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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>
<thead>
<tr>
<th>Symbols</th>
<th>Standards Tested and Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>2004/ 108/ EU (EMC), EN61326-1</td>
</tr>
<tr>
<td>FDA</td>
<td>Title 21 Code of Federal Regulations, chapter 1, sub-chapter J</td>
</tr>
</tbody>
</table>

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)

![Radiation Labels](image)

*Figure 1: Radiation Labels*

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

Operator Safety

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

---

**WARNING!**

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

---

Electrical Hazards

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

The analyzer is a Class 1 laser product that complies with:
- 21 CFR 1040.10 and 1040.11
- EN 60825-1:2014

---

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

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

---

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

---

Safety Provisions for a Chemical Spill

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

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

Text Formats

This section describes 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

<table>
<thead>
<tr>
<th>Icon</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>! NOTE</td>
<td>Emphasizes facts and conditions important to analyzer operation.</td>
</tr>
<tr>
<td>! WARNING!</td>
<td><strong>General Warning Icon</strong>: gives general safety information that must be followed to avoid hazardous conditions.</td>
</tr>
<tr>
<td>! WARNING!</td>
<td><strong>Electrical Warning Icon</strong>: warns of potential electrical shock hazard.</td>
</tr>
<tr>
<td>! WARNING!</td>
<td><strong>Laser Warning Icon</strong>: warns of potential laser hazard.</td>
</tr>
</tbody>
</table>
Transportation and Storage of Boxed Analyzers

When transporting and storing boxed analyzers:

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

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

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

Table 3: Transportation and Storage Icon Descriptions

<table>
<thead>
<tr>
<th>Icon</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon 1]</td>
<td>Store your analyzer in a sheltered, dry area. Do not let the box get wet.</td>
</tr>
<tr>
<td>![Icon 2]</td>
<td>Transport and store the analyzer box with the arrows on the box pointing up.</td>
</tr>
<tr>
<td>![Icon 3]</td>
<td>The analyzer is fragile. Transport carefully. Do not drop the box.</td>
</tr>
</tbody>
</table>

Positioning the analyzer

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

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

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

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

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

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

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

Please have the following information available when requesting an RMA number:
- Part Number
- Serial Number (Located on the back panel of the analyzer)
- Description of the Problem

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

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

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

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

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

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

---

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

---

12
1  Analyzer Overview

The ABB-LGR GLA351 series are Enhanced Performance QC Benchtop analyzers that measure concentrations of gas in parts per billion (ppb) and parts per million (ppm). Isotope ratios are shown in parts per thousand (‰).

NOTE

This analyzer is a Class 1 laser product.

Performance Specifications

Ambient Humidity

- <99% relative humidity non-condensing

Operating Temperature

- 0 - 45°C

Maximum Altitude

- 6,000 Feet

Power Requirements

- 115/230 VAC, 50/60 hz
- 400 Watts (steady state)

Fuse Ratings

- 250 VAC
- 10 Amps

Cable Plugs and Voltage for EC Countries

- See page 115

WARNING

Always use the power supply cord provided by ABB-LGR. See page 115 for a description of power cords for a specific country.
External Dimensions:
- 16"H x 17"W x 45"D

Weight:
- 68 kg
Standard Components
This section describes the analyzer components. Verify that each of the system components has arrived before installation.

The standard components include:
- GLA451 Series Analyzer
- Analyzer power cord
- User Guide (this document)
- USB flash drive
- Serial port connection cable (null modem type)
- Exhaust muffler

Applicable for isotopic analyzers:
- Pretreatment box

Optional Components

Available on select analyzers.

- Multiport Inlet Unit
  - Multiport Inlet Unit
  - Power cable
  - 25-pin control signal cable
- Batch Injection System
  - Syringe injection port
  - 100 mL syringe
  - Centering needle
  - Septa (box of 50)
  - Septum puller
- External pump System
  - External pump
  - Pump power cord
  - Teflon connection tube
- External Dynamic Dilution System (EDDS)
  - Power cable
  - BNC Control Cable
  - ¼" x 6' Teflon connection tube with Swagelok tee connector
This analyzer has been CE certified using data cables three meters long or less. Connecting the analyzer using longer data-cables is not recommended.

If you have not received all of these components, contact ABB-LGR at icos.support@ca.abb.com.
Figure 2 shows the front of the analyzer.

**Figure 2: Front Panel**

Figure 3 shows the back of the analyzer with connections. Port locations may vary for different analyzer types.

**Figure 3: Back Panel**
Power Connections
Figure 4 shows the power connections on the back panel, and Table 4 describes the connections.

![Figure 4: Power Connections](image)

**Table 4: Power Connections and AC Voltage Selection Switch Description**

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

---

**NOTE**

If you require a different power source, please contact ABB-LGR.
Data Interface Connection Ports

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

- Analog 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).
- 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.
- TO MIU port (25-pin data port) – For connecting to a Multiport Inlet Unit (optional).
- DCS port (BNC male port) – Used to control the optional External Dynamic Dilution System (EDDS).

Figure 5 shows an example of the 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 standard plumbing analyzers. Configurations will vary depending on the analyzer type and may not include an external pump.

---

**NOTE**

For the GLA451-AAQC plumbing diagram, refer to Figure 7.

---

For standard operation, the pump draws gas through the Sample Inlet port on the back panel of the analyzer. The gas is filtered through a filter before entering the pressure controller, which determines the analyzer flow rate. The gas then travels through the optical cell and is exhausted through the Exhaust port. The acceptable inlet gas pressure range is 1 to 5 psig.

*Figure 6: Plumbing Diagram*
Plumbing Diagram for the GLA431-AAQC

For standard operation, the internal pump draws gas through the Sample Inlet port (1/4” Swagelok) on the back panel of the analyzer. The gas travels through a low flow orifice and is filtered through a Teflon Membrane filter. The gas then travels through the optical cell and is exhausted through the Internal Pump Exhaust port (1/4” Swagelok).

Figure 7 shows the plumbing diagram for the GLA431-AAQC.

Optional Fast Flow Mode

Analyzers with fast flow capabilities (external pump on/ internal pump off) measure data at a higher flow rate.

---

**NOTE**

Cap the *Internal Pump Exhaust* port with the provided ¼” Swagelok cap during Fast-Flow operation.
**Fast and Slow Flow Pump Options**

The analyzer comes equipped with an internal pump. However, the optional external pump provides the ability to achieve up to 10 Hz flow response.

In fast-flow mode, you must connect a compatible external pump to the analyzer. Table 5 describes the compatible pump options.

Flow-through times of the available external pumps:

- ACC DP3H pump: provides flow-through (1/e) time = 1.2 seconds
- ACC DP4H pump: provides flow-through (1/e) time = 0.7 seconds
- Dry Scroll pump: provides flow-through (1/e) time = 0.1 seconds

Table 5 describes the compatible pump options.

