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ABB MEASUREMENT & ANALYTICS | USER MANUAL

# User Manual | OA-ICOS™

## GLA132 Series Ultraportable Analyzers



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## Disclaimer

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

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

## 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

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# 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
	2004/108/EU (EMC), EN61326-1
	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 OA-ICOS™ cell. The fiber laser is visible only when the insulated enclosure is removed from the OA-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  $\leq 6.8$  V DC.

## Laser Hazards

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

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



**WARNING**

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

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



**WARNING**

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

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## 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!	<b>General Warning Icon:</b> gives general safety information that must be followed to avoid hazardous conditions.
 WARNING!	<b>Electrical Warning Icon:</b> warns of potential electrical shock hazard.
 WARNING!	<b>Laser Warning Icon:</b> 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.

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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](mailto: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](mailto:icos.support@ca.abb.com)

Please contact [icos.support@ca.abb.com](mailto:icos.support@ca.abb.com) and your local sales representative for more details.



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

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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).



This analyzer is a Class 1 laser product.

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## 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 93.



Always use the power supply cord provided by ABB-LGR. See page 93 for a description of power cords for a specific country.

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### **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

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Available on select analyzers.

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- 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
- 



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

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**The wireless user interface will not work if:**

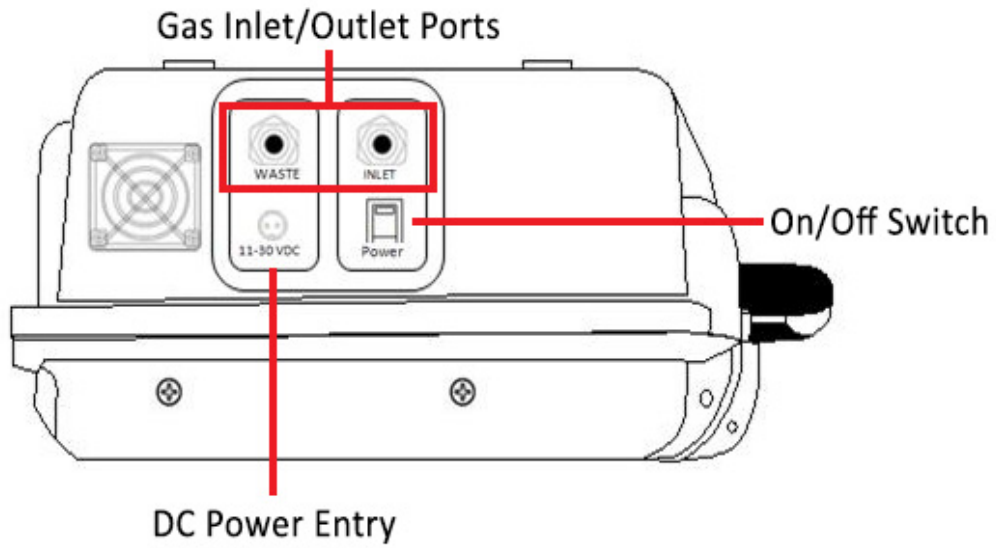
- The analyzer has a system failure
- The hard drive fails or is corrupted
- Battery power to the analyzer is interrupted

**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.**

---

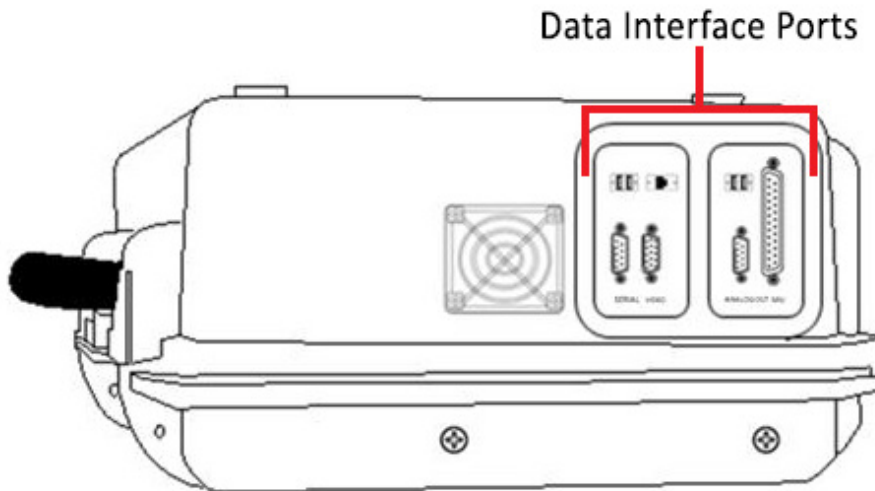
If you have not received all of these components, contact ABB-LGR at [icos.support@ca.abb.com](mailto:icos.support@ca.abb.com).

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

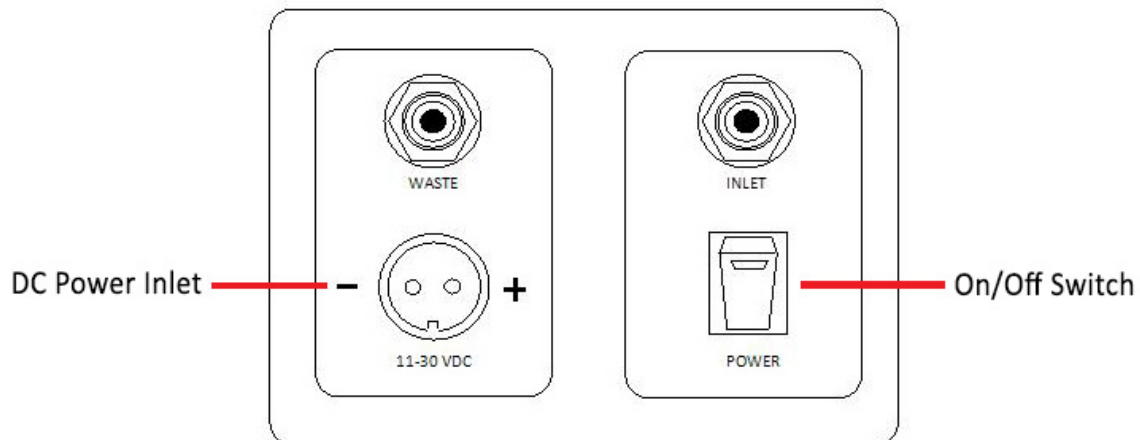
The power connector is on the left side panel of the analyzer. (Figure 4)

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

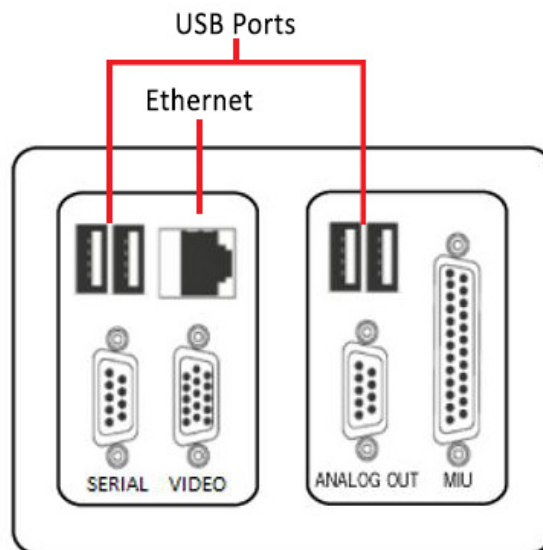
If the analyzer malfunctions and requires emergency shutdown:

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).
- WVIA- Only applicable for the GLA132-WVIA



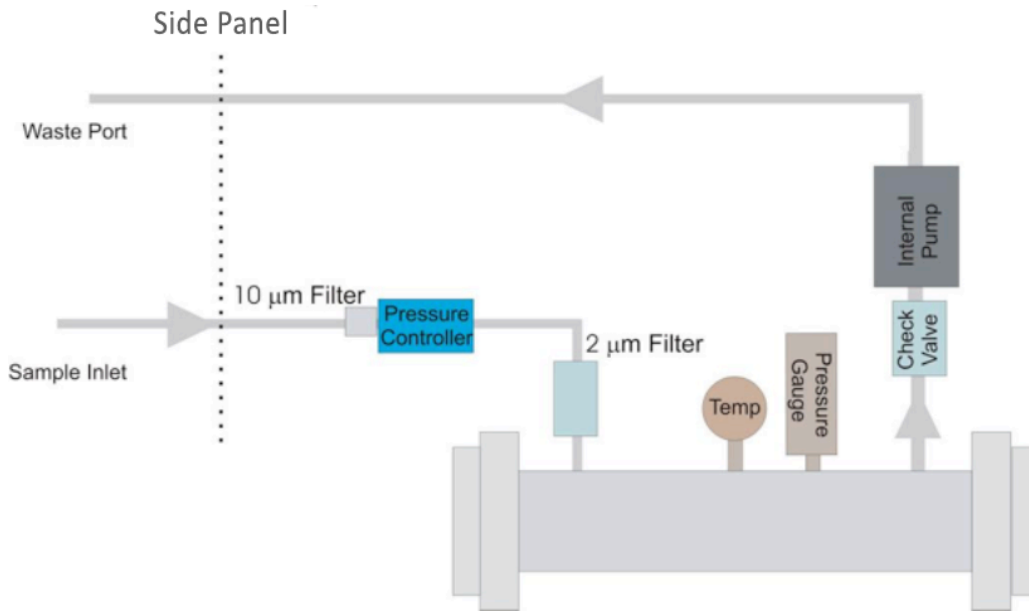
**Figure 5: Data Interface Connection Ports**

## Plumbing Diagram

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

### Standard Plumbing

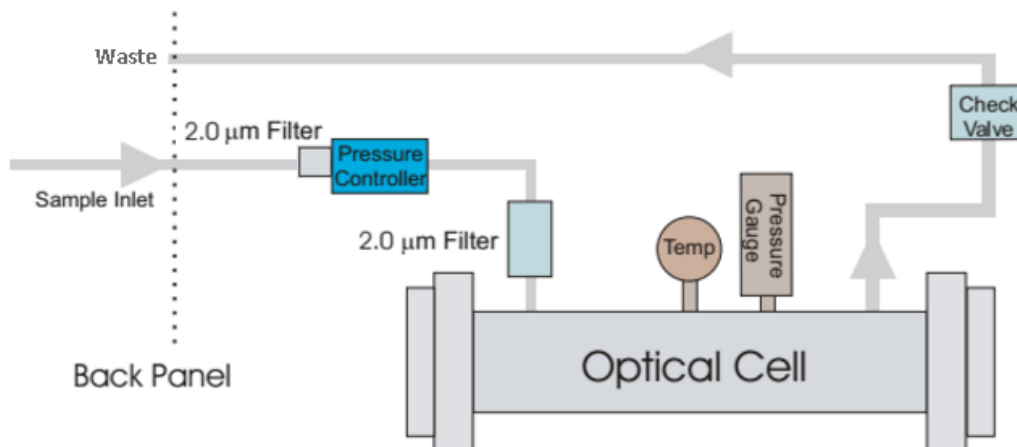
Figure 6 shows an example of the internal flow of gas in an ultraportable analyzer. Plumbing configurations will vary depending on the analyzer type.



**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

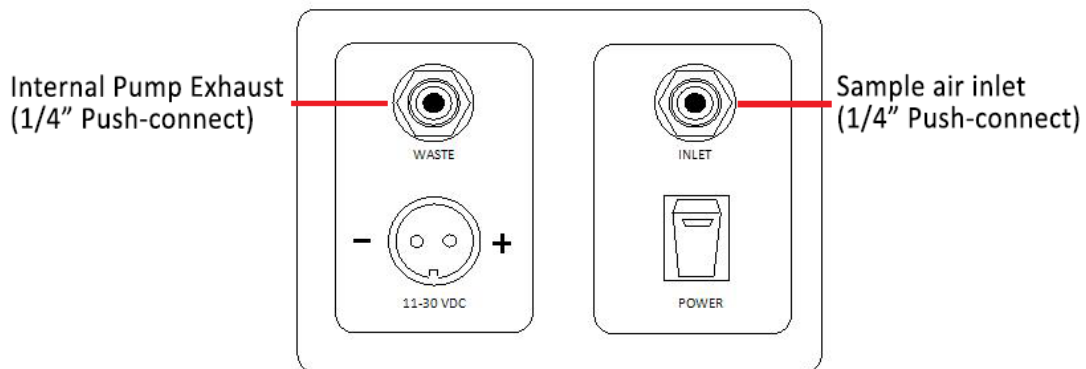
The inlet and outlet ports are located on the left side panel of the analyzer. (Figure 8)

- Gas to be measured is connected to the 1/4" 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 1/4" 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
	<p>The laser is rated Class 3 (invisible laser radiation) when the housing is open.  <b>Only trained maintenance personnel may open the analyzer housing.</b></p>
	<p>General laser warning label.</p>



**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 1/4" sample tube (not provided) from the 1/4" 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 1/4" push connect INLET port on the right panel of the analyzer. (Figure 10)



*Figure 10: Portable Analyzer External In-Line Filter*



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

### 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)



---

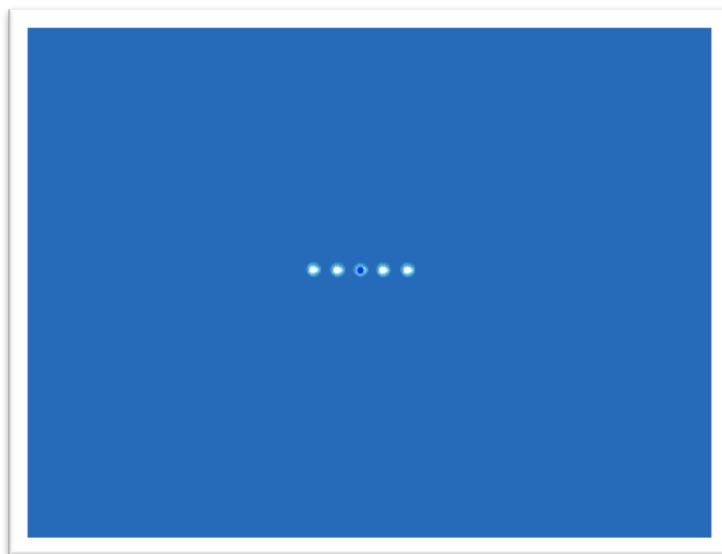
**The wireless interface will not work if:**

- **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.**

---

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**

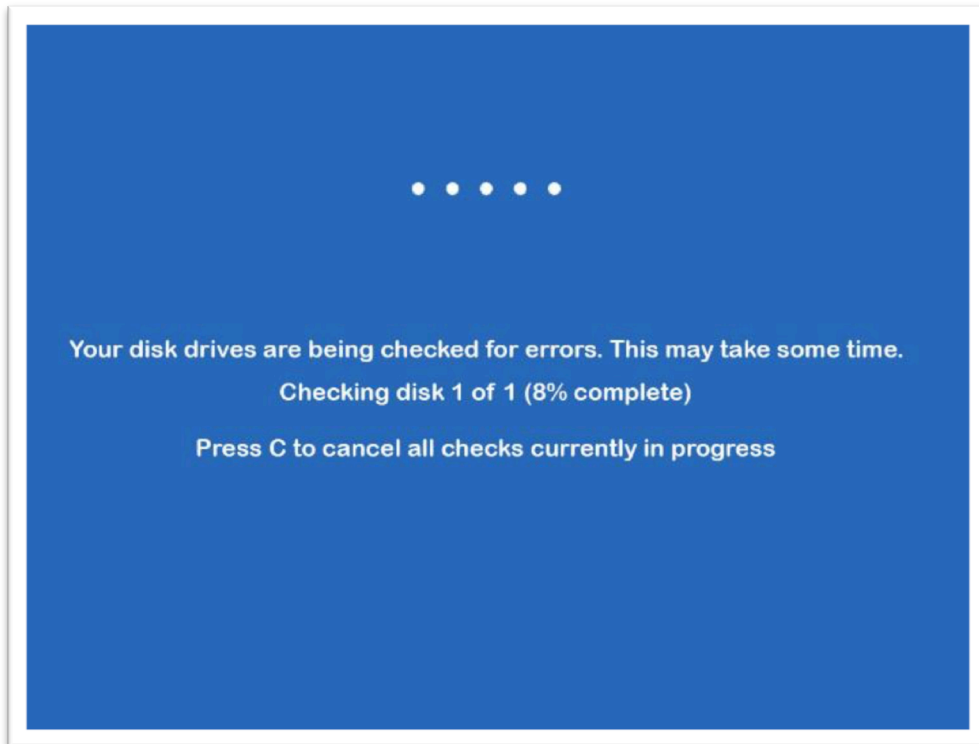
## File System Integrity Check

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

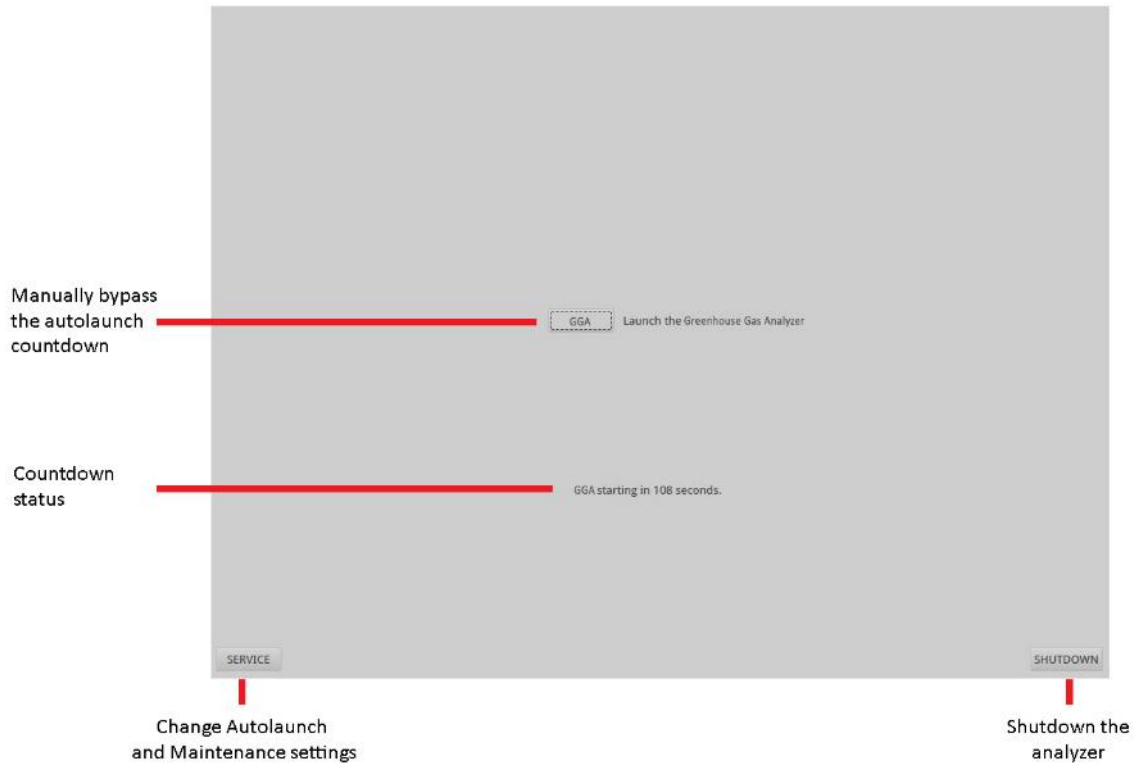
The exact final cell temperature will be analyzer specific (~25°C).

