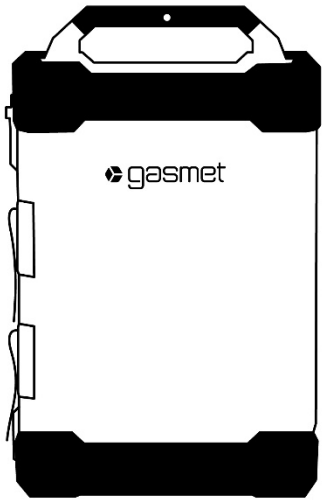
gasmet

A Nederman Company

GT6000 Mobilis FTIR Gas Analyzer



Instruction and Operating Manual

v.E.1.02

Warranty Statement

This warranty applies to the Gasmet brand name products sold with this warranty statement. This warranty is applicable in all countries and may be enforced in any country where Gasmet Technologies Oy or its subsidiaries or its authorized service providers offer warranty service subject to the terms and conditions set forth in this warranty statement. The warranty period varies by product, check the warranty period, if necessary.

Gasmet Technologies Oy and its subsidiaries guarantee that all products manufactured and sold by it are free of defects in materials and workmanship under normal use during the warranty period.

The products of Gasmet Technologies Oy and its subsidiaries are manufactured using new materials or new and used materials equivalent to new in performance and reliability. Spare parts may be new or equivalent to new.

Gasmet Technologies Oy and its subsidiaries agree to either replace or repair free of charge (Ex Works Vantaa, Incoterms 2020) any such defective product or part that is returned to its repair facility within one (1) year of the delivery date. All parts or products removed under this warranty become the property of Gasmet Technologies Oy or its subsidiaries. The replacement product or part takes on the warranty status of the removed product or part.

The warranty does not extend to any product from which the serial number has been removed or that has been damaged or rendered defective (a) as a result of accident, misuse, abuse, normal wear of components or other external causes; (b) by operation outside the usage parameters stated in the user documentation that is provided with the product; (c) by the use of parts not manufactured by Gasmet Technologies Oy and its subsidiaries; or (d) by modification or service by anyone other than Gasmet Technologies Oy and its subsidiaries.

Gasmet Technologies Oy and its subsidiaries are not liable for any damages caused by the product or the failure of the product to perform, including any loss of profits or savings, incidental damages, or consequential damages.

Recycling Information

At the end of the product's life cycle, we encourage you to recycle the product in accordance with best local recycling practices. Contact your local authorities for more information on recycling of your old product. You can also contact Gasmet Technologies Oy for advice (contact@gasmet.fi).

⚠ WARNING. READ BEFORE USING ANALYZER

To avoid possible electrical shock or personal injury, follow these guidelines:

- Use the analyzer only as specified in this manual or the analyzer could be irreversibly damaged.

- Do not use the analyzer or probe if they appear damaged, or if they operate incorrectly. If in doubt, have the analyzer serviced by trained service personnel.

- Always use the proper original Gasmet parts, and respect Gasmet suggested measurement conditions.

- Always use correct analyzer input voltage. Check the operating voltage on the analyzer, next to the power switch.

- Always use a proper earth ground under external AC/DC power supply unit use.

- Do not use the analyzer in EX rated areas.

- Do not drop or cause mechanical shock to the analyzer.

- The GT6000 Mobilis Instruction and Operating Manual should be read and understood before operating your unit.

SYMBOLS

~	**AC** (Alternating Current)		
⚠	**Important information, refer to manual**		**WEEE symbol** (Waste Electrical and Electronic Equipment Directive)
CE	**Conforms to European Union Directives**		**Canadian Standards Association**

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1. Introduction

GT6000 Mobilis is an FTIR gas analyzer designed for on-site measurements of inorganic and organic hot and wet gases in various applications such as short-term emission monitoring and combustion research.

This manual provides operation instructions for GT6000 Mobilis. Manuals for the Calcmet Easy and Calcmet Expert software as well as the PSS Base and Plus sampling systems complement this manual and are referred to in this manual.

Before starting to operate the GT6000 Mobilis gas analyzer, read this Instruction & Operating Manual carefully and thoroughly. Improper use of the analyzer may damage the equipment.

If you do not understand something or are unsure what to do, please do not hesitate to contact your local distributor or Gasmet Technologies Oy. The contact information is at the bottom of every page.

Please remember that measuring conditions should be non-condensing. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2. Technical data

SYSTEM SPECIFICATIONS

Measuring principle	Fourier transform infrared, FTIR	
Multigas capability	Simultaneous analysis of up to 50 gas compounds	
Response Time	Typically < 120 s	
Power supply	115 / 230 V / 50 -60 Hz **Power consumption:** Max. 300 W	
Analysis Software	Calcmet (Required operating system: Windows 10 / Windows 11)	
Data Connection	USB (HID), Ethernet, Bluetooth, WiFi Access Point and WiFi Station	
Sample pump	Recommended: Gasmet PSS Base or PSS Plus.	
Sample gas filtration	Minimum 2 µm particulate filtration. Recommended: Gasmet PSS Base or PSS Plus with standard filter.	
Gas fittings	**Sample in:**	6 mm Swagelok, stainless steel
	Sample out:	8 mm Swagelok, stainless steel
	Interferometer purge:	6 mm quick connect, stainless steel
Enclosure	**Dimensions:**	474 x 315 x 183 mm
	Material:	ABS PC
	IP class:	IP42
Weight	11.2 kg	
Product compliance	CE, UKCA	
Spectrometer	**Resolution:**	4/8 cm^{-1}
	Detector:	Thermoelectrically cooled MCT
	Beamsplitter:	Antireflection coated ZnSe
	Wave number range:	900 - 4 400 cm^{-1}
Sample cell	**Structure:**	Multi-pass, fixed path length 5.0 m
	Material:	100 % purity gold coated aluminum
	Mirrors:	100% purity gold coated metal mirrors with protection layers
	Volume:	0.5 liters
	Temperature:	50 °C or 180 °C

OPERATING AND STORAGE CONDITIONS	
Sample gas pressure	Ambient
Sample gas flow rate	Recommended: Gasmet PSS Base or PSS Plus with nominal flow of 4 l/min. If another sampling system is used, flow rate should be 2 – 8 l/min
Storage temperature	-20°C to 60°C, Non-condensing
Operating temperature	Long term -5 to 40 °C, short term -10 to 50 °C

PERFORMANCE SPECIFICATIONS	
Zero-point drift	< 2 % of measuring range per zero-point calibration interval
Sensitivity drift	None
Linearity deviation	< 2 % of measuring range
Temperature drift	< 2 % of measuring range across long term operating temperature range
Pressure influence	1 % change of measuring value for 1 % sample pressure change. Ambient pressure changes measured and compensated
Background measurement interval	24 hours, with nitrogen (5.0 or higher N_2 recommended)
Zero gas	Nitrogen (5.0 or higher purity)

3. List of Items Delivered for GT6000 Mobilis

The standard GT6000 Mobilis package includes the following parts:
> GT6000 Mobilis FTIR gas analyzer
> Power cable
> USB cable for GT6000 Mobilis
> Gasmet USB flash drive including software, manuals and other relevant documentation
> Insulator rings

The options available are:
> PSS Plus portable sampling system
> PSS Base portable sampling system
> PSP4000 portable sample probe with one PTFE filter
> Heated sample lines
> Heated sample probe tube

> Gasmet tablet
> Calcmet Expert License Key
> Ethernet cable for GT6000 Mobilis
> Transport case for GT6000 Mobilis

The following functions have been factory set up in accordance with customer order specification:

> Installation of software and analysis options in Calcmet software on the Gasmet tablet.
> Configuration of Bluetooth connection on the Gasmet tablet.
> Library and analysis options in Calcmet library if the Gasmet tablet is not ordered.

4. Installation

This chapter describes the requirements and safety precautions considering installation and installation location. When using the analyzer for the first time, perform the analyzer inspection described below.