<table>
<thead>
<tr>
<th>Modes of Operation</th>
<th>Internal</th>
<th>N920</th>
<th>N940</th>
<th>XDS-35</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Mode</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fast Flow Mode</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>See Appendix F</td>
</tr>
</tbody>
</table>

See the *Fast Flow Operation Appendix* on page 100 for detailed instructions on fast-flow mode.
Gas Inlet/Outlet Connections

The gas inlet and outlet ports are located on the back panel of the analyzer. (Figure 3) Configurations will vary among analyzer types. These ports are shown in detail in Figure 8.

The unit ships with inlets and outlets capped for protection. The connections use Swagelok fittings ISO thread size 1/4", 3/8", and 1/2".

![Figure 8: Gas Inlet/Outlets](image)

When the internal pump is in use, the TO EXTERNAL PUMP port must remain capped with the provided cap.

Exhaust ports for internal pumps:
- The Internal Pump Exhaust port is located on the back panel of the analyzer. It can either be connected to the provided muffler (Figure 9) to expel exhaust into the room air, or the exhaust can be routed to the facility ventilation system using ½" tubing.

![Figure 9: Exhaust Muffler](image)

External pump exhaust ports:
- For optional external pumps, the exhaust port is located on the pump. It can either be connected to the provided muffler (Figure 9) to expel exhaust into the room air, or the exhaust can be routed to the facility ventilation system.

![Figure 10: External Pump Exhaust Muffler](image)
Warning Labels and Descriptions

This section describes the warning labels shown on the analyzer.
- Table 6 gives a description of the warning labels.
- Figure 11 shows the location of the labels on the analyzer.

Table 6: Warning Labels and Descriptions

<table>
<thead>
<tr>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="CAUTION CLASS IV LASER RADIATION WHEN OPEN AVOID EXPOSURE TO BEAM" /></td>
<td>The laser is rated Class 3 (invisible laser radiation) when the housing is open. <strong>Only trained maintenance personnel may open the analyzer housing.</strong></td>
</tr>
<tr>
<td><img src="image" alt="DANGER" /></td>
<td>General laser warning label.</td>
</tr>
</tbody>
</table>

Figure 11: Warning Label Locations
Ventilation and Power Requirements
A continuous flow of air is pumped through the inlet port and out through the TO EXT PUMP port on the back panel of the analyzer.

- Do not block the front or back panels.
- Leave at least four inches of free space at the front and back of the analyzer for proper ventilation and cooling.
- Leave sufficient space behind the analyzer to unplug the power cord.
- If mounting the analyzer in an equipment rack, no side clearance is required.

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 front panel on/off switch. (Figure 2)
2. Unplug the power cord from the analyzer back panel. (Figure 4)
3. Notify trained service personnel that the analyzer needs repair or servicing.
2 Analyzer Setup

Connect the Power Cords
1. Connect the analyzer power cord from the AC power port on the back panel to a grounded outlet of your power supply. (Figure 4)
2. If applicable, connect the external pump’s power cord from the pump to the EXT. PUMP POWER port on the back panel 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. For the GLA451-N2O12, GLA451-OC5, GLA451-N2O13, and GLA451-AAQC, connect the provided exhaust muffler with Swagelok adaptor to the INTERNAL PUMP EXHAUST port to exhaust into the room air, or route to your facility ventilation system, using \( \frac{1}{4} \)” tubing. (Figure 12)

![Figure 12: Exhaust Muffler](image)

2. If applicable, connect a \( \frac{1}{4} \)” sample tube (not provided) from the INLET port on the back panel of the analyzer to your sample source.
3. If applicable, connect the External Pump’s 6’ x 3/8” Teflon tubing with Swagelok fittings from the external pump to the TO EXT PUMP port on the back panel of the analyzer. (Figure 3)
   a. Cap the Internal Pump Exhaust port with the provided \( \frac{1}{4} \)” Swagelok cap if using the external pump. (Figure 8)
Attach and Tighten the Swagelok Connectors

1. Tighten the Swagelok connections to between 1/4 and 1/2 turn past finger tight. Leave a gap of at least 3.5 mm as shown in Figure 13.
2. Table 7 lists the Swagelok fitting sizes and recommended wrench sizes.

![Swagelok Connection Gap](image)

**Figure 13: Swagelok Connection Gap**

**Table 7: Recommended Wrench Sizes for Swagelok Fittings**

<table>
<thead>
<tr>
<th>Swagelok Fitting Size</th>
<th>Recommended Wrench Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4”</td>
<td>9/16”</td>
</tr>
<tr>
<td>3/8”</td>
<td>11/16”</td>
</tr>
</tbody>
</table>
3 Initialize and Run the Analyzer

To initialize the analyzer:

1. Press the power switch on the front of the analyzer to the ON position. (0 = OFF / - = ON)
   The internal computer initializes, and a screen (Figure 14) displays as the program loads.
   The Launch Service screen displays after initialization. (Figure 16)
2. Click on the launch button button to manually launch the analyzer.
   a. The launch button is the abbreviated name of the gas analyzer. For example, the GLA451-OCS button displays OCS. (Figure 16)
   b. If you don’t make a selection within 120-seconds, the analyzer automatically defaults to the Main Panel Numeric display. (Figure 20)
3. Click on the maintenance SERVICE button (Figure 16) if you need more time or need to choose a maintenance setting. (Figure 17)

---

**Important!**

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

**Do not turn off the computer during the monthly maintenance!**

---

*Figure 14: 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 15 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.

---

**WARNING**

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

---

![Figure 15: File System Integrity Check Screen](image)

**Figure 15: File System Integrity Check Screen**

Thermal Stabilization

Run the analyzer for four hours before collecting data. This allows the internal temperature to stabilize. The exact final cell temperature will be analyzer specific (~45°C).
The Launch Service Screen
The Launch Service screen displays when initialization is completed. From this interface, you can:

- Bypass the auto launch countdown to manually start recording measurements by clicking the **launch button**.
  - The **launch button** is the abbreviated name of the gas analyzer. For example, the GLA451-OCS launch button displays **OCS** as shown in Figure 16.
- Open the auto launch window by clicking **Service**.
- Turn off the analyzer by clicking **Shutdown**.

Figure 16 shows the Launch Service screen.

![Launch Service Screen](image-url)
The Auto Launch Screen

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

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

Figure 17 shows the Auto Launch Screen.

![Auto Launch Screen](image)

*Figure 17: 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 18)

   ![Figure 18: Control Bar Security Button](image)

2. For initial login, use the default Linux credentials for the username and password (Figure 19), as follows:
   
   User: lgr
   
   Password: 3456789

   ![Figure 19: Login Dialog Box](image)

   **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.

3. Click Login.
Main Panel

After the software launches, the **Main Panel** is displayed. Figure 20 shows an example of a **Main Panel**. 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 37 - 39 for detailed Temperature Status and Analyzer Status descriptions.

This panel contains the **User Interface Control Bar** (Figure 21) and **Numeric Display**.

![Figure 20: Main Panel](image)

\[
\text{[CH}_4\text{]} = 1.841 \text{ PPM} \\
\delta^{13}\text{C} = -73.02 \% \\
\text{[H}_2\text{O]} = 419.290 \text{ PPM}
\]
User Interface Control Bar

Use the control bar to operate the analyzer.

