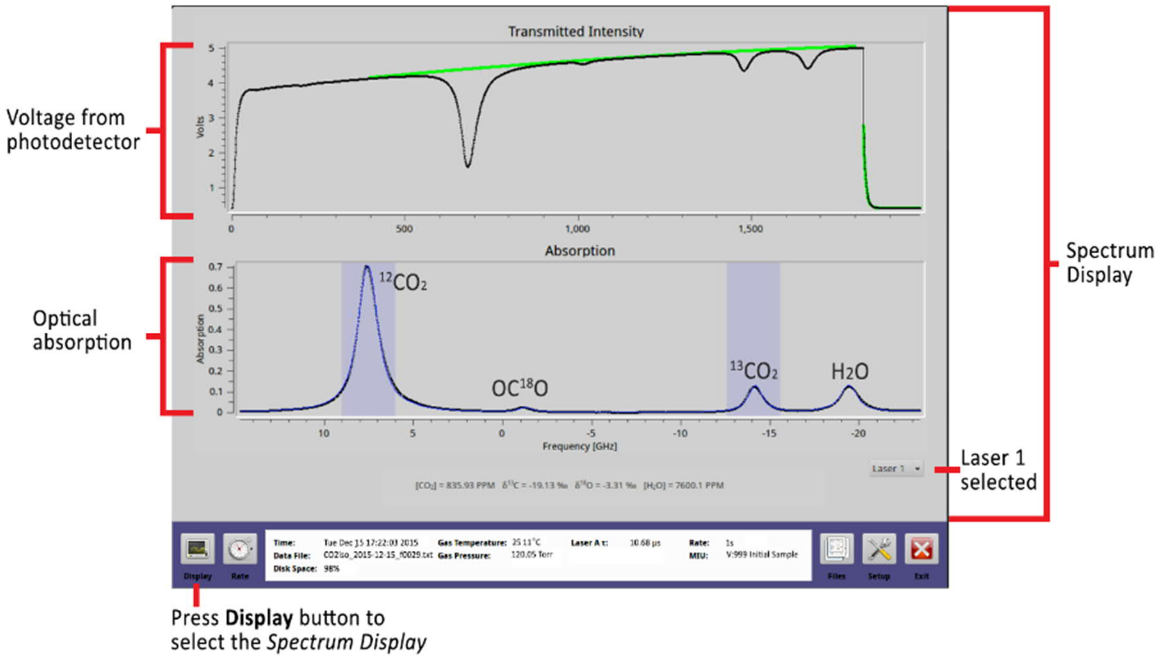


Figure 113: Spectrum Display (GLA431-CCIA2)

GLA132-EAA Ammonia Analyzer

Figure 114 shows the *Spectrum Display* for the GLA132-EAA.

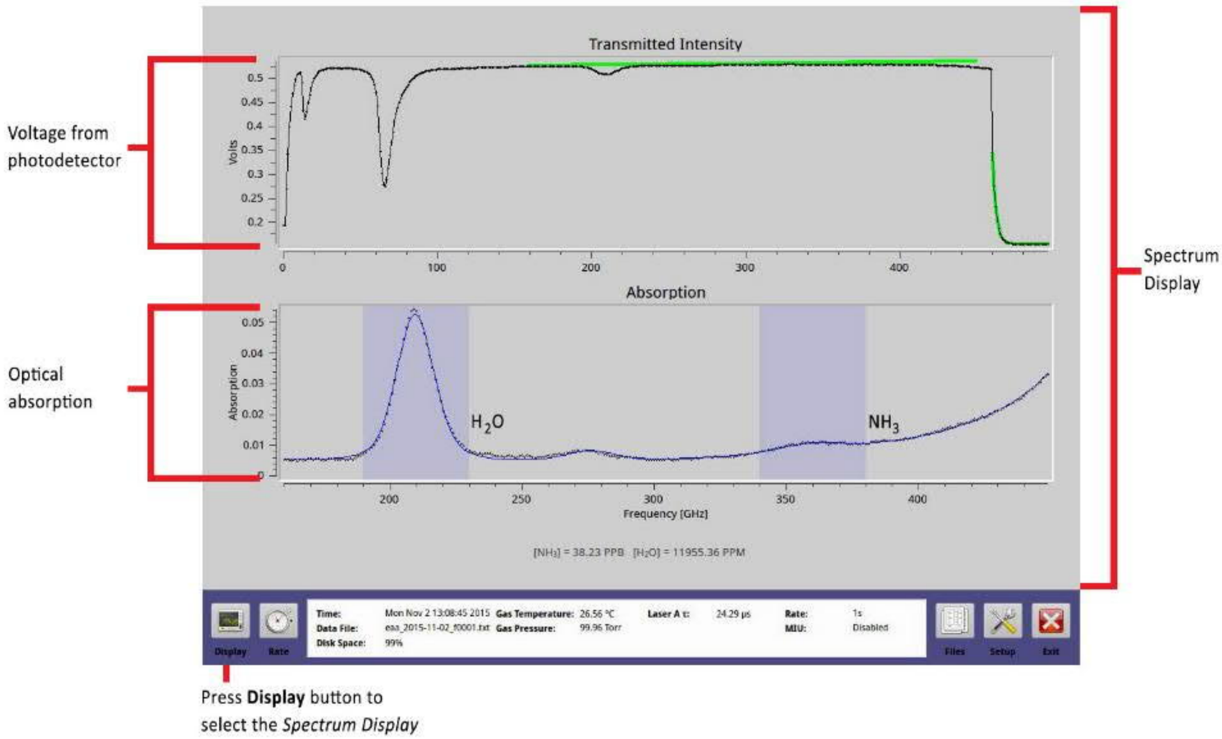


Figure 114: Spectrum Display (GLA132-EAA)

GLA132-GGA Greenhouse Gas Analyzer

Figure 115 and Figure 116 show the *Spectrum Display* for the GLA132-GGA.

Laser 1 (also referred to as laser A) displays CH_4 and H_2O peaks.

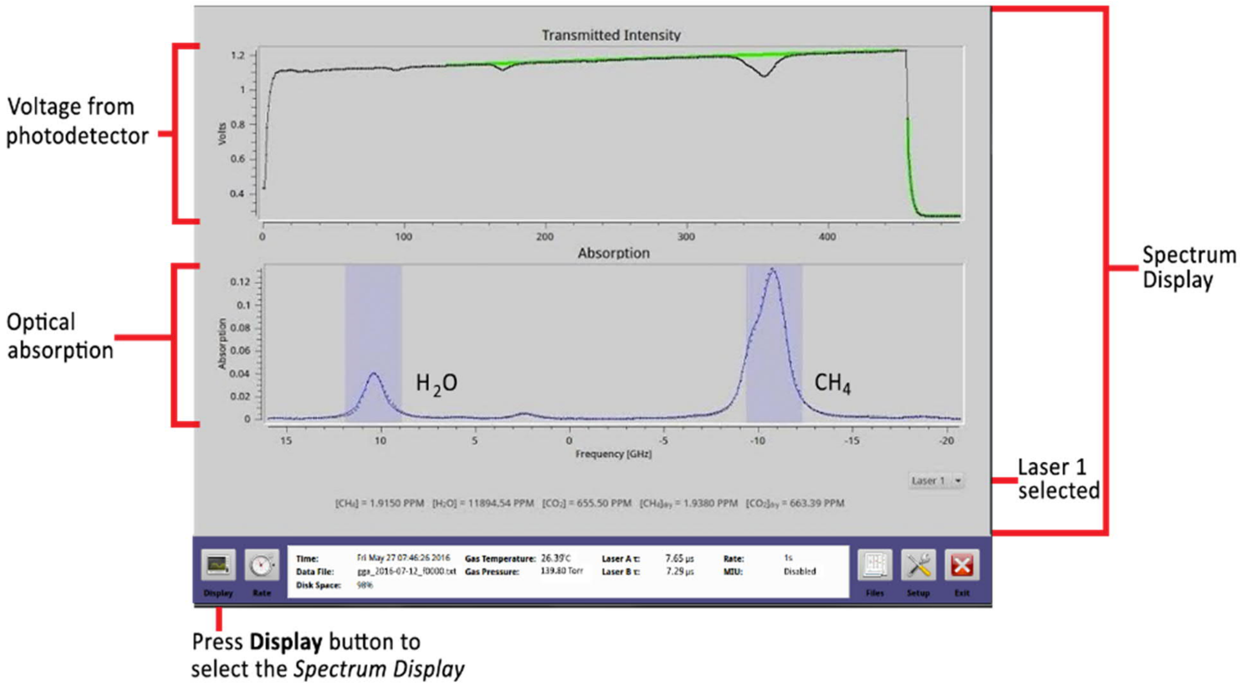


Figure 115: Spectrum Display (GLA132-GGA)

Laser 2 (also referred to as laser B) displays the CO_2 peak.