During installation of the analyzer, the safety of any system incorporating the equipment is the responsibility of the assembler of the system.

4.1. Analyzer Inspection

The analyzer must be inspected within 30 days from the date of delivery, to ensure that the warranty is valid in full. If you noticed that something is missing or the analyzer is damaged during transportation, please contact the nearest distributor or Gasmet Technologies Oy. Before you make this inspection, it is recommended to read this manual, especially chapter 5.

1. Check the condition of the shipping box.
2. Check that no items listed in Chapter *List of Items Delivered* are missing.
3. Check visually that the analyzer's enclosure is undamaged.
4. Check that the product power supply specification and available power supply are matching. Switch the analyzer power on. Follow instructions in chapter 5.
5. Connect the analyzer to PC. Follow instructions in chapter 5.
6. Connect a sample line from PSS to *Sample In.* Follow instructions in chapter 5.
7. Verify that the analyzer is warmed up before activating the measurement and PSS

Wait before the analyzer has reached the stable operating conditions. Measure hardware status. Observe that Status is showing OK. Otherwise wait for the analyzer to fully warm up and stabilize and repeat the hardware status measurement.

4.2. Lifting and carrying instructions

When operating the analyzer, place the analyzer in horizontal position (Figure 1) front panel facing the user. Carry the analyzer from the handle. Do not use any carrying equipment that is not approved by Gasmet.

Figure 1. Correct operating position for GT6000 Mobilis.

4.3. Storage and Packaging Conditions

The analyzer must be stored in a dry and condensation-free place. Gasmet original package or optionally GT6000 Mobilis transport case must be used to store the equipment.
The following storage conditions should be respected:

- -20 - +60 °C storage temperature
- 5 - 95 % relative humidity, non-condensing

Do not drop the analyzer even when stored in its original package or in its transport case.

Keep the box and packaging materials in case the unit needs to be returned for service.

4.4. Safety precautions

4.4.1. Installation Location

The analyzer must be installed and operated in a dry and condensation-free place. The environment should be clean enough so that no dirt will accumulate on or inside of analyzer.

The installation location must be preferably free of strong vibrations. Shocks during transport, for example, can cause serious damage. When transporting the instrument, use the original box or transport case with original shock absorbing materials.

Avoid using the equipment in wet conditions. Limited water proofing to IP42 conditions horizontal operating position (Figure 1) when power entry cover is attached. Note that the IP rating is not applicable in other positions, e.g., the carrying position.

The socket outlet to which the power cable is connected shall be in vicinity of the equipment and easily reachable.

4.4.2. Sample Gas Supply

The sampling system is as crucial to the success of the measurement as the analyzer itself is. With GT6000 Mobilis, the use of Gasmet PSS Base or PSS Plus is recommended. If Gasmet PSS Base or Plus is not available to be used as preferred sampling system, please observe the following:

1. Use proper sampling system. Most installations require heated sample lines, heated sample filters, and a heated sample pump. Some installations require special sample line materials, stainless steel for example, to avoid adsorption of specific components.
2. During operation, keep gas flow constant. Maximum recommended flow rate is 4 l/min. If the gas flow is high, a considerable backpressure builds up in the sample cell due to flow resistance. This may lead to significant measuring errors.
3. Heated sample lines must be used to prevent condensation as well as to ensure sample temperature uniformity to minimize error. If condensation is expected in the sample gas line, install a condensate separator at the lowest point of the line. The analyzer will be damaged if condensation enters or occurs inside the sample cell.
4. Sample gas and zero gas must be at the same temperature as the analyzer's sample gas cell.
5. Install an external dust filter (two microns) if the sample gas contains particles. A heated sample filter is obligatory if the sample gas contains condensable components.
6. Extremely reactive gases in high concentrations (for example, chlorine gas c(Cl_2) > 5 %), solid particles, and condensate must never be introduced in the gas cell.
7. For sampling and sample conditioning, the Gasmet PSS Base or Plus is the easiest solution as it automatically does everything needed, so you do not need to worry about the setup. The pump of PSS will not start if the complete system sample train temperatures are not high enough. In case of a generic sampling system, the sample gas pump should be switched off until the gas analyzer has reached stable operation condition. Sample cell should never be in contact with sample gas unless the analyzer has reached stable operation conditions. User must ensure that all necessary gas supply lines are connected and the operating temperature of all parts (heated lines, sampling systems, and analyzer) is reached.
8. If measurements are performed in a closed sample gas cycle without PSS Base or PSS Plus, a sample cell with internal pressure measurement is used.
9. During background measurement, zero gas must be flowed into the sample cell. Like the sample gas, the zero gas should flow through the sampling system before it reaches the analyzer.
10. All the sample gas and zero gas valves should be controlled by the control outputs.
11. The sample cell must be empty of the sample gas when the power is off. Always purge the sample cell with dry N_2 gas before switching the power off.

4.4.3. Ventilation Requirements

Care should be taken in order to ensure a free convection airflow around the GT6000 Mobilis and avoid fan obstruction in operation. Do not block fans air circulation. This would decrease life expectancy of most of the internal components.

4.4.4. Protective Earthing Instructions

Precautions should be taken so that the protective earthing scheme on the analyzer is not defeated.

⚠ **Never connect the power cord to an AC mains socket that has no protective earth. Use only certified Power Supply Cord.**

4.4.5. Power supply

The analyzer must be connected to a power source with the correct AC voltage. Do not use with an extension cord or receptacle unless all three blades can be fully inserted to prevent blade exposure. Always use correct analyzer input voltage. Check the operating voltage on the analyzer, next to the power switch. The operating voltage of the analyzer has two options: 115V and 230V and can be changed by the user. Find more information in chapter 7.2.

Use an uninterruptible power supply (UPS) if the electric power is subject to major disturbances or power failures.

All cautions and warnings on the equipment must be noted. If the equipment is not in use for a long time, disconnect it from the mains to avoid damage from transient over-voltage.

⚠ **Please make sure that before connecting the power cord to the analyzer the power switch is in off position.**

⚠ **Avoid using the equipment in wet conditions. Limited water resistance in horizontal orientation, according to IP42 conditions.**

⚠ **The power cord should be routed so that it is unlikely that it will be damaged. If the power cord is damaged, DO NOT OPERATE THE UNIT!**

4.4.6. Sound Level

The highest sound pressure level of the analyzer has been measured at a point 1 m from the enclosure of the equipment.The maximum sound level is 50 dBA. Many authorities consider sound level created by the GT6000 Mobilis as below hazard threshold. Special means, such as the use of protective earpieces, can decrease the sound level for the operator.

4.4.7. Explosion Protection

⚠ **For your own safety, the equipment must not be used in hazardous areas (EX-rated areas).** The standard enclosure is not explosion proof. The equipment should not be used to measure explosive gas mixtures or gases that might form an explosive gas mixture with the ambient air.

Gasmet Technologies Oy assumes no responsibility if GT6000 Mobilis is used in hazardous areas.

5. Setup and operation

This chapter provides instructions to software installation, setup of software and analyzer, and basic operation of the analyzer. Please refer to Calcmet Easy and Calcmet Expert manuals for further instructions on the use and features of the software.

5.1. Quick Tablet Guide

Refer to Windows 10 / Windows 11 user guide for further instructions. Below are some tips regarding the use of the tablet:

- Turn on the device: Press the power button for few seconds to turn on your device.
- Turn off the device: Press the power button for a few seconds and slide down with your finger to turn off.
- Entering the Suspend Mode: Your device automatically suspends after a period of inactivity. To manually suspend the device, briefly press the power button.
- To access software functions requiring the use of right-click, press the screen for a few seconds.

5.2. Software installation and setup

Calcmet installation file is located on USB Flash drive supplied with the analyzer. If you have purchased optional tablet, Calcmet software has already been installed and the Bluetooth connection is already configured.