**Figure 21: 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 22)
- **Alarm Status Display** – shows the operational status of the analyzer. (Figure 23)
- **Spectrum Display** – Displays the raw and fitted spectral scans. (Figure 24)
- **Time Chart Display** – Displays the concentration over time. (Figure 26)

Rate – Adjusts the rate at which data is written to the log file. (Figure 27)

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
- Rate – Sampling Frequency
- Disk Space – Remaining hard-drive space

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

Setup – Accesses additional configuration and service menus.

Exit – Exits the application and shuts down the analyzer.
Main Panel Displays
Click the Display button to change the display in the Main Panel. Clicking the Display button multiple times lets you cycle through the 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
- Spectrum
- Time Chart

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 22 shows an example of the Numeric Displays screen. It displays the numeric readout of the last measurements of gas at a specific concentration. Concentrations vary depending on the type of analyzer.

\[
[CH_4] = 1.841 \text{ PPM} \\
\delta^{13}C = -73.02 \% \\
[H_2O] = 419.290 \text{ PPM}
\]

Figure 22: Numeric Display
Alarm Status Display

The **Alarm Status** display (Figure 23) 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 23 shows the **Alarm Status Display** with all parameters functioning properly.

![Alarm Status Display](image)

**Figure 23: Alarm Status**
Table 8 describes fault criteria for the Temperature Alarms.

**Table 8: Fault Criteria for Temperature Alarms**

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

If the Alarm Status is **Yellow** or **Red**, please refer to the Maintenance section on page 65. If issue continues, please contact Support@lgrinc.com.
Table 9 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 9: Fault Criteria for Analyzer Alarms**

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

If the Alarm Status is Yellow or Red, please refer to the Maintenance section on page 65. If issue continues, please contact icos.support@ca.abb.com
Spectrum Display

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

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

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

For an analyzer that is a dual-laser system, there is a drop-down selector in the lower right portion of the Spectrum Display that lets you toggle between the two lasers:

- Laser 1 (also referred to as laser A)
- Laser 2 (also referred to as laser B)

The measured concentrations are shown in parts per million (ppm), parts per billion (ppb) or ‰ (permil) on the bottom of the Spectrum Display.

Figure 24 and Figure 25 show an example of Spectrum Displays.
Figure 25 shows a *Spectrum Displays* in dry air.

---

**Figure 25: Spectrum Display (Dry Air)**

**Table 10: Spectrum Displays for different analyzer types**

<table>
<thead>
<tr>
<th>Analyzer Type</th>
<th>Figure for Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLA451-AAQC</td>
<td>Figure 115</td>
</tr>
<tr>
<td>GLA451-N2O12</td>
<td>Figure 116</td>
</tr>
<tr>
<td>GLA451-N2O13</td>
<td>Figure 117</td>
</tr>
<tr>
<td>GLA451-OC5</td>
<td>Figure 118</td>
</tr>
</tbody>
</table>
**Time Chart Display**

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

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

Figure 26 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 26: TimeChart Display*
Rate Control
Data is acquired at 1 Hz rate and averaged for a selected interval (1 to 100 seconds) before being written to the data file and plotted on the time chart. Longer averaging periods (or equivalently, slower data acquisition rates) will yield better measurement precision than shorter averaging periods.

When the Rate button (clock icon) on the User Interface Control Bar (Figure 21) is selected, a pop-up box appears to allow rate control adjustments to the operating mode and plot frequency. Selections in this window will vary, depending on analyzer type.

![Rate Control Screen (GLA451-N2O13)](image)

*Figure 27: Rate Control Screen (GLA451-N2O13)*

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. The Data Rate Control Adjustment panel appears. (Figure 27)
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.
      ii. The external pump is powered off.
   b. Fast-flow mode
      i. The internal pump is powered off.
      ii. The external pump is powered on.
3. Click Save.
For select analyzers, the **Batch Injection System** allows you to manually introduce individual samples to the analyzer, using syringe injection. (Figure 27) See **Batch Mode Operation** on page 100 for more information.

1. Click the **Syringe Injection** radio button for **Batch Mode Operation**.

The **Plot Frequency** radio buttons allow you to select between manually or automatically plotting the data. (Figure 27)

To adjust the frequency:

1. Click the **Rate** button (clock icon) on the **User Interface Control Bar**. (Figure 21)
   a. The **Data Rate Control Adjustment** panel appears. (Figure 27)

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, current data is added to the **Main Panel** display.

3. Click the **Plot every Nth fit** radio button to automatically set the rate at which the data is updated on the **Main Panel** display.
   a. For example, if you set the value to 5, a data point will be saved every 5 seconds.

4. Click **Save**.

---

**NOTE**

The analyzer restarts sampling at whatever rate was set last.

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

- Each time the analyzer is re-started, the most recent file name is displayed in the form: xxx_2020-12-29_f0001.txt, where the:
  - First characters represent the analyzer model
  - 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
- Delta values (if applicable)
- Cell pressure (Torr)
- Cell temperature (Celsius)
- Ambient Temperature (Celsius)

The format can be changed in the Time/Files menu of the Setup panel. (Figure 35)

Figure 28 shows a typical data file example.

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.

*Figure 28: The Beginning of a Typical Data File*
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 21) to access the **File Transfer Menu**. (Figure 29)
2. Insert a USB storage device into the USB port on the front or back panel of the analyzer.
3. Click on the **Mount USB** button. (Figure 29)

   ![File Transfer Menu: Local Hard Drive (left pane) and USB Flash Drive (right pane)](image)

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. 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*.

---

![NOTE]

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

The analyzer hard drive contains two types of directories:
- Daily Directory
- Archive Directory

Daily Directory

The local hard drive (Figure 29) 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 30)

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

Examples of files in the daily directory are shown in Figure 30.

Figure 30: Daily Directory
Archive Directory

The local hard drive (Figure 29) creates an archived folder containing zipped files organized by date. (Figure 31)

To access the archived files, double-click the Archive folder. (Figure 29)

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 31.

![Archive Directory](image)

*Figure 31: Archive Directory*
File Transfer Error Screen

The *File Transfer Error screen* (Figure 32) displays when:

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

Try again with a correctly inserted USB device.

![Copy operation was aborted or failed due to a full USB key.](image)

*Figure 32: File Transfer Error*
Setup Menu
The Setup menu allows access to additional configurations and services. Selections in this menu will vary, depending on analyzer type.

To enter Setup mode:

1. Click the Setup button on the User Interface Control Bar. (Figure 33)

![Figure 33: Setup Button on the User Interface Control Bar](image)

2. The default Time/Files screen is displayed. (Figure 34)

![Figure 34: Setup Menu Tabs with Time/Files Screen Selected](image)
The *Setup* menu has function tabs at the top of the screen that allows you to configure the analyzer mode and settings. (Figure 34) These tabs will vary among analyzer types.

These tabs let you:
- Manage file saving settings
- Adjust the current time/date settings
- Configure the Analog Output
- Configure the Serial Output
- Calibrate the analyzer to a local gas standard
- Enable the laser-offset adjustment
- Configure the optional Multi-Port Inlet Unit (MIU)
- Configure the optional External Dynamic Dilution System (EDDS)
- 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.