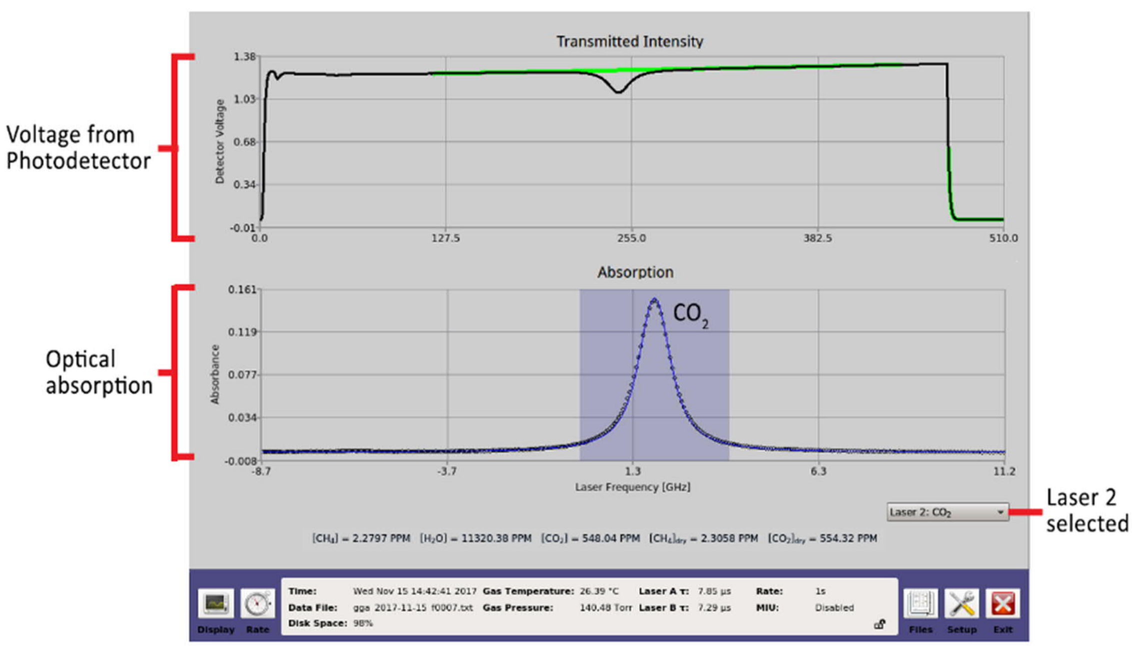


Figure 116: Spectrum Display (GLA132-GGA)

GLA132-H2SN Hydrogen Sulfide Analyzer

Figure 117 shows the *Spectrum Display* for the GLA132-H2SN.

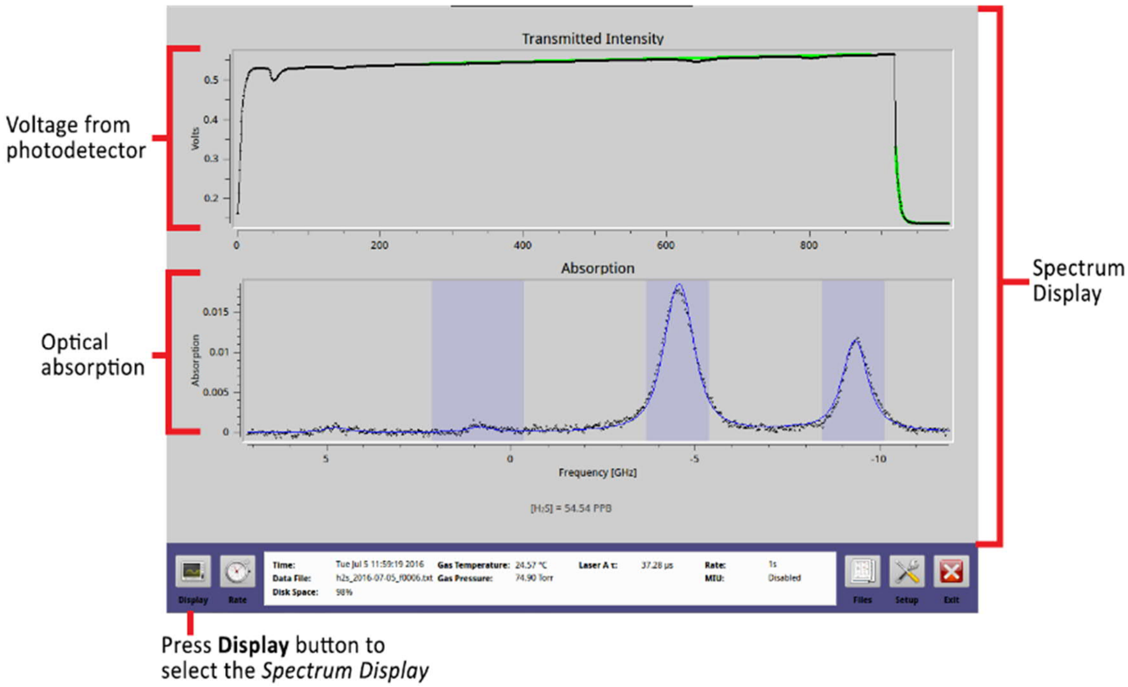


Figure 117: Spectrum Display for Laser 1 (GLA132-H2SN)

GLA132-HCl Hydrogen Chloride Analyzer

Figure 118 shows the *Spectrum Display* for the GLA132-HCl.

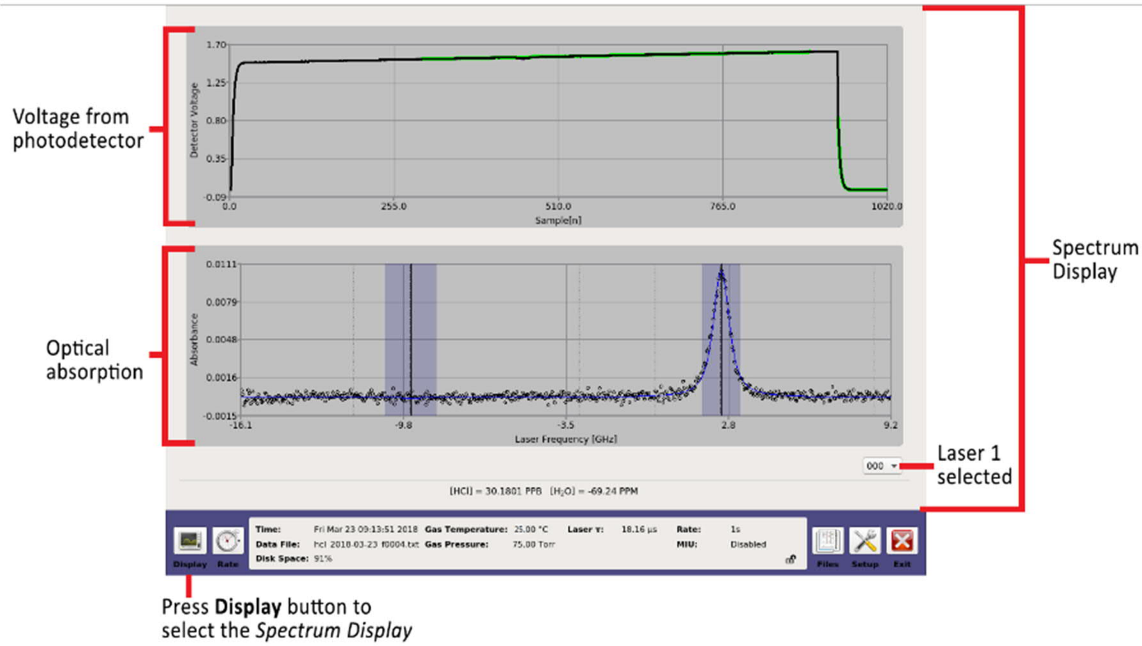


Figure 118: Spectrum Display for Laser 1 (GLA132-HCl)

GLA132-HF Hydrogen Fluoride Analyzer

Figure 119 shows the *Spectrum Display* for the GLA132-HF.