C++ redistributable packages are required to be installed before installing Calcmet Software. Redistributable packages are available in the same folder where Calcmet installer package resides.

Files	Calcmet version	Description
vcredistx86_2010.exe	32-bit (32-bit Windows)	Visual C++2010 Redistributable Package
vcredist_x64_2010.exe	64-bit (64-bit Windows)	Visual C++2010 Redistributable Package
vcredist_x86_2015.exe	32-bit (32-bit Windows)	Visual C++2015 Redistributable Package
vcredist_x64_2015.exe	64-bit (64-bit Windows)	Visual C++2015 Redistributable Package

Table 1. C++ redistributable packages required for Calcmet installation.

It is recommended that the program would be installed to its default location in **C:\Gasmet Technologies\Calcmet** directory. The software works on other directories too, but the demo library settings will not work, as they need the files to be located in these specific folders.

- It is not recommended to install Calcmet under program files at all, as administrator privileges are required to write to program files, which may cause issues.

To install Calcmet to your PC, run the Calcmet installer package from your Calcmet software. You may also optionally create the folders listed in Table 2 to your hard disk, although they are created during the install or when the directory is first required once the software is running.

C:\CalcmetLibrary\	recommended folder for reference spectra
C:\CalcmetDemoLib\	recommended folder for demo libraries
C:\CalcmetSamples\	recommended folder for sample spectra and residuals
C:\CalcmetResults\	recommended folder for analysis results
C:\CalcmetBackgrounds\	recommended folder for background spectra
C:\CalcmetLog\	recommended folder for log files

Table 2. Folders for Calcmet software.

After the setup procedure, you should have the files listed in Table 3 in **C:\Gasmet Technologies\Calcmet** directory.

Windows 10 32-bit	**Windows 10 / Windows 11 64-bit**	**Description**
Calcmet.exe	Calcmet.exe	The executable main program file
LibFT260.dll	LibFT260-64.dll	Application extension file
hasp_windows_82882.dll	hasp_windows_x64_82882.dll	Application extension file
ftd2xx.dll	ftd2xx.dll	Application extension file
Calcmet.MET	Calcmet.MET	Preset analysis method definitions
CalibrationInfo.dat	CalibrationInfo.dat	Latest calibration information (example)
CALCMET.BKGX	CALCMET.BKGX	Latest background (example)
Version history.txt	Version history.txt	Version information text file

Table 3. List of files after Calcmet setup.

Once the files have been installed, it will still be necessary to set the reference spectrum libraries (calibrations), and other settings to make the measurements and analysis. Refer to the later chapters of this manual for description on setting all the analysis and measuring parameters.

The installation also includes the default library and some demo libraries tailored for different applications. These are for demonstration and training purposes only and should not be used for analyzing any real measurements.

All the demo library files can be found in **C:\CalcmetDemoLib** and the reference spectra for the demo libraries are situated in respective sub folders under the same path. During software installation setup the user can choose not to install the demo libraries, if desired.

An optional compiled html help file (**Calcmet.chm**) on the Calcmet program features can also be dropped into the installation folder for quick reference. The in-program help is accessible from the ‘F1’ key or by clicking help menu option.

5.2.1. Installing calibration files

Optionally there can be analyzer specific calibrations supplied with the analyzer. To use the calibrations, copy the folder including the reference spectra and the .CLIB file under the C:/ from Gasmet USB.

If the reference spectrum files (*.REFX) and library files (*.CLIB) were copied from the Gasmet USB, it may be that the files are write protected. To later make any changes to settings, it will be necessary to deactivate write protection from these files. This can be done by opening the file properties of all these files and unchecking the “Read-Only” option.

5.2.2. Calcmet Software Configuration

When the Calcmet software starts, a welcome window “Welcome to Calcmet” appears. You can select the communication mode and the corresponding settings. Click “OK”.
If you have a Calcmet Expert License Key, insert it now.

5.3. Connecting sample lines

There are three gas inlet/outlet fittings, all on the same side of the GT6000 Mobilis. Connect sample inlet tubing to the Sample in, sample outlet line (at least a 10 cm sample line) to Sample out and possible purge gas to the Purge air inlet.

To connect a line to the Purge air quick connect fitting, make sure that the collar is pressed in before inserting the line. The line is properly connected when the collar releases from the pressed in state. To disconnect, release the line by pressing the collar of the fitting and pull the tube gently out.

To connect a line to the Swagelok fittings, make sure that your line has the right size Swagelok fittings, and screw it in place. Secure the line in place with the strap in the line holder. Place insulator rings around the fitting to prevent cold spots. For reference, see Figure 2.

Figure 2. Connecting heated lines to the analyzer.

Use heated sample lines for sample entering the analyzer. To prevent condensate entering the analyzer at sample outlet, connect a sample line to the Sample out-port, and point it downwards, to prevent the flow of possible condensate into the analyzer. Condensed sample can ruin the sample cell!

If you are measuring gases that are potentially harmful, irritating or toxic, use a sufficiently long sample line to conduct the outlet gases away from you, while making sure that long sample out lines or possible exhaust system does not affect sample cell pressure.
Sample cell pressures that differ from ambient pressure can affect measuring results and damage the analyzer.

The heated lines may emit odor and/or visible fumes during the first heating to full temperature. The first heating needs to be performed in a well-ventilated area or outside to minimize exposure to the fumes.

Note that the gas fittings are hot when analyzer is warming up, operated and cooling down.

5.4. Startup and connecting to PC/tablet

Connecting to analyzer can be divided into two parts. One relates to configuration of laptop/tablet and other relates to configuration of the analyzer. In this section, only settings for the laptop/tablet are discussed. In order to make changes in the configuration for the analyzer, please refer to Calcmet Easy manual. If optional tablet is purchased with the analyzer, Bluetooth is already paired, and settings can be found in *Configuration* menu. Default settings for each mode can be found in Table 4.

Mode		Configuration Mode	Default settings
Cable mode	HID	USB	Baud rate: 115200
	Ethernet	TCP/IP	IP address: 192.168.64.64 Port: 23
Wireless mode	Bluetooth	Bluetooth	Baud rate: 115200
	Wi-Fi station	TCP/IP	IP address: 192.168.64.64 Port: 8080
	Wi-Fi access point	TCP/IP	IP address: 192.168.64.64 Port: 8080 SSID: Gasmet_SNxxxxx Pre-shared key: password64

Table 4. Communication settings.

5.4.1. Cable mode

5.4.1.1. USB

To operate the analyzer via USB connection, switch the analyzer to cable mode from front panel, connect analyzer and laptop/tablet via USB cable and select *USB* as connection mode in *Configuration* dialog. Baud rate to be used is 115200.

5.4.1.2. Ethernet

To be able to use the analyzer with ethernet interface, your laptop/tablet needs to be connected in the same subnetwork. This does not necessarily mean that your device and the analyzer must be used in the same place: the concept of subnetwork is not physical. There are usually multiple ways to do it ranging from connecting the analyzer directly with the cable or having a cable/Wi-Fi connection to your router, to having a mobile VPN connection from another country. How to access the same sub network is totally dependent on your network topology. Contact your network administrator for assistance.

To operate the analyzer via Ethernet connection, switch the analyzer to cable mode, connect analyzer and laptop/tablet via Ethernet cable or other network, and select *TCP/IP* as connection mode in *Configuration* dialog. Enter IP address of the analyzer and use port 23. Default IP address is 192.168.64.64.

5.4.2. Wireless connections

5.4.2.1. Wi-Fi Station

In Wi-Fi Station mode, the analyzer is connected to an existing wireless network such as office *Wi-Fi*. To be able to use Calcmet with the analyzer like this, your laptop/tablet needs be connected in the same subnetwork. This does not necessarily mean that your device and the analyzer must be used in the same place: the concept of subnetwork is not physical. There are usually multiple ways to do it ranging from connecting directly to the same Wi-Fi access point, or having a cable connection to your router, to having a mobile VPN connection from another country. How to access the same subnetwork is totally dependent on your network topology. Contact your network administrator for assistance.