## 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

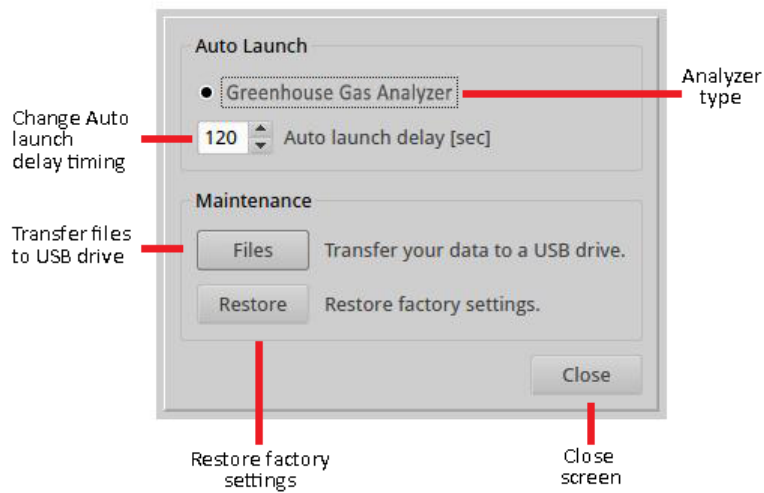
The Auto Launch and Maintenance settings are available when you click the **Service** button on the *Launch Service* screen.

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.

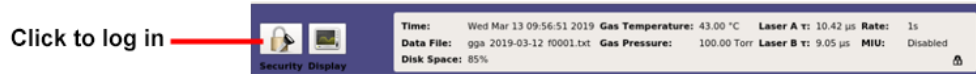


**Figure 14: Auto Launch Screen**

## 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.

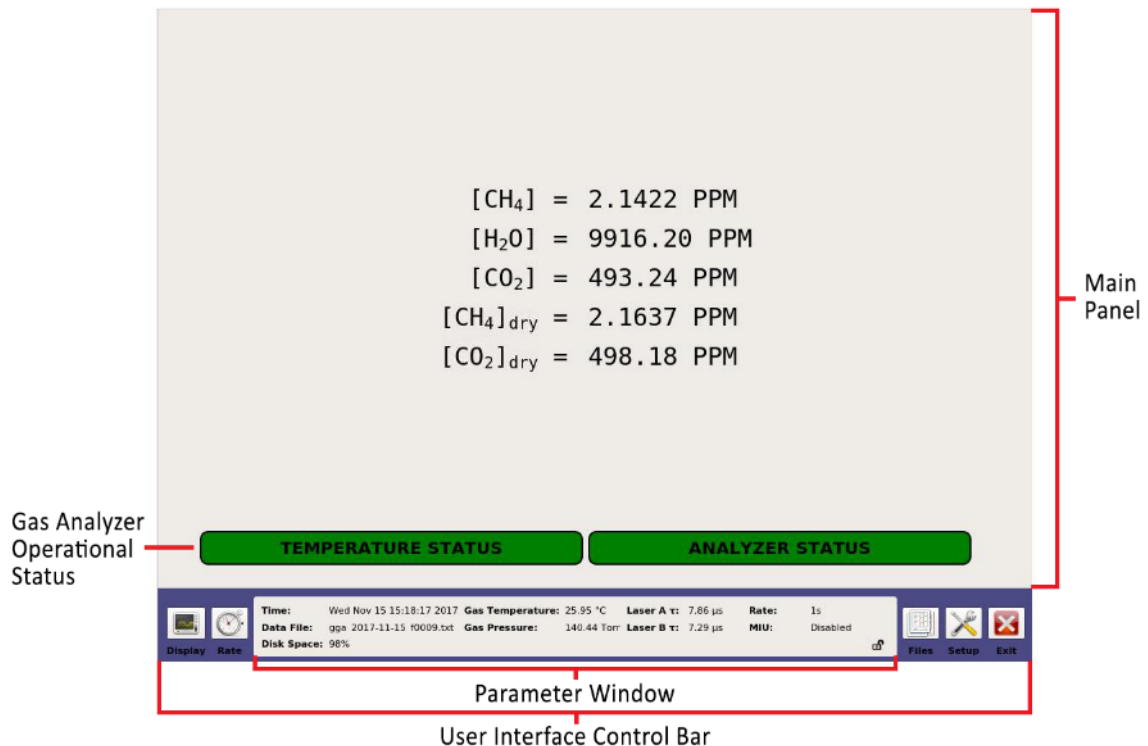
The operational status of the analyzer is displayed at the bottom of the main panel:

- **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.



Refer to the *Alarm Status Display* section on pages 31 - 33 for detailed *Temperature Status* and *Analyzer Status* descriptions.

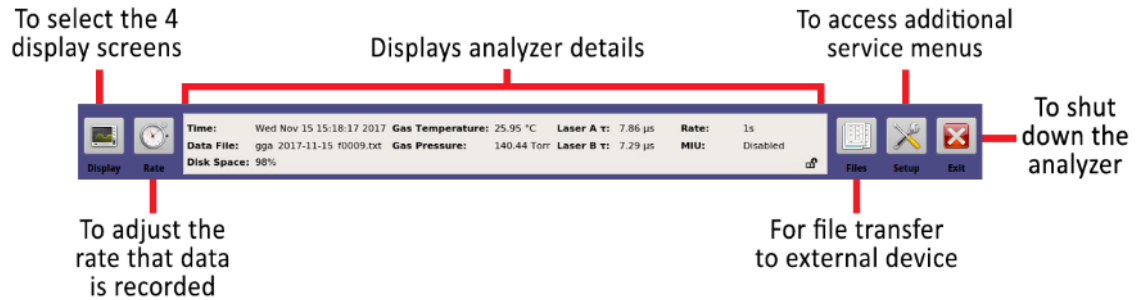
This panel contains the *User Interface Control Bar* (Figure 18) and *Numeric Display* (Figure 19)



**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  $\tau$  – Laser A ring-down time (micro-seconds -  $\mu$ s)
- Laser B  $\tau$  – Laser B ring-down time (micro-seconds -  $\mu$ s)
  - 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:

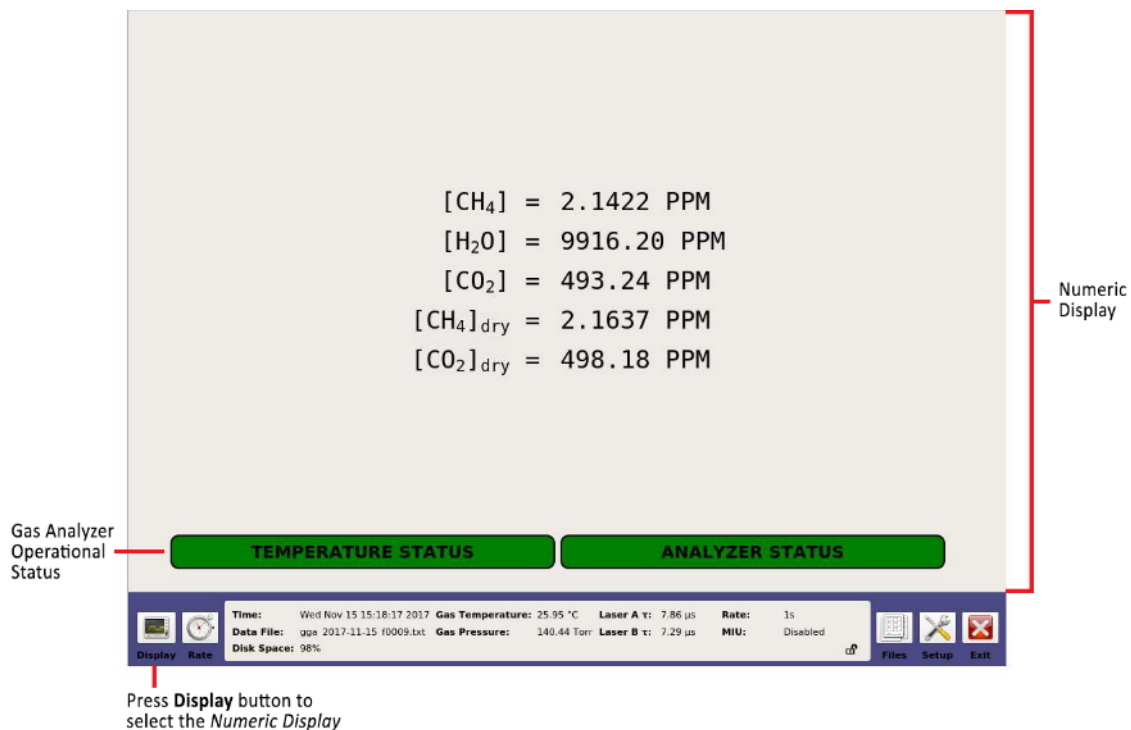
- Numeric
- Alarm Status
- Spectrum
- TimeChart

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**

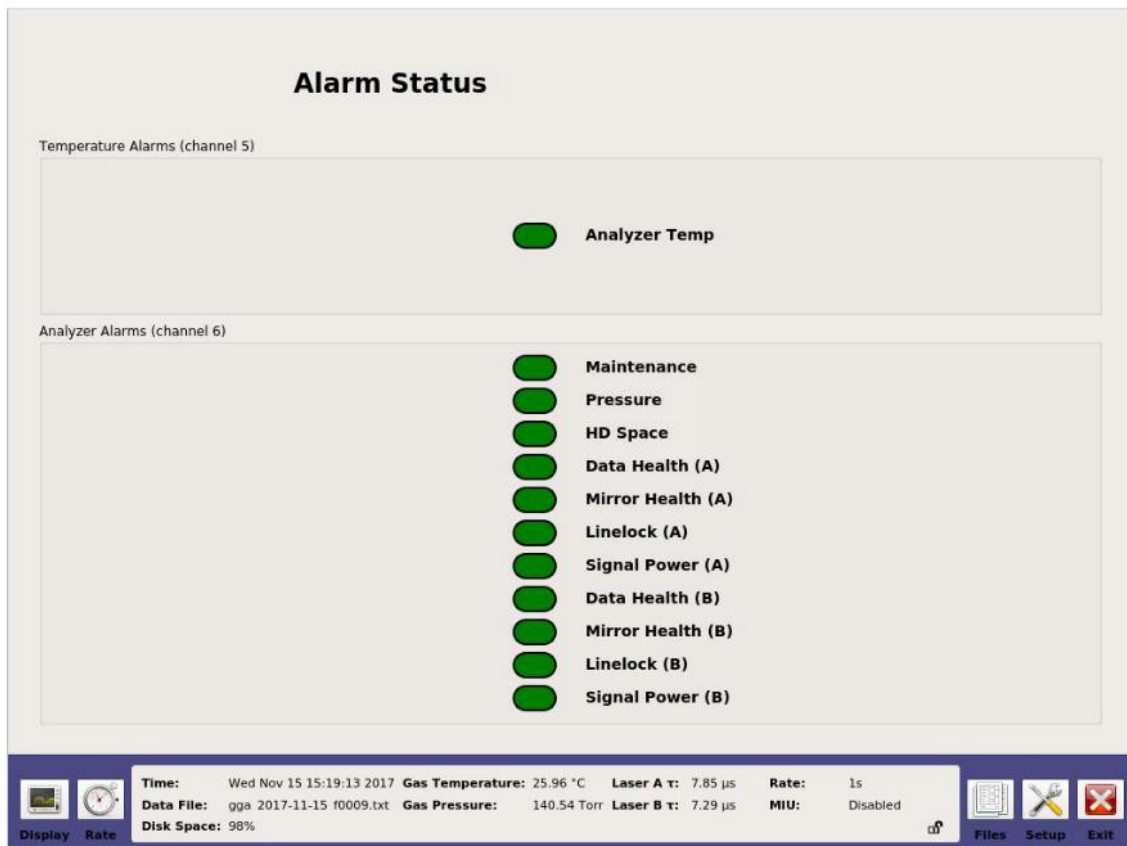
## Alarm Status Display

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 be 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	<b>CROSS OVER</b>		
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	<b>Dead Band</b>		
20	Acceptable Range	No warning/alarm	No warning/alarm



If the *Alarm Status* is **Yellow** or **Red** please refer to the *Maintenance* section on page 59. If issue continues, please contact at [icos.support@ca.abb.com](mailto:icos.support@ca.abb.com).

Table 6 describes fault criteria for the Analyzer Alarms.



'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	<b>CROSS OVER</b>		
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	<b>Dead Band</b>		
20	Performance	No warning/alarm	No warning/alarm



If the Alarm Status is **Yellow** or **Red**, please refer to the *Maintenance* section on page 59. If issue continues, please contact [icos.support@ca.abb.com](mailto:icos.support@ca.abb.com).

## Spectrum Display

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

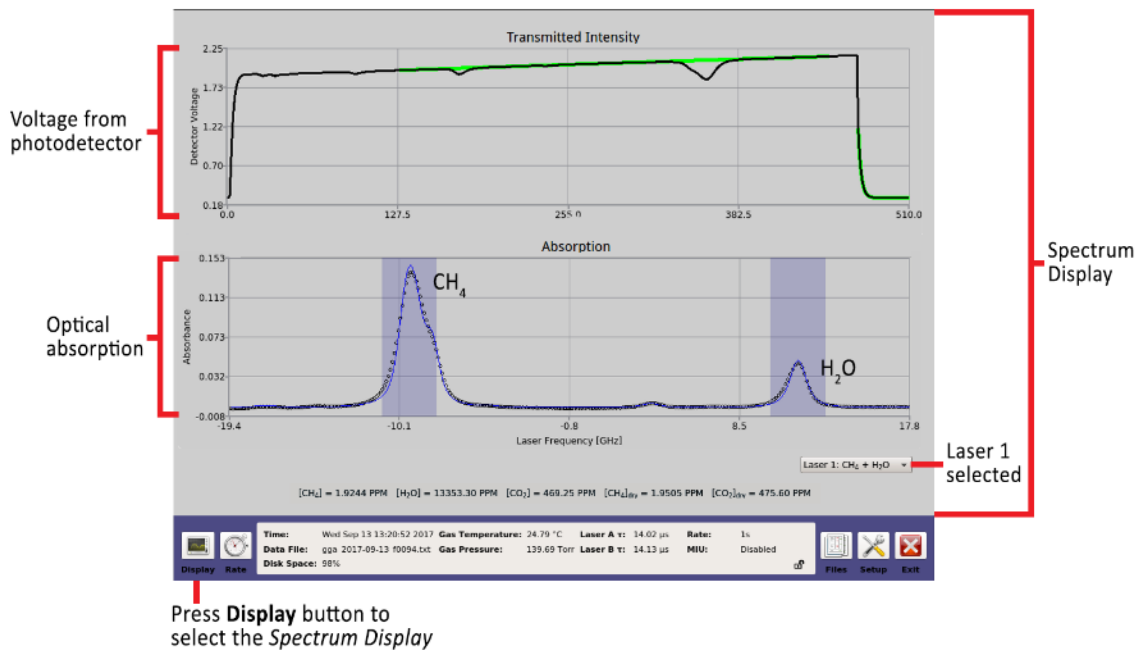
The top plot shows the voltage from the photodetector as the laser scans across the absorption features.

