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WARNING! This Instrument contains a Class IIIb laser inside.

There is a Class IIIb laser inside this instrument that complies with 21 CFR 1040.10 and 1040.11. Users should take appropriate precautions to ensure that the laser is off when the instrument cover is removed.
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1 Installation

Included Components

The Los Gatos Research (LGR) Ultra-Portable Greenhouse Gas Analyzer (Ultra-Portable GGA) is comprised of several components. Be sure to check that each of the system components has arrived before beginning the installation procedure. You should have received:

- Ultra-Portable Greenhouse Gas Analyzer (Ultra-Portable GGA), Model No. 915-0011
- Instrument Power Cord
- AC-DC Power Supply
- External In-line Filter (push-connect)
- Null Modem type Serial Data Cable
- USB Flash Drive
- Ultra-Portable GGA Users Guide (this document)
- Certificate of Compliance

If you have not received all of the above included components, please contact LGR (650-965-7772 or support@lgrinc.com).

Optional Components

See Accessories and Optional Components in the back section of this manual.

- DC Power Pack, with Battery (915-9400-1200)
- DC Power Case, no Battery (915-9400-0000)
- Battery Hook-up Kit (915-9200-0000)
- Ultra-Portable GGA Back Pack (915-9500-0000)
- Wireless User Interface with iPad (915-9001-0000)
- Wireless User Interface with Nexus7 tablet (915-9002-0000)
- Replacement Fuses, In-line Filters, Side Covers (915-9300-0000)
- Secondary AC-DC Power Supply (915-9100-0000)

⚠️ Warning

The wireless user interface will not work if:
- The analyzer has a system failure
- The hard drive fails or is corrupted
- Battery power to the analyzer is interrupted

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

Figure 1: Ultra-Portable GGA; Left side, DC Power Entry, Gas Inlet and Exhaust connections.

Gas Exhaust Port
(1/4” tube).
(See Detail Figure 6)

Gas Inlet Port
(1/4” tube)
(See Detail Figure 6)

DC power entry
(See Detail Figure 3)

Power Switch
(See Detail Figure 3)

Figure 2: Ultra-Portable GGA; Right Side, Data Port Connections.

Data Port Connections,
(See Figure 4)
Electrical Power Connection

To operate the Ultra-Portable GGA, the AC/DC Power Supply must be connected to the power entry port on the left side of the unit (see Figure 1 and Figure 3). Operation using an external battery is also possible by using the Battery Hook-up Kit. The battery voltage must be in the range of 10-30 volts DC, and has a continuous discharge rate to power 80 watts (or higher).

*Figure 3: DC Power Entry module with internal fuse.*
Data Interface Connections

The Ultra-Portable GGA has nine data interface connection ports on the right side panel (See Figure 2 and Figure 4).

Figure 4: Data interface connections.

- **USB ports (four)** – Used for transferring files to USB memory devices or connection of other USB devices, such as a keyboard or mouse.
- **Serial port** – Used for real-time measurement output directly to an external computer or data logging system.
- **Ethernet port** – Enables the instrument to be connected to a Local Area Network (LAN) and the data directory is made available as a Windows™ network shared directory.
- **MIU** – Multi-port Inlet Unit connection is used to control the optional Multi-port Inlet Unit. The functionality of the data interface connections for the MIU is discussed in the “Multi-port Inlet Unit” section on page 71.
- **The Analog Output port** – Provides a DC voltage that is proportional to the measured methane, carbon dioxide or water vapor concentration. If these outputs are connected to an external device, it should be terminated into a moderate/high impedance (>1 kOhm). Figure 5 shows the connector and the pins. The pin assignments for the Analog Output Connector are listed in Table 1 below.
**Figure 5: Analog Output Connector**

![Analog Output Connector](image)

**Table 1: D Sub Pins and Pin Assignment**

<table>
<thead>
<tr>
<th>D Sub pins</th>
<th>Pin Assignment</th>
<th>Output Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CH4 Signal</td>
<td>0 – 5 Volts</td>
</tr>
<tr>
<td>2</td>
<td>CO2 Signal</td>
<td>0 – 5 Volts</td>
</tr>
<tr>
<td>3</td>
<td>H2O Signal</td>
<td>0 – 5 Volts</td>
</tr>
<tr>
<td>4</td>
<td>Empty</td>
<td>–</td>
</tr>
<tr>
<td>5</td>
<td>Empty</td>
<td>–</td>
</tr>
<tr>
<td>6</td>
<td>CH4 Ground</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>CO2 Ground</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>H2O Ground</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>Empty</td>
<td>–</td>
</tr>
</tbody>
</table>

**Gas Inlet/Outlet Connections**

The gas inlet and outlet ports of the instrument are on the left side panel (see **Figure 6**). The gas to be measured should be connected to the inlet port (1/4" push-connect), the waste port (1/4" push-connect) must be open. The acceptable inlet gas pressure range is 0 to 10 psig. In the normal mode of operation, the pump draws sample through the instrument from the inlet, and exhausted through the waste port (1/4" push-connect). This waste port may be connected to a muffler to expel the instrument exhaust into the room air or the exhaust can be routed to an appropriate ventilation system via ¼" tubing.

**Figure 6: Gas inlet (1/4" tube) and Internal Pump Exhaust (1/4" tube) connections.**
2 Operating the Ultra-Portable GGA

Warning

The wireless user interface will not work if:
- The analyzer has a system failure
- The hard drive fails or is corrupted
- Battery power to the analyzer is interrupted

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

Starting up the Ultra-Portable GGA

After the appropriate electric, gas and data connections are made; the instrument can be started up by using the power switch on the left side of the instrument. To start up the Ultra-Portable GGA:

1. Press the power switch on the left side of the unit (see Figure 1) to the ON position.

2. The internal computer will boot and the screen will appear to be busy as the program loads (See Figure 7).

3. It will then go to a Launch Service screen (Figure 8). Click on the GGA tab.

4. If no selection is made within the 120-second wait period, then the GGA will automatically go to the default Auto Launch window (see Figure 9). To avoid the timeout and the Auto-Launch sequence, then click on the maintenance SERVICE tab which will give the user more time and the option of going to a files maintenance menu.

Figure 7: Ultra-Portable GGA Start-up Screen in busy mode as the program loads.
NOTE: Once a month, the instrument will automatically perform a thorough file system integrity check during startup. This maintenance will take approximately one to two minutes before it continues to load the software.

IMPORTANT! Do not turn off the computer during this monthly maintenance.