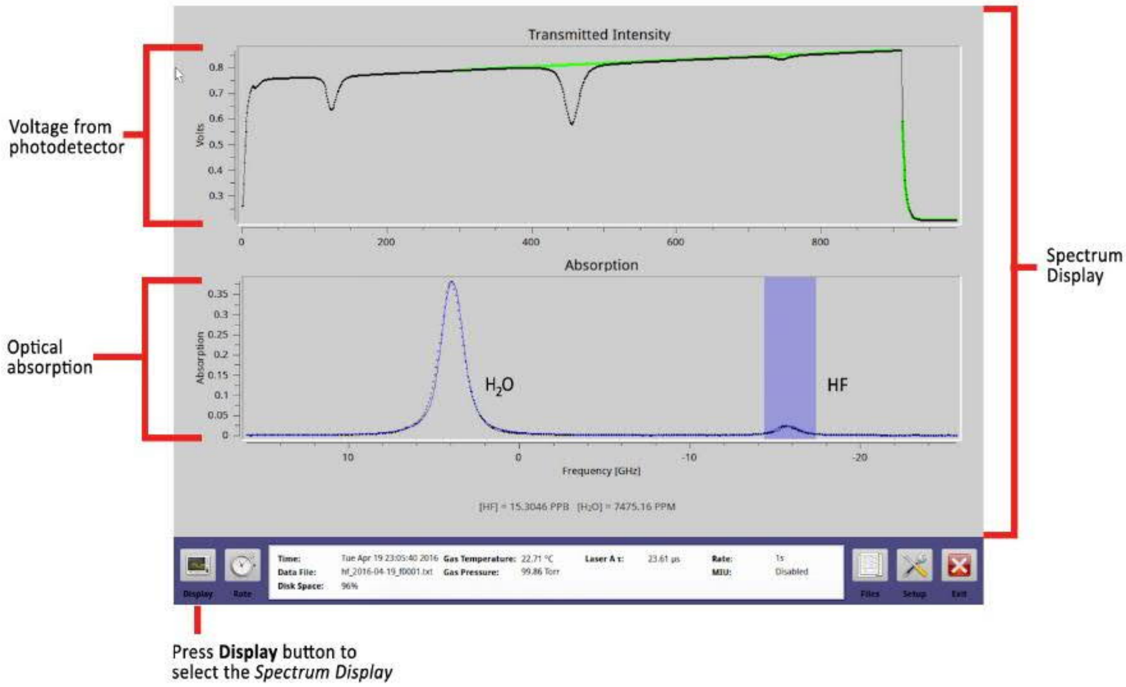


Figure 119: Spectrum Display (GLA132-HF)

GLA132-HFHC Hydrogen Fluoride and Hydrogen Chloride Analyzer

Figure 120 and Figure 121 show the *Spectrum Display* for the GLA132-HFHC.

Laser 1 (also referred to as laser A) displays HF and H_2O peaks.

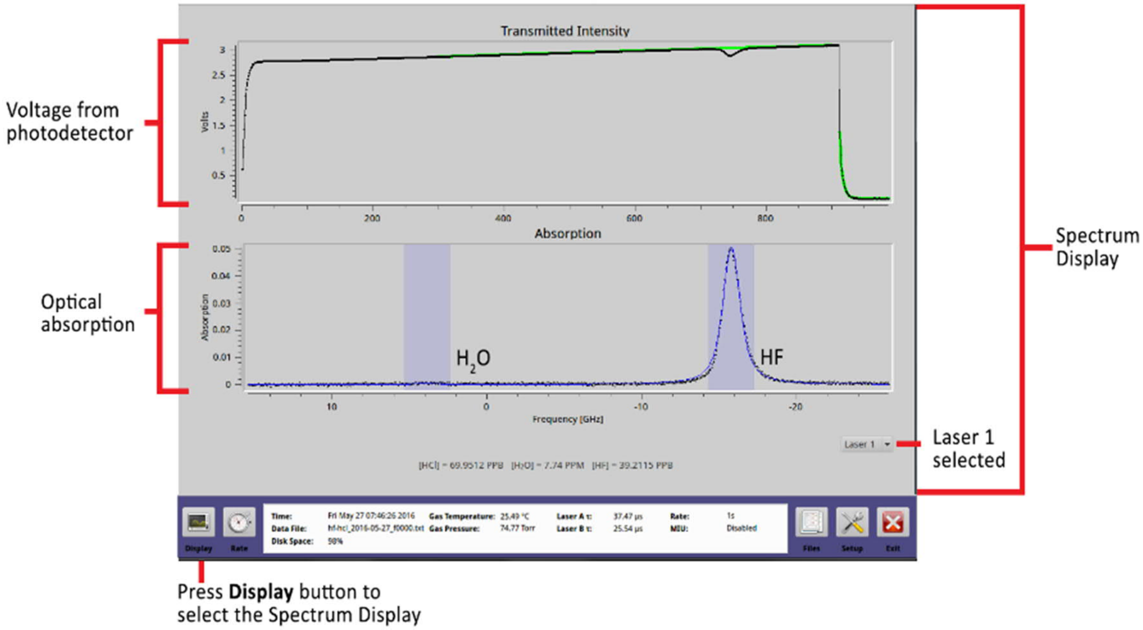


Figure 120: Spectrum Display for Laser 1 (GLA132-HFHC)

Laser 2 (also referred to as laser B) displays HCl and H_2O peaks.

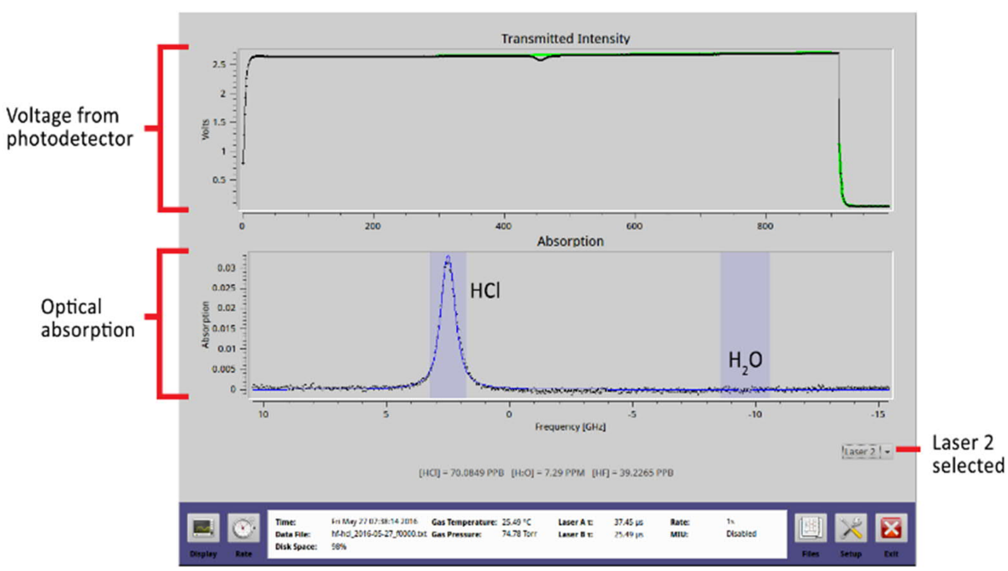


Figure 121: Spectrum Display for Laser 1 (GLA132-HFHC)

GLA132-MCEA1 Carbon Monoxide / Carbon Dioxide / Methane Analyzer

Figure 122 and Figure 123 show the *Spectrum Display* for the GLA132-MCEA1.