![Figure 35: Functions of the Time/Files Menu](image-url)
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 11.

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

### Table 11: Available Time Stamp Formats

<table>
<thead>
<tr>
<th>Time Stamp Name</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Local American</td>
<td>mm/ dd/ yyyy, hh:mm:ss.sss</td>
</tr>
<tr>
<td>Absolute Local European</td>
<td>dd/ mm/ yyyy, hh:mm:ss.sss</td>
</tr>
<tr>
<td>Absolute GMT American</td>
<td>mm/ dd/ yyyy, hh:mm:ss.sss</td>
</tr>
<tr>
<td>Absolute GMT European</td>
<td>dd/ mm/ yyyy, hh:mm:ss.sss</td>
</tr>
<tr>
<td>Relative Seconds After Power On</td>
<td>ssssss.sss</td>
</tr>
<tr>
<td>Relative Seconds in Hours, Minutes, Seconds</td>
<td>hh:mm:ss.sss</td>
</tr>
</tbody>
</table>
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.

![NOTE]

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

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

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

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

Calibration Procedure:
1. Click the Setup button on the User Interface Control Bar. (Figure 33)
2. Select the Calibration tab at the top of the screen to enter the Calibration menu. (Figure 36)

Figure 36 shows an example of the Calibration screen.

3. On the top, right panel of the screen under Reference Gas Settings, select the checkbox next to the gas you want to calibrate.

**Figure 36: Calibration Setup Screen**

For the GLA451-N2O12 and GLA451-N2O13, the N₂O isotopes must be calibrated at the same time. Check each N₂O box as shown in Figure 36. H₂O may be calibrated separately.
4. Enter the known concentration for your local gas standard.
5. Connect your reference gas supply to the ¼” Swagelok inlet port on the back panel of the analyzer. (Figure 3)
6. Open the valve on your gas supply.
7. Click the **NEXT** button on the lower, right panel of the screen to begin calibration. (Figure 36)
8. Each step is displayed in the lower-right panel of the calibration screen as the analyzer performs the calibration.

Figure 37 shows the calibration process as a flow chart.

![Figure 37: Calibration Flow](image)

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 want to calibrate.

---

**NOTE**

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

Use the *Laser Adjust* tab to manually adjust the laser’s wavelength to compensate for any cumulative drift. (Figure 38)

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 38 shows an example of the offset between absorption peaks and target lines. For a 2-laser system, both lasers are adjusted separately.

*Figure 38: 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 33)
2. Select the **Laser Adjust** tab at the top of the screen. (Figure 38)
3. Select the **Disable Laser Frequency Lock** check box to allow manual control of the laser.
4. Adjust the **Laser A Voltage** using the arrow buttons to shift the peaks until they are centered on their respective target lines.
   a. Up Arrow: Peaks adjust to the right
   b. Down Arrow: Peaks adjust to the left
5. Deselect the **Disable Laser Frequency Lock** check box. The software resumes automatic tracking and control of the laser wavelength.
6. Click **Close** to exit the menu and return to the *Main Panel*.

Figure 39 and Figure 40 shows the laser voltage adjusted so that the absorption peaks are centered on the target lines.

![Figure 39: Absorption Peaks Centered Correctly on Target Lines](image)

Peaks are centered on target lines. No adjustments needed.
Figure 40: Absorption Peaks Centered Correctly on Target Lines (Ambient Air)
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 41)

See Appendix E: Multi-Port Inlet Unit on page 90 for detailed instructions on configuring and controlling the MIU.

Figure 41: 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 concentrations and the analog output voltage, using the spinner controls, or by manually typing a number into the field. The dropdown spinner controls let you select the concentration value that will correspond to the maximum 5 VDC analog output.

For example:

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

---

**NOTE**

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

---

*Figure 42: Analog Output Screen*
**DCS Tab**

The External Dynamic Dilution System (EDDS) is an optional accessory.

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

The EDDS can be enabled/disabled using the radio buttons; and the dilution factor can be set using the drop-down selection box on the DCS screen. (Figure 43)

See Appendix F: External Dynamic Dilution System (Optional) on page 95 for detailed instructions on setting up and operating the EDDS.

*Figure 43: Dilution Control System (DCS) Tab*
Service Tab

ABB-trained field service engineers monitor the performance of the analyzer via the Service screen. (Figure 44)

- 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 44: 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 45)
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 46)

   ![Figure 45: User Interface Control Bar Exit button](image)

3. Click the **OK** button to halt data acquisition, close the current data file, and display the shutdown screen. (Figure 46)

   ![Figure 46: Analyzer Shutdown Prompt](image)

4. When the “**You may turn off the instrument**” message displays (Figure 47), you can safely shut off power to the analyzer by pushing the **OFF** switch on the front of the analyzer. (Figure 2)

   ![Figure 47: Final Shutdown Screen](image)

---

**NOTE**

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

Daily Operation Checklist

Table 12 describes routine maintenance tasks that keep your analyzer operating smoothly.

Table 12: Maintenance Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 1-2 days</td>
<td>• On the <em>Spectrum Display</em>, verify that the spectrum is correct.</td>
</tr>
<tr>
<td></td>
<td>The spectrum should appear as shown in Figure 24. Become familiar</td>
</tr>
<tr>
<td></td>
<td>with the normal appearance of the spectrum (the best way of</td>
</tr>
<tr>
<td></td>
<td>diagnosing analyzer performance). Any deviations from normal</td>
</tr>
<tr>
<td></td>
<td>could indicate a problem with the analyzer.</td>
</tr>
<tr>
<td></td>
<td>• Log the transmitted intensity displayed in the upper panel of the</td>
</tr>
<tr>
<td></td>
<td>spectrum screen. Any decrease in transmitted intensity could be</td>
</tr>
<tr>
<td></td>
<td>indicative of dirty mirrors.</td>
</tr>
<tr>
<td></td>
<td>• Log the analyzer pressure. Any decrease in pressure could be</td>
</tr>
<tr>
<td></td>
<td>indicative of an obstruction in the flow system. An increase in</td>
</tr>
<tr>
<td></td>
<td>pressure could be indicative of a leak in the system or a pump</td>
</tr>
<tr>
<td></td>
<td>failure.</td>
</tr>
<tr>
<td>Every 3-6 days</td>
<td>• Check the Laser Offset and adjust if necessary. (Figure 38)</td>
</tr>
</tbody>
</table>

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.

For the GLA451-OCS, 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.

For the GLA451-AAQC, because of the relatively short path length, the ring-down is too short to actively measure. To track mirror reflectivity, monitor the measured value of the reference standards and note any decrease.