Figure 8: Launch Service Screen

Click here to manually launch the GGA

Countdown to Auto Launch

Figure 9: Auto Launch Window

Click Maintenance FILES tab to transfer files to USB drives

Click SERVICE tab to delay Auto Launch
NOTE: LGR recommends running the instrument for 30 minutes before starting work. The exact final cell temperature will be instrument-specific. This allows for all components to thermally stabilize.

Main Panel

After initialization is complete, the Ultra-Portable GGA software will display the Main Panel of the user interface and the instrument will begin to draw in gas and display the results in Numeric Display (see Figure 11). Whenever the analyzer is turned on or rebooted, the Main Panel defaults to the Numeric Display.

User Interface Control Bar

The User Interface Control Bar is displayed at the bottom of the screen (see Figure 10 and Figure 11) and enables the user to easily control the operation of the analyzer by using the button icons described below.

Figure 10: User Interface Control Bar

- Display button (monitor icon) – Controls the how data is displayed in the Main Panel. Data is displayed in the Main Panel in one of the three ways described below. Click on the Display button to change how the data is displayed.
  - Numeric Display – Default display—this display appears when the analyzer is turned on or rebooted. It displays the numeric readout of the last measurement (see Figure 11).
  - Spectrum Display – Displays the raw and fitted spectral scans (see Figure 12).
  - TimeChart Display – Displays the concentration over time (see Figure 13).
- Rate button (clock icon)– Allows the user to adjust the rate at which data is written to the log file.
- Parameter Window – Displays the current time, current log filename, gas temperature, measurement cell pressure, cavity Ring-Down time, and remaining space on the hard drive.
- Files button (page icon) – Allows easy transfer of files onto USB storage devices.
- Setup (tools icon) – Accesses additional configuration and service menus.
- Exit button (X icon) – Exits the application and shuts down the Analyzer.
Display

Click the Display button to change how the data being measured will be displayed in the Main Panel (see Figure 11). Data can be displayed in Numeric, Spectrum and TimeChart displays, each described in more detail below.

Numeric Display

This is the default display and appears when the analyzer is first turned on or rebooted. Figure 11 shows the numeric readout of the last measurements of methane, water, and carbon dioxide in parts per million (ppm) mixing ratio units.

Figure 11: Main Panel in Numeric Display

Click on the Display icon to change how data is displayed in the Main Panel.
Spectrum Display

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

The Spectrum Display consists of two graphs (see Figure 12): the top graph shows the voltage from the photodetector as the laser scans across the methane, water and carbon dioxide absorption features; the bottom graph shows the corresponding optical absorption displayed as black circles, and the peak fit resulting from signal analysis as a blue line.

The measured CH$_4$, H$_2$O and CO$_2$ concentrations are shown in parts-per-million (ppm).

Spectrum Display shows the laser transmission through the ICOS measurement cell (Figure 12, top graph) recorded as the laser is tuned across the selected wavelength region near 1.60 microns. The CH$_4$, H$_2$O and CO$_2$ absorption lineshapes that result from a detailed analysis of the measured transmission signal are shown in Figure 12, bottom graph. The Laser selection drop-down box in the lower right portion of the screen allows the user to select and display the methane, water and carbon dioxide spectrums.

- Laser 1 displays the CH$_4$ and H$_2$O spectrum
- Laser 2 displays the CO$_2$ spectrum

Figure 12: Main Panel in Spectrum Display
**TimeChart Display**

Click the **Display** button to switch to TimeChart Display.

The TimeChart shown in Figure 13 shows a continuous record of methane, water, or carbon dioxide concentrations. A 10-point running average (in black) is shown going through the raw data (shown in color).

Click on the drop-down box in the lower-right corner of either window to change displays of methane, water or carbon dioxide concentrations. These data are also being saved to the file indicated in the middle left corner of the Parameter Window, along with a continuous record of the pressure, temperature, and mirror ring-down time.

The user may change the rate at which data are written to the log file by selecting the **Rate** button (Figure 13). Data will be acquired at a 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; so the user may trade off precision in concentration for precision in time.

*Figure 13: Main Panel in TimeChart Display*
Rate Control

Data is collected and saved to the file indicated in the middle left of the parameter window. You can change the rate at which data is written to the log file by selecting **Rate** button (clock icon) on the User Interface Control Bar (**Figure 14**), and changing the speed on the Data Rate Control Adjustment Panel. In Normal mode, data will be 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 period (or equivalently, slower data acquisition rates) will yield better measurement precision than shorter averaging periods.

*Figure 14: Data Rate Control Adjustment Screen*
Operating the Ultra-Portable GGA

Parameter window

The Parameter window (white-center panel of the User Interface Control Bar (see Figure 15) shows the current time, cell temperature (Celsius), cell pressure (Torr), and cell ring-down time (microseconds). The current data filename is also shown as well as the available hard-drive space left on the instrument.

Figure 15: Parameter viewing window.

File Transfer Menu

The File Transfer menu is used for accessing data collected by the analyzer.

Each time the instrument is re-started, the most recent file name is displayed in the form of: gga_10Apr2013_f0001.txt is displayed, where the first 3 characters represent the instrument model (gga) and the next 9 characters represent the date (ddMonyyyy) and the 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 instrument is left in continuous operation, a new data file will automatically be created every 24 hours in order to keep data file sizes manageable. This interval is adjustable in the “File Settings” dialog of the Setup Menu (described later in this manual). The data files are written in text (ASCII) format and contain labeled columns as shown in Figure 16.
Figure 16: The beginning of a typical data file, showing data columns with time, methane concentration, cell pressure, cell temperature, etc. Instrument settings are encoded after the end of the data columns.

The “Time” column reports the time stamp of each recorded measurement; its format is set by the user in the “Time/Files” menu of the “Setup” panels (see page 28). Also reported are:

- $[\text{CH}_4]$ (ppm)
- $[\text{H}_2\text{O}]$ (ppm)
- $[\text{CO}_2]$ (ppm)
- $[\text{CH}_4]_d$ (ppm)
- $[\text{CO}_2]_d$ (ppm)
- Cell pressure (Torr)
- Cell temperature (Celsius)
- Ambient Temperature (Celsius)
- Ring-Down Time (microseconds)

**NOTE:** In the listed variables above ($[\text{CH}_4]_d$ (ppm) and $[\text{CO}_2]_d$ (ppm), the “d” stands for “Dry Mole”.

For each of these measurements there is an additional adjacent column reporting the standard deviation of the measurement (designated with ‘_sd’ tag). The standard deviation is zero when the instrument 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 instrument for that data file. The settings are typically not needed by the user, but are stored for diagnostic or troubleshooting purposes.