Laser 1 (also referred to as laser A) displays CH_4 and H_2O peaks.

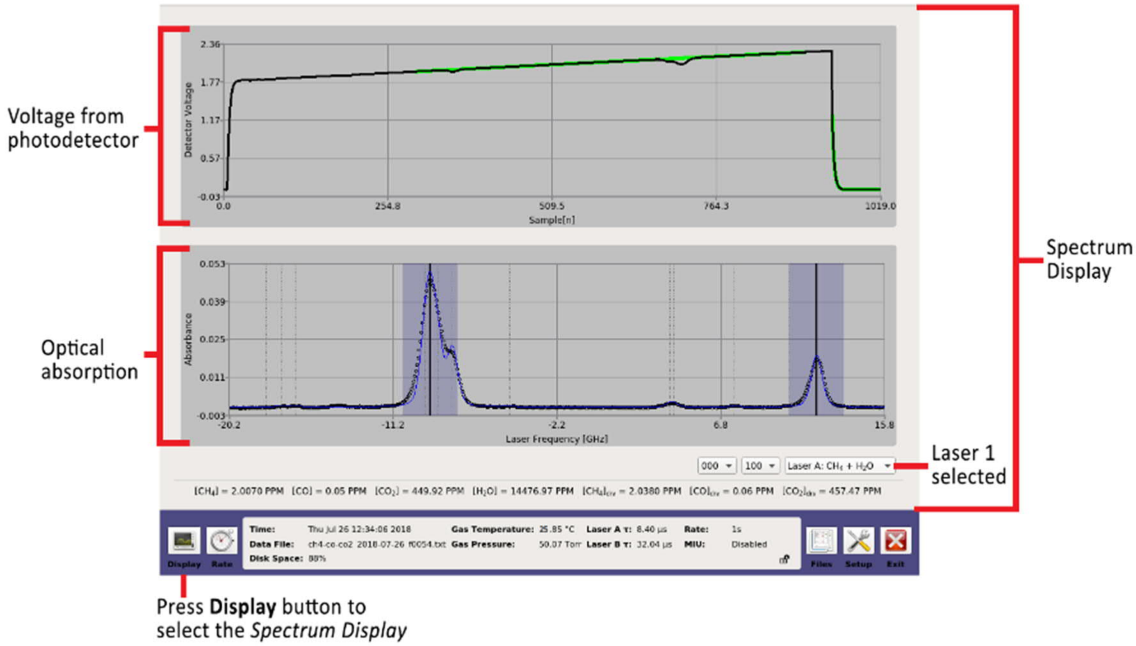


Figure 122: Spectrum Display for Laser 1 (GLA132-MCEA1)

Laser 2 (also referred to as laser B) displays CO_2 and CO peaks.

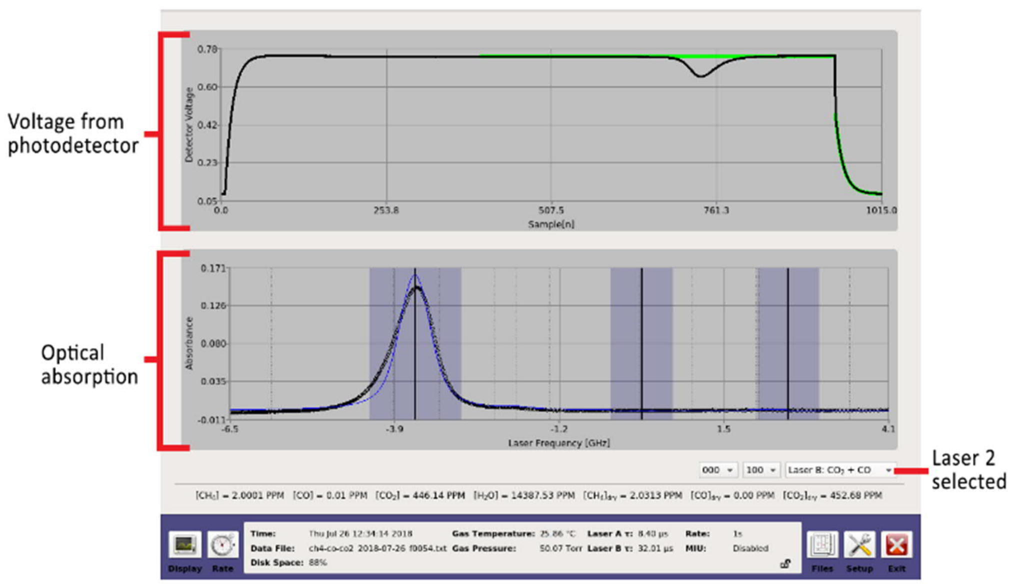


Figure 123: Spectrum Display for Laser 1 (GLA132-MCEA1)

GLA132-OXCC Industrial Emissions Analyzer

Figure 124 and Figure 125 show the *Spectrum Display* for the GLA132-OXCC.

Laser 1 (also referred to as laser A) displays the O_2 and H_2O peaks.

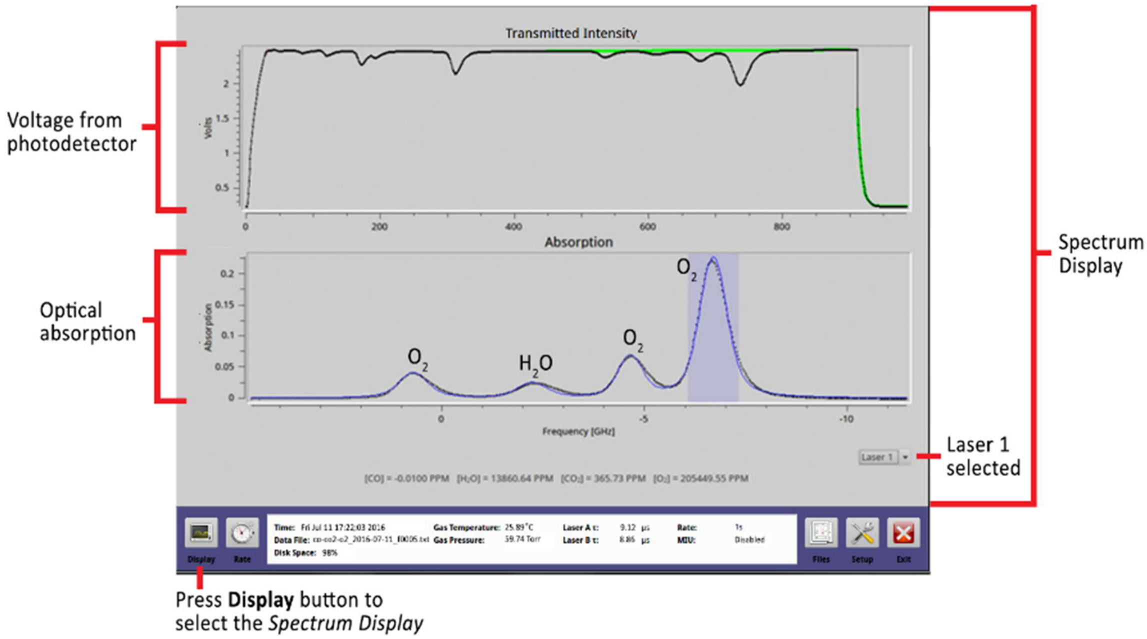


Figure 124: Spectrum Display (GLA132-OXCC)

Laser 2 (also referred to as laser B) displays the CO and CO_2 peaks.