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

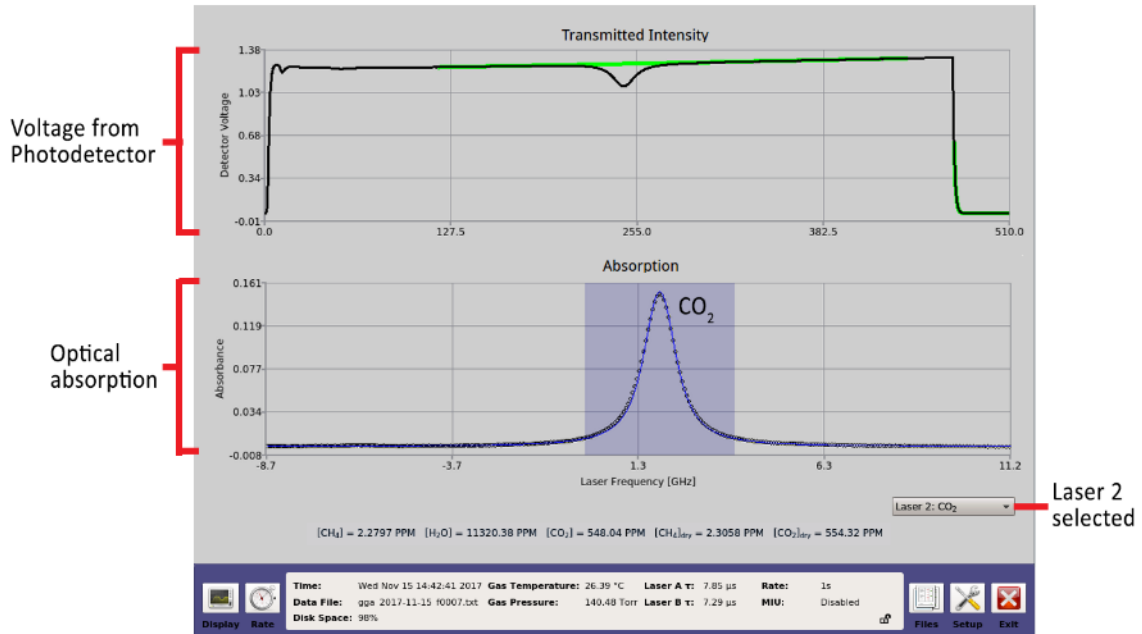
Figure 21 and Figure 22 show the *Spectrum Displays* for the GLA132-GGA. The GLA132-GGA is a dual-laser system. The **drop-down selector** in the lower right portion of the *Spectrum Display* lets you toggle between the two lasers:

- Laser 1 (also referred to as laser A) displays CH<sub>4</sub> and H<sub>2</sub>O peaks. (Figure 21)
- Laser 2 (also referred to as laser B) displays the CO<sub>2</sub> 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 88 to view the *Spectrum Displays* for different analyzer types.

**Table 7: Spectrum Display for different analyzer types**

Analyzer Type	Figure for Reference
GLA132-CCIA2	Figure 87
GLA132-GGA	Figure 88 and Figure 89
GLA132-SOFX1	Figure 90 and Figure 91

## TimeChart Display

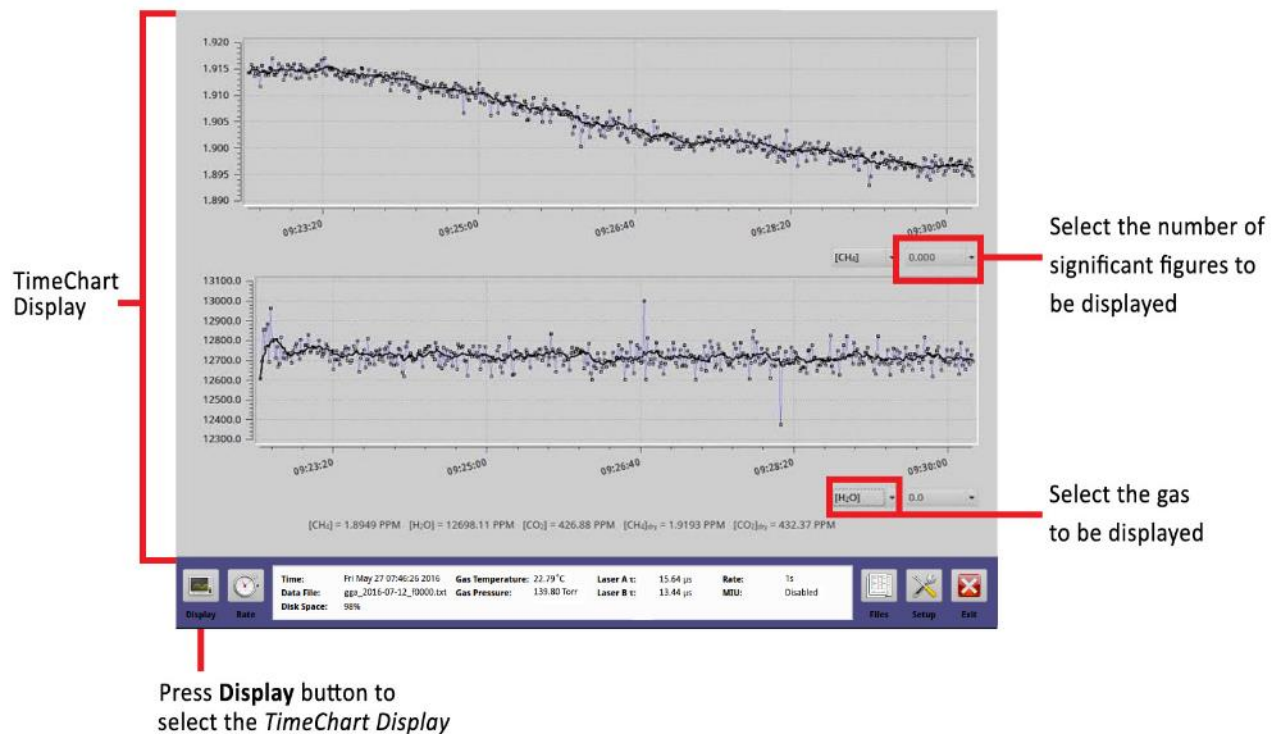
Click the **Display** button on the *User Interface Control Bar* to switch to *TimeChart* Display. (Figure 23)

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*.



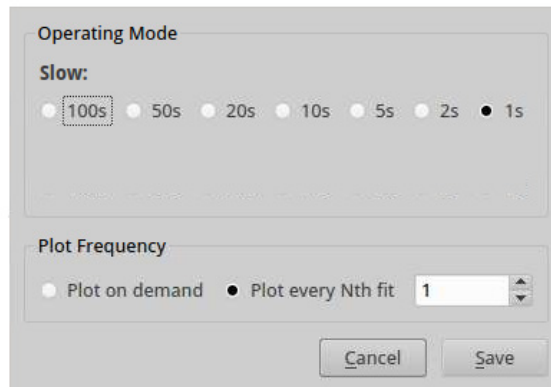
**Figure 23: TimeChart Display (GLA132-GGA)**



## 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**.



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)**

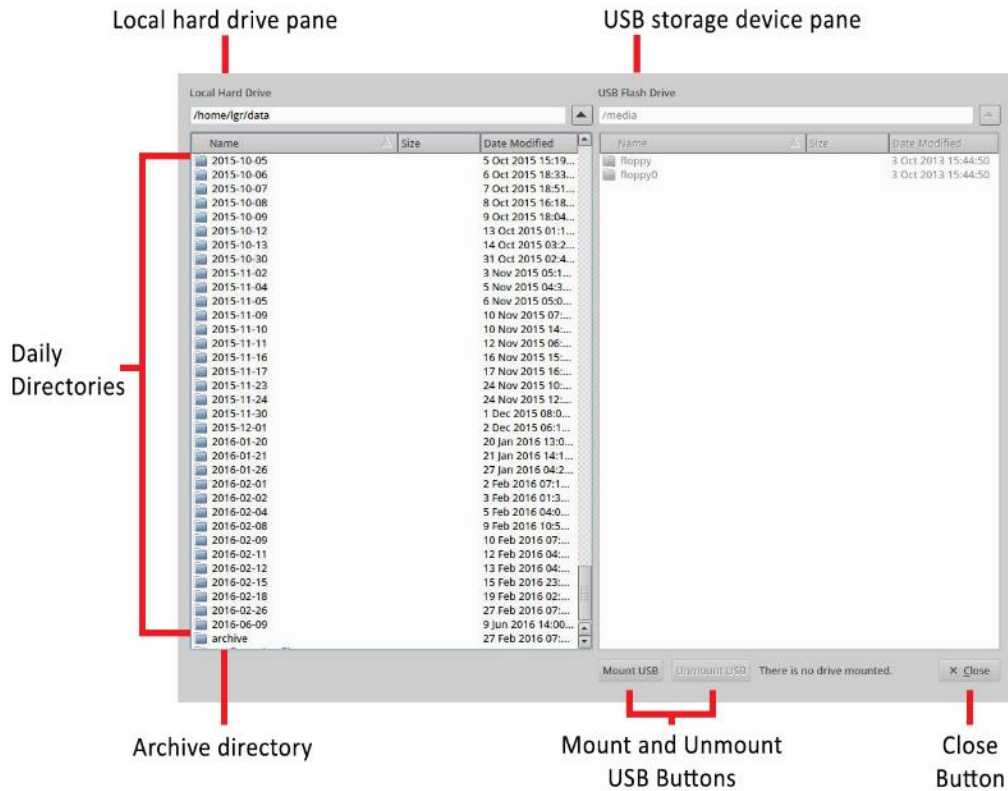
For each measurement there is an adjacent column reporting the standard deviation of the measurement (with sd suffix).

- 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.



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

When you have finished transferring files:

5. Click the **Unmount USB** button.  
Wait for the *Safe to Remove USB Memory Device* message before removing the USB memory device.
6. Click **Close** to exit the *File Transfer Menu*.



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

---

## Types of directories in the local hard drive

The analyzer hard drive contains two types of directories:

- Daily Directory
- Archive Directory

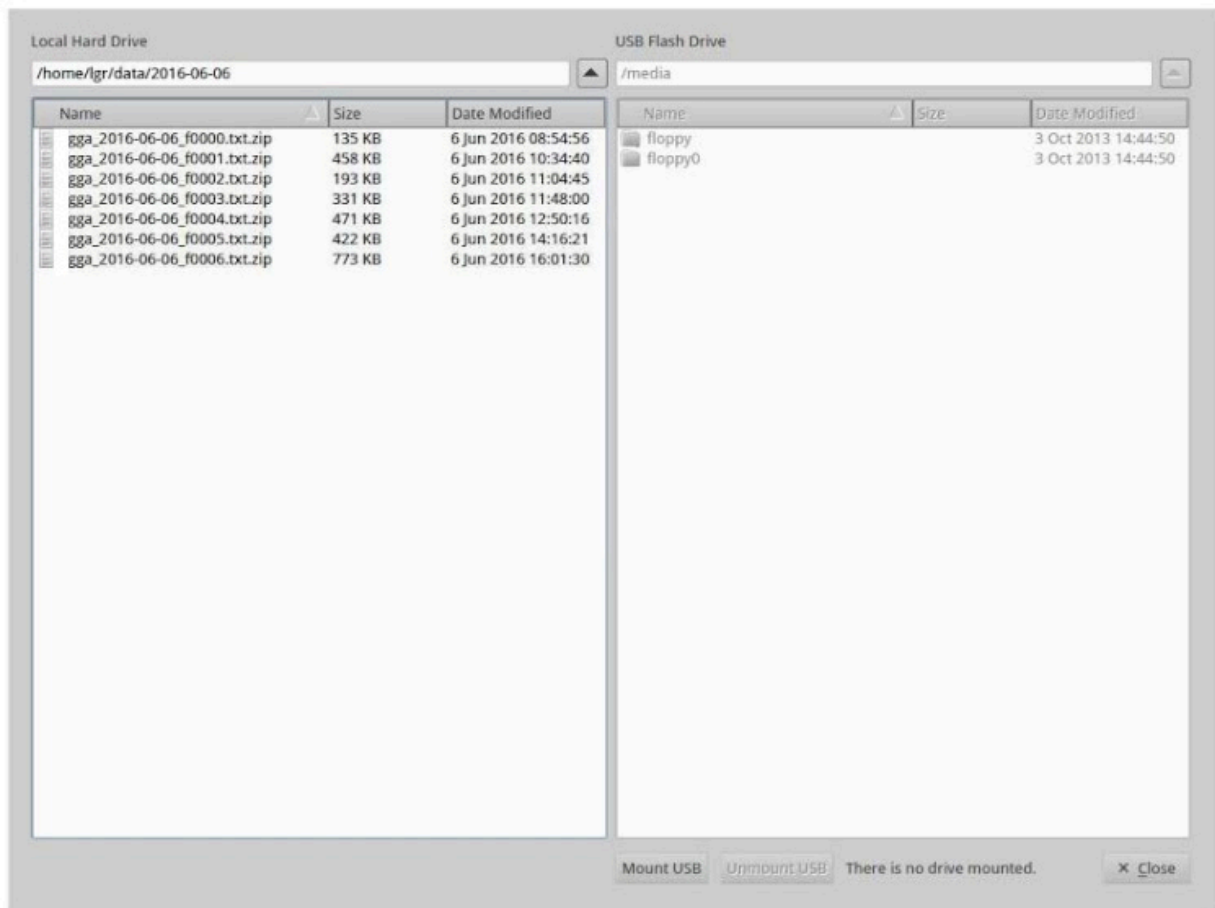
### Daily Directory

The local hard drive (Figure 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**

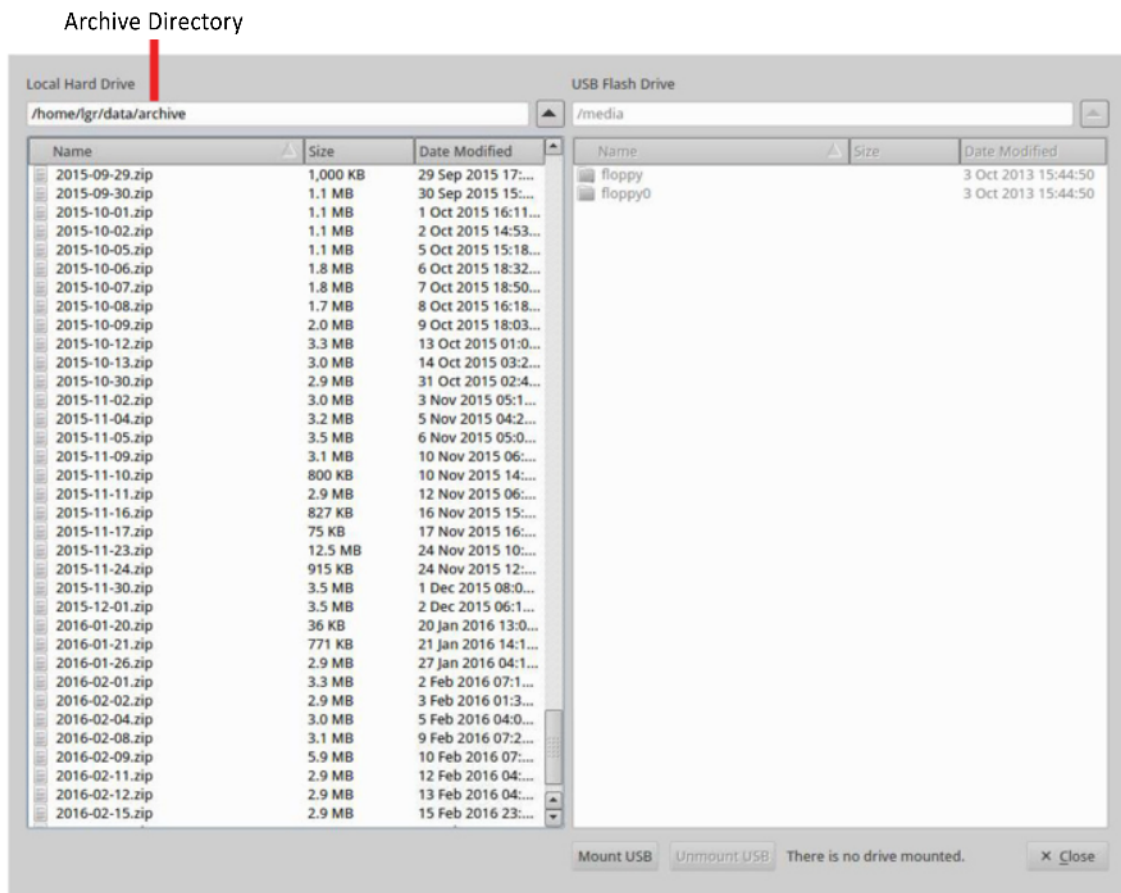
## Archive Directory

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**

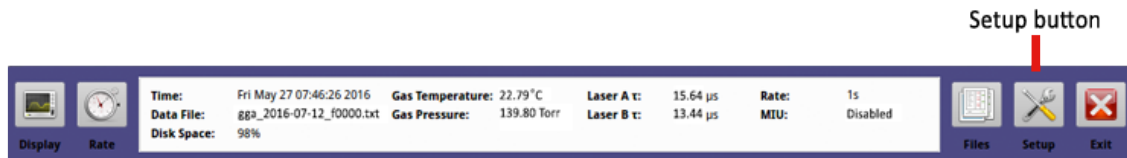


## Setup Menu

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

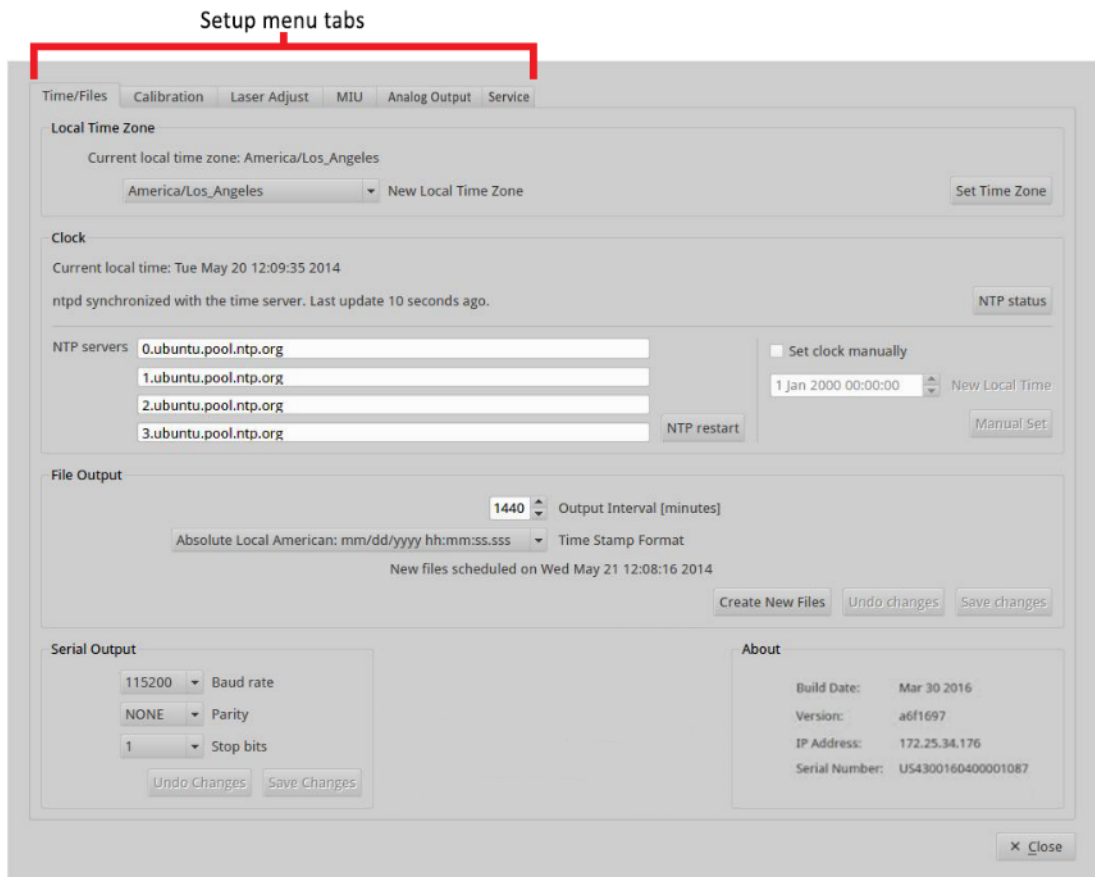
To enter *Setup* mode:

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.