The user may transfer data files from the instrument hard disk to a USB memory device by dragging and dropping the files from the left side, hard disk pane to the right side, USB device pane. The directory windows default to the local drive on the left screen and the USB memory device on the right. The user may navigate through folders, create directories, and delete files and directories. The user may also use the left mouse button to highlight one or multiple files in the windows and drag and drop to copy the files between the directories.
Operating the Ultra-Portable GGA

Figure 17: Typical daily directory and archive of data files.

Figure 18: Daily directories contain the flow-(f) files. Inside the Flow Through data directory, the serial number is preceded by an f for flow through mode data files.
The instrument data directory (left pane of Figure 17) is composed of two types of directories – the archive directory and daily directories. Inside the archive directory (shown in Figure 18) the instrument automatically generates a single zip archive file that contains all the data files recorded on a given day named (ddMonYYYY.zip). The daily directories (shown in Figure 18) are automatically created every day that the instrument operates, and contain one subdirectory for flow through mode. The flow directory contains all data files taken that day in flow through mode (Figure 18). The serial number of the data file is preceded by an “f” for flow through mode data files.

**Figure 19: Archive directory. For convenient data transfer and archiving, a single zip archive file is created to contain all the data from each day of operation.**
NOTE: Files may be managed within the local drive by selecting and dragging and dropping files into designated folders. Files can then be organized into directories by creating a folder, copying the desired files to that folder, then deleting the original files.

WARNING: Removal of the USB memory device before prompted to do so may result in loss of data.

When finished transferring files, the user must click **Unmount** button (Figure 19), then click the **Close** button. If the user forgets to insert a USB device before entering the file transfer mode, or if the USB device is full or not recognized, the instrument will display a “pop up” warning as seen in Figure 20.

*Figure 20: File Transfer Error. User forgot to insert a USB device, or USB device is full.*
Setup Panel

The Setup Panel allows access to additional configuration and service menus. To enter Setup mode:

1. Click the **Setup** button on the User Interface Control Bar (Figure 21).

![Figure 21: Setup button on the User Interface Control Bar](image)

2. When entering Setup mode, it will display the default Time/Files screen on the Setup Menu Panel (Figure 22).

![Figure 22: Setup Menu Tabs with Time/Files screen selected](image)

The Setup Menu Panel has specific function tabs at the top of the screen that allows the user to configure the instrument mode and settings. These tabs allow the user to:

- Manage file saving settings
- Adjust the current time/date settings
- Configure the Serial Output
- Configure analog output
- Calibrate the instrument to a local gas standard
Operating the Ultra-Portable GGA

- Enable the laser offset adjustment.
- Configure the optional Multi-port Inlet Unit (Manifold)

The following menus are available to make adjustments to the analyzer and its operation:

**Time/File Settings Menu**

The Time/File Settings Menu allows the user to adjust the timestamp format of the data files and the new file creation interval (when running continuously). The available timestamp formats are shown below in Table 2.

The Time/Files screen also has other adjustment menus for setting the time zone, manually setting the clock, adjusting the Serial Configuration, and adjusting the Analog Output setting.

**Table 2: Available Time Stamp Formats.**

<table>
<thead>
<tr>
<th>Time Format</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>sssssss.sss</td>
</tr>
<tr>
<td>Relative Seconds in Hours, Minutes, Seconds</td>
<td>hh:mm:ss.sss</td>
</tr>
</tbody>
</table>

**Clock Set Menu**

The Clock Set Menu lets the user adjust the current time and date settings of the instrument (Figure 23). The time zone and daylight savings enable/disable may also be set here.

**Serial Configuration Menu**

The Serial Configuration Menu (Figure 23) allows the user to change how the data reported at the RS-232 port is configured. Standard settings for Baud Rate, Parity, and Stop Bits are provided. Note that the actual rate of serial output is equal to the Logged File Rate (i.e. 1 Hz) divided by the Rate specified in the Serial Configuration Menu.

**NOTE: When connecting the serial port of the instrument to an external computer, a null modem type serial cable should be used.**
Operating the Ultra-Portable GGA

Data Analog Output Menu

The Data Analog Output Menu is also displayed on the Time/Files screen as shown in Figure 23. The Data Analog Output port has a 16-bit voltage range from 0 to 5 volts. The user may specify a conversion between the methane, water, and carbon dioxide ppm measurement and the analog output voltage using the dropdown spinner controls in the Data Analog Output box.

NOTE: The user may also type the number into this field.

The dropdown spinner controls allow the user to select what concentration value will correspond to the maximum 5 VDC analog output. For example, the user may wish to 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. On the other hand, if the user wants exactly two times greater sensitivity on the analog output, with the expectation that the concentration will not go above 5 ppm, the user may set 5 Volts = 5 ppm. If the measured concentration goes above the maximum expected value for the Data Analog Output, the on-screen displays and data files will continue to record the correct measured concentration, but the Data Analog Output will simply saturate at its maximum value of 5.0 volts until the concentration drops back into the expected range.

Figure 23: Various Functions of the Time/File Settings menu
Calibration Menu

The Ultra-Portable GGA is equipped with a calibration routine. Los Gatos Research recommends periodic referencing rather than user calibration to ensure measurement accuracy and consistency. However, if the user desires to calibrate the instrument, then follow these steps.

Calibration can be achieved by attaching a tube, regulated at a pressure just slightly above ambient atmosphere (< 10 psig), from a local gas standard to the instrument inlet. The sequence of calibration steps is illustrated below.

1. Click the Calibration tab on The Setup Menu Panel to bring up the Calibration Setup Screen window (Figure 24), which displays information about the most recent calibration. To start Calibration, enter data in Total ppm dropdown menu, and then click START.

*Figure 24: Calibration Setup Screen*

2. Toggle and select the desired reference gas setting in the Calibrate selection box (Figure 25) and then click the NEXT button.
3. Click the **Next** button after opening the reference gas valve, ([Figure 25](#)).

4. The instrument then proceeds to the Equilibrating reference gas mode, ([Figure 26](#)).

5. Enter the known total concentration (in ppm) of the individual gas to be calibrated (CH₄, H₂O, or CO₂) into the corresponding field, select the box next to the species to be calibrated, and click **NEXT**.

6. The screen will prompt you that the instrument is ready to calibrate, and to click the **START** button once it become active, ([Figure 28](#)).

7. Click **NEXT** when consistent flow has been established, the transfer tube is fully flushed with the calibration gas, and you are ready to begin calibration.