To be able to use this communication method, the analyzer needs to be configured first for it to be able to connect to the Wi-Fi network. The configuration is done with Calcmet by using USB cable as communication method. In Calcmet, access analyzer settings from *Analyzer setup* menu item. Configure the analyzer by setting SSID, pre-shared key, subnet mask, default gateway and static IP address according to your network administrator. Details for configuring this can be found in Calcmet Easy user manual. Once analyzer is configured, turn the knob to Wi-Fi station option. In *Configuration* dialog, choose TCP/IP mode and enter the static IP in the settings. Port for this option is 8080.

5.4.2.2. Wi-Fi Access Point

In this mode, the analyzer is configured as a *Wi-Fi Access Point*, which means that the analyzer creates its own Wi-Fi network around it that other devices can detect and connect to. This communication mode is convenient when there's no existing Wi-Fi network in the working area for the analyzer to connect to.

To use the analyzer in this mode, turn the knob on the analyzer to Wi-Fi access point option. On the laptop/tablet, analyzer can be found in available wireless networks similar to any other Wi-Fi network. For example, if analyzer's serial number is 12345, SSID visible in available networks would be Gasmet_SN12345. Default password is password64. Connect to this Wi-Fi access point from laptop/tablet. In the *Configuration* dialog, select TCP/IP mode and enter IP address and port number. Default IP address is 192.168.64.64 and port is 8080.

5.4.2.3. Bluetooth

When wireless communication is preferred, using Bluetooth is a good choice. One advantage over Wi-Fi Access point is that if laptop/Bluetooth has only one Wi-Fi adapter, it can be used for other purposes such as connecting to the internet. On the other hand, Bluetooth does require device pairing the first time it is used, while Wi-Fi methods do not.

If laptop/tablet and analyzer are already paired via Bluetooth, *Mode* can be selected to Bluetooth in Calcmet's *Configuration* dialog and analyzer's Bluetooth address can be entered. This address can be found from Windows Control Panel's 'Device and Printers' option. Right click on paired Gasmet device and select 'Properties'. Navigate to the tab 'Bluetooth' and write down the 'Unique identifier', twelve hexadecimal digits. This is the analyzer's Bluetooth address based on which Calcmet will find the correct analyzer. Baud rate to be used for this option is 115200.

If they are not already paired, instructions about how to pair are explained in Calcmet Easy user manual. As pairing needs exchange of randomly generated six digits number, that is possible using *Analyzer Setup* options only.

For Windows 11, if Gasmet device is not discoverable, under 'Bluetooth and Devices', go to Device Settings > Bluetooth devices discovery, and change default to 'Advanced' (Figure 3).

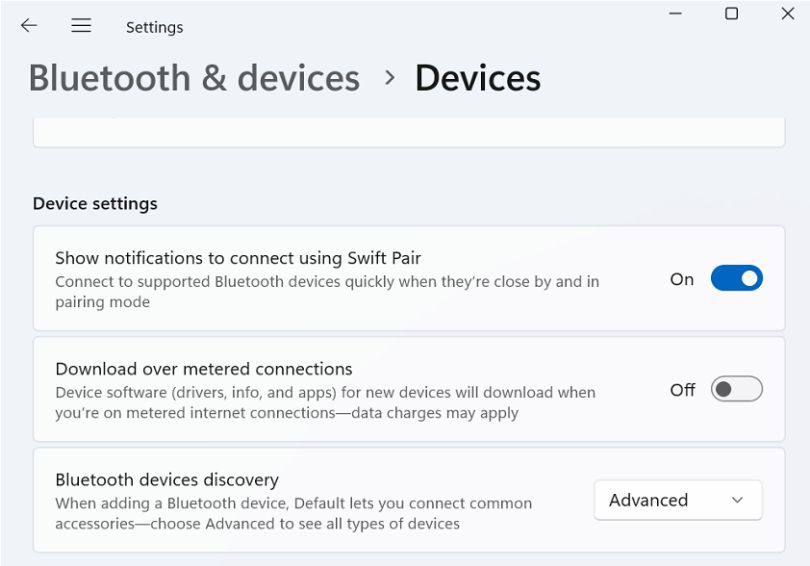


Figure 3. Change Bluetooth devices discovery to Advanced in order to make Gasmet device discoverable

5.4.3. Remote use

Calcmet Easy can be utilized to operate the analyzer remotely. For this purpose, *Wi-Fi station* or *Ethernet* options can be used. Make sure both devices are in the same network.

5.5. Calcmet setup

This chapter lists the most important settings in Calcmet Easy. For further information, see Calcmet Easy manual.

5.5.1. Autosaving

Select *Autosave* in the menu. Select which files are saved and where. It is recommended to save both the results and the sample spectra. Sample spectra can be re-analyzed later if needed as the original raw data is stored, whereas result files only contain the results of the initial analysis. Make sure that data is being saved before starting the measurements.

5.5.2. Selecting measuring times

Select *Measuring Times* to configure flush time, pump time, sampling time and measuring interval for continuous measurements.

5.5.3. Selecting the application

Select and load the application by clicking *Select Application* in the menu.

5.5.4. Selecting the measured components and their settings

If necessary, edit the analysis settings by selecting *Edit Application* in the menu.

5.6. Hardware status

Before making the background measurement, ensure that the analyzer has been powered up for at least 45 minutes if used at room temperature. Warm-up time increases by 15 minutes per each temperature decrease of 20 °C from room temperature. At the end of this warm-up time, measure the hardware status by selecting *Hardware.* Hardware status measurement will be taken and a dialog with list of hardware parameters, their values and units will be displayed. If “OK” is displayed for the “Status” in the list, it means all the parameters are within the normal range and analyzer is ready for measurements. If it shows “Not OK”, it means some parameters are out of defined limits for normal functioning and measurements taken will not be valid. If the problem persists, service should be contacted in this case to fix the issues. At the same time, “Details” button will appear in the dialog that can be clicked to view the details of the issues as shown in Figure 4.