If the measured value of a known reference cylinder has changed more than 20%:
1. Request a mirror cleaning kit from ABB-LGR and clean the mirrors.
2. Measure the reference cylinder again.
3. If the analyzer performance does not improve, contact ABB-LGR.
   o Technical Support: icos.support@ca.abb.com

**WARNING!**

Only authorized persons may open the analyzer cover or perform internal maintenance. Make sure the analyzer is unplugged before working with the internal components. Failure to do so may result in damage to the analyzer and electric shock.
Replace the Power Inlet Fuse
If the fuse on the power inlet blows or is otherwise damaged, the analyzer shuts down. To replace the fuse:

1. Unplug the analyzer.
2. On the back panel of the analyzer, locate the fuse above the power inlet. (Figure 48)

![Figure 48: Analyzer Fused Inlet]

3. Use a flathead screwdriver to remove the fuse.
   a. Insert the head of the screwdriver into the slot below the fuse. (Figure 49)

   ![Figure 49: Remove the Fuse]

   b. Push down on the screwdriver handle to remove the fuse holder from the power inlet.
   c. Remove the fuse from the fuse holder. (Figure 50)

   ![Figure 50: Remove the Fuse from the Fuse Holder]

4. Insert a new fuse into the fuse holder.
5. Re-insert the holder into the power inlet. Push it in until you hear a click.
6. Plug the power cord into the back panel of the analyzer.
7. Resume analyzer operation.
Appendix A: About Gas Analyzers and Laser Absorption Spectroscopy

Conventional Laser Absorption Spectroscopy

For gas measurements based on conventional laser-absorption spectroscopy (Figure 51), a laser beam is directed through a sample, and the mixing ratio (or mole fraction) of a gas is determined from the measured absorption using Beer’s Law, which may be expressed:

\[ \frac{I_v}{I_o} = e^{-S L X P \phi_v} \]

Where:
- \( I_v \) is the transmitted intensity through the sample at frequency
- \( I_o \) is the (reference) laser intensity prior to entering the cell
- \( S \) is the absorption line strength of the probed transition
- \( L \) is the optical path length of the laser beam through the sample
- \( X \) is the mole fraction
- \( P \) is the gas pressure
- \( \phi_v \) is the line-shape function of the transition at frequency \( v \)

In this case,

\[ \int \phi(v) dv = 1 \]

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

Figure 51: Typical Laser Absorption Spectroscopy Setup
Integration of the measured spectra with the measured values of:
- Gas temperature
- Gas pressure
- Path length
- Line strength of the probed transition

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

\[ \chi = \frac{-1}{SLP} \int \ln \left( \frac{I_v}{I_o} \right) dv \]

Use this equation to determine gas concentrations, even in hostile environments without using calibration gases or reference standards. These values are measured:
- Mixtures containing several species
- Flows at elevated temperatures and pressures
ABB-LGR’s Off-Axis Integrated-Cavity Output Spectroscopy (Off-Axis ICOS)

Off-Axis ICOS uses a high-finesse optical cavity as an absorption cell as shown in Figure 52. Unlike multi-pass detectors, which are typically limited to path lengths of less than two hundred meters, an Off-Axis ICOS absorption cell effectively traps the laser photon so that, on average, they make thousands of passes before leaving the cell.

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

Figure 52: Schematic Diagram of an Off-Axis ICOS Analyzer

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

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

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

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

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

If the analyzer does not receive a reply, the analyzer:
- Disables the Ethernet port.
- Does not attempt another DHCP request until the analyzer is restarted.

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

To access the data directory:

1. Click **Start > Run**, and enter the IP address of the analyzer: Example: \192.168.100.29

   Refer to the *Time/Files menu* (Figure 35) 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 35 shows the location of the IP address.

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

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

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

It is possible to access the shared analyzer data directory from operating systems other than Windows. The analyzer uses a Samba server to share the data directory, which could be accessed by any appropriate Samba client application.
Appendix C: Wireless Router Setup (Optional)

The analyzer can be ordered with an optional TP-Link wireless router. 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 76 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 77 (Appendix D: Set Up Devices for Remote Access Using VNC Software) for details on setting up devices for remote access using VNC software (optional).
Configure Router for Access-Point Mode

1. Using a phone, tablet, or laptop, connect to the router using the SSID and password on the router. (Figure 53)

![Figure 53: Router SSID and Password Location](image)

2. On the same device, launch a Web browser, then type http://tplinkwifi.net in the address bar. (Figure 54)

![Figure 54: Logging In](image)

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

4. Click Login.
5. On the left panel, click **Quick Setup**. (Figure 55)

![Quick Setup Screen](image)

**Figure 55: Start Router Configuration**

6. Click **Next**.

7. In the **Main Panel**, select the **Access Point** button. (Figure 55)

8. Click **Next**.

9. In the **Wireless Setting** screen, do one of the following: (Figure 56)

   a. To keep the default **Wireless Network Name** and/or **AP Wireless Password**, click **Next**.

   b. 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**.

![Wireless Setting Screen](image)

**Figure 56: Wireless Setting Screen**
10. In the **Network Setting** screen, click **Next**. (Figure 57)

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

*Figure 57: Network Setting Screen*
Connect Analyzer to Local Network

1. Unplug the black cable from the router \textit{LAN/WAN} port. (Figure 58)

   \textbf{Figure 58: Unplug Cable and Remove Ethernet Union}

2. Remove the Ethernet union (next to the router). (Figure 58)
3. Plug the black cable into either port of the Ethernet union. (Figure 59)

   \textbf{Figure 59: Plug Cables into Ethernet Union}

4. Plug the blue cable into the other port of the Ethernet union. (Figure 59)
5. Connect a local area network (LAN) cable from an external computer to the analyzer Ethernet port, located on the external side panel.
Appendix D: Set Up Devices for Remote Access Using VNC Software

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

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

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

Set up VNC Software on Android Devices

1. On the Android device, go to **Settings > WiFi > Connect to Wireless Network**.
2. Connect to the wireless SSID network listed on the router sticker. Enter the TP-Link wireless router (example: **TP-LINK-775C**) as shown in Figure 53.
   a. For ultraportable analyzers, the TP-Link wireless router is installed inside the analyzer and may be accessed by opening the case.
   b. For all other analyzers, the optional TP-Link wireless router is attached to the outside of the case.
3. Select **SSID**.
4. Enter the wireless password printed on the router sticker. (Figure 53) Every router has a different, unique SSID number, and wireless password.
5. Select **Connect**. (Figure 60)
6. A verification message appears, showing that the Android device is connected to the router. (Figure 61)

![Figure 61: 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 62)

![Figure 62: Android-vnc-viewer Install Screen]

---

**NOTE**

An Internet connection is required for this step.

---

**NOTE**

Complete instructions for installing the Android-vnc-viewer can be found online at: [http://code.google.com/p/android-vnc-viewer/wiki/Documentation](http://code.google.com/p/android-vnc-viewer/wiki/Documentation)
10. Open the VNC application on the Android device by selecting the VNC application icon. (Figure 63)

![VNC Application Icon](image.png)

**Figure 63: VNC Application Icon**

11. The Android VNC screen appears. (Figure 64)

![VNC Application Installation Setup Screen](image.png)

**Figure 64: 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 65)
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 53) 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 66)

![Figure 66: Network Connections Screen](image)

4. The **Enter Password** screen appears. (Figure 67) In the Password field, enter the wireless password on the router sticker. (Figure 53)

5. Select **Join**.

![Figure 67: Router Connection Screen](image)
6. The *Network Connections* screen confirms that the iOS device is connected to the router. (Figure 68)

![Figure 68: Router Connection Confirmation Screen](image)

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 69.
   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 69: Device IP Address Confirmation Screen](image)

9. Install the VNC software by searching and installing it from the App store.
   a. *Mocha VNC Lite for iOS* is the software used in this example. (Figure 70)
   b. An Internet connection is required for this step.