8. Close the reference gas valve and open the sample gas valve. Click the **Next** button when done. (If **NEXT** is not clicked within 60 seconds, calibration will be aborted and normal sample measurement will continue). The instrument will run the calibration routine for approximately two minutes. The screen will prompt you indicating when the calibration is finished and that the user should disconnect the calibration gas.

**NOTE:** The time of latest calibration is also stored in the instrument configuration files for future reference.
NOTE: The user may instead leave the local standard gas connected for a short time to verify a successful calibration – to do so press OK and the instrument will resume normal measurement mode. The user can then verify that the displayed concentration correctly corresponds to the standard gas.

9. When Calibration is finished, you are prompted to disconnect the calibration gas.

*Figure 26: Calibration Menu, Equilibrating reference gas.*
Figure 27: Calibration Menu, Measuring reference gas.

Figure 28: Calibration Done. Close the reference gas valve and click the NEXT button.
**Note on Mirror Ring-Down Time**

The mirrors of the internal measurement cell are protected from contamination by an inlet filter and pump check valves. However, it is possible over time and with continued use that the mirrors may gradually decline in reflectivity. This will not create errors in the measured methane concentration, as the mirror reflectivity is continually monitored and the measurement is fully compensated. However, if a significant change occurs in the Mirror Ring-Down time (for example, greater than 20% reduction in Ring-Down time), the precision of the instrument may be reduced. Users should occasionally take note of the Ring-Down time and request instruction from LGR on mirror cleaning if a significant reduction in Ring-Down time occurs.
Laser Adjust Menu

The Laser Adjust Menu allows manual adjustment of laser voltage offset control. Manual adjustment of laser offset may be required under conditions where the laser wavelength has drifted beyond the automatic control range of the instrument, as seen in Figure 31, or if the instrument is operated outside the specified environment temperature range.

To manually adjust the laser offset:

1. Select the Laser Adjust tab on the Setup menu.
2. Click and select the “Disable Laser Frequency Lock” as shown in the lower left corner of Figure 31.
3. Click the Laser Voltage adjustment dropdown menu on the lower right corner of the Main Panel (Figure 32).
4. The user should now use the + and – controls on this spinner to manually center the CH₄ and H₂O absorption feature on the target lines (as shown in Figure 32). Once the absorption features have been centered, uncheck “Disable Laser Frequency Lock” (lower left corner of Figure 32). This will allow the software to resume automatic tracking and control of the laser wavelength.
5. After disabling manual control of the laser offset, click Close to exit the menu and return to the Main Panel.

Figure 31: Laser Adjust Control Panel. In this figure, both laser offsets need adjustment.
Figure 32: Top panel, Laser A offset, voltage is properly adjusted to center the H$_2$O and CH$_4$ features on the target lines. Bottom panel, Laser B voltage is also properly adjusted to center the CO$_2$ features on the target lines.
Manifold Menu for Multi-port Inlet Unit (Optional)

This panel configures the control of the optional Multi-port Inlet Unit (MIU) if present. Details of its operation are further described in the corresponding section in “Appendix C: Multi-port Inlet Unit (Optional)” on page 71. If the MIU is not present, it should be ‘disabled’ in this menu.

Figure 33: Gas Manifold Control panel for the (optional) Multi-Port Inlet Unit (see Appendix C: Multi-port Inlet Unit [Optional] on page Appendix C: Multi-port Inlet Unit 71 for operation)
Operating the Ultra-Portable GGA

Shutting Down the Ultra-Portable GGA

To shut down the Ultra-Portable GGA, complete the following steps:

1. Click the Exit button on the User Interface Control Bar.

*Figure 34: User Interface Control Bar exit button*

The Exit button prompts you to verify that you want to shut down the instrument to prevent accidental button presses from causing interruption in data acquisition.

*Figure 35: Instrument Shutdown Prompt*

2. Click the OK button to halt data acquisition, close the current data file and display the shutdown screen.
3. After the “You may turn off the instrument” message displays, as shown in Figure 36, the user can safely shut off power to the instrument by pushing the ON/OFF switch on the left side of the instrument.

NOTE: Failure to wait for the Power Down command to display before shutting off power to the instrument may result in file system instability.
3 Wireless Router Setup

The Ultra-Portable GGA comes with a wireless router installed in the machine, the ZyXEL Portable Wireless Router, and can be accessed by opening the case.

This section provides instructions for configuring the wireless router so it can connect other devices to the analyzer.

Router Modes

There are three ways or modes in which the Wireless Router can be set up:

- **Wireless Router Mode** – This is the default mode of the Wireless Router. Use this mode to connect devices wirelessly to the analyzer, thereby creating your own network. The router will issue IP addresses for the analyzer and the wireless device(s).

- **Access Point Mode** – Use this mode to connect the analyzer to an existing network via a LAN connection. This mode does not issue IP addresses but will allow wired and wireless devices on an existing network to access the analyzer via a LAN connection.

- **Client Bridge Mode** – Use this mode to connect the analyzer wirelessly to an existing network. This mode does not issues IP addresses but will allow wired or wireless devices on an existing network to connect wirelessly to the analyzer.

Once you have configured the router according to one of the three methods above, the analyzer will be wirelessly accessible. For wireless control of the analyzer via a remote device, you must then install the appropriate VNC (virtual network client) software on your remote device. Instructions to do this are in Chapter 4, “Setting up Devices for Remote Access Using VNC Software” on page 51.
Configuration for Wireless Router Mode

To configure the wireless router for wireless router mode, slide the mode switch on the router to the “Router” position (see Figure 37).

Figure 37: Switch on Wireless Router set to Wireless Router Mode

The diagram below shows how the wireless router connects wireless devices to the analyzer. In this “Wireless Router Mode” the wireless router forms its own network, and issues IP addresses to the analyzer and client devices via DHCP (Dynamic Host Configuration Protocol). This mode is primarily intended for standalone operation of the analyzer in the field.

Figure 38: Wireless Connection Diagram in Router Mode

In order for your wireless devices to access and control the analyzer, you must first install VNC (virtual network client) software on your wireless device, and join the wireless router network. For instructions about how to do this, see Chapter 4, “Setting up Devices for Remote Access Using VNC Software” on page 51.
Configuration for Access Point Mode

To configure the wireless router for Access Point mode, slide the mode switch on the router to the AP position (see Figure 39).