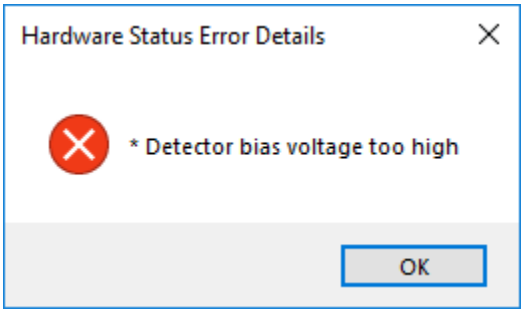


Figure 4. Hardware status error details

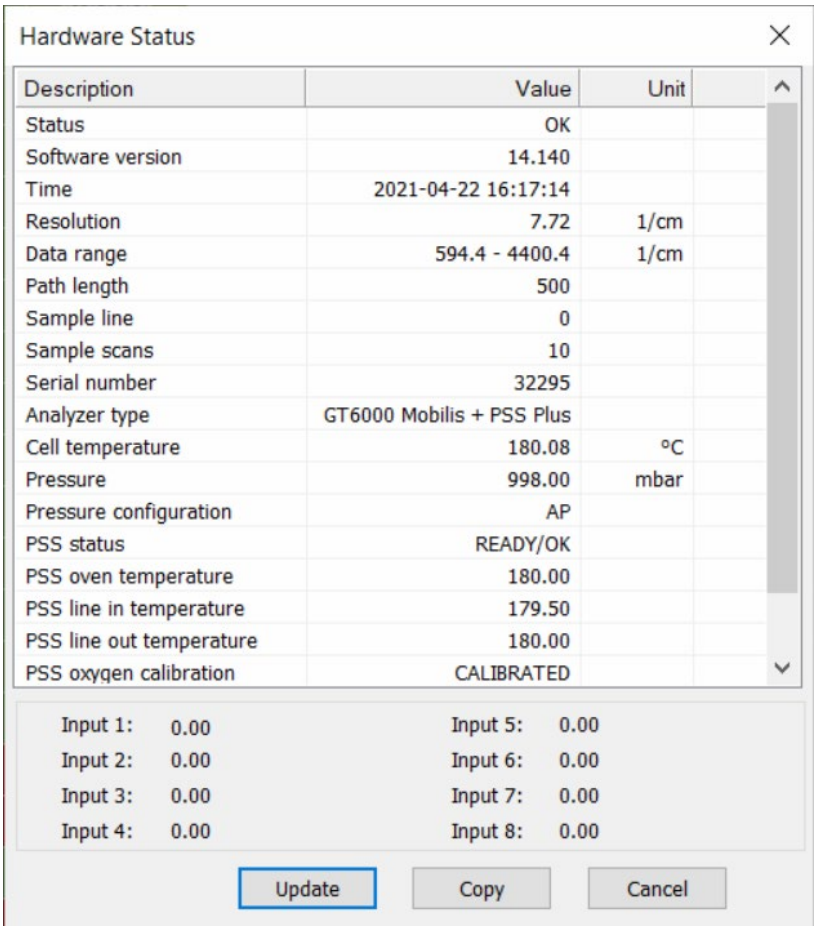


Figure 5. Hardware status. If "Not OK" Details button is displayed

5.7. Interferometer purge

Connect zero gas to purge inlet of the analyzer and adjust the flow to approximately 0.5 l/min in order to purge interferometer.Unless permanent purge is used, it is recommended start purging latest when starting to stabilize the analyzer. Only N_2 or dry and clean instrument air should be used to purge the analyzer. GT6000 Mobilis interferometer enclosure is tight and will hold majority of the purge gas in the interferometer for hours. If you are performing high accuracy measurements, continuous purge is required.
When measuring in the field while the interferometer is filled with purge gas, it is recommended to fill the interferometer again after 12 hours. Background measurement is recommended to be done as close to the measurements as possible.

If the interferometer is not filled with purge gas periodically when measuring, purge gas will eventually leak out.

5.8. Background measurement

Perform a background measurement with nitrogen every day before measurements. Good background is required to obtain accurate analysis results.

Connect nitrogen supply to your PSS Base or Plus. When using a nitrogen bottle, use a regulator. Check PSS Base and Plus manual for full instructions.

If you are not using a sampling system, connect the nitrogen supply directly to analyzer Sample In. use regulator and flow controller.

5.0 purity nitrogen should be used for the background measurement. Adjust the flow to approximately 2 l/min. Wait for 5 minutes to be certain that the sample cell is completely flushed with nitrogen. Click *Background* in Calcmet Easy top banner to start the background measurement. When you do a background measurement, the view will automatically change to the Background view. If background is successfully measured, “Background OK” -message is displayed in the bottom banner.

The default measurement time for the background measurement is 3 minutes. The background measurement time can be changed in the Calcmet Expert, see Calcmet Expert manual for instructions.
The background spectrum is used in following measurements of sample gas as the reference level of signal strength at various wavelengths. Measuring a new background spectrum constitutes the zero calibration of the gas analyzer and is the only calibration required for operation. You are now ready to start sample measurements.

5.9. Measurement and results

This chapter gives brief instructions on how to do measurements using the Calcmet Easy software. For further instructions on the use of Calcmet Easy, please refer to the Calcmet Easy user manual. For the use of Calcmet Expert, refer to Calcmet Expert user manual.

5.9.1. Starting a measurement

Do a single 5 s or 60 s measurement by clicking the respective icons. Start a continuous measurement by clicking *Continuous*. Stop the measurement by clicking *Stop*. You can configure the measurement time from the menu by selecting *Measuring Times*.

5.9.2. Looking at the results

In Calcmet Easy there are five different views that you can use to visualize the results. You can change the view from the arrows in the top right corner. Look at the top left corner to see which view you are in.

5.9.2.1. Results View

Look at the results view to see the concentrations of the components in the sample gas. You can see the used ranges for each component in the column *Range*. The ranges can be modified for each

component by selecting *Edit Application* in the menu, and then selecting the desired component and clicking *Measuring Ranges*.

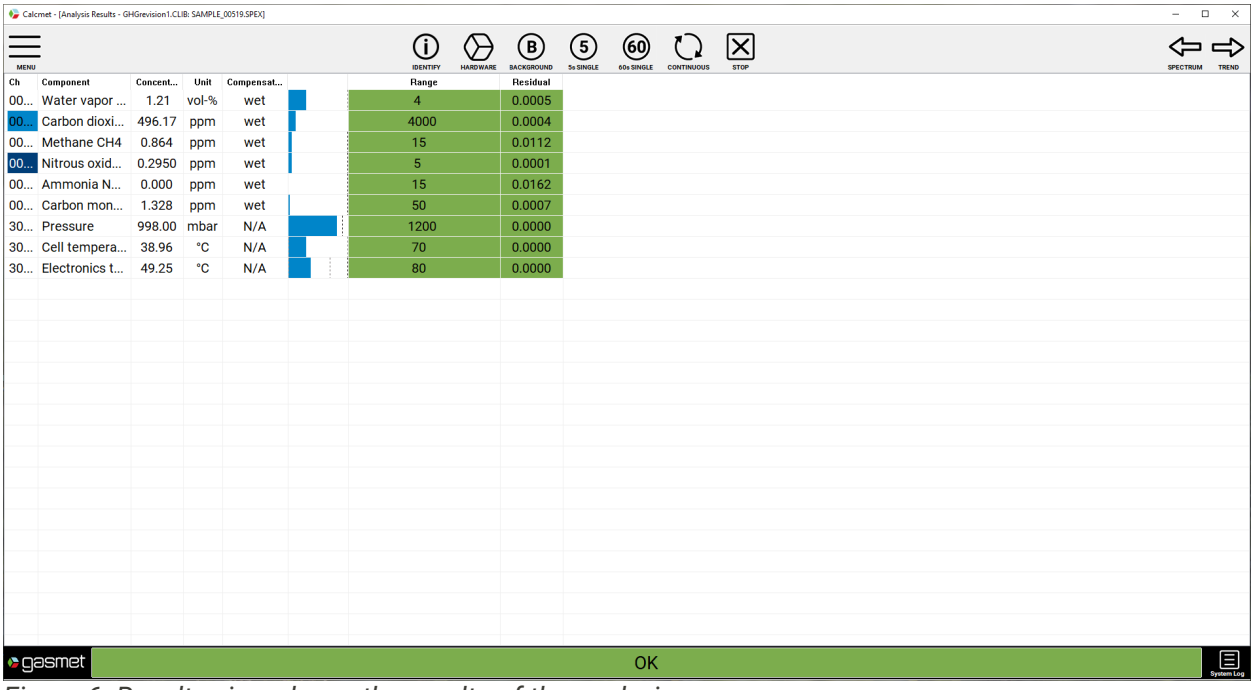


Figure 6. Results view shows the results of the analysis.

Residual-column shows the difference between the sample spectrum and the calculated model spectrum in absorption units. If the residual value is too high, a warning will appear. High residual values can indicate the presence of an unknown component.

You can hide columns by right clicking a column (or pressing for few seconds, if you are using a touchscreen device) and unticking the columns you want to hide.