---

**NOTE**

Complete instructions for installing *Mocha VNC Lite for iOS* can be found online at: [http://www.mochasoft.dk/iphone_vnc_help2/help.htm](http://www.mochasoft.dk/iphone_vnc_help2/help.htm).
10. Open the application and select **Configure**. (Figure 71)

11. The **Configure Screen** prompts you for the server IP address and password. (Figure 72)

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 73)

![Figure 73: Setup Configurations Screen](image)

**Tap IP Config to connect the device to the analyzer.**

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 74) The screen size is adjustable to fit the screen of the device.

![Figure 74: Analyzer Software Interface Screen (Size Adjustment for iOS Devices)](image)
Set up VNC Software on Windows Devices


2. Locate the sticker on the router. (Figure 53)

3. Click on the *Wireless Network Connections* icon in the bottom left of the screen (Figure 75) to open the *Windows Wireless Networks* dialog-box. (Figure 76)

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 77)

5. In the *Security key* field, enter the wireless password located on the router sticker. (Figure 53)
6. Click OK.

![Network Connections Security Screen](image)

*Figure 77: Network Connections Security Screen*

7. The *Connection Status* dialog-box displays. (Figure 78)

![Current Connectivity Screen](image)

*Figure 78: Current Connectivity Screen*
8. Check the connection to make sure the device is connected through the wireless router by selecting the router. (Figure 79)

![Wireless Network Connection Screen](image1)

*Figure 79: 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 80)

![Current Connectivity Screen](image2)

*Figure 80: Current Connectivity Screen*
10. The *Wireless Network Connection Status* dialog-box displays. (Figure 81)

![Figure 81: Wireless Network Connection Status Window](image)

11. Click the **Details** button to display the *Network Connection Details* window. (Figure 82)

![Figure 82: Network Connection Details Window](image)
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 82)

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

14. Open the program by clicking the Connect button. (Figure 83)

15. Enter the analyzer’s address in the VNC server address field (192.168.100.100 or 192.168.100.101), from Figure 82.

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

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

Wireless devices can compete for dynamic addresses. If the 192.168.100.100 address does not connect, then use 192.168.100.101.
Appendix E: Multi-Port Inlet Unit (Optional)

The Multiport Inlet Unit (MIU) directs samples of multiple unknown gases and multiple reference gases through a series of inlet ports and digitally controlled valves directly into the inlet port of the analyzer. The gas manifold control screen (Figure 84) controls which gases are introduced into the inlet port of the analyzer in what order and for how long.

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

ABB-LGR offers two versions of the MIU:
- 8 port
- 16 port

Figure 84 shows the front panel of a 16 port MIU.

Figure 84: 16 Port MIU Front Panel

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

NOTE
Figure 85 shows the back panel of a 16 port MIU. The MIU inlet ports are labeled numerically on the back panel of the MIU. The outlet port connects to the gas inlet on the analyzer. The MIU is shipped with these accessories:

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

Set Up the MIU

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

Disconnect the MIU
1. Push the outer ring around the inlet and outlet connectors on the MIU to release the 1/4” tubing.
Control the MIU Using the Analyzer Setup Panel

1. Click **Setup** on the *User Interface Control Bar.* (Figure 88)
2. Click on the **MIU tab** at the top of the *Setup* menu selection bar. (Figure 86)
   a. The **MIU setup** menu becomes active. Use the menu to specify what ports are sampled and for how long.

Figure 86 shows the *Gas Manifold Control Screen* for the MIU not yet enabled.

*Figure 86: Gas Manifold Control Screen for the MIU, not yet enabled*
3. Populate the unknown gas valve sequence:
   a. Valve - The current valve being sampled (corresponds to the port number on the MIU).
   b. Seconds - How long the analyzer should sample the gas (in seconds).
   c. Description - Input a short text description associated with the gas connected to that valve.

![Figure 87: Gas Manifold Control Screen for the MIU, Enabled](image)

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

5. Click on the **Start with reference gas valve sequence** check box if you wish to run your reference gases first.

---

**NOTE**

If a valve is set to 0, the entry is ignored. Each defined gas is sampled sequentially in its respective group (unknown or reference).
6. Use the **arrow scroll bar** to select the number of times to run the unknown gas sequence for each reference gas sequence. (Figure 87)
7. Select **Save Changes** to save your current configuration.
8. To begin sampling, click **Close**. (Figure 87)

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

While the MIU is operating, the current valve being sampled/referenced and its text description is shown in the parameter window of the **User Interface Control Bar**. (Figure 88)

The description is:
- Displayed on the parameter window of the **User Interface Control Bar** during analysis. (Figure 88)
- Saved to a data file

![Figure 88: User Interface Control Bar (showing MIU information)](image)

9. When sampling is complete, disable the MIU by returning to the **MIU screen**, and uncheck the **MIU Enable** check box. (Figure 87)
Appendix F: External Dynamic Dilution System (Optional)

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

The EDDS:
- Automatically dilutes the sample stream with zero-air whenever the concentration rises above the target (2, 5, or 10 ppm). It maintains the target concentration at that level.
- Has a response time constant of approximately 2 minutes, so a sudden rise in concentration will cause the concentration to over-range for up to 2 minutes while the DCS adjusts the concentration to target.

The sample and the zero-air flow in through the gas inlets and are mixed in the EDDS. Both the sample and the zero-air must:
- Be pressurized to between 15 and 50 PSIG
- Have a sample gas flow capability of 200 SCCM
- Have a zero-air flow capability of 2.2 SLPM

When transitioning from a large concentration to a lower concentration of gases, a memory effect may result from residual gas in the analyzer. Verify that the gas from the previous sample has had time to exit the system. Residual gas can also be removed by switching inlet lines, using shorter line lengths, or flushing lines with zero-air.
Connect the EDDS
This section describes the EDDS hardware and how to connect it. (Figure 90)

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

Figure 90: EDDS Connection System
Sample Inlet Tee Connector
The diluted gas flows into analyzer through a T-connector that allows for steady flow past the inlet to the analyzer. (Figure 91)

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

![Sample Inlet Tee Connector Image]

*Figure 91: Inlet T-Configuration for the EDDS*

---

**WARNING**

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

Depending on the sample concentration the mass flow controllers adjust the amount of dilution:
- Sample flow can vary from 0 to 200 SCCM
- Zero-air flow can vary from 0 to 2.2 SLPM

Flow through the measurement cell should remain steady at approximately 180 SCCM or less, with the excess flow vented out through the inlet tee.
Optional External Throttle Valve
An optional external throttle valve (Figure 92) lets you adjust the gas flow to the analyzer. Use the throttle valve to restrict the:
- Total flow into the analyzer to less than 200 SCCM
- Source gas to less than 180 SCCM for proper dynamic dilution control

The flow rate can be measured at the inlet if necessary.