**Figure 39: Switch on Wireless Router set to AP Mode**

The diagram below shows how the router works in AP mode to connect wired and wireless devices to the analyzer via a LAN connection. In this “Access Point Mode,” the wireless router is connected to an existing local area network (LAN) via a standard Ethernet jack, and the analyzer and wireless client devices are issued IP addresses via the DHCP server on that LAN. This mode is primarily intended for connecting wired and wireless devices to the analyzer on an existing network, such as in a laboratory or other large facility environment.

**Figure 40: Wireless Connection Diagram in AP Mode**

In order for your wired and wireless devices to access and control the analyzer, you must install VNC (virtual network client) software on the device. For instructions about how to do this see Chapter 4, “Setting up Devices for Remote Access Using VNC Software” on page 51.
Configuration for Client Bridge Mode

To configure the wireless router for Client Bridge mode, slide the mode switch to the AP position (see Figure 41), then follow the instructions in the section below called, “Setting up the Client Bridge Mode Configuration.”

Figure 41: Switch on Wireless Router set to AP for Client Bridge Mode

The diagram below shows how the router works in Client Bridge mode to wirelessly connect devices on an existing network to the analyzer. In this Client Bridge Mode, the wireless router is connected to an existing local area network (LAN) via a wireless link, and the analyzer and wireless devices are issued IP addresses via the DHCP server on that LAN. This mode is primarily intended for connecting the analyzer to an existing LAN in situations where a wired connection to the LAN is not available (e.g., on the roof of a facility, or in an outbuilding).

Figure 42: Wireless Connection Diagram in AP for Client Bridge mode

Setting up the Client Bridge Mode Configuration

1. In order to configure the router to operate in Client Bridge mode, you must first connect a computer to the wireless router via a standard Ethernet cable (wired) connection.

2. The computer then needs to be set with a Static IP address. This means that you need to manually set an IP address on your computer. To do this, follow the steps below for the appropriate computer system.
• **Windows XP**
  A  Click on **Start > Control Panel** (set for Classic View) > **Network Connections**.
  B  Right click on **Local Area Connections** and click on **Properties**. In **Properties**, scroll down the list and highlight **Internet Protocol (TCP/IP)** and click **Properties**.
  C  Select **Use the Following IP Address**.
  D  Type in “192.168.100.10”.
  E  Click on the **Subnet Mask** box and it will fill in automatically with “255.255.255.0”.
  F  Click **OK** at the bottom then click on **Close** to close the **Properties** window.

• **Windows Vista and Windows 7**
  A  Click on **Start > Control Panel > Network and Internet > Network Sharing Center**.
  B  On the left side of **Network and Sharing Center**, click on **Manage Network Connections** (in Vista) or **Change Adapter Settings** (in Windows 7).
  C  Right click on **Local Area Connection** and click on **Properties**.
  D  In this window, highlight **Internet Protocol Version 4** and click **Properties**.
  E  Select **Use the Following IP Address** and type in “192.168.100.10”.
  F  Click on the **Subnet Mask** box and it will fill in automatically with **255.255.255.0**.
  G  Click **OK** and then **Close** on the Properties window.

• **Macintosh Apple Computer**
  A  Click the **Apple Icon** in the top right corner.
  B  Select **System Preferences**.
  C  Click on **Network** then **Ethernet**.
  D  Click on the dropdown box next to **Configure IPv4** and set it to **Manually**.
  E  For the **IP Address** type in “192.168.100.10”.
  F  Click on the **Subnet Mask** box and enter **255.255.255.0**.
  G  Click on **Apply**.

3. Once your computer is set with a Static IP address, you should be able to open a browser and access the router interface by typing in “192.168.100.1” in the address bar.
**Wireless Router Setup**

**Changing Your Computer Back**

4. After setting up the Router, you will need to change your computer back to the way it was. Go through the appropriate steps listed above again and
   - On Windows, change the setting to **Obtain an IP Address Automatically** and **Obtain a DNS Server Address Automatically**.
   - On Macintosh, change the **Configure IPv4** setting to **Use DHCP**.

**Setting up the Wireless Router**

5. Flip the switch on the side of the Wireless Router from Router Mode to AP Mode (see Figure 43).

**Figure 43: Set Switch on AP**

6. Open a browser window and type in “192.168.100.1” and press **Enter** to display the Login Screen (see Figure 44).

**Figure 44: Authentication Screen**

7. The login screen for the router will display. In the **User Name** field, enter “admin”; in the **Password** field, enter “1234”, and click **Login**.
8. On the left side of the screen, click on **Wireless>Basic Settings**.

*Figure 45: ZyXEL Wireless>Basic Settings Screen*

9. Change the **Wireless Mode** from AP to **Client**, and then click **Apply** at the bottom of the page.

*Figure: 46 Wireless Basic Settings – Changing Wireless Mode to Client*

10. You will receive a message warning about using WPA/WPA2 mixed mode. This means that the wireless router you are connecting with must be strictly in WPA or WPA2 mode, but not both. Click on **OK**.

*Figure 47: Warning Message*
11. Next, click on Wireless > Site Survey.

*Figure 48: Wireless > Site Survey Screen*

12. Click on the Site Survey button to bring up a list of wireless networks that are close by in location. Select the bubble to the right of your network and click Next at the bottom of the page.

*Figure 49: List of Wireless Networks that are near by*

13. On the next screen you will need to input the security settings of your wireless router.
14. Once you have input the values for your network security, click **Connect**. If successfully connected you will get a message saying you were able to connect.

**Figure 51: Successfully Connected Message Screen**

Completing Setup

15. At this point, close your browser window and follow the instructions in the “Changing Your Computer Back” section on page 46 above.

Once this is done, you can connect the analyzer to the LAN port of the ZyXEL router and it will connect to your main wireless router through the bridge that was just created.

In order for your wired and wireless devices to control the analyzer, you must install VNC (virtual network client) software on the device. For instructions about how to do this, see Chapter 4, “Setting up Devices for Remote Access Using VNC Software” on page 51.
4 Setting up Devices for Remote Access Using VNC Software

There 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, tablet, etc)
- iOS based devices (smart phones, tablets, laptops, etc)
- Windows based devices (smart phones, tablets, laptops, etc)

Each of these devices uses VNC (Virtual Network Client) software to access and control the analyzer through the router. Follow the instructions below to install and setup VNC software on the type of device you want to connect to the analyzer through the router.

Setting 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 that matches the sticker on the ZyXEL Wireless Router, in this case, ZyXEL-0335CB (see Figure 52). The ZyXEL Wireless Router is installed inside the instrument and may be accessed by opening the case.