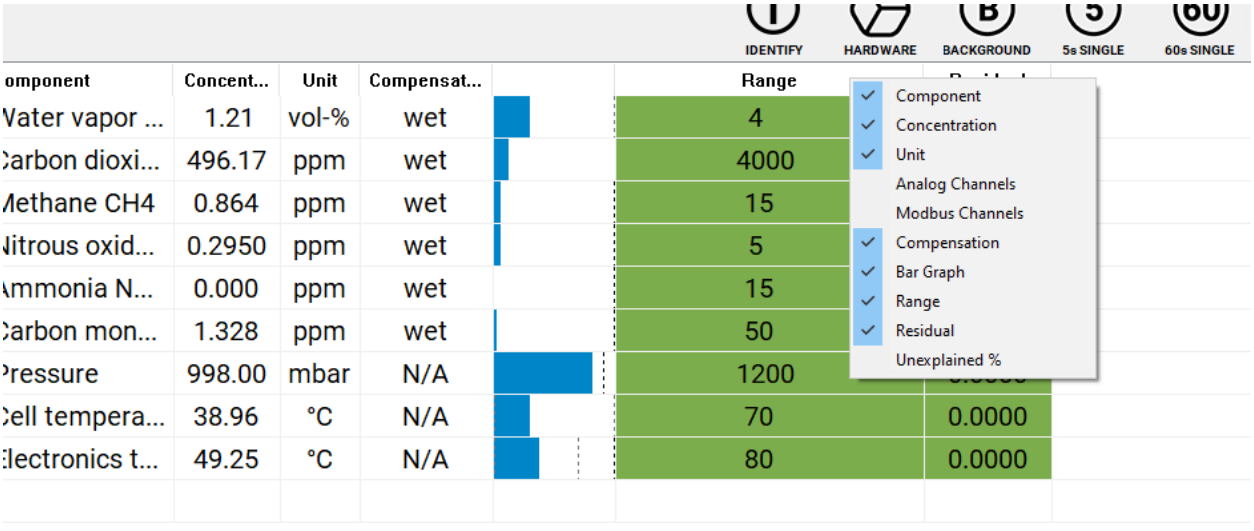


Figure 7. In results view columns can be hidden or displayed by right-clicking the column header.

You can hide a component by right-clicking it (or pressing for few seconds, if you are using a touchscreen device) and selecting *Do not display*. Hidden components will still be included in the analysis.

Figure 8. In results view components can be hidden or displayed by right-clicking the component.

5.9.2.2. Spectrum View

In the spectrum view, you can see the sample spectrum. This is the default view displayed when you open Calcmet Easy. X-axis shows the wavenumber and y-axis the absorbance.
Zoom in by dragging the desired area in the spectrum. Zoom out with a right click (or by pressing few seconds, if using a touchscreen device), or by using the toolbar on the right.

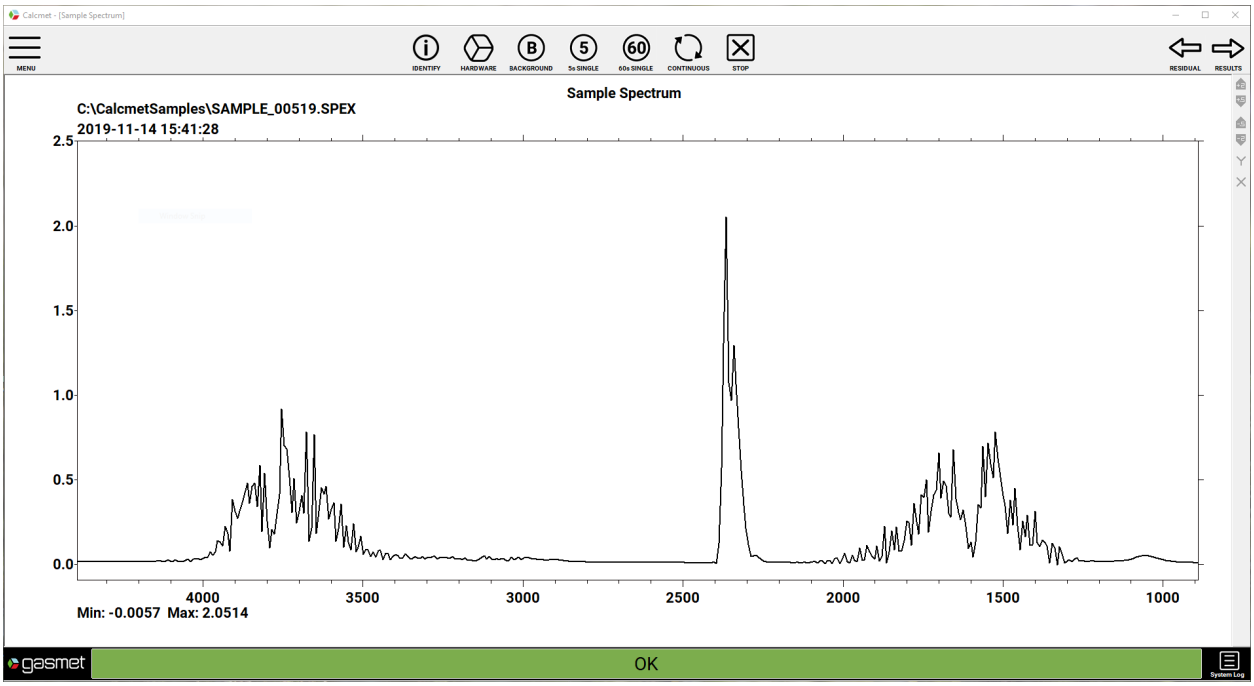


Figure 9. Spectrum view shows the measured/loaded sample spectrum. Zooming buttons are located on the right.

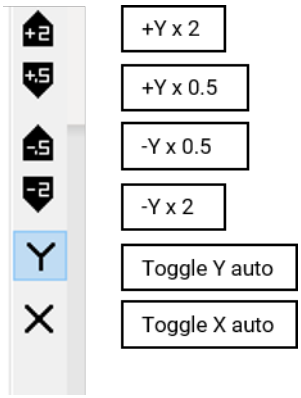


Figure 10. Zooming toolbar allows you to zoom the sample spectrum.

5.9.2.3. Residual View

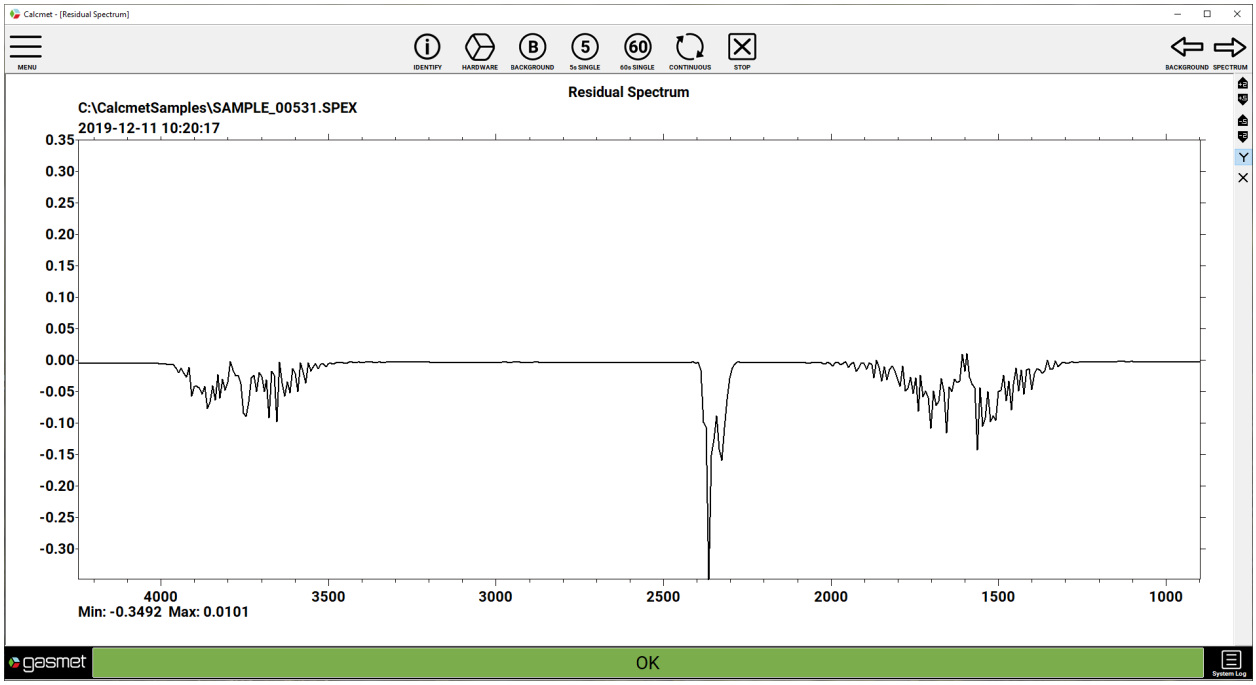


Figure 11. Residual view shows the residual spectrum. Zooming buttons are located on the right.