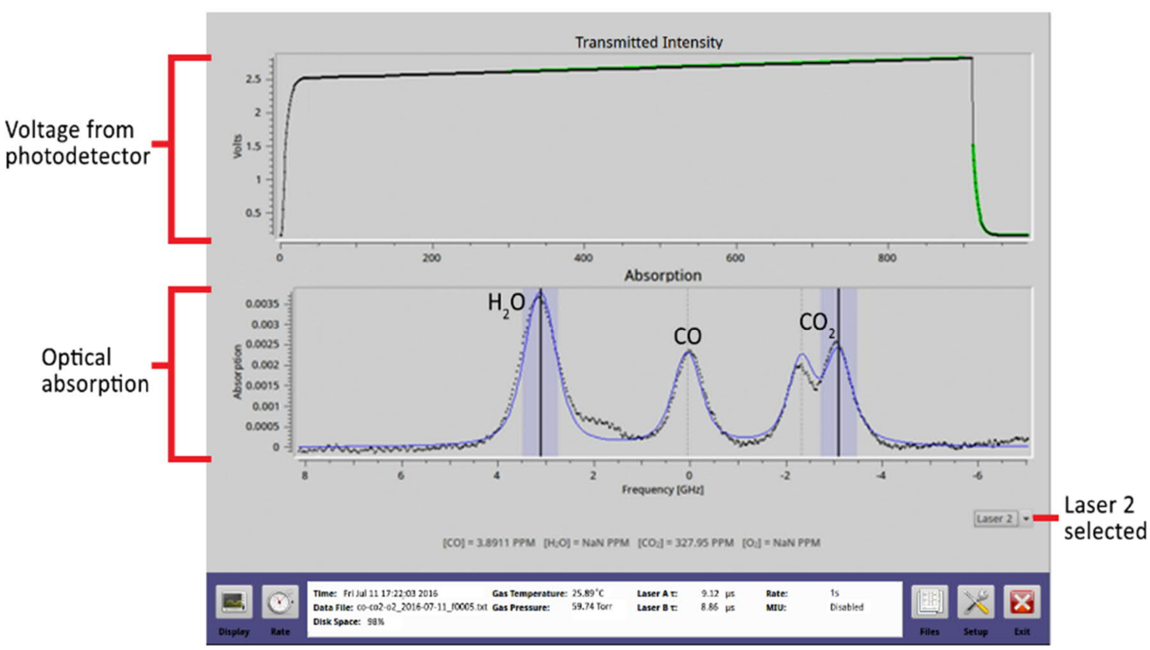


Figure 125: Spectrum Display (GLA132-OXCC)

GLA132-SAM Hydrogen Sulfide and Ammonia Analyzer

Figure 126 - Figure 129 shows the *Spectrum Display* for the GLA132-SAM.

Laser 1 (also referred to as laser A) displays the NH_3 and H_2O peaks.

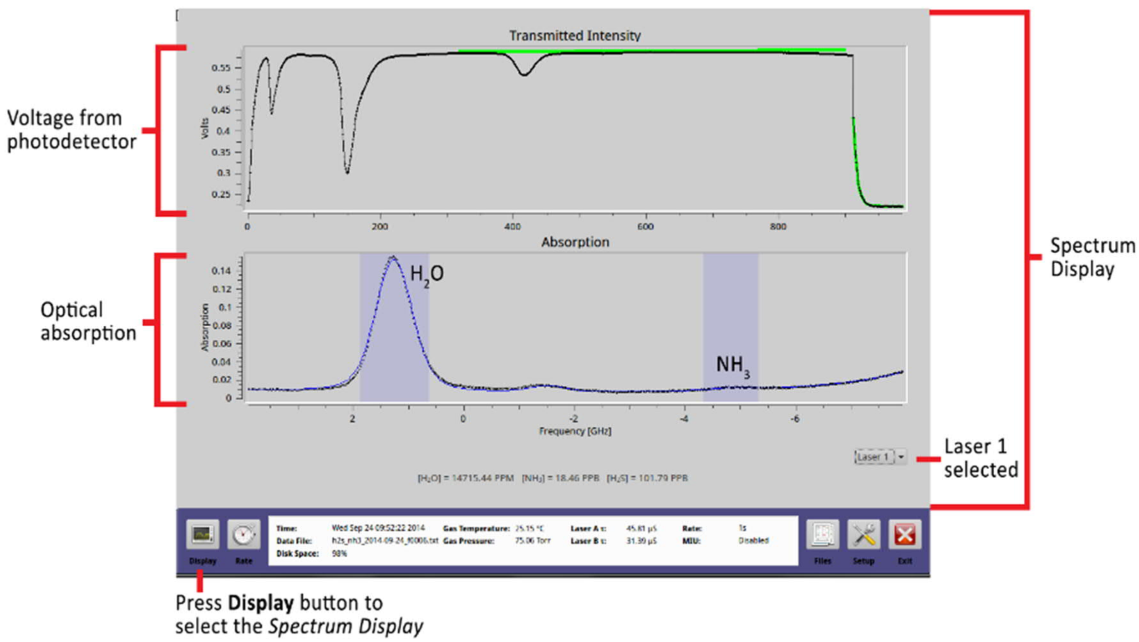


Figure 126: Spectrum Display – Ambient Air (GLA132-SAM)

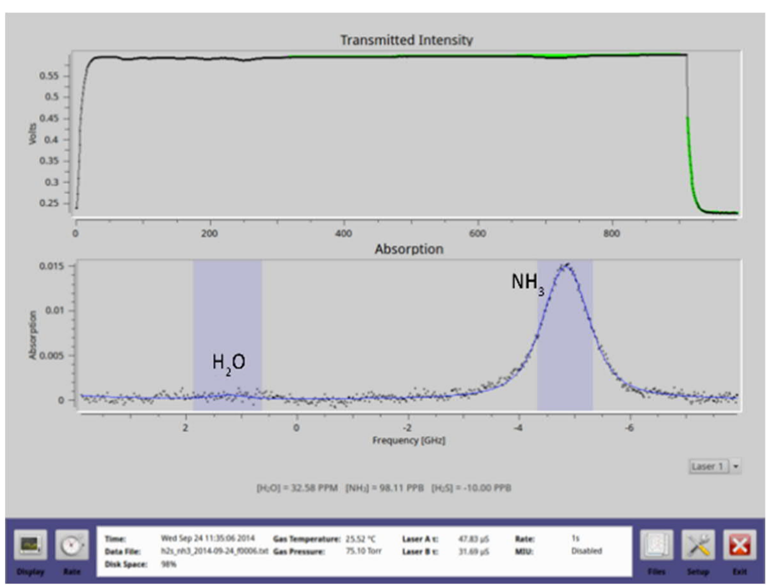


Figure 127: Spectrum Display for Laser 1 – (NH_3 at 100ppb) (GLA132-SAM)

Laser 2 (also referred to as laser B) displays the H_2S peaks.

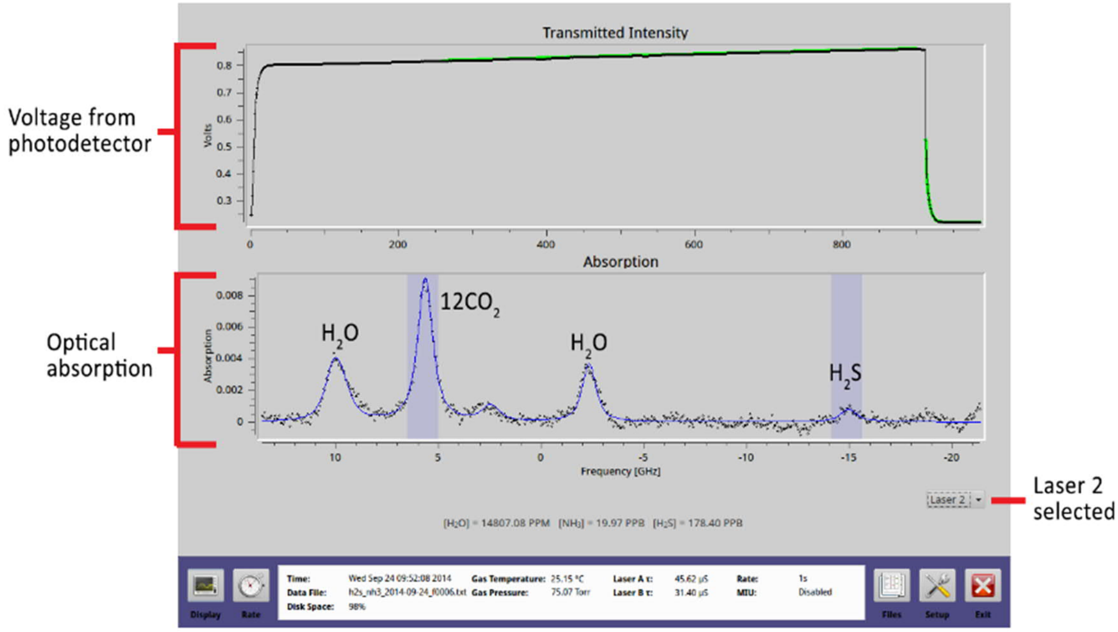


Figure 128: Spectrum Display for Laser 2- (Ambient Air) (GLA132-SAM)