   Figure 52: Wireless Router Sticker

   [Image of a labeled Wireless Router Sticker]

   SSID Network: in this case, ZyXEL-0335CB
   Wireless Password: in this case, B08CDB18

3. Select SSID and type in the Wireless Password that matches the sticker on the router, in this case, B08CDB18, and click Connect (see Figure 53).

   NOTE: Every router will have a different, unique SSID number and Wireless Password.
4. The following screen will display showing that the Android device is connected to the router.

**Figure 53: Password Connection Screen**

Enter the Password that appears on the sticker on the router, and then tap the **Connect** button.

5. Ensure that the IP address of the Android device is correct by holding your finger down on the network connection icon (see **Figure 54**). The IP address of the Android device will either be **192.168.100.100** or **192.168.100.101**.

**NOTE:** Remember the IP Address of the Android device because it will be necessary to refer to it in Step 9, below.

6. Install VNC software/connect with VNC software by searching and installing from the store: in the Google Play store, search for “Android-vnc-viewer” and install the application by tapping on the **Install** button.

**NOTE:** Internet connection is required for this step.

**NOTE:** Complete instructions for installing the “Android-vnc-viewer,” can be found online at:

Figure 55: “Android-vnc-viewer” Install Screen

7. Open the VNC application on the Android device by tapping on the icon pictured below:

Figure 56: VNC Application Icon
8. The following screen will appear:

*Figure 57: VNC Application Installation Setup Screen*

9. In the **Address** field, type in the correct address of the **analyzer**, which will either be **192.168.100.100** or **192.168.100.101**, depending on the IP address of the Android device that was displayed in Step 5 above; 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 5 is 192.168.100.101, then the IP address of the analyzer will be 192.168.100.100 (and vice-versa) and therefore, **192.168.100.100** must be entered into the Address field in the screen above, as displayed in this example.

10. In the **Password** field, type **lgrvnc**

11. Tap the **Connect** button to connect the Android device to the analyzer. The analyzer software interface screen will display on the device; the screen size is adjustable to fit the screen of the device.
Figure 58: Screen Size Adjustment Panel for Android Device

Use this slider bar to adjust screen size
Setting Up VNC Software on iOS Devices

1. On the iOS device (iPad, iPhone, etc.), go to **Settings>WiFi>Connect to Wireless Network**.

2. Connect to the wireless SSID network that matches the sticker on the router, in this case, **ZyXEL-0335CB** (see Figure 59). The ZyXEL Wireless Router is installed inside the instrument and may be accessed by opening the case.

   **Figure 59: Wireless Router Sticker**

3. Select the appropriate SSID network, in this case **ZyXEL-0335CB** (see Figure 60).

   **Figure 60: Network Connections Screen**
4. Once selected, the following screen will appear (see Figure 61, below). In the Password field, type in the Wireless Password on the sticker on the router, in this case, B08CDB18, and tap Join.

   NOTE: Every router will have a different, unique SSID number and Wireless Password.

   **Figure 61: Router Connection Screen**

   ![Router Connection Screen]

5. The following screen will display, confirming that the iOS device is connected to the router.

   **Figure 62: Router Connection Confirmation Screen**

   ![Router Connection Confirmation Screen]

Select the Network to check the IP address of the device (see Figure 63), which should be 192.168.100.100 or 192.168.100.101.

   NOTE: Remember the IP Address of the device because it will be necessary to refer to it in Step 10, below.
6. Install VNC software/connect with VNC software by searching and installing it from the App store. Mocha VNC Lite for iOS is the software used in this example.

**NOTE:** 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)

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Mocha VNC Lite is the software selected.
7. Once installed, open the application and tap **Configure**.

8. The screen below will display (see **Figure 65**).

   **Figure 65: Mocha VNC Lite Configure Screen**

9. In the **VNC server address** field type in the correct address of the **analyzer**, which will either be **192.168.100.100** or **192.168.100.101**, depending on the IP address of the device that was displayed in Step 6, above; the IP address of the **analyzer** will be whichever address the device is *not*.

   For example, if the IP address of the **device** that was displayed in Step 6 is **192.168.100.101**, then the IP address of the **analyzer** will be **192.168.100.100** (and vice-versa) and therefore, **192.168.100.100** must be entered into the **VNC server address** field in the screen above, as shown in this example.

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

11. Tap **Connect >**, to display the screen below that shows the configurations that have been set up.
Figure 66: Setup Configurations Screen

12. Tap the IP Config that is setup, in this case, **192.168.100.100**, to connect the iOS device to the Analyzer. The analyzer software interface screen will display on the device; the screen size is adjustable to fit the screen of the device (see Figure 67).

Figure 67: Screen size adjustment panel for iOS device

*Use this slider bar to adjust screen size*
**Setting Up VNC Software on Windows Devices**

1. On your Windows device, open wireless router options.

2. Locate the router sticker on the back of the analyzer as pictured below. The ZyXEL Wireless Router is installed inside the instrument and may be accessed by opening the case.

![Wireless Router Sticker](image)

**Figure 68: Wireless Router Sticker**

3. Click on the Wireless Connections icon in the bottom left part of the screen (see **Figure 69**) to open the Windows Wireless Networks window (see **Figure 70**).

![Wireless Connections Icon](image)

**Figure 69: Wireless Connections Icon**

SSID Network: in this case, ZyXEL-0335CB

Wireless Password: in this case, B08CDB18

Click on the Wireless Network Connections icon.
Setting up Devices for Remote Access Using VNC Software

Figure 70: Windows Wireless Networks

4. Select the appropriate SSID network, in this case ZyXEL-0335CB (see Figure 70) to display the screen below (Figure 71).

Figure 71: Network Connections Security Screen

5. In the Connect to a Network box that appears, in the Security key field, type in the Wireless Password that matches the router sticker, in this case, B08CDB18, and click OK.

NOTE: Every router will have a different, unique SSID number and Wireless Password.
6. Check the connection to make sure the device is connected through the Wireless Router by selecting the router as shown in the screen below.

*Figure 72: Wireless Network Connection Screen*

7. Check the IP address of the Windows device by right clicking on the **ZyXEL-0335CB** Network Connection, then clicking on **Status** (see *Figure 73*) to display the Wireless Network Connection Status window (see *Figure 74*).

*Figure 73: Current Connectivity Screen*
8. Click on the Details box to display the Network Connection Details window (see Figure 75).