Figure 92: External Throttle Valve
Enable the EDDS

1. Click Setup on the User Interface Control Bar. (Figure 93)
2. Click on the DCS tab at the top of the Setup menu selection bar. (Figure 94)
3. Use the radio buttons to Enable or Disable the EDDS.
4. Use the drop down selection box to set the dilution factor.
5. Click Save.
6. Click Close to begin the dilution.

Figure 94 shows the DCS Screen for the EDDS enabled.
Appendix G: Fast-Flow Operation

Analyzers with the Fast-flow feature:
- Measure data at a higher flow rate than a standard analyzer.
- Use an external pump to increase the flow rate of gas during measurement.
- Use a throttle valve to adjust the pressure inside the analyzer.

Figure 95 shows a plumbing diagram of an analyzer with the Fast-Flow option.

![Figure 95: Plumbing Diagram for Fast-Flow Mode](image)

The AAQC and OCS analyzers do not include a throttle valve since they are back side pressure controlled.
Figure 96 shows the plumbing diagram of a GLA451-AAQC.

During high-flow mode, the External pump is on and then Internal pump is off. The external throttle valve (Figure 97) is used in conjunction with the electronic pressure controller to adjust the flow through the analyzer. The throttle valve reduces the pressure of the gas to the pressure controller, while the pressure controller regulates the fine adjustments to maintain cell pressure. The high-flow throttle valve:

- Provides coarse manual control of the flow to compensate for various external inlet configurations.
- Optimizes the pressure at the target set point (≈140 Torr) during high flow operation.
Figure 97 shows the external throttle valve assembly.

![Diagram of External Throttle Valve](image)

**Figure 97: High Flow Throttle Valve**

**Fast-Flow Setup and Operation**

1. Connect the optional External Pump.
   a. Connect the external pump’s power cord from the pump to the EXT. PUMP POWER port on the back panel of the analyzer.
   b. Connect the provided 6’ x 3/8” Teflon tubing with Swagelok fittings from the external pump to the TO EXT PUMP port on the back panel of the analyzer.
   c. Press the Power switch on the front of the pump.
2. With the *Internal* pump running (in standard mode), make note of the Gas Pressure reading within the Parameter Window of the User Interface Control Bar. (Figure 98)

![User Interface Control Bar with Pressure Reading](image)

**Figure 98: User Interface Control Bar showing Pressure Reading and Rate Icon**
3. Cap the Internal Pump Exhaust port with the provided ¼” Swagelok cap.
4. Click the Rate button (clock icon) on the User Interface Control Bar (Figure 98) to access the Data Rate Control Adjustment Panel. (Figure 99)
5. Click the Operating Mode radio buttons in the FAST row to select the rate at which data is acquired. Click Save.
   - The Internal pump will shut OFF, and the External Pump will power ON.
     o Fast = External pump on/ Internal pump off
     o Slow = External pump off/ Internal pump on

   ![Figure 99: Data Rate Control Adjustment Panel]

   The analyzer restarts sampling at whatever rate was set last.

   !NOTE

6. To begin adjustments to the external throttle valve, turn the valve clockwise until it is completely closed.
   a. The gas flow will be routed through the electronic pressure controller.
   b. The pressure controller is fully open but not able to pass sufficient flow to the cell at its target pressure.
7. Turn the throttle valve counter-clockwise to open, while watching the Gas Pressure reading in the Parameter Window of the User Interface Control Bar. (Figure 98)
   a. Find the midpoint control range by slowly opening and closing the high flow throttle valve while observing the reported cell pressure and noting the points at which the control range begins and ends.
      i. Each analyzer has a unique pressure set point. For example, if the cell pressure is 140 Torr in slow mode, then the pressure reading should be 140 Torr in high flow mode as well.
      ii. The gas pressure is reduced to the point that it is within the electronic pressure controller’s range. The ideal setting for the high flow throttle valve is the middle of the electronic pressure controller’s range.
b. Set the valve position to the middle of this range.
   i. This control range typically spans approximately \( \frac{1}{2} \) turn of the high flow throttle valve.

Figure 100 shows a diagram of an analyzer’s control range with the set point at 140 Torr.

![Control Range Diagram](image)

**Figure 100: Control Range Diagram**

8. Verify that the cell pressure is the same in both flow modes (with external pump and internal pump)

---

**NOTE**

The maximum range and reading display of the pressure transducer is approximately 155 Torr—any time the cell pressure is above 155 Torr the display will remain locked at 155 Torr.

---

To determine if your analyzer is capable of fast-flow mode, contact ABB-LGR at icos.support@ca.abb.com.
Appendix H: Batch Mode Operation

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

Figure 101 shows the plumbing configuration for the optional batch mode.

![Batch Injection Plumbing Diagram](image)

**Figure 101: Batch Injection Plumbing Diagram**

**Accessories Required for Batch Injection**

The necessary hardware and supplies for batch mode operation include:

- An external pump (KNF 920)
  - Pump slave power cord
  - Pump connection kit
- Additional ports on the front and back panels of the analyzer. (Figure 102)
  - Syringe injection port (front panel)
  - Zero-air inlet 1/4" Swagelok port (back panel)
- A 140mL Syringe with needle
- A 22-gauge centering needle
- Septa (Box of 50)
- A septum puller
**Hardware Setup**

Setup the External Connections:

1. Connect the External Pump:
   a. Connect the pump’s power cord from the pump to the *EXT. PUMP POWER* port on the back panel of the analyzer.
   b. Connect the provided 6’ x 3/8” Teflon tubing with Swagelok fittings from the external pump to the *TO EXT PUMP* port on the back panel of the analyzer.
   c. Connect the provided exhaust muffler to the exhaust port of the pump to exhaust into the room air, or route to your facility ventilation system.

2. Connect your Zero-Air source to the ¼” Swagelok Zero-Air Inlet port on the back panel of the analyzer. (Figure 102)
   a. Zero-Air flow should be set between 5 and 10 psig.

*Figure 102: External Batch Connections for a 911 Series Analyzer*
**Software Setup**

1. If applicable, in the parameter window of the *User Interface Control Bar*, verify that the optional MIU and WVISS accessories are not enabled. (Figure 103)
   a. Disable the *Multi-Port Inlet Unit (MIU)* if your analyzer is configured with this optional accessory. To disable the MIU:
      i. Click **Setup** on the *User Interface Control Bar*. (Figure 103)
      ii. Click on the **MIU tab** at the top of the *Setup* screen. (Figure 104)
      iii. Uncheck the checkbox at the bottom of the screen to disable the MIU. (Figure 104)
      iv. Click **Save Changes**. (Figure 104)
      v. Click **Close** to exit the *Setup* menu. (Figure 104)
b. Disable the Water Vapor Isotope Standard Source (WVISS) if your analyzer is configured with this optional accessory. To disable the WVISS:

i. Click **Setup** on the User Interface Control Bar. (Figure 105)

![Figure 105: Setup button on the User Interface Control Bar](image)

ii. Click on the **WVISS** tab at the top of the Setup screen. (Figure 106)

iii. Select **Single Stage WVISS Disabled** in the drop down menu in the WVISS mode section. (Figure 106)

iv. Click **Save Changes**. (Figure 106)

v. Click **Close** to exit the Setup menu. (Figure 106)

![Figure 106: Control Menu for the (Optional) WVISS](image)
2. Select Batch Injection mode in the analyzer software:
   a. Click the RATE button (clock icon) in the User Interface Control Bar. (Figure 107)

3. The Operating Mode pop-up menu displays. (Figure 108)
   a. Select either:
      - Syringe Injection
      - Syringe Injection (Dilution x10), if applicable
        o The sample will be diluted x10 by filling the cavity with zero air before measurement.