Residual view shows the difference between the sample spectrum and the calculated model spectrum as a spectrum.

5.9.2.4. Trend View

Trend view shows the change of the concentration of chosen components as functions of time. You make the components visible in the trend view in the Results view by clicking the respective number in the first column.

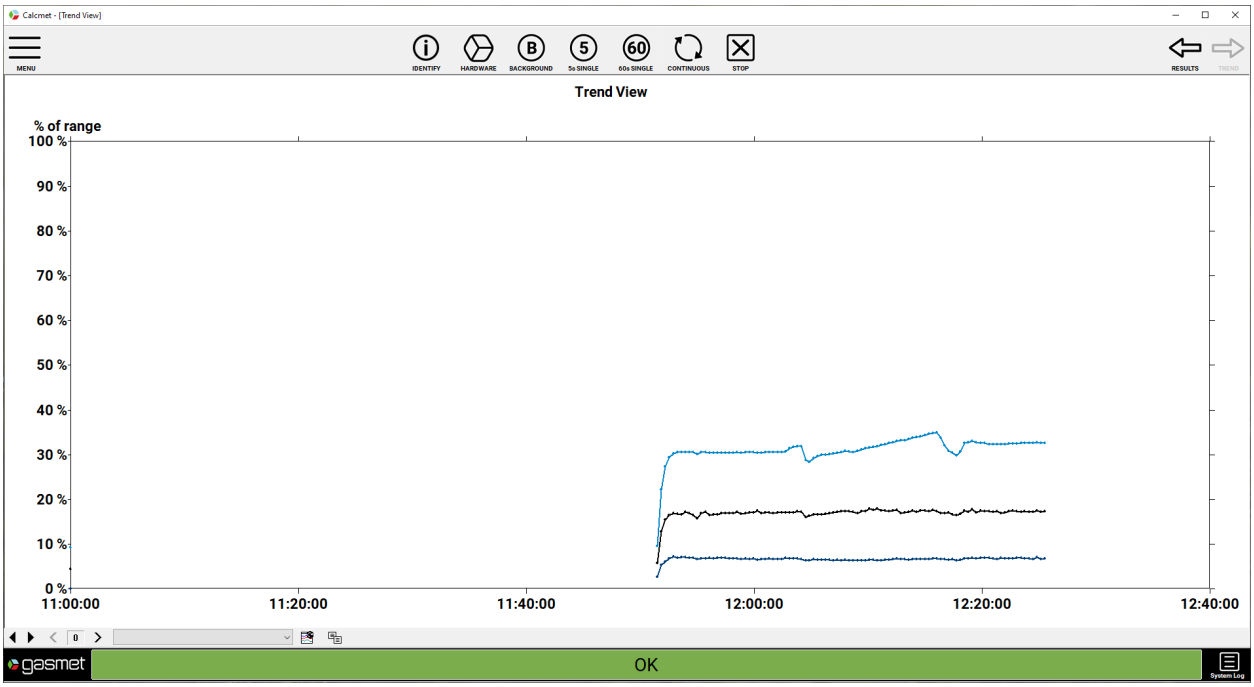


Figure 12. Trend view shows the concentration of selected components as a function of time.

Ch	Component	Concent...	Unit	Compensat...		Range	Residual
1	Water vapor ...	0.00	vol-%	wet		30	0.0000
2	Carbon dioxi...	0.00	vol-%	wet		20	0.0000
3	Carbon mon...	0.00	ppm	wet		100	0.0000
4	Methane CH4	0.00	ppm	wet		100	0.0000
5	Nitrous oxide...	0.00	ppm	wet		100	0.0000

Figure 13. Components can be selected to be shown in the trend view by clicking the number of the component. The color in the first column indicates the component depicted in the trend view as well as the color representing it.

5.9.2.5. Opening and reanalyzing spectrum files

You can open previously measured spectra either by selecting *Load Spectrum* from the menu, or by dragging the spectrum file to Calcmet. You can also reanalyze the loaded spectrum by editing the analysis settings.

5.10. Stopping the measurement

Flush the analyzer with nitrogen, instrument air or clean ambient air until the analysis result show that no sample gas remains in the analyzer. Stop the measurement by clicking Stop. Switch the analyzer off by turning the power switch to OFF-position.

Disconnect the equipment from AC outlet before cleaning the enclosure. Check the probe filter and replace it if necessary. If there is dirt on the analyzer enclosure, use a soft cloth to wipe it off.

6. Analyzer safety and maintenance

This chapter describes the maintenance plan and instructions for the maintenance. Proper handling and damage prevention are also explained. Read these instructions carefully to keep your analyzer in good condition.

6.1. Damage prevention

Improper handling of any components inside the analyzer may damage it. Thus, adjustment of any components inside the analyzer voids the warranty. Any service operations that require opening the case of the analyzer should be performed only by a trained service personnel. The case should only be opened when the analyzer is turned off, AC power cord and the gas lines are disconnected/removed.

The user should pay attention to the following points:

> Every time after the measurements, the sample cell should be carefully flushed with nitrogen gas or dry instrument air. If corrosive gases remain in the sample cell, the optics inside the sample cell will be damaged. Measuring strongly acidic or caustic gases will irreversibly damage the sample cell. Moreover, immediately after sample gas measurements, pump ambient air through the entire system (including probe and sample lines), at least for 10 minutes, until concentrations have gone back down. After ambient air flushing, flush the analyzer and PSS with dry gas (instrument air or nitrogen) for 5 minutes. Inadequate flushing can result in damage to the system. A careful flushing routine is especially important after measuring wet and corrosive gases.

> If the sample gas contains solid particles, it should be filtered before introducing it into the sample cell. Regularly check the sample and probe filters you use and replace them when necessary to prevent particulates entering the sample cell. If it is not filtered, dirt will accumulate in the sample cell and lower the quality of the measurements. Any liquid droplets or aerosols inside the gas cell may destroy sample cell mirrors or optical windows.

> After power has been switched off for a longer period or the unit is used in extremely humid ambient conditions, it is recommended to purge the interferometer and sample cell with dry nitrogen gas to avoid condensation on optical components.

> The pressure and temperature of the sample gas should always be kept as stable as possible. However, the gas entering the sample cell should already be as close as possible to the sample cell temperature.

> In case of overpressure in the stack, probe must be out of stack when measuring background. Overpressure can cause the sample gas to flow into the measuring system, considerably decreasing the background quality.

> Intensive shocks may damage the analyzer. Be always very careful when you move or transport the instrument.

> Use a soft cloth to wipe off the dirt on the case. Do not use strong detergents or acetone.

> Never replace Gasmet Power supply cord by an inadequately rated cord.

6.2. Maintaining the analyzer

6.2.1. Maintenance plan

To keep your analyzer in optimal condition, maintenance is recommended at certain intervals. Recommended maintenance and intervals are defined in Table 5. After maintenance, the analyzer is visually inspected and correct operation is ensured.

Maintenance interval	Maintenance work
After every use	Disconnect the equipment from AC outlet before cleaning the enclosure. Check the probe and sampling system filters and replace it if necessary. Read the instructions given below.
1 month	Visual inspection (according to the instructions given below).
Approximately 12 months	Annual service: analyzer inspection, cleaning, mirror drive service, and water calibration (performed by trained service personnel).