Figure 75: Network Connection Details Window

Check the IP Address of the Windows device, which in this case, is 192.168.100.101.
9. Check the **IPv4 Address** of the Windows device, which should be either **192.168.100.100** or **192.168.100.101**; in this case, the Windows device IP address is 192.168.100.101 (see Figure 75)

**NOTE:** Remember the IP Address of the device because it will be necessary to refer to it in Step 12, below.


**NOTE:** Internet connection is required for this step.

**NOTE:** Complete instructions for installing Real VNC Viewer for Windows can be found online at:

[http://www.realvnc.com/products/vnc/documentation/5.0/guides/user/Chapter1.html](http://www.realvnc.com/products/vnc/documentation/5.0/guides/user/Chapter1.html)

11. Open the program by clicking on the **Connect** button.

*Figure 76: Real VNC Viewer Installation Screen*

12. Type in the IP address of the **analyzer**, which will either be **192.168.100.100** or **192.168.100.101**, depending on the IP address of the device that was displayed in Step 9, above; the IP address of the **analyzer** will be whichever address the device is **not**.

In the example in Step 9 above, the IP address of the Windows **device** that was displayed is 192.168.100.101, therefore, the IP address of the **analyzer** will be 192.168.100.100 and therefore, 192.168.100.100 must be entered into the **VNC server address** field (and vice-versa).

13. When prompted, type in the Password, which will be **lgrvnc**
Appendix A: About Gas Analyzers and Laser Absorption Spectroscopy

Conventional Laser Absorption Spectroscopy

For gas measurements based on conventional laser-absorption spectroscopy (see Figure 77), 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:

\[
\text{Beer's Law: } I_v = I_o \cdot e^{-\left(\frac{\Delta v}{\Delta v_0}\right)}
\]

where \( I_v \) is the transmitted intensity through the sample at frequency \( v \), \( I_o \) is the (reference) laser intensity prior to entering the cell, \( P \) is the gas pressure, \( S \) is the absorption line strength of the probed transition, \( L \) is the optical path length of the laser beam through the sample, \( M \) is the mole fraction and \( \Delta v_0 \) is the lineshape function of the transition at frequency \( \Delta v \). In this case,

If the laser linewidth 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 absorption feature.

Figure 77: Typical Laser Absorption Spectroscopy Setup

Subsequent integration of the measured spectra together with measured values of gas temperature, gas pressure, optical path length and the line strength of the probed transition allow determination of the mole fraction directly from the relation:
This strategy has been proven successful in determining gas concentrations in mixtures containing several species, in flows at elevated temperatures and pressures, and in hostile environment, without using calibration gases or reference standards.

Until recently, high-sensitivity trace-gas measurements have been possible only by using expensive lasers (e.g., lead-salt or quantum-cascade) or broadband lamps that operate in the mid-infrared region where absorption features are strong. LGR’s advances in cavity-enhanced absorption-spectroscopy techniques provide dramatic increases in the optical path length (as described below) and as a result, enable ultrasensitive trace-gas measurements using robust, reliable, room-temperature diode lasers that operate in the near infrared.

**LGR’s Off-Axis Integrated-Cavity Output Spectroscopy (Off-Axis ICOS)**

Off-Axis ICOS utilizes a high-finesse optical cavity as an absorption cell as shown in Figure 78. Unlike conventional multi-pass arrangements, which are typically limited to path lengths 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 78: Schematic Diagram of an Off-Axis ICOS Instrument*

Because the path length depends only on optical losses in the cavity and not on a unique beam trajectory (like conventional multipass 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 combined with measured gas temperature and pressure in the cell, effective path length, and known line strength, used to determine a quantitative measurement of mixing ratio directly and without external calibration.
Appendix B: Accessing Data Using a LAN Ethernet Connection

This procedure describes how to access the analyzer data directory as a Windows™ Share via a Local Area Network (LAN) Ethernet connection.

The data files stored on the internal hard disk drive of the analyzer may be accessed as a Windows™ Share via a Local Area Network (LAN) ethernet connection. The following prerequisites are necessary for this function to operate:

1. The analyzer must be connected to a Local Area Network (LAN) via the RJ-45 ethernet connection on the rear panel.
2. The analyzer must receive a response to a DHCP (Dynamic Host Configuration Protocol) request when the instrument is booted. If the analyzer does not receive a reply, it will disable the ethernet port and not attempt another DHCP request until the analyzer is restarted.

When these prerequisites are met, the data directory may be accessed via a Windows computer on the same LAN as follows:

5. Click “Start”, then “Run”, then type the following into the “Open” command field: \LGR-XX-XXXX (where XX-XXXX is the serial number of the analyzer).
6. In a short time (usually between 10 and 60 seconds for the first access) a Windows share directory window will be displayed with a subdirectory named “lgrdata” displayed.
7. Double-click on the “lgrdata” directory, and you will see a listing of the data files stored on the internal hard disk drive of the analyzer. You may open or transfer any of the data files as you would with any Windows™ share drive.

Additional Notes

- The analyzer shared data directory may (or may not) be visible by “browsing” for it in the Windows “Network Neighborhood”. If it is, it will be in the workgroup called “LGR” and the computer name will be “LGR-XX-XXXX” where XX-XXXX is the analyzer serial number.

- You can open the data file that is currently being written into by the analyzer without interrupting the analyzer operation (you will see a snapshot of the file as it was when you opened it). You will notice that the current data file is only updated occasionally (every 4 kB worth of data), so a new data file will appear empty until enough data is collected and written to disk.

- If a LAN is not available, you may plug the analyzer into a simple standalone broadband router (such as a Netgear Model RP614 – approximately $45). This will enable the analyzer to obtain a DHCP address from the router when the analyzer is started. You may then plug any Windows™ computer into the same broadband router and 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 at boot and will shut down its Ethernet interface.

• You may be able to access the shared analyzer data directory from computers running operating systems other than Windows™. The analyzer uses a Samba server to share the data directory, and it may be accessed by any appropriate Samba client application.
Appendix C: Multi-port Inlet Unit (Optional)

The Multi-port Inlet Unit (MIU) is designed to allow the instrument to switch automatically between various inlets giving the user the opportunity to sample different unknowns in different locations as well as sampling different references. The unit contains a manifold of digitally controlled valves which are programmed to allow any one of the 16 input ports to be directed to the instrument inlet port. The Multi-port Inlet Unit is shown in Figure 79 and Figure 80.

Figure 79: Multi-port Inlet Unit (front view).

Figure 80: Multi-port Inlet Unit (back view) showing the various connections. The unit supports up to 16 inlet ports labeled numerically. The outlet port connects to the gas inlet of the analyzer. The included 25-pin control cable connects the instrument to the Multi-port Inlet Unit. An additional power cable is included to power the Multi-port Inlet Unit.
The power and control cable connections are shown in Figure 81 and Figure 82.