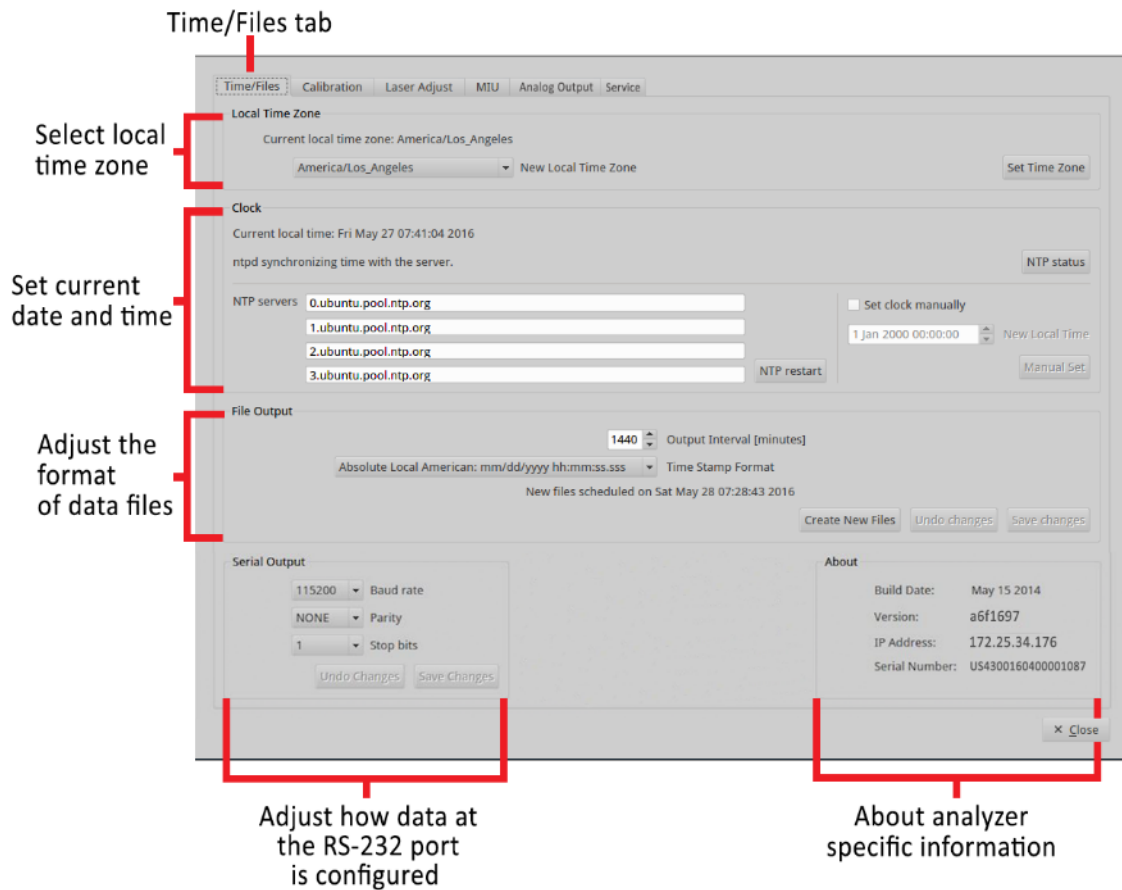
These tabs let you:

- 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
  - 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.



**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.



**Water vapor analyzers are calibrated differently, and users must refer to the Appendix: Calibration of WVIA and TWVIA analyzers on page 83.**

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)

Calibration tab

Time/Files Calibration Laser Adjust MIU Analog Output Service

0.12  
0.1  
0.08  
0.06  
0.04  
0.02  
0  
15 10 5 0 -5 -10 -15 -20  
Laser A

0.2  
0.15  
0.1  
0.05  
0  
10 5 0 -5 -10  
Laser B

Reference Gas Settings

Calibrate

Total [H<sub>2</sub>O] ppm 10060.00

Last cal: Wed May 15 13:30:26 2013

Calibrate

Total [CH<sub>4</sub>] ppm 1.77

Last cal: Tue Apr 30 15:32:47 2013

Calibrate

Total [CO<sub>2</sub>] ppm 750.00

Last cal: Tue Apr 30 16:38:54 2013

Calibrate

Click START to calibrate

Next Start

Close

Check the box above the gas you wish to calibrate

Enter the known standard concentration

Most recent calibration

Exit calibration screen

Becomes active once a Calibrate checkbox has been selected

**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.



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

---

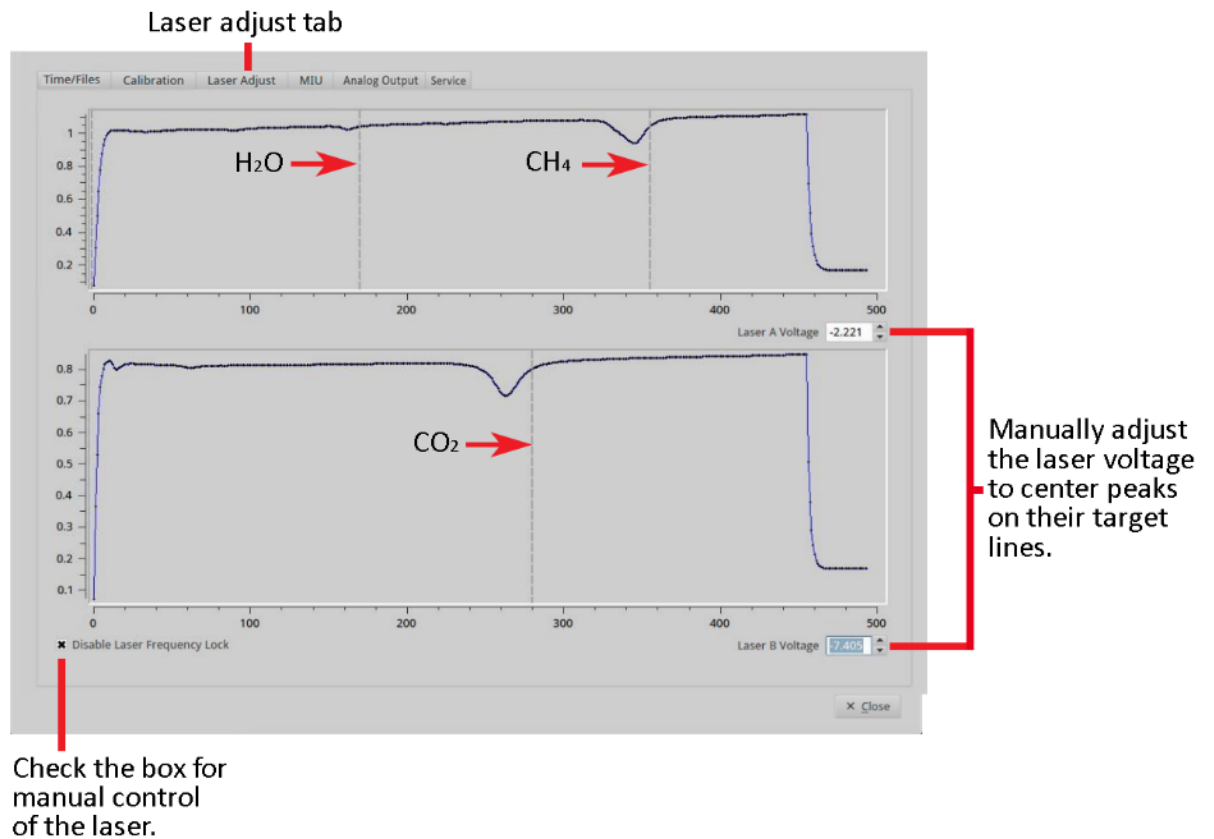
## Laser Adjust Tab

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.

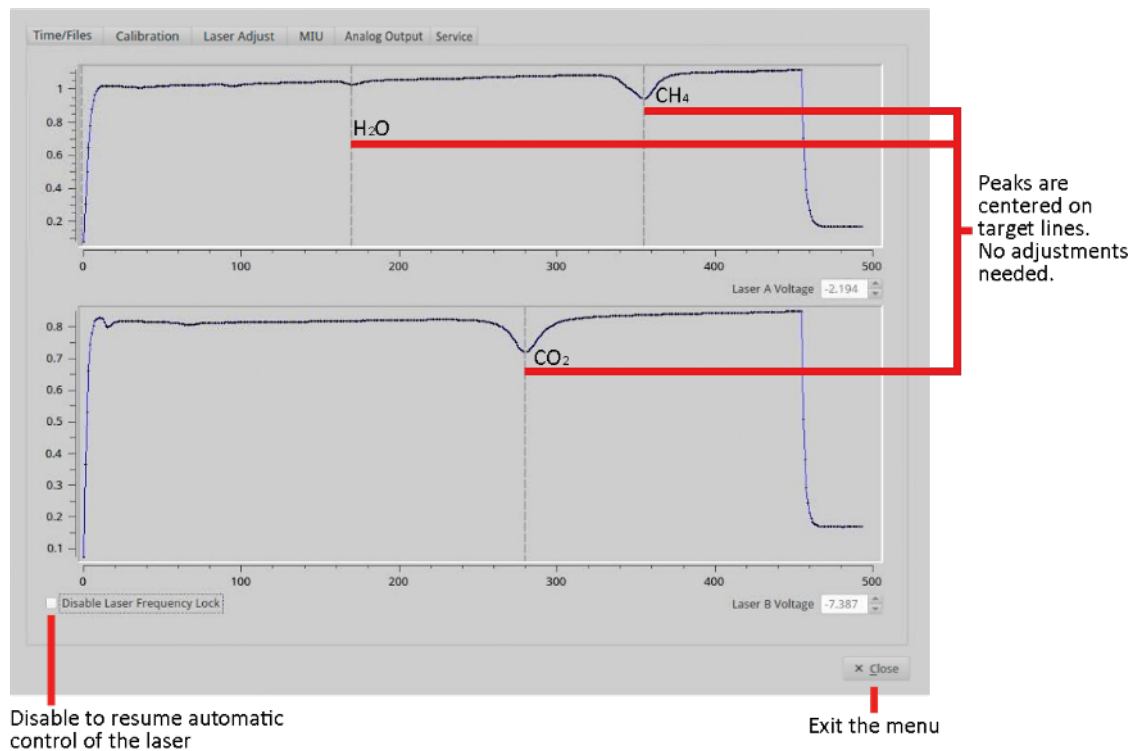


**Figure 35: Absorption peaks off of target lines. Laser voltage adjustment needed.**

## 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.



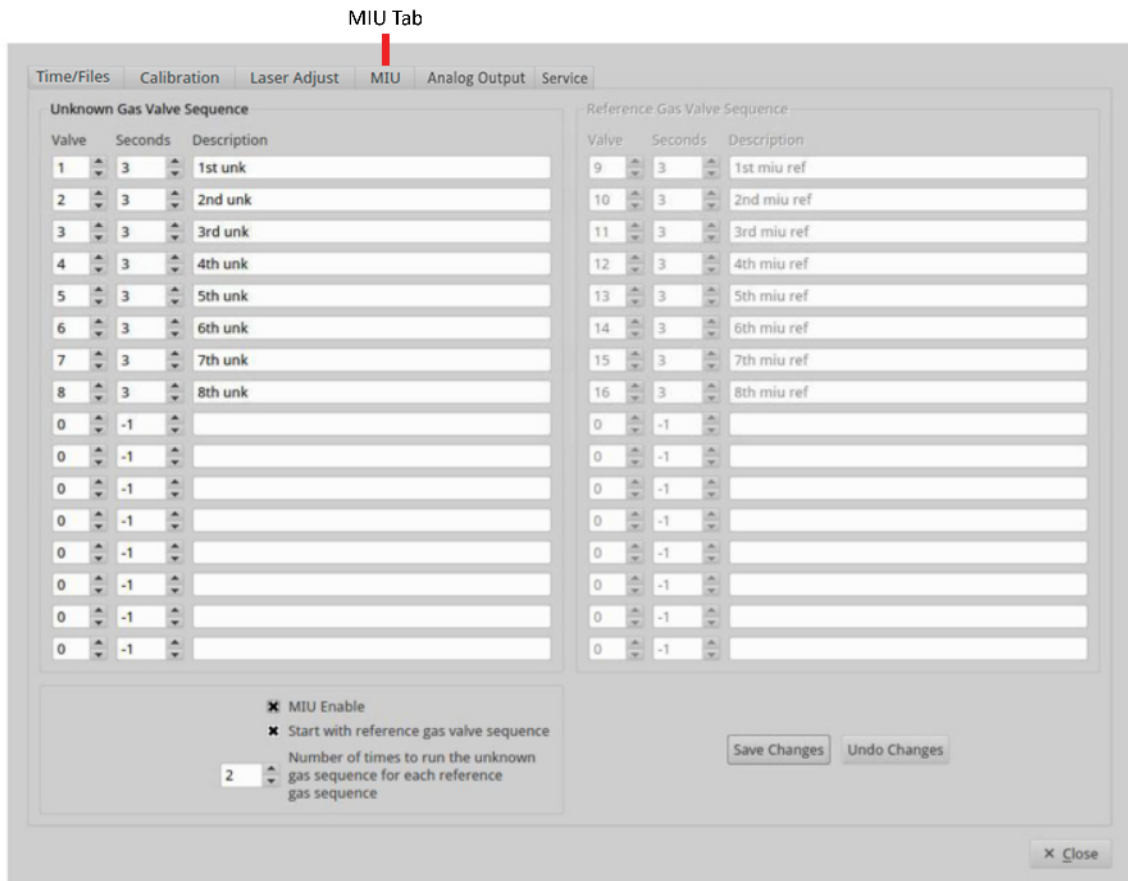
**Figure 36: Absorption Peaks Centered Correctly on Target Lines**



## 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)



**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.

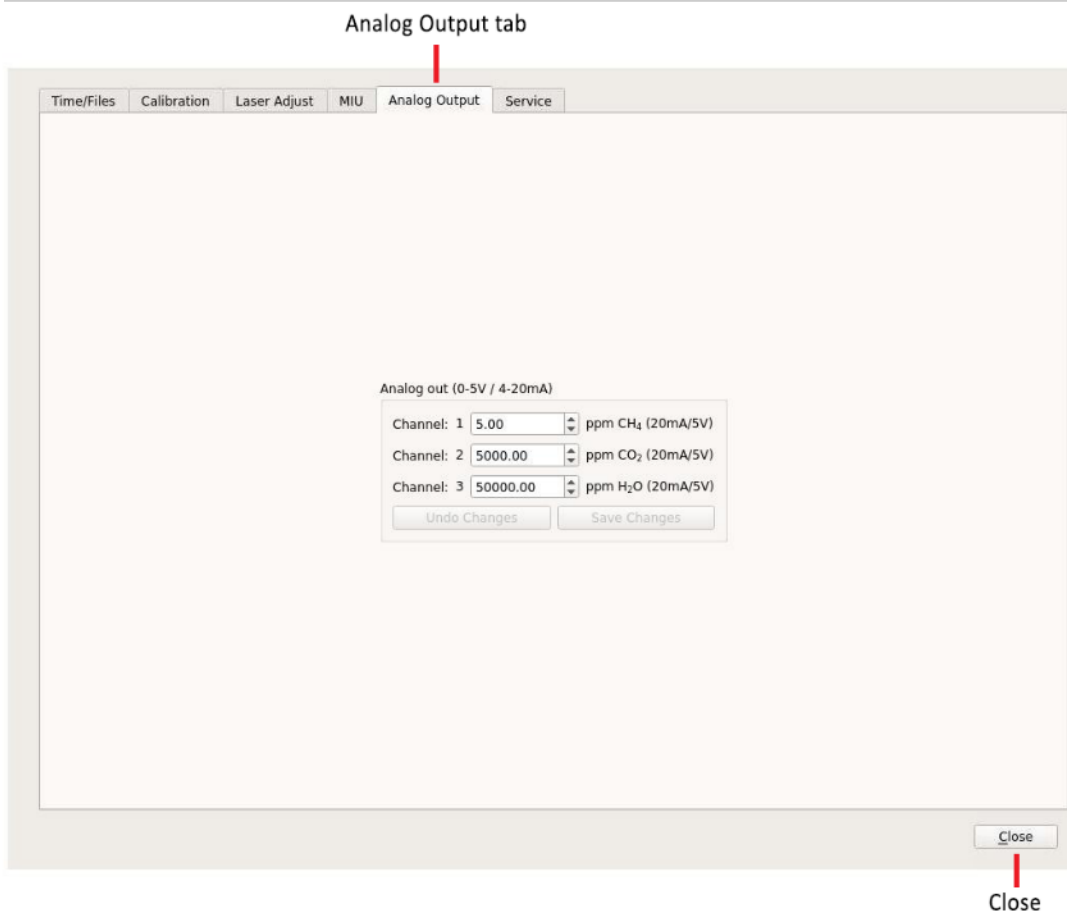
The user can specify a conversion between gas concentration and the analog output voltage, using the spinner controls, or by manually typing a number into the field. (Figure 38) The dropdown spinner controls let you select the concentration value that will correspond to the maximum 5 VDC analog output.