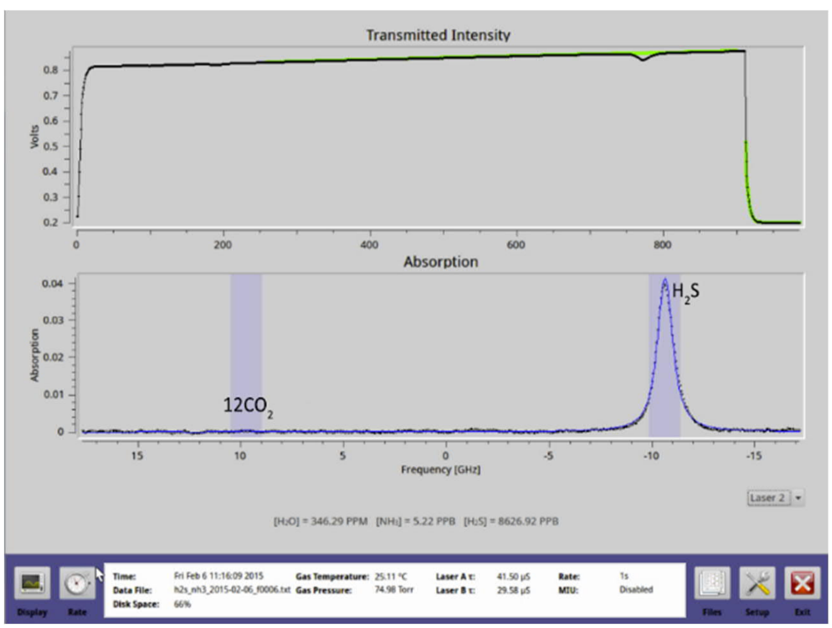


Figure 129: Spectrum Display for Laser 2 – (H_2S at 10ppm) (GLA132-SAM)

GLA132-SOFX1 Soil Gas Analyzer

Figure 130 and Figure 131 and show the *Spectrum Display* for the GLA132-SOFX1.

Laser 1 (also referred to as laser A) displays the CH_4 and CO_2 peaks.

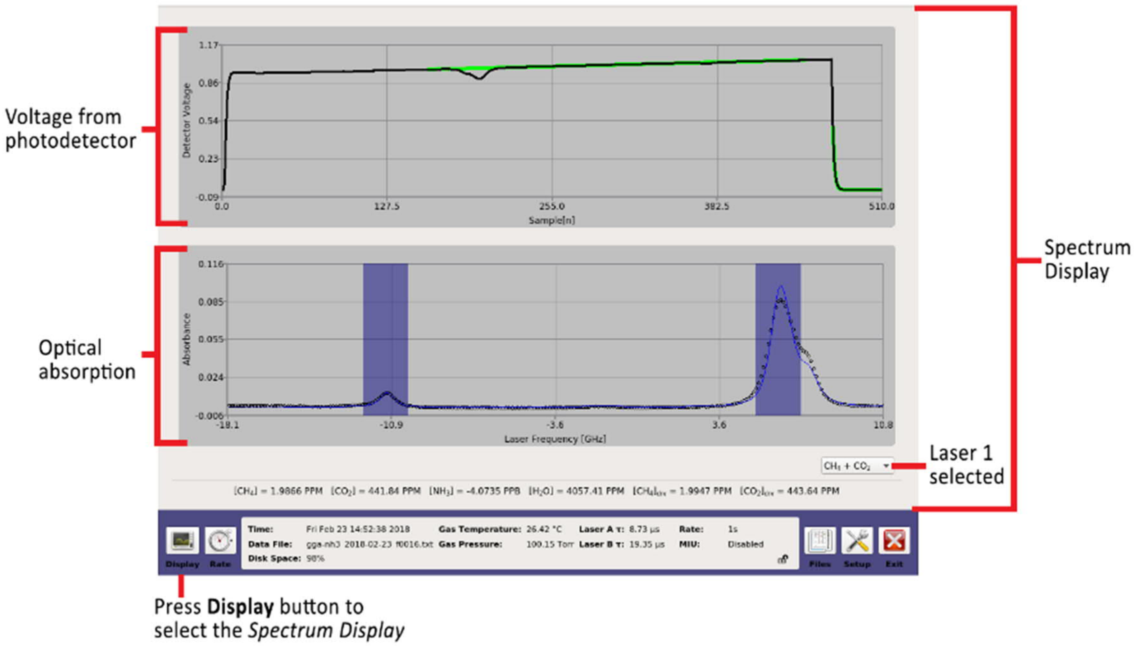


Figure 130: Spectrum Display for Laser 1 (GLA132-SOFX1)

Laser 2 (also referred to as laser B) displays the NH_3 and H_2O peaks.

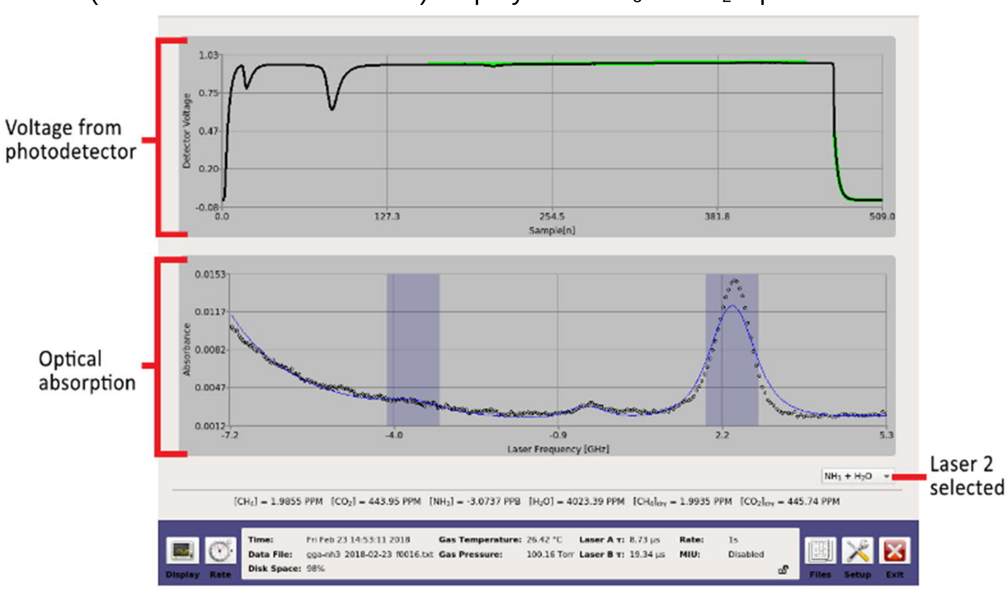


Figure 131: Spectrum Display for Laser 1 (GLA132-SOFX1)

GLA132-SOFX2 Soil Gas Analyzer – High Ammonia

Figure 132 and Figure 133 show the *Spectrum Display* for the GLA132-SOFX2.

Laser 1 (also referred to as laser A) displays the CH_4 and CO_2 peaks.