**Figure 81: Power and Control connections for the Multi-port Inlet Unit.**

**Figure 82: Connection of Multi-port Inlet Unit control cable to the Analyzer.**

Gas connections are made using ¼” Teflon tubing. Care should be taken to insure that the tubing has been pushed in entirely so as to avoid leaks in the seals.

**IMPORTANT NOTE – For tube removal you must first push in the outer ring around the connector to allow the tube to be released and pulled free.**
**Figure 83:** The ‘Outlet Port’ of the Multi-port Inlet Unit connects to the Inlet Port of the Analyzer.

**Figure 84:** Insertion of sample tube into inlet port ‘1’ on the Multi-port Inlet Unit.

**IMPORTANT NOTE** – for tube removal you must first push in the outer ring around the connector to allow the tube to be released and pulled free.

The user can configure which ports are sampled and for how long. This is accessed by selecting the Setup button on the User Interface Control Bar, and then selecting the MIU tab.
Figure 85: Gas manifold control for the Multi-port Inlet Unit. The user configures which inlet ports are being used and for how long the instrument should sample each one (in seconds). The control allows two groupings of inlets: unknown and reference. The defined inlets are sampled sequentially with multiple unknown cycles allowed between a reference cycle. A short text description of the inlet can also be entered which is logged in the data file along with the valve number.

Figure 85 shows the gas manifold control for the Multi-port Inlet Unit. The user configures which inlet ports are being used and for how long the instrument should sample each one (in seconds). The ports are identified by a valve number ranging from 1 to 16 (if a valve is set to 0, the entry is ignored). The user can also input a short text description which is associated with the valve, saved in the data file, and displayed on the parameter window during the instrument run. The control allows two groupings of inlets: ‘unknown’ and ‘reference’. All defined inlets are sampled sequentially in their respective group. The user can decide how many cycles of the unknown group to sample before running a reference group. The user can also indicate whether to start with the reference group first.

The enable/disable toggle button allows the user to specify whether the unit is being used. If it is enabled, the valve numbers and text descriptions are added to the data file to allow the user to identify which sections of the data run are associated with a particular valve.
Figure 86: Selected columns from the data file showing the appended columns indicating active valve number and user description.

While the Multi-port Inlet Unit is operating, the current valve being sampled (and its text description) is shown on the MIU Setup Menu screen (see Figure 85). Figure 86 shows the data files associated with the MIU’s operation. And Figure 87 (below), shows the User Interface Control Bar with the Parameter Window indicating that the MIU is Enabled.

Figure 87: Parameter window showing the Multi-port Inlet Unit (MIU) is enabled.

The Multi-port Inlet Unit allows the user to sample multiple sources, including references, allowing for a more automated deployment. By sampling suitable references periodically during an ongoing data run, the user can post-correct the data for long-term drift when active calibration cannot be done.

NOTE: The control of the Multi-port Inlet Unit is unidirectional. The instrument does not receive feedback on the MIU state. If the MIU is enabled in the ‘Set Up’ panel, the data file will be tagged with MIU valve descriptions whether or not the MIU is properly connected, powered, etc; the data file simply logs the condition of the control signal to the MIU.

NOTE: The valves in the Multi-port Inlet Unit are normally closed with power off. However, upon instrument start-up, all the valves will receive an ‘open’ signal until the instrument software has properly booted and initiated the data collection. If pressurized tanks are connected to the instrument (such as reference tanks), there will be a short period of time (~ 1 to 2 minutes) where the tanks will be exposed to other inlet ports during this start-up time.
Appendix D: Warranty

Warranty Details

Each Los Gatos Research Inc. (LGR) instrument is warranted by LGR to be free from defects in material and workmanship; however, LGR’s sole obligation under this warranty shall be to repair or replace any part of the instrument which LGR’s examination discloses to have been defective in material or workmanship without charge and only under the following conditions, which are:

1. The defects are called to the attention of LGR in writing within one year after the shipping date of the instrument.

2. The instrument has not been maintained, repaired or altered by anyone was not approved by LGR.

3. The instrument 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 it is a distributor or direct customer of LGR or a distributor’s customer, packs and ships or delivers the instrument to LGR (at LGR’s main office in Mountain View, CA) within 30 days after LGR has received written notice of the defect. Unless other arrangements have been made in writing, transportation to LGR is at customer expense.

5. No-charge repair parts may be sent at LGR’s sole discretion to the purchaser for installation by purchaser.

6. LGR’s liability is limited to repair or replace any part of the instrument without charge if LGR’s examination discloses that part to have been defective in material or workmanship.

The laws of some locations may not allow the exclusion or limitation on implied warranties or on incidental or consequential damages, so the limitations herin 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 date the instrument shipped to a user who is a customer or eighteen months from the date of shipment to an LGR-authorized distributor, whichever is earlier.

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

LGR provides direct assistance in the use and application of all of its instruments through email, telephone, and if necessary, in person. Training and installation services are available anywhere in the world.

Please contact us 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 one of our sales representatives at sales@lgrinc.com 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 (if applicable)
- 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, LGR will pay the shipping charges on the return of the merchandise to the customer.

Contact Information

For questions regarding the operation of this instrument, please contact:

Los Gatos Research
67 East Evelyn Avenue, Suite 3
Mountain View, CA 94041

Phone: 650-965-7772
Fax: 650-965-7074
Sales: sales@lgrinc.com
Technical Support: support@lgrinc.com
Accessories and Optional Items

For prices and availability, please contact LGR (650-965-7772 or support@lgrinc.com).

Figure 88: Ultra-Portable GGA opened and (optional) Battery/DC Power Pack with Charger and Power Cable inside Portable Case.
Figure 89: AC-DC power supply (included).  Figure 90: External push-connect In-line filter (included).

Figure 91: Wireless User Interface with Apple iPad (optional).
Figure 92: Wireless User interface with Nexus7 tablet (optional).

Figure 93: Ultra-Portable GGA with field back pack (optional).
**Figure 94: Battery Hook-up Kit for Connection to Automobile Power or Lead-Acid Battery (optional).**

Automobile Hook-Up Kit. Cable connects to car cigarette lighter plug.

Lead-Acid Battery Hook-Up Cables

**Figure 95: External Filter Replacement Kit (optional).**

**Figure 96: Replacement Fuse for Automobile Power and Analyzer Fuse (optional).**

Replacement Fuse for Automobile cigarette lighter plug

Replacement Fuse for Analyzer
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