4. Click Save.
5. The *Batch Injection Measurement* screen displays. (Figure 109)
   a. This screen combines the three *Main Panel* display modes on one screen:
      - Numeric Display
      - Spectrum Display
      - TimeChart Display
   b. The *Batch Mode Status* display box in the lower right screen shows the status of the current injection. (Figure 109)

*Figure 109: Batch Injection Measurement Screen*
Batch Mode Processing

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

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

Figure 110 shows the Batch Injection Measurement screen displayed as a flow diagram to show the batch measurement procedure.
To begin batch mode processing:

a. Click **NEXT** in the *Batch Mode Status* display box. (Figure 109)
   i. Each step is displayed in the lower-right panel of the screen as the analyzer prepares for the injection.
b. The ICOS cavity is pumped out.
c. The ICOS cavity is flushed with Zero Air twice before requesting the sample.
d. The analyzer Prompts you to inject >140mL of Sample Gas into the syringe port on the front panel of the analyzer.
e. Fill the 140mL syringe with your sample, and insert the needle into the syringe port on the front of the analyzer.
   ii. The suction from the cavity should automatically draw your sample into the cavity. Light pressure on the syringe will help to introduce the sample.
   iii. You have 120 seconds to inject the sample.

---

**NOTE**

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

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

To replace the septum:
1. Click the Rate button on the User Interface Control Bar. (Figure 107)
2. The Operating Mode pop-up menu displays. (Figure 111)
3. Set the analyzer to Slow (Continuous Flow) mode by selecting one of the radio buttons under the Slow option. (Figure 111)

![Figure 111: Rate Control Screen set to Slow Flow Mode](image)

4. Unscrew the septum nut from the injection port as shown in Figure 112.

![Figure 112: Septum Nut with used septum](image)

5. Remove the red septum with white Teflon coating from the inside of the septum nut, using the provided septum puller. Discard the used septum.
6. Obtain a new septum from the provided package.
7. Slide the septum nut and new septum onto the provided blunt 22-gauge needle. The Teflon-coated side of the septum must face away from the septum nut. (Figure 113)

![Figure 113: Septum inserted on needle with Teflon coating facing away from the septum nut](image)

8. Slide the needle with septum assembly onto the injection port on the front panel of the analyzer. (Figure 114)

![Figure 114: Needle and Septum assembly attached to the injection port](image)

9. Hand-tighten the septum-nut firmly.
10. Manually actuate the needle five times to confirm that the septum is adequately pre-drilled.
11. Remove the needle from the septum nut.
Appendix I: Spectrum Displays

<table>
<thead>
<tr>
<th>Analyzer Type</th>
<th>Figure for Reference</th>
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</thead>
<tbody>
<tr>
<td>GLA451-AAQC</td>
<td>Figure 115</td>
</tr>
<tr>
<td>GLA451-N2O12</td>
<td>Figure 116</td>
</tr>
<tr>
<td>GLA451-N2O13</td>
<td>Figure 117</td>
</tr>
<tr>
<td>GLA451-OCS</td>
<td>Figure 118</td>
</tr>
</tbody>
</table>

GLA451-AAQC Enhanced Performance QC Benchtop Trace Ammonia Analyzer

Figure 115 shows the *Spectrum Display* for the GLA451-AAQC.

![Spectrum Display](image-url)
GLA451-N2O12 Enhanced Performance QC Benchtop Isotopic Nitrous Oxide Analyzer

Figure 116 shows the Spectrum Display for the GLA451-N2O12.

![Spectrum Display](image)

**Figure 116: Spectrum Display (GLA451-N2O12)**
GLA451-N2O13 Enhanced Performance QC Benchtop Isotopic Nitrous Oxide Analyzer

Figure 117 shows the Spectrum Display for the GLA451-N2O13.

Press Display button to select the Spectrum Display

Figure 117: Spectrum Display (GLA451-N2O13)
GLA451-OCS Enhanced Performance QC Benchtop Carbonyl Sulfide Analyzer

Figure 118 shows the Spectrum Display for the GLA451-OCS.

Press Display button to select the Spectrum Display

*Figure 118: Spectrum Display (GLA451-OCS)*
Appendix J: Cables

Table 13 describes the power cables shipped with your analyzer.

### Table 13: Power Cables

<table>
<thead>
<tr>
<th>Region</th>
<th>Cable Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia and New Zealand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>![Diagram of power cable for Australia and New Zealand]</td>
</tr>
<tr>
<td></td>
<td>1. CORDAGE: SAA, 3 x 1.0mm, UNSHIELDED, CEE COLOR CODE, TEMP. RATING: 70°C, RATING: 250V 10A, JACKET COLOR: BLACK</td>
</tr>
<tr>
<td></td>
<td>2. PLUG: AS 3112/AUSTRALIAN</td>
</tr>
<tr>
<td></td>
<td>3. CONNECTOR: IEC 60320-C-13 APPROVALS: AUSTRALIA, NEW ZEALAND ROHS COMPLIANT</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
</tr>
<tr>
<td></td>
<td>![Diagram of power cable for United Kingdom]</td>
</tr>
<tr>
<td></td>
<td>1. CORDAGE: H05VV-F, 3x1.0mm, CEE COLOR CODE, TEMP. RATING: 70°C, RATING: 250V, 10A, JACKET COLOR: BLACK</td>
</tr>
<tr>
<td></td>
<td>2. PLUG: UK PLUG BS1363A (SUPPLIED WITH 13A FUSE)</td>
</tr>
<tr>
<td></td>
<td>3. CONNECTOR: IEC 60320-C13 APPROVALS: UNITED KINGDOM, CE ROHS COMPLIANT</td>
</tr>
</tbody>
</table>
Europe

1. CORDAGE: HO5VV-F, 3 x 1.0mm, UNSHIELDED, CEE COLOR CODE, TEMP RATING 60°C, RATING: 250V 10A, JACKET COLOR: BLACK
2. PLUG: IEC 884/CEE7-VII
3. CONNECTOR: IEC 60320 C13 APPROVALS: CB, GERMANY, DENMARK, NORWAY, FINLAND, BELGIUM, NETHERLANDS, SWEDEN, AUSTRIA, ROHS COMPLIANT

United States

1. CORDAGE: SJT, 16AWG / J-C, UNSHIELDED, CEE COLOR CODE, TEMP RATING 60°C, RATING: 125V 13A, JACKET COLOR: BLACK
2. PLUG: NEMA 5-15P
3. CONNECTOR: IEC 60320 C-13 APPROVALS: UL, cUL
ROHS COMPLIANT
ABB Measurement & Analytics

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

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