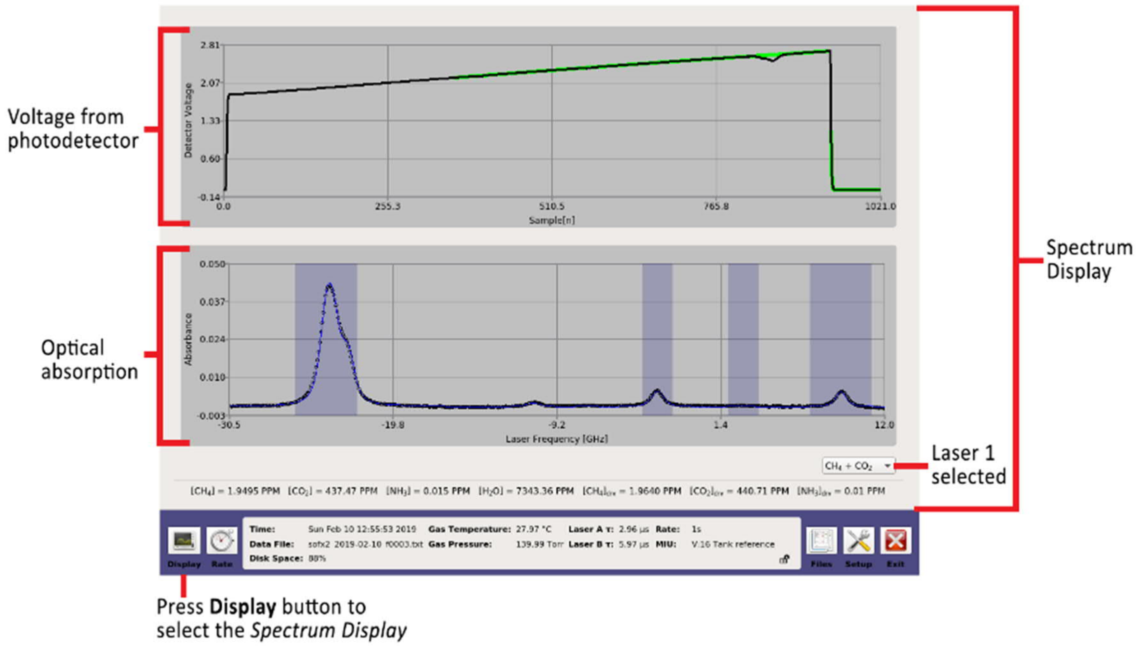


Figure 132: Spectrum Display for Laser 1 (GLA132-SOFX2)

Laser 2 (also referred to as laser B) displays the NH_3 and H_2O peaks.

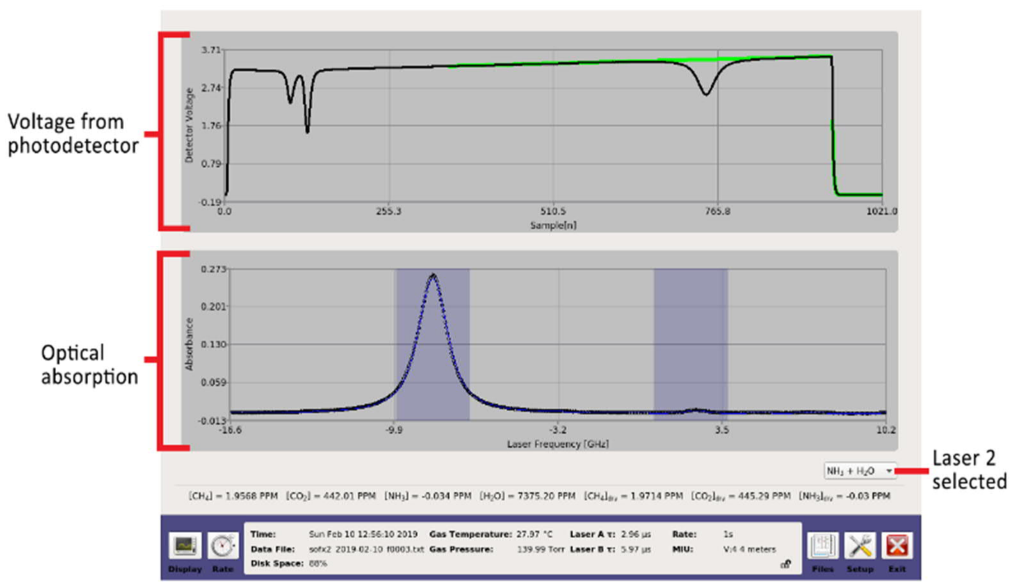


Figure 133: Spectrum Display for Laser 1 (GLA132-SOFX2)

GLA132-WVIA Ultraportable Water Vapor Isotopic Analyzer

Figure 134 shows the *Spectrum Display* for the GLA132-WVIA.

Laser 1 (also referred to as laser A) displays the HOD, $H_2{}^{16}O$, and $H_2{}^{18}O$ peaks.

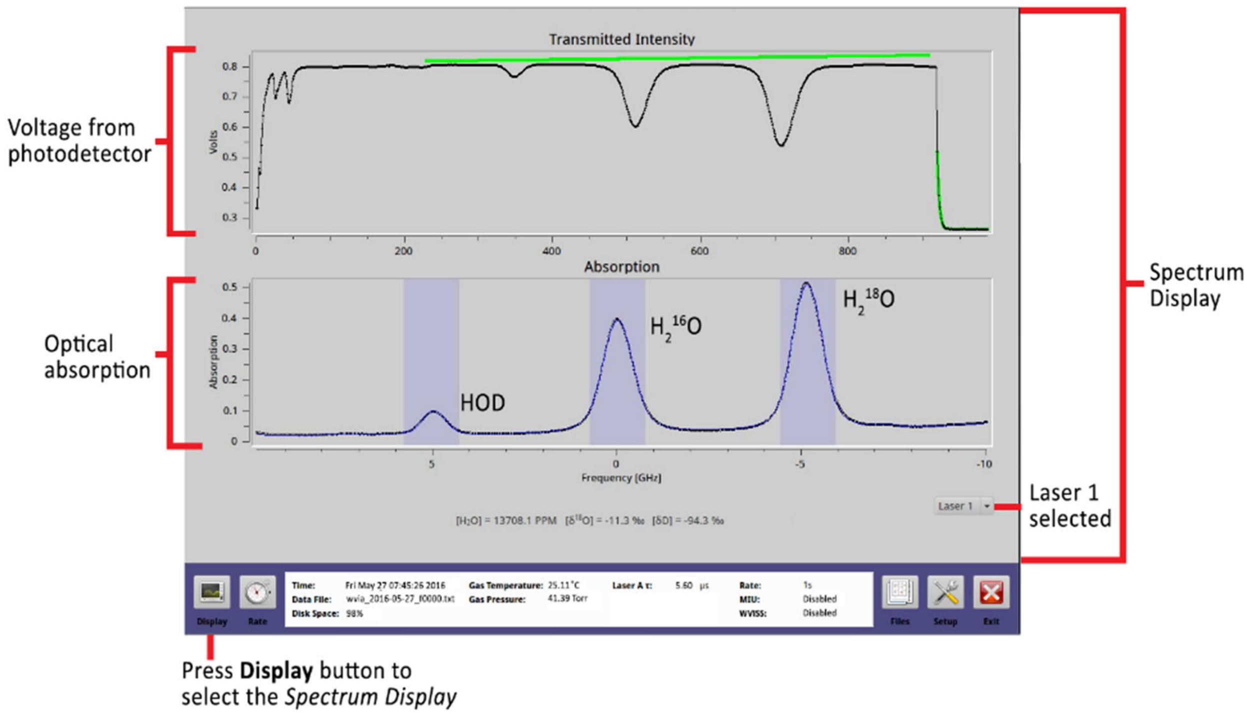


Figure 134: Spectrum Display (GLA132-WVIA)

Appendix I:Isotope Definitions

The CCIA measures the concentration of $^{12}CO_2$, $^{13}CO_2$, and $OC^{18}O$. These concentrations are used to calculate the total CO_2 and the isotope ratios 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:

CO_2	X_CO2__ppm
$\delta^{13}C$	D13C_VPDB_CO2
$\delta^{18}O$	D18O_VPDB_CO2
$[^{16}O^{12}C^{16}O]$	X_CO2_626__ppm
$[^{16}O^{13}C^{16}O]$	X_CO2_636__ppm
$[^{16}O^{12}C^{18}O]$	X_CO2_628__ppm

The isotope ratios are reported in ‰ relative to Vienna Pee Dee Belemnite converted to CO_2 (VPDB-CO2). The standards listed below were taken from IAEA-TECDOC-825.