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.

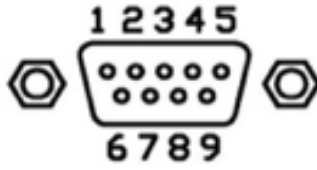


**If the measured concentration goes above the maximum expected value for the Analog Output, the on-screen displays and data files continue to record the correct measured concentration, but the Analog Output will saturate at its maximum value of 5.0 volts until the concentration drops back into the expected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



**Figure 38: Analog Output Screen**

Figure 39 shows the analog output connector.



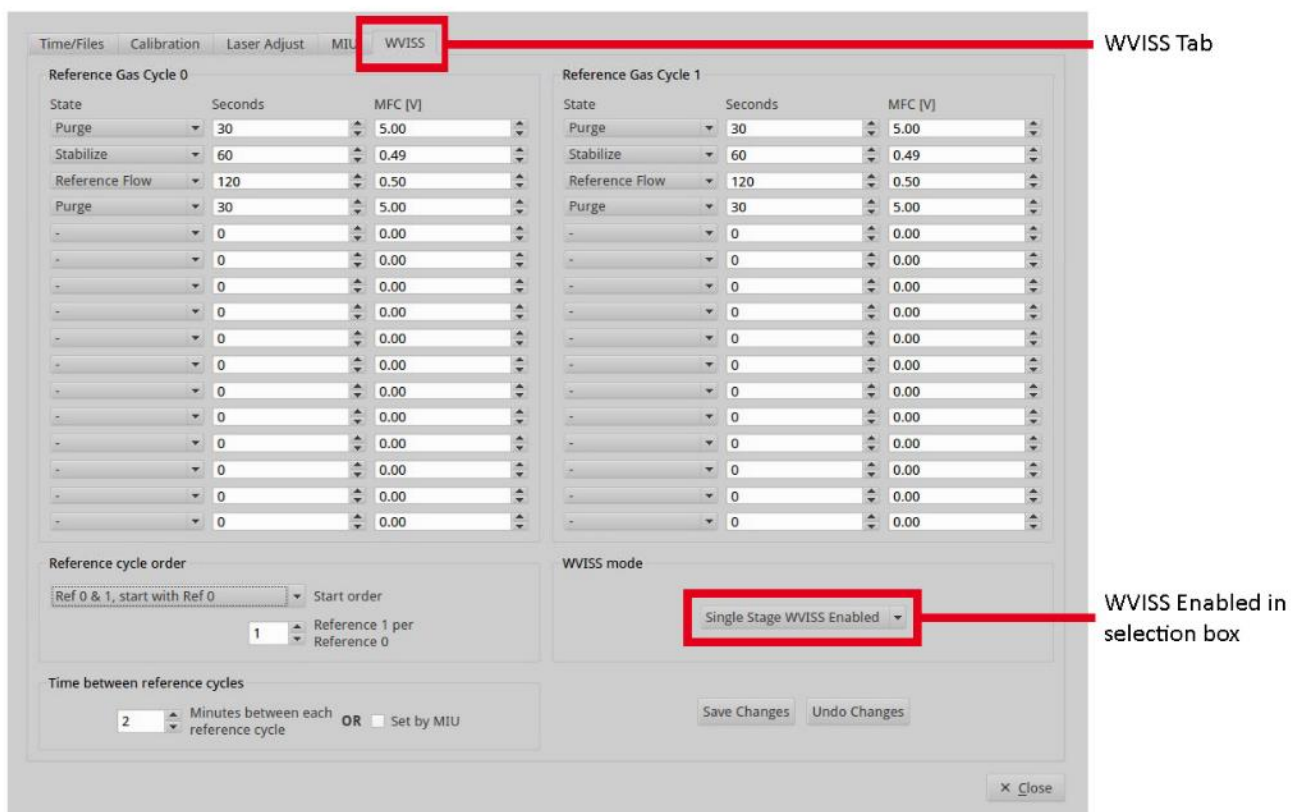
*Figure 39: Analog Output Connector*

## 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.

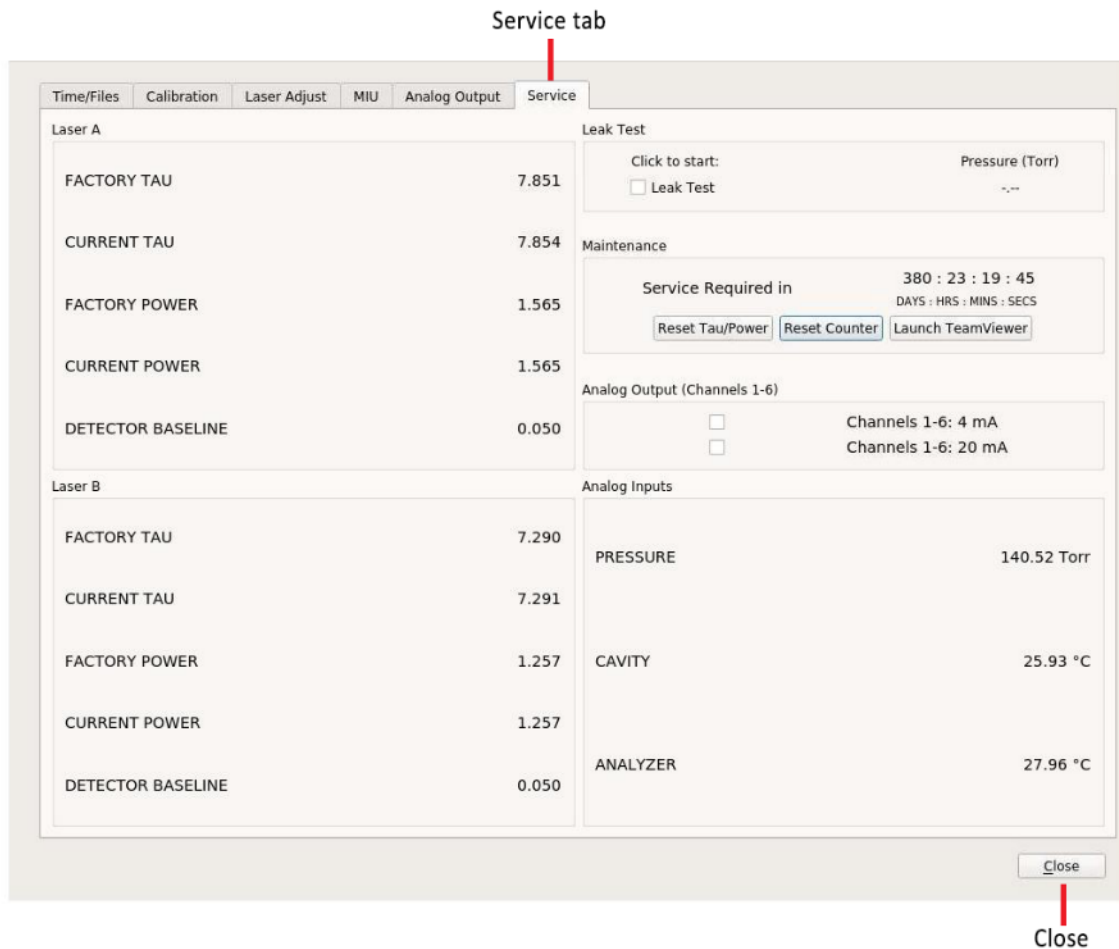


**Figure 40: WVISS Tab**

## 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

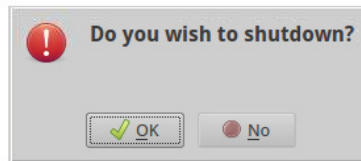
To shut down the analyzer:

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)



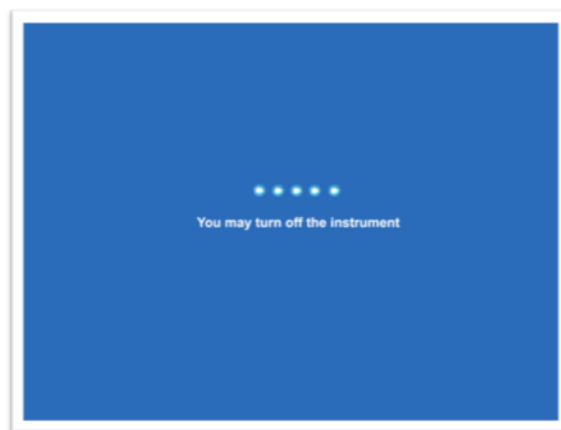
**Figure 42: User Interface Control Bar Exit Button**

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**



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	<ul style="list-style-type: none"><li>• On the <i>Spectrum Display</i>, 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.</li><li>• Log the transmitted intensity displayed in the upper panel of the spectrum screen. Any decrease in transmitted intensity could be indicative of dirty mirrors.</li><li>• 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.</li></ul>
Every 3-6 days	<ul style="list-style-type: none"><li>• Check the Laser Offset and adjust if necessary. (Figure 35)</li></ul>

### 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](mailto:icos.support@ca.abb.com)



**WARNING!**

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

## Replace the 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**

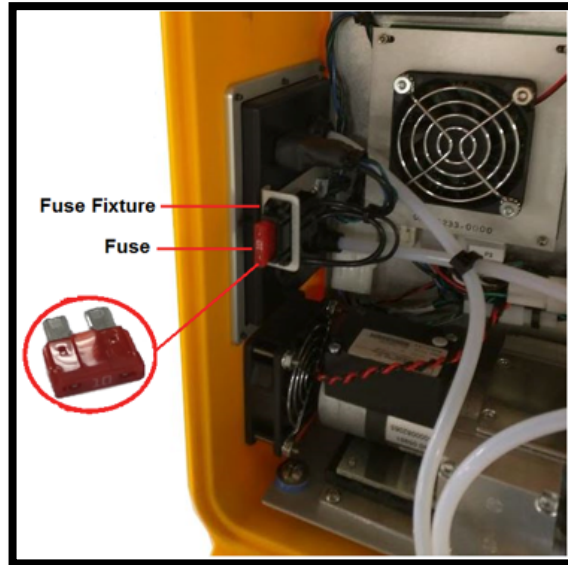
4. Open the case top. (Figure 46)



**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: 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 B: 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](http://www.tp-link.com/support) and enter the TP-Link model number (TL-WR802N).



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

---

### Local Connection

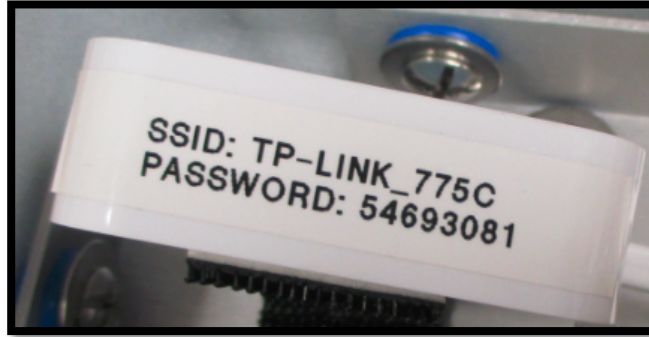
You can also bypass the wireless router if you want to connect the analyzer to a local network. Refer to the *Connect Analyzer to Local Network* section on page 69 for instructions on this configuration.

### 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 70 (Appendix C: Set Up Devices for Remote Access Using VNC Software) for details on setting up devices for remote access using VNC software (optional).

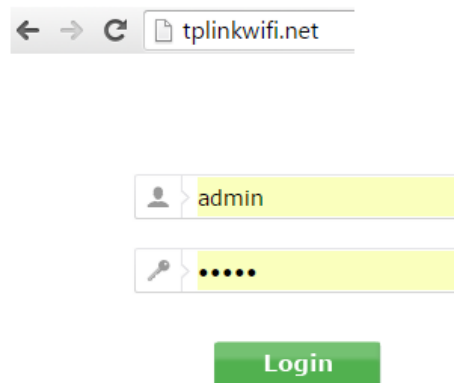
## Configure Router for Access-Point Mode

1. Using a phone, tablet, or laptop, connect to the router using the SSID and password on the router. (Figure 50)



**Figure 50: Router SSID and Password Location**

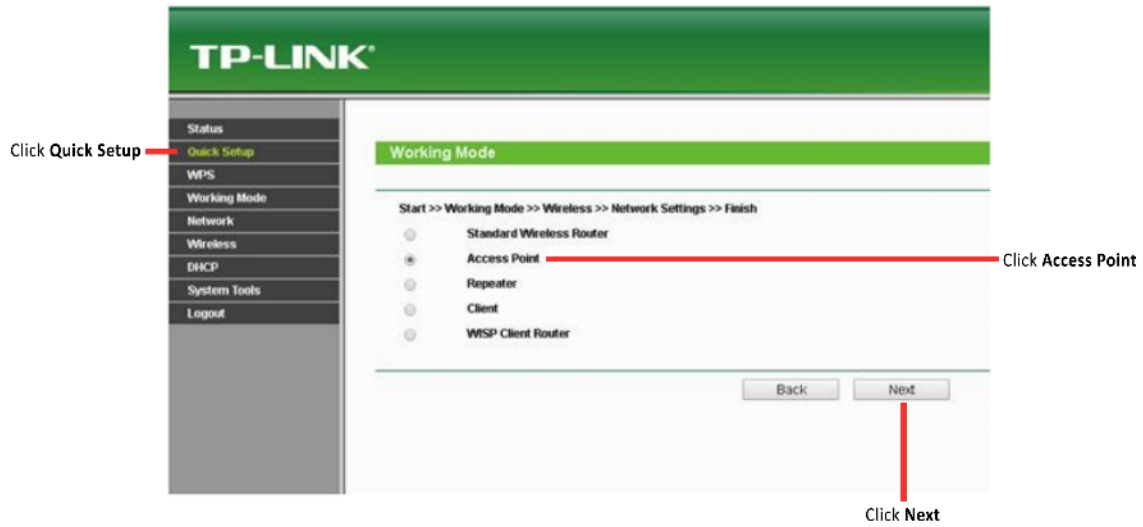
2. On the same device, launch a Web browser, then type <http://tplinkwifi.net> in the address bar. (Figure 51)



**Figure 51: Logging In**

3. Enter **admin** (in lowercase) for the username, and enter **Lgr123456789** for the password.
4. Click **Login**.

5. On the left panel, click **Quick Setup**. (Figure 52)



**Figure 52: Start Router Configuration**

6. Click **Next**.
7. In the *Main Panel*, select the **Access Point** button. (Figure 52)
8. Click **Next**.

9. In the *Wireless Setting* screen, do one of the following: (Figure 53)
- 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**.

Working Mode    Operation Mode    **Wireless Setting**    Network Setting    Finish

**AP Mode Setting:**

Wireless Network Name(SSID): TP-LINK\_0919 (also called SSID)

Region: United States

Warning: Ensure you select a correct country to conform local law. Incorrect settings may cause interference.

Channel: Auto

Wireless Security Mode: Most Secure(WPA/WPA2-PSK)

Wireless Password: 12345670

You can enter ASCII or Hexadecimal characters. For Hexadecimal, the length should be between 8 and 64 characters; for ASCII, the length should be between 8 and 63 characters. For good security it should be of ample length and should not be a commonly known phrase.

Back    Next

**Figure 53: Wireless Setting Screen**

10. In the *Network Setting* screen, click **Next**. (Figure 54)

Working Mode    Working Mode    Wireless Setting    **Network Setting**    Finish

Type: Smart IP(DHCP)

Note: The IP parameters cannot be configured if you have chosen Smart IP (DHCP). In this situation the device will help you configure the IP parameters automatically as you need.

IP Address: 192.168.0.254

Subnet Mask: 255.255.255.0

We recommend you configure this AP with the same IP subnet and subnet mask, but different IP address from your root AP/Router.

DHCP Server:  Disable  Enable

Back    Next

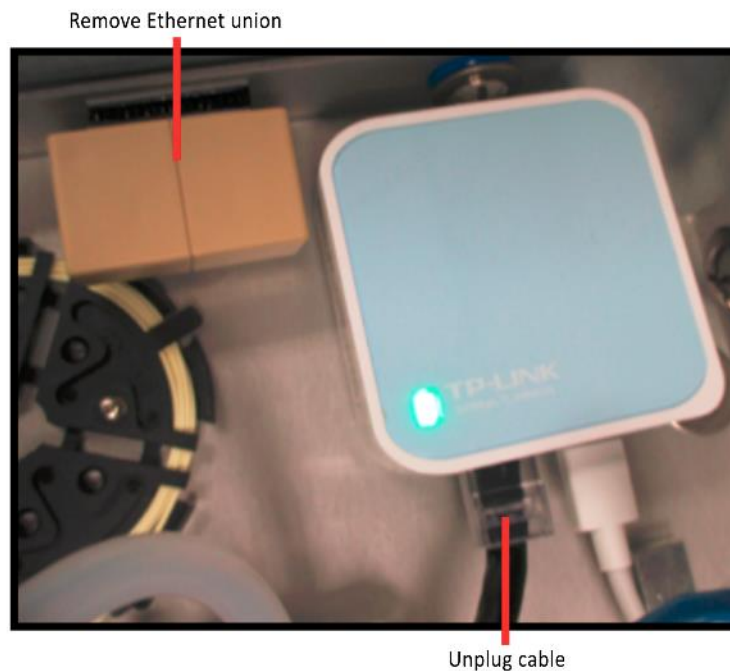
**Figure 54: Network Setting Screen**

11. Click **Finish**.
12. Restart the analyzer.



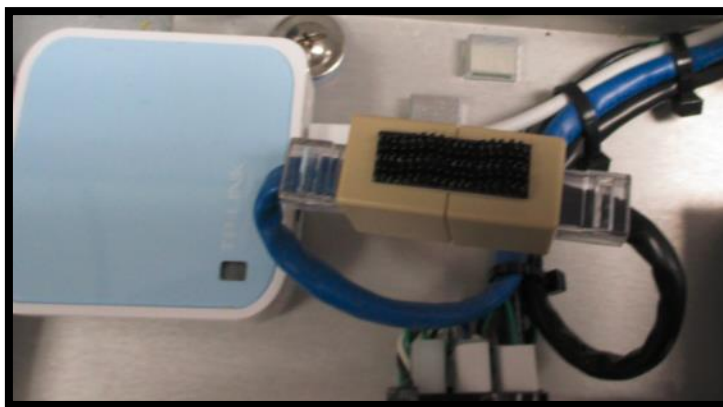
## Connect Analyzer to Local Network

1. Unplug the black cable from the router LAN/WAN port. (Figure 55)



**Figure 55: Unplug Cable and Remove Ethernet Union**

2. Remove the Ethernet union (next to the router). (Figure 55)
3. Plug the black cable into either port of the Ethernet union. (Figure 56)



**Figure 56: Plug Cables into Ethernet Union**

4. Plug the blue cable into the other port of the Ethernet union. (Figure 56)
5. Connect a local area network (LAN) cable from an external computer to the analyzer Ethernet port, located on the external side panel.