(R_{13}) VPDP-CO_2	0.0112372
(R_{18}) VPDP-CO_2	0.002088349077

Total CO_2 is defined as the sum of all the isotopes:

$$CO_2 = [^{16}O^{12}C^{16}O] + [^{16}O^{13}C^{16}O] + [^{16}O^{12}C^{18}O]$$

The isotope ratios are defined according to:

$$\delta^{13C} = \left[\frac{(R_{13})_{Meas}}{(R_{13})_{VPDB-CO2}} - 1\right] \times 1000$$

$$\delta^{18O} = \left[\frac{(R_{18})_{Meas}}{(R_{18})_{VPDB-CO2}} - 1\right] \times 1000$$

Where the measured ratios are calculated from the measured concentrations:

$$(R_{13})_{Meas} = \frac{^{13}C}{^{12}C} = \frac{[^{16}O^{13}C^{16}O]}{[^{16}O^{12}C^{16}O]}$$

$$(R_{18})_{Meas} = \frac{^{18}O}{^{16}O} = \frac{[^{16}O^{12}C^{18}O]}{2[^{16}O^{12}C^{16}O] + [^{16}O^{12}C^{18}O]}$$

To convert the output oxygen isotope ratios from VPDB-CO2 to VSMOW use the follow formulas:

$$\delta^{18O-VSMOW} = \left[\frac{(R_{18})_{VPDB-CO2}}{(R_{18})_{VSMOW}}\left(\frac{\delta^{18O-VPDB}}{1000} + 1\right) - 1\right] \cdot 1000$$

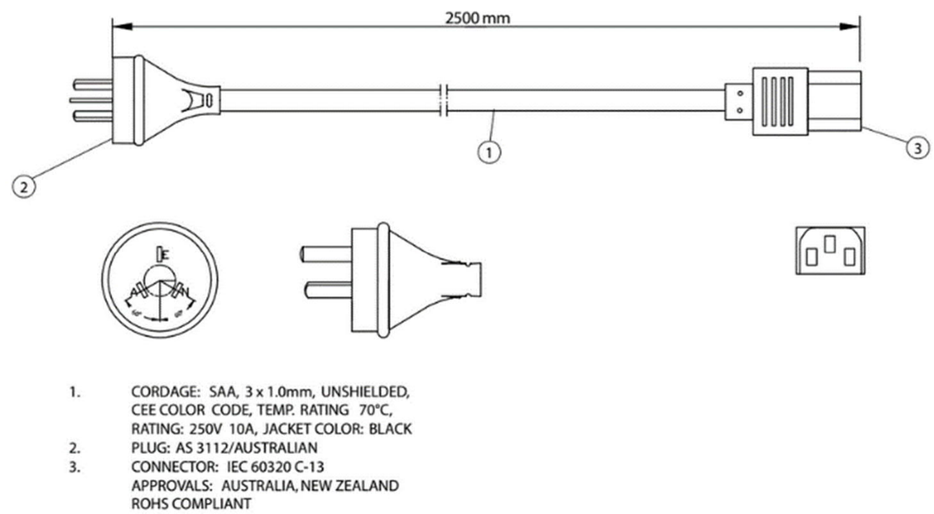
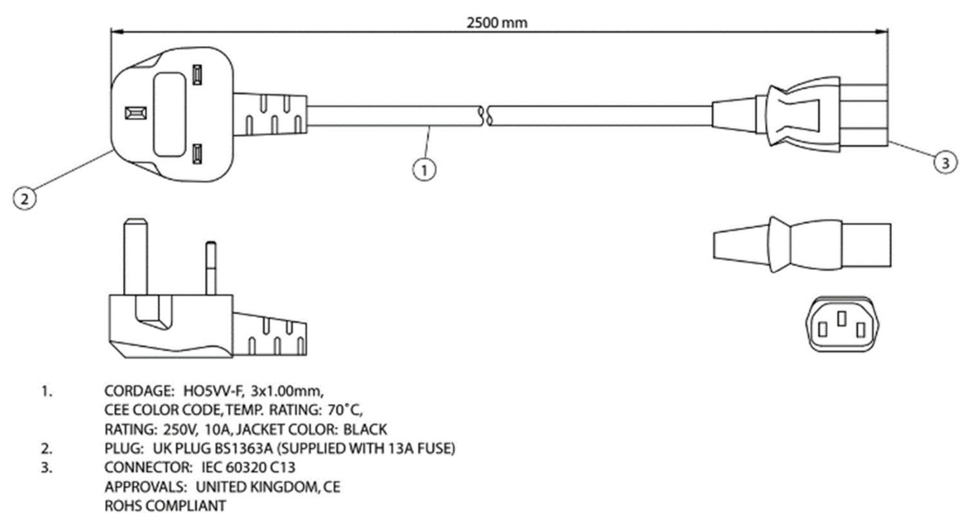
To use a calibration or reference gas where the oxygen isotope ratios are known relative to VSMOW, convert them to VPDB-CO2 using the following formulas:

$$\delta^{18O-VPDB} = \left[\frac{(R_{18})_{VSMOW}}{(R_{18})_{VPDB-CO2}}\left(\frac{\delta^{18O-VSMOW}}{1000} + 1\right) - 1\right] \cdot 1000$$

Appendix J: Cables

Table 11 describes the power cables shipped with your analyzer.

Table 11: Power Cables

Region	Cable Specifications
Australia and New Zealand	
United Kingdom	

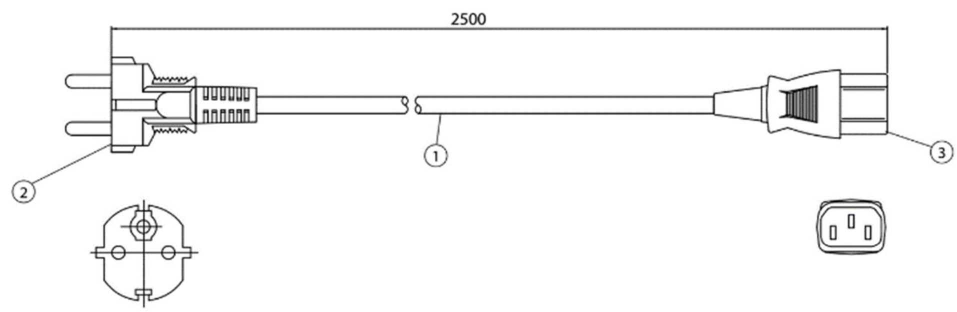
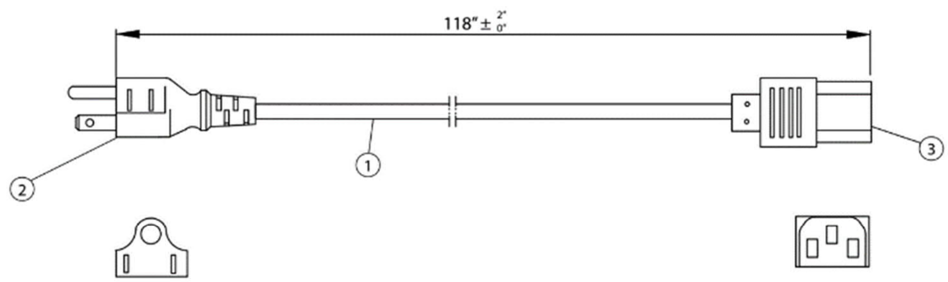
Europe	 1. CORDAGE: H05VV-F, 3 x 1.0mm, UNSHIELDED, CEE COLOR CODE, TEMP. RATING 60°C, RATING: 250V 10A, JACKET COLOR: BLACK 2. PLUG: IEC 884/CEE7-VII 3. CONNECTOR: IEC 60320 C13 APPROVALS: CB, GERMANY, DENMARK, NORWAY, FINLAND, BELGIUM, NETHERLANDS, SWEDEN, AUSTRIA, ROHS COMPLIANT
United States	 1.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

For your local ABB contact, visit:
abb.com/contacts

For more product information, visit:
abb.com/measurement

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