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

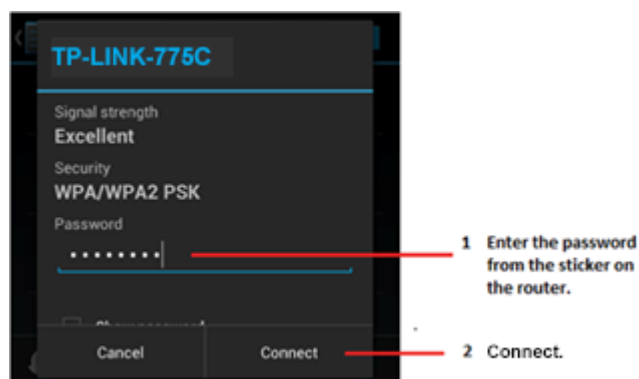
Listed below are three types of devices that can be connected to the analyzer through the wireless router to access information:

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

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

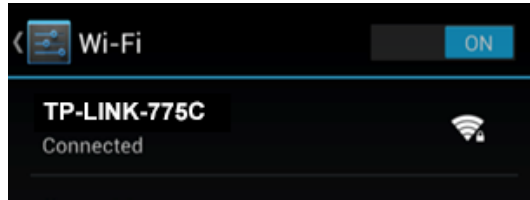
## Set up VNC Software on Android Devices

1. On the Android device, go to **Settings > WiFi > Connect to Wireless Network**.
2. Connect to the wireless SSID network listed on the router sticker. Enter the TP-Link wireless router (example: **TP-LINK-775C**) as shown in Figure 50.
  - 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 50) Every router has a different, unique SSID number, and wireless password.
5. Select **Connect**. (Figure 57)



**Figure 57: Password Connection Screen**

6. A verification message appears, showing that the Android device is connected to the router. (Figure 58)



**Figure 58: Connectivity Confirmation Screen**

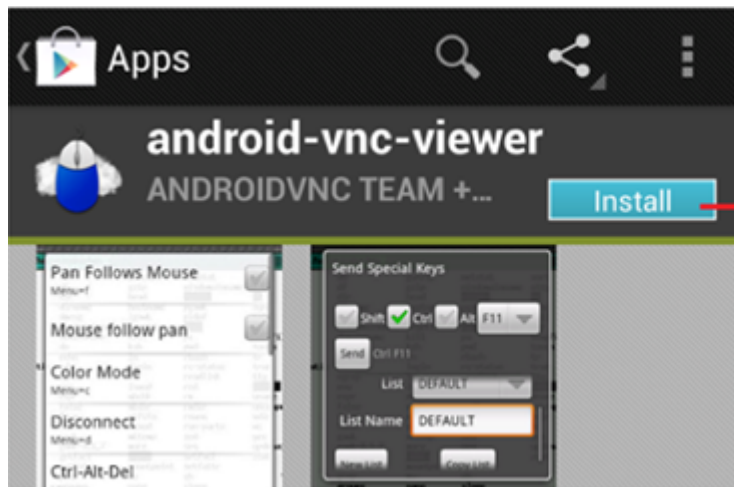
7. Ensure that the IP address of the Android device is correct by holding your finger down on the network connection icon. The IP address of the Android device is either 192.168.100.100 or 192.168.100.101.
  - a. Wireless devices can compete for dynamic addresses. If the 192.168.100.100 address does 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 59)



**An Internet connection is required for this step.**



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



Tap Install

**Figure 59: Android-vnc-viewer Install Screen**

10. Open the VNC application on the Android device by selecting the **VNC** application icon. (Figure 60)



**Figure 60: VNC Application Icon**

11. The Android VNC screen appears. (Figure 61)

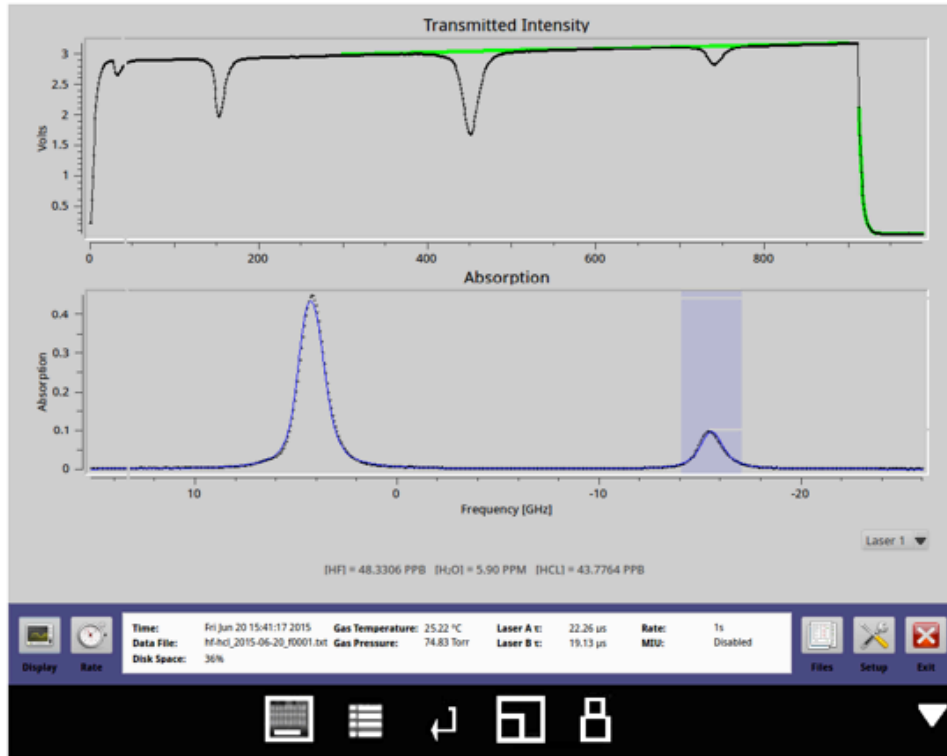


**Figure 61: VNC Application Installation Setup Screen**

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 62)



**Figure 62: Analyzer Software Interface Display with Size Adjustment for Android Devices**

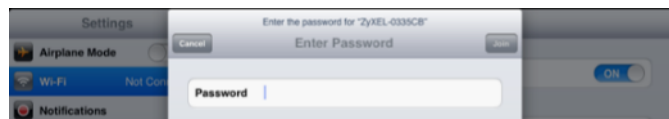
## Set up VNC Software on iOS Devices

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 50)  
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 63)



**Figure 63: Network Connections Screen**

4. The *Enter Password* screen appears. (Figure 64) In the Password field, enter the wireless password on the router sticker. (Figure 50)
5. Select **Join**.



**Figure 64: Router Connection Screen**

6. The *Network Connections* screen confirms that the iOS device is connected to the router. (Figure 65)



**Figure 65: 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 66.
  - 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 66: 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 67)
  - An Internet connection is required for this step.

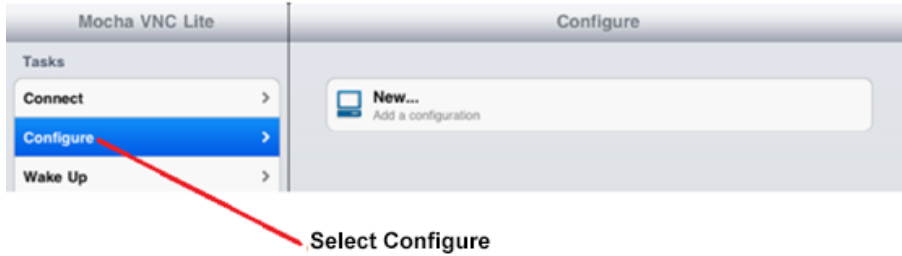


Complete instructions for installing *Mocha VNC Lite for iOS* can be found online at: [http://www.mochasoft.dk/iphone\\_vnc\\_help2/help.htm](http://www.mochasoft.dk/iphone_vnc_help2/help.htm).



**Figure 67: VNC Selection Screen**

10. Open the application and select **Configure**. (Figure 68)



**Figure 68: Mocha VNC Lite Configure (New) Screen**

11. The *Configure Screen* prompts you for the server IP address and password. (Figure 69)



**Figure 69: 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**.

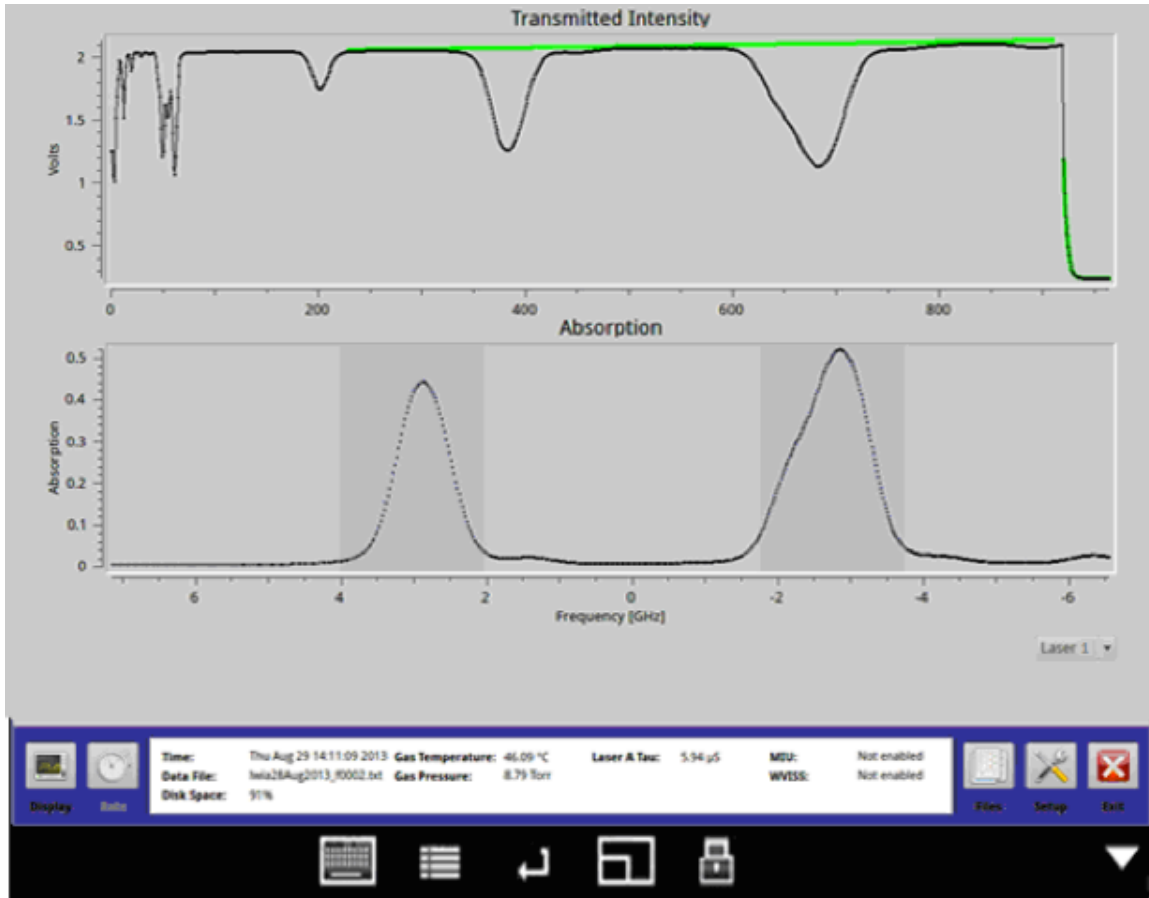
The *Setup Configuration* screen displays the IP address. (Figure 70)



**Figure 70: Setup Configurations Screen**



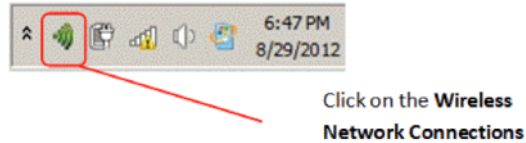
15. To connect the iOS device to the analyzer, tap the **IP Config** you set up. The analyzer software will display on the device. (Figure 71) The screen size is adjustable to fit the screen of the device.



**Figure 71: 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 50)
3. Click on the **Wireless Network Connections** icon in the bottom left of the screen (Figure 72) to open the *Windows Wireless Networks* dialog-box. (Figure 73)



**Figure 72: Wireless Connections Icon**



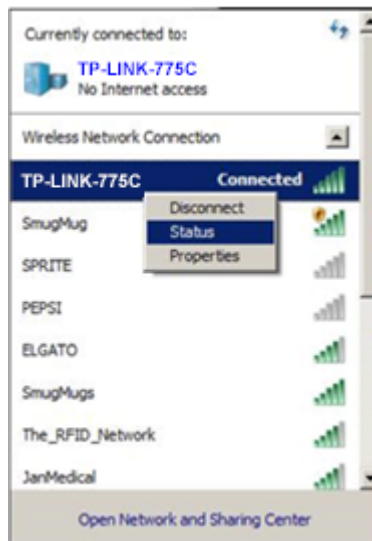
**Figure 73: Windows Wireless Networks**

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 74)
5. In the *Security key* field, enter the wireless password located on the router sticker. (Figure 50)
6. Click **OK**.



**Figure 74: Network Connections Security Screen**

7. The *Connection Status* dialog-box displays. (Figure 75)



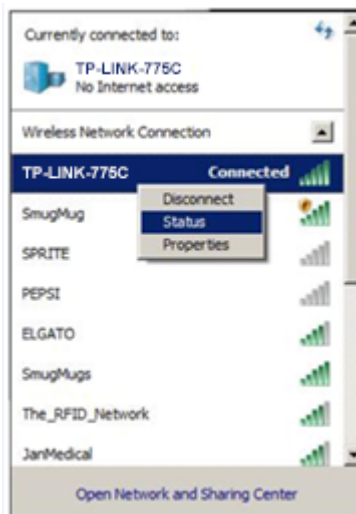
**Figure 75: Current Connectivity Screen**

8. Check the connection to make sure the device is connected through the wireless router by selecting the router. (Figure 76)



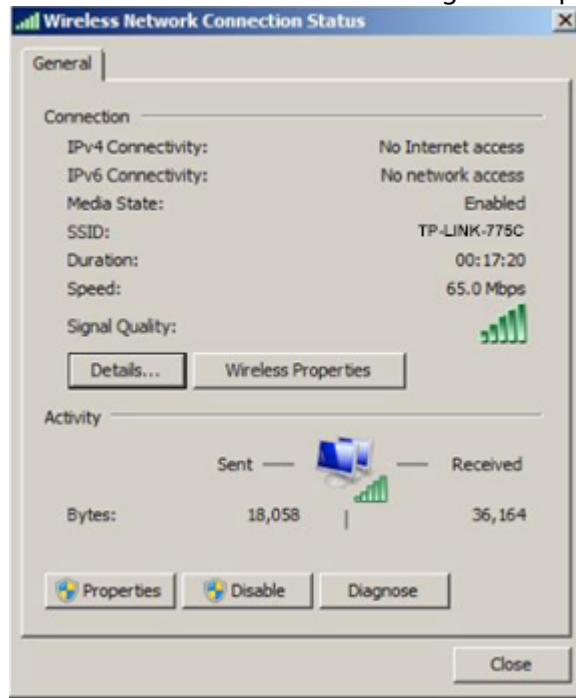
**Figure 76: Wireless Network Connection Screen**

9. Verify the IP address of the Windows device:
  - a. Right-click on the **TP-LINK-775C** network connection.
  - b. Click **Status**. (Figure 77)



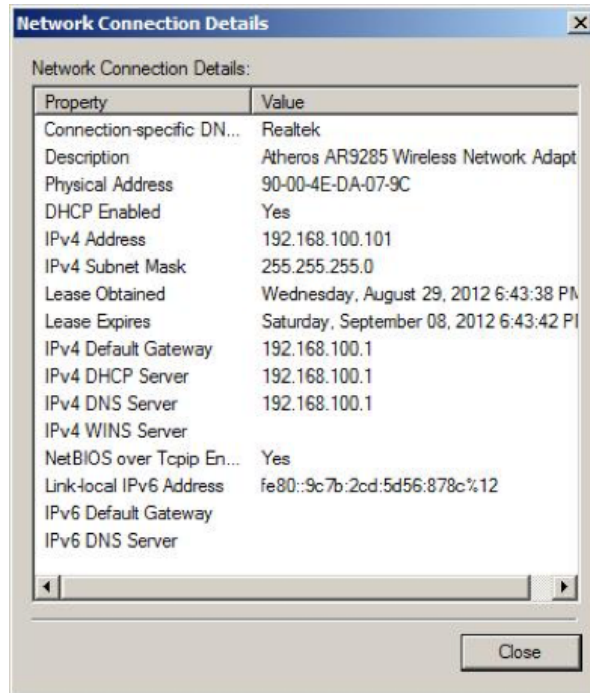
**Figure 77: Current Connectivity Screen**

10. The *Wireless Network Connection Status* dialog-box displays. (Figure 78)



**Figure 78: Wireless Network Connection Status Window**

11. Click the **Details** button to display the *Network Connection Details* window. (Figure 79)



**Figure 79: Network Connection Details Window**

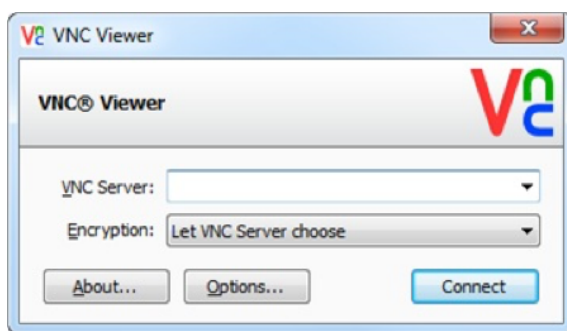
12. Verify the *Ipv4 Address* of the Windows device, which should be either **192.168.100.100** or **192.168.100.101**. For example, the Windows device IP address is **192.168.100.101**. (Figure 79)
13. Install the VNC software by going to the *RealVNC* website and downloading the RealVNC Viewer “EXE” file from <http://www.realvnc.com/download/>.



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>

---

14. Open the program by clicking the **Connect** button. (Figure 80)



**Figure 80: 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 79.

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

For example, if the IP address of the Windows device that was displayed in Step 12 is **192.168.100.101**, then the IP address of the analyzer will be **192.168.100.100**.

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

# Appendix D: 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.

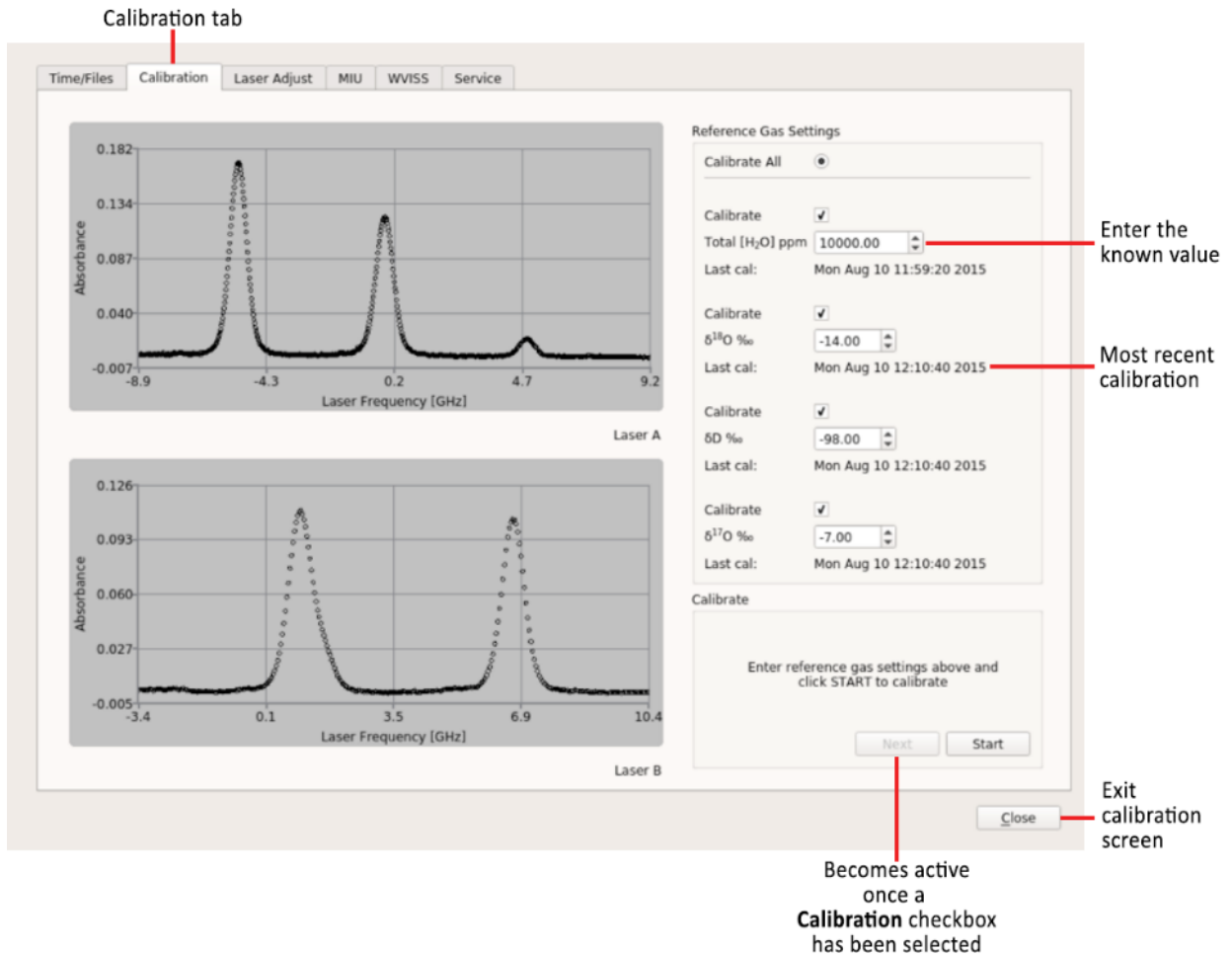
## To Calibrate the Water Concentration

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<sub>2</sub>O.
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  $\delta D$ ,  $\delta^{18}O$  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 81)



**Figure 81: User Interface Control Bar**

6. Select the **Calibration** tab at the top of the screen to enter the *Calibration* menu. (Figure 82)

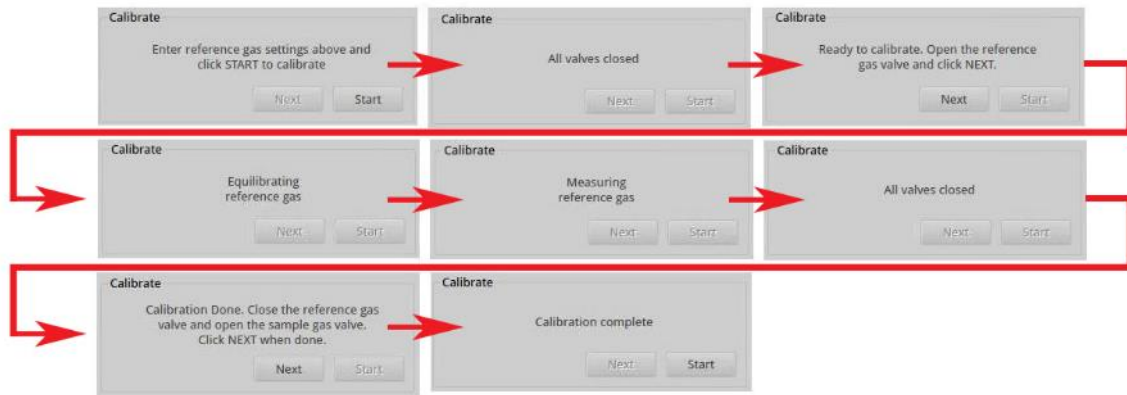


**Figure 82: Calibration menu**

7. Enter the known concentration of water vapor (example: 10,060ppm if the Dew Point Generator is set to 7 Volts). (Figure 82)
8. Enter the averaged values of δD, δ<sup>18</sup>O and δ<sup>17</sup>O in PP\_MIL (‰). (Figure 82)
9. Click the **NEXT** button on the lower, right panel of the screen to begin calibration. (Figure 82)



- Each step is displayed in the lower-right panel of the calibration screen as the analyzer performs the calibration. Figure 83 shows the calibration process as a flow chart.



**Figure 83: Calibration Flow**

- When the *Calibration Complete* message is displayed, click the **CLOSE** button.
- Enter *TimeChart* by selecting the **Display** button on the *User Interface Control Bar* (Figure 81) and verify that the displayed concentration is reporting the expected value.



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

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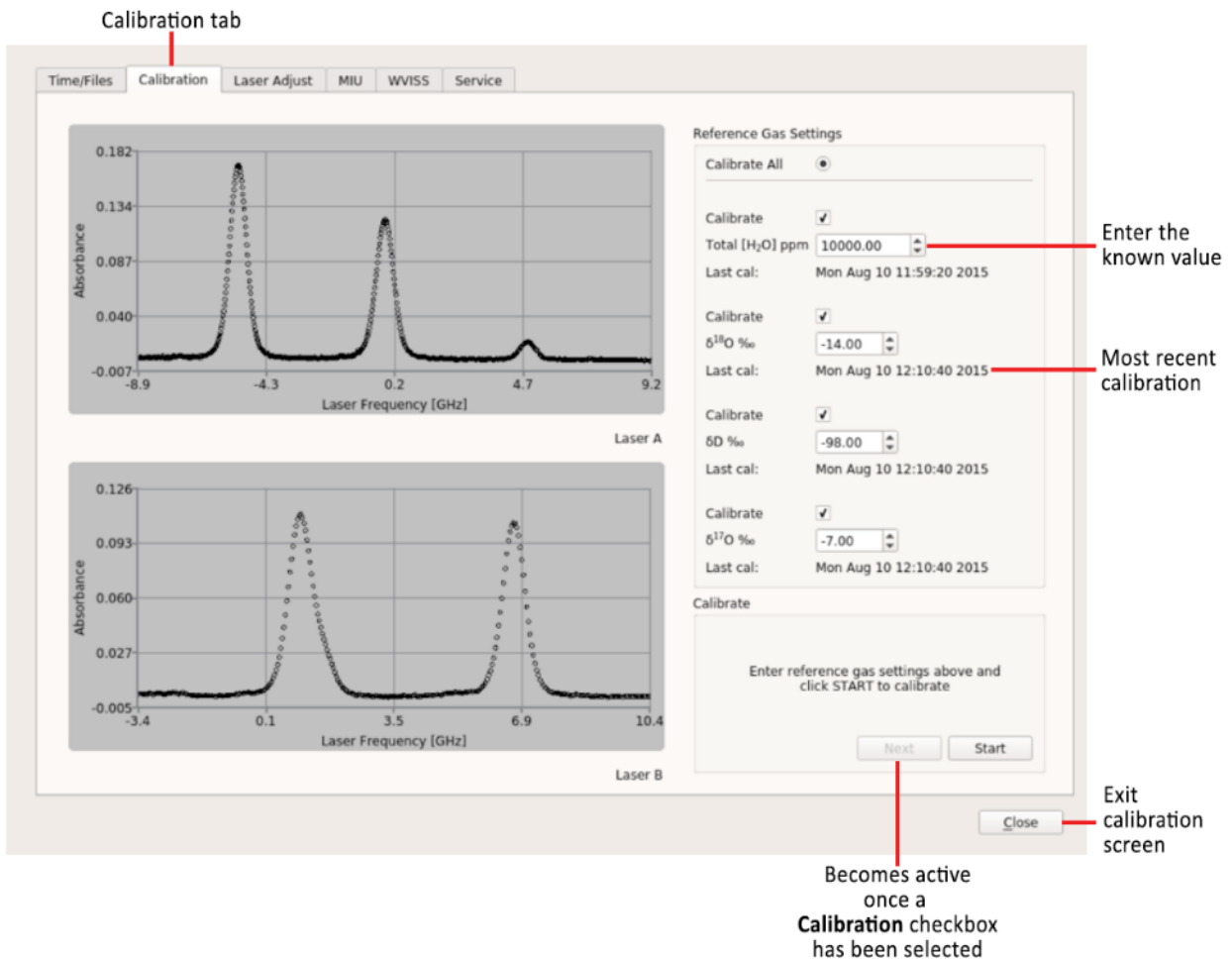
## To Calibrate the Isotope Values

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 84)



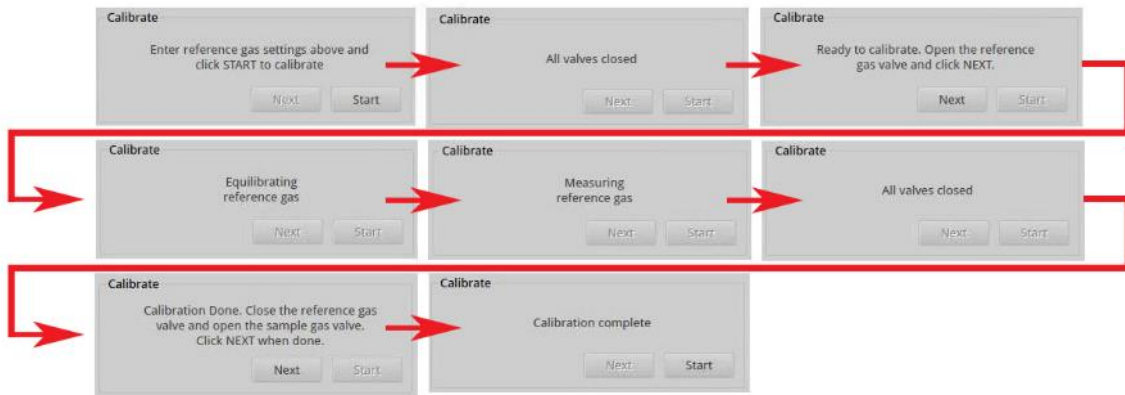
**Figure 84: User Interface Control Bar**

6. Select the **Calibration** tab at the top of the screen to enter the *Calibration* menu. (Figure 85)



**Figure 85: Calibration menu**

7. Enter 10,000ppm into the Total [H<sub>2</sub>O] ppm field. (Figure 85)
8. Enter the values of  $\delta D$ ,  $\delta^{18}O$  and  $\delta^{17}O$  in PP\_MIL (‰) that are labeled on the Water Standard Bottle. (Figure 85)
9. Click the **NEXT** button on the lower, right panel of the screen to begin calibration. (Figure 85)
10. Each step is displayed in the lower-right panel of the calibration screen as the analyzer performs the calibration. Figure 86 shows the calibration process as a flow chart.



**Figure 86: Calibration Flow**

11. When the *Calibration Complete* message is displayed, click the **CLOSE** button. (Figure 85)
12. Enter *TimeChart* by selecting the **Display** button on the *User Interface Control Bar* (Figure 84), and verify that the displayed isotope values correctly correspond to the values listed on the bottle.



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

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# Appendix E: Spectrum Displays

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

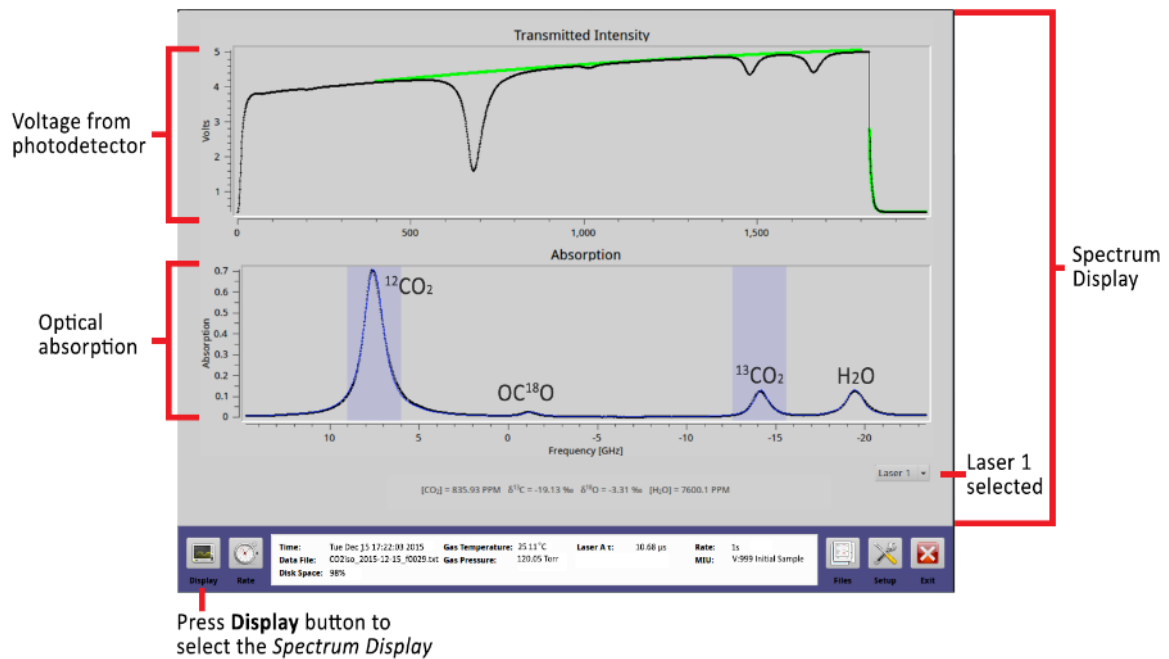
**Table 10: Plumbing Diagram for different analyzer types**

Analyzer Type	Figure for Reference
GLA132-CCIA2	Figure 87
GLA132-GGA	Figure 88 and Figure 89
GLA132-SOFX1	Figure 90 and Figure 91

## GLA431-CCIA2 Carbon Dioxide Isotopic Analyzer

Figure 87 shows the *Spectrum Display* for the GLA132-CCIA2.

Laser 1 (also referred to as laser A) displays the  $^{12}\text{CO}_2$ ,  $\text{OC}^{18}\text{O}$ ,  $^{13}\text{CO}_2$ , and  $\text{H}_2\text{O}$  peaks.

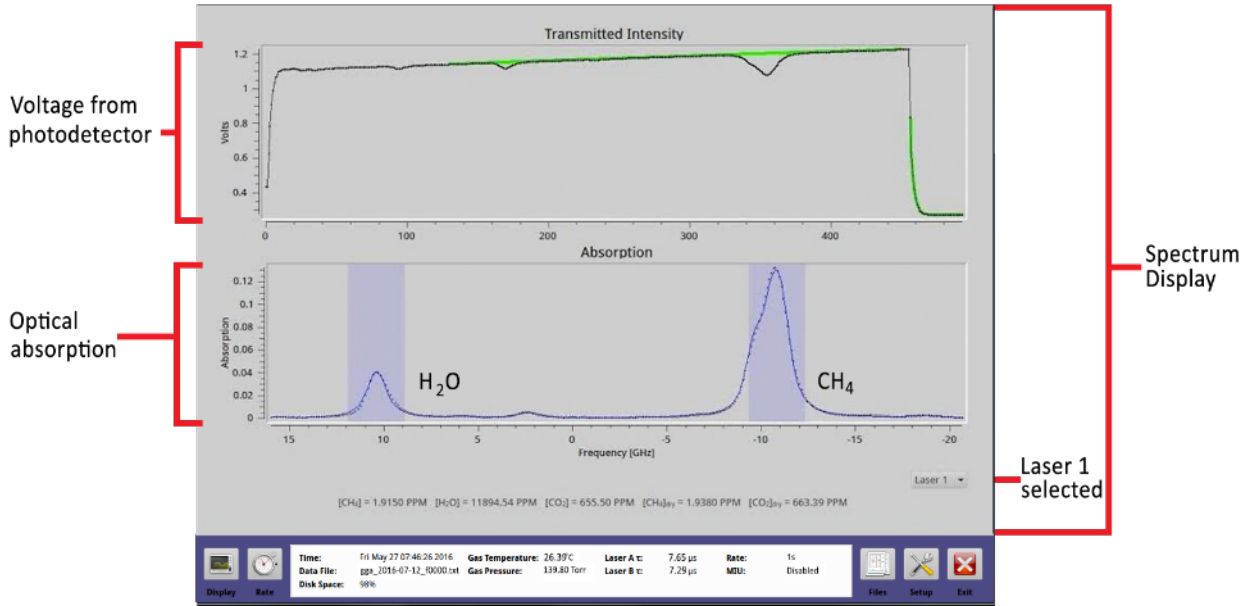


**Figure 87: Spectrum Display (GLA431-CCIA2)**

## GLA132-GGA Greenhouse Gas Analyzer

Figure 88 and Figure 89 show the *Spectrum Display* for the GLA132-GGA.

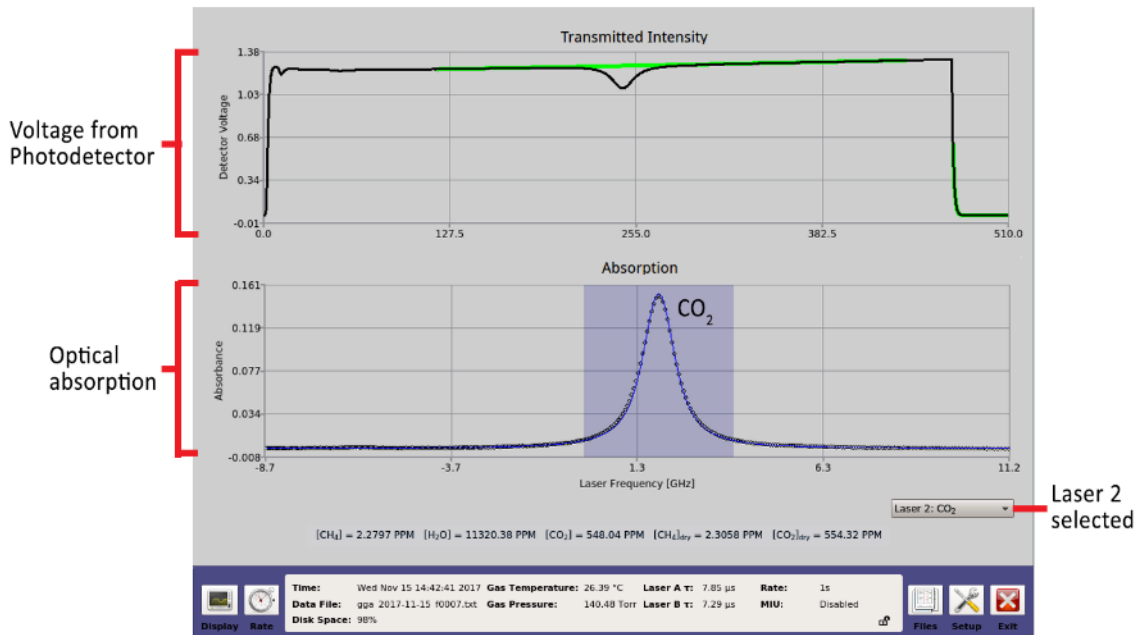
Laser 1 (also referred to as laser A) displays CH<sub>4</sub> and H<sub>2</sub>O peaks.



Press **Display** button to select the *Spectrum Display*

**Figure 88: Spectrum Display (GLA132-GGA)**

Laser 2 (also referred to as laser B) displays the CO<sub>2</sub> peak.

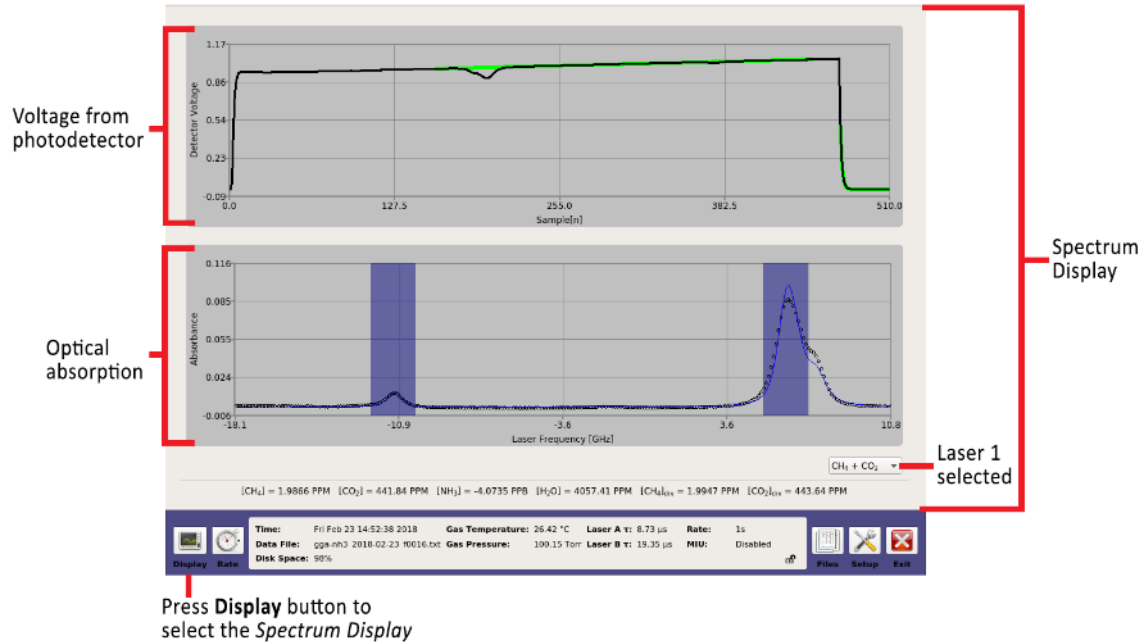


**Figure 89: Spectrum Display (GLA132-GGA)**

## GLA132-SOFX1 Soil Gas Analyzer

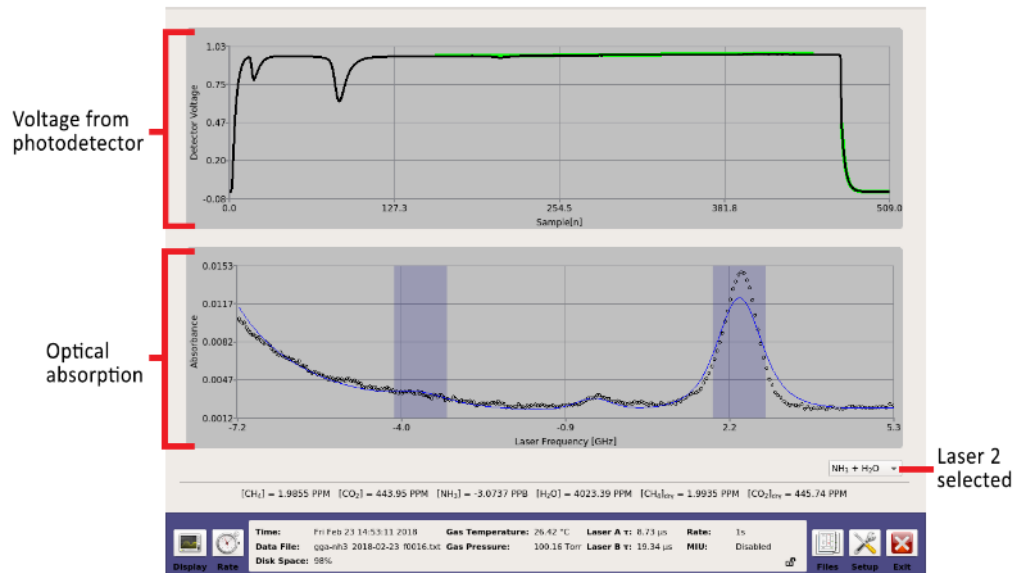
Figure 90 and Figure 91 and show the *Spectrum Display* for the GLA132-SOFX1.

Laser 1 (also referred to as laser A) displays the CH<sub>4</sub> and CO<sub>2</sub> peaks.



**Figure 90: Spectrum Display for Laser 1 (GLA132-SOFX1)**

Laser 2 (also referred to as laser B) displays the NH<sub>3</sub> and H<sub>2</sub>O peaks.



**Figure 91: Spectrum Display for Laser 1 (GLA132-SOFX1)**

## Appendix F: Isotope Definitions

The CCIA measures the concentration of  $^{12}\text{CO}_2$ ,  $^{13}\text{CO}_2$ , and  $\text{OC}^{18}\text{O}$ . These concentrations are used to calculate the total  $\text{CO}_2$  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:

$\text{CO}_2$	X_CO2__ppm
$\delta^{13}\text{C}$	D13C_VPDB_CO2
$\delta^{18}\text{O}$	D18O_VPDB_CO2
$[^{16}\text{O}^{12}\text{C}^{16}\text{O}]$	X_CO2_626__ppm
$[^{16}\text{O}^{13}\text{C}^{16}\text{O}]$	X_CO2_636__ppm
$[^{16}\text{O}^{12}\text{C}^{18}\text{O}]$	X_CO2_628__ppm

The isotope ratios are reported in ‰ relative to Vienna Pee Dee Belemnite converted to  $\text{CO}_2$  (VPDB- $\text{CO}_2$ ). The standards listed below were taken from IAEA-TECDOC-825.

( $R_{13}$ ) VPDP- $\text{CO}_2$	0.0112372
( $R_{18}$ ) VPDP- $\text{CO}_2$	0.002088349077

Total  $\text{CO}_2$  is defined as the sum of all the isotopes:

$$\text{CO}_2 = [^{16}\text{O}^{12}\text{C}^{16}\text{O}] + [^{16}\text{O}^{13}\text{C}^{16}\text{O}] + [^{16}\text{O}^{12}\text{C}^{18}\text{O}]$$

The isotope ratios are defined according to:

$$\delta^{13\text{C}} = \left[ \frac{(R_{13})_{\text{Meas}}}{(R_{13})_{\text{VPDB-CO}_2}} - 1 \right] \times 1000$$

$$\delta^{18\text{O}} = \left[ \frac{(R_{18})_{\text{Meas}}}{(R_{18})_{\text{VPDB-CO}_2}} - 1 \right] \times 1000$$

Where the measured ratios are calculated from the measured concentrations:

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

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

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

$$\delta^{18\text{O-VSMOW}} = \left[ \frac{(R_{18})_{VPDB\text{-CO}_2}}{(R_{18})_{VSMOW}} \left( \frac{\delta^{18\text{O-VPDB}}}{1000} + 1 \right) - 1 \right] \cdot 1000$$

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:

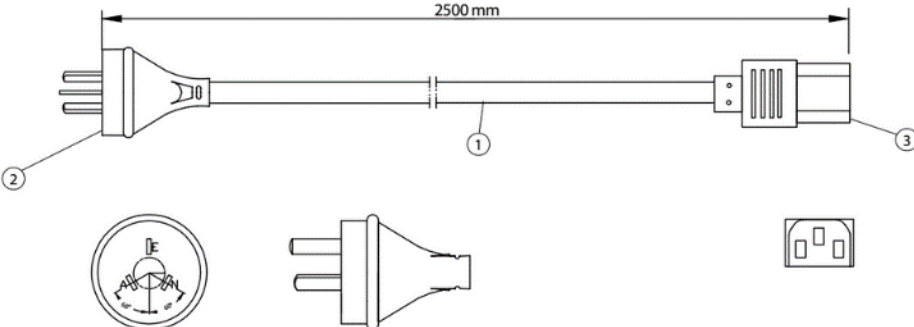
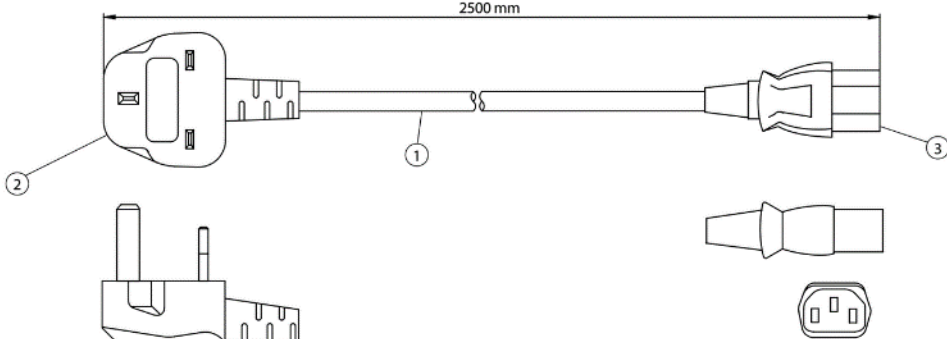
$$\delta^{18\text{O-VPDB}} = \left[ \frac{(R_{18})_{VSMOW}}{(R_{18})_{VPDB\text{-CO}_2}} \left( \frac{\delta^{18\text{O-VSMOW}}}{1000} + 1 \right) - 1 \right] \cdot 1000$$

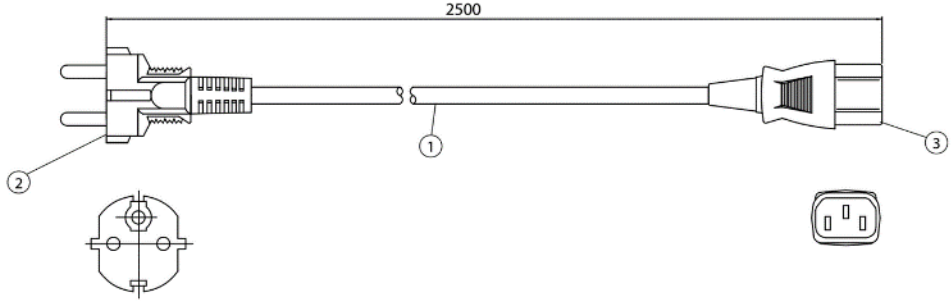
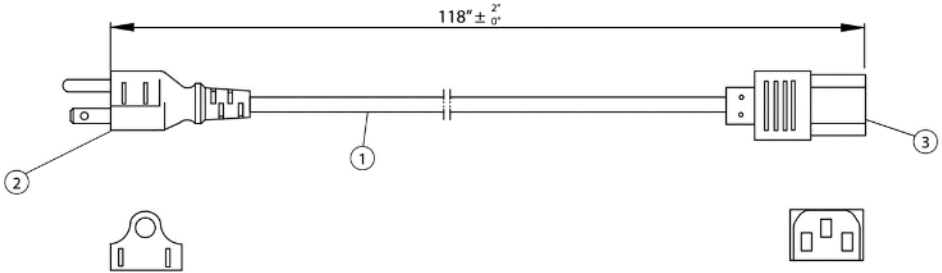


# Appendix G: Cables

Table 11 describes the power cables shipped with your analyzer.

**Table 11: Power Cables**

Region	Cable Specifications
<p><b>Australia and New Zealand</b></p>	 <ol style="list-style-type: none"> <li>1. CORDAGE: SAA, 3 x 1.0mm, UNSHIELDED, CEE COLOR CODE, TEMP. RATING 70°C, RATING: 250V 10A, JACKET COLOR: BLACK</li> <li>2. PLUG: AS 3112/AUSTRALIAN</li> <li>3. CONNECTOR: IEC 60320 C-13 APPROVALS: AUSTRALIA, NEW ZEALAND ROHS COMPLIANT</li> </ol>
<p><b>United Kingdom</b></p>	 <ol style="list-style-type: none"> <li>1. CORDAGE: HO5VV-F, 3x1.00mm, CEE COLOR CODE, TEMP. RATING: 70°C, RATING: 250V, 10A, JACKET COLOR: BLACK</li> <li>2. PLUG: UK PLUG BS1363A (SUPPLIED WITH 13A FUSE)</li> <li>3. CONNECTOR: IEC 60320 C13 APPROVALS: UNITED KINGDOM, CE ROHS COMPLIANT</li> </ol>

<p><b>Europe</b></p>	 <ol style="list-style-type: none"> <li>1. CORDAGE: H05VV-F, 3 x 1.0mm, UNSHIELDED, CEE COLOR CODE, TEMP. RATING 60°C, RATING: 250V 10A, JACKET COLOR: BLACK PLUG: IEC 884/CEE7-VII</li> <li>2. CONNECTOR: IEC 60320 C13 APPROVALS: CB, GERMANY, DENMARK, NORWAY, FINLAND, BELGIUM, NETHERLANDS, SWEDEN, AUSTRIA, ROHS COMPLIANT</li> </ol>
<p><b>United States</b></p>	 <ol style="list-style-type: none"> <li>1. CORDAGE: SJT, 16AWG / 3C, UNSHIELDED, CEE COLOR CODE, TEMP. RATING 60°C, RATING: 125V 13A, JACKET COLOR: BLACK PLUG: NEMA 5-15P</li> <li>2. CONNECTOR: IEC 60320 C-13 APPROVALS: UL, cUL ROHS COMPLIANT</li> </ol>



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