Table 5. Maintenance intervals for GT6000 Mobilis.

6.2.2. Visual Inspection

When you make the visual inspection, check that:

- Analyzer cover is somewhat clean and unharmed.
- Front panel, gas fittings, connectors are in good condition.
- Sample gas flow is correct: when PSS pump is on, you can feel a gas flow from the sample outlet. (Caution: outlet gas is hot)

6.2.3. Sample Cell Inspection

The sample cell inspection can be made for all types of sample cells. Only a trained service personnel may perform sample cell inspection. The operation includes following procedures:

> Sample cell optical window check.
> Sample cell mirror inspection.
> Water calibration.
> Operational test.

6.2.4. Replacing ventilation filter

The ventilation filter is located on the backside (**not** below the front panel) of the unit. To change the filter, see Figure 14. Use a 2 mm hex key. Be careful to not overtighten the screws to prevent damage.

1.

2.

Figure 14. Replacing the ventilation filter. 1. Unscrew the screws on the yellow cover. 2. Remove the cover. Remove the filter, place a new filter and screw the cover back on.

7. GT6000 Mobilis technical description

7.1. Analyzer Enclosure

GT6000 Mobilis specially designed enclosure is made of ABS/PC, material used for hard-plastic parts. In order to comply with EMC (Electromagnetic Compatibility), the enclosure receives a thin layer of copper coating.

7.2. Power Supply

Only a Gasmet specified power cable must be used with GT6000 Mobilis analyzer. Switch the analyzer on and off from the power switch on the side of analyzer.

The power entry module is protected with a cover, in order to protect the unit from water and dust. The cover can be removed, e.g., to change a fuse. The easiest way to remove the cover, is to push the cover with a screwdriver on the side hole where the cover is attached.

⚠ **Note that without the cover attached, the analyzer will not be IP42 proofed, and shall not be used outdoors or in wet conditions.**

⚠ GT6000 Mobilis has two possible operating voltages: 115 V and 230 V. **Always check that you are using correct operating voltage!** The voltage setting can be confirmed by checking the marking on red background above the power switch (see “1.” in Figure 16)

The fuses are disposable and located in the power entry module next to power switch. The fuse is 2 A for 230 V operating mode and 4 A for 115 V operating mode. Fuse are put in a fuse holder that

can be inserted in two orientations. The orientation defines if the analyzer works in 115V or 230V setting.

To change a fuse or the operating voltage, follow the steps below and see Figure 16:

1. Remove the power unit cover by pushing from the side ( ) with e.g. a screwdriver.
2. Lift the lid next to the power inlet.
3. Lift the red fuse holder from its compartment.
4. Replace the fuses if necessary. If changing operating voltage, flip the fuse so that the desired voltage value is visible when the lid is closed.
5. Close the lid.

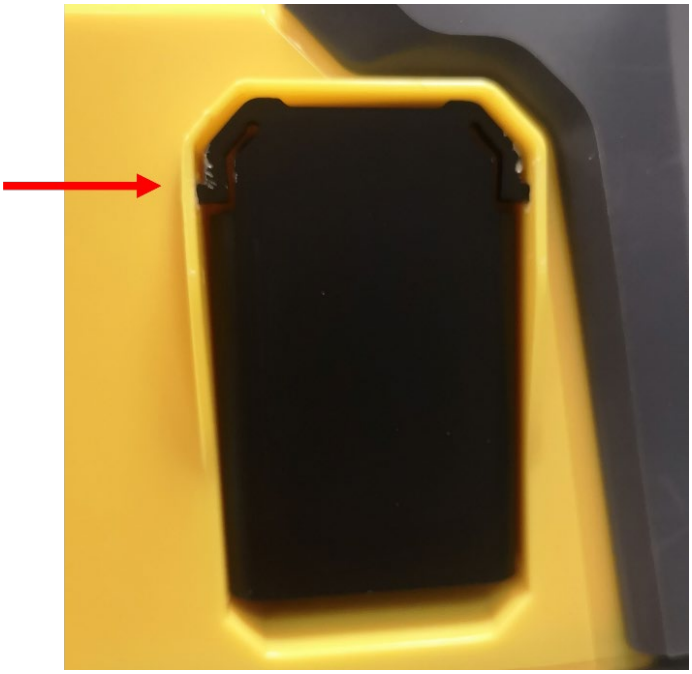


Figure 15. To remove the power unit cover, push from hole on the side as indicate by the arrow.

Figure 16. Replacing the fuse. 1. When the fuse compartment lid is closed, the operating voltage setting is visible. 2. Fuse compartment lid opened. 3. Empty fuse compartment. 4. The fuse holder.

7.3. Front Panel

Communication ports for analyzer – PSS communication and analyzer – PC communication, communication method rotary switch and inlet for purge gas are in the GT6000 Mobilis front panel.

Figure 17. GT6000 Mobilis front panel.

7.3.1. Gas Fittings

All gas connectors in the GT6000 Mobilis analyzer are grouped together on the same side of the analyzer. For metric version, the sample in fitting is 6 mm Swagelok, sample out 8 mm Swagelok.Interferometer purge has 6 mm quick connect fitting. The quick-connect fitting accepts 6 mm OD PTFE or PFA tubing. The quick-connect fitting engages the tube when the tube is pushed in, and the tube is released by pressing the collar while pulling the tube gently. For inch version, both sample in and sample out are ¼'' Swagelok fittings. Interferometer purge has ¼'' quick connector.

The sample gas connectors are:

> *SAMPLE IN*: Connection of the sample gas inlet. External sampling system is connected here.
> *SAMPLE OUT*: Sample gas outlet.
> PURGE AIR: Connection of a low flow (0.5 l/min) zero gas in order to purge interferometer. Only N_2 or dry and clean instrument air should be used to purge the analyzer.

Follow the instructions below in order to connect/disconnect 6 mm OD PTFE or PFA tube to/from the quick-connect fittings:

To connect a tube to the analyzer,insert a tube to the appropriate inlet/outlet by pushing the tube as far as it goes into the connector.
To disconnect a tube from the analyzer,
push the blue connector collar downwards with thumb and index finger and simultaneously pull the tube upwards.
Place the connector cover on the connectors if necessary.

7.3.2. Communication Ports and Communication Switch

Gasmet USB or Ethernet cable is connected to the analyzer – PC communication port when using cable communication.
For communication between PSS and analyzer, connect communication cable to *PSS communication port* and PSS. Using the rotary communication switch, four modes of communication between the analyzer and PC are possible:

- Communication switch in Cable mode (USB/Ethernet)
- Communication switch in Bluetooth mode
- Communication switch in Wi-Fi access point mode
- Communication switch in Wi-Fi station mode

Appendix A: Gasmet Sales and Support Offices

MANUFACTURER	SUBSIDIARY IN GERMANY
Gasmet Technologies Oy Mestarintie 6, 01730 Vantaa, Finland contact@gasmet.fi +358 9 7590 0400	**Gasmet Technologies GmbH** Ostring 4, 76131 Karlsruhe, Holstenstraße 27, 24568 Kaltenkirchen, Germany sekretariat@gasmet.com +49 721 62656-0
SUBSIDIARY IN UNITED KINGDOM	**SUBSIDIARY IN NORTH AMERICA**
Gasmet Technologies (UK) Ltd. Woolleys Farm, Welford Road, Naseby Northampton, NN6 6DP, United Kingdom contact.uk@gasmet.com +44 1908 227722	**Gasmet Technologies Inc.** 5865 McLaughlin Rd. Unit #1, Mississauga ON L5R 1B8, Canada sales@gasmet.com (+1) 866 685 0050
SUBSIDIARY IN ASIA	**SUBSIDIARY IN SWIZERLAND**
Gasmet Technologies (Asia) Ltd. Unit No 11, 8/F, Po Lung Centre, No. 11 Wang Chiu Road Kowloon Bay, Kowloon, Hong Kong sales@gasmet.com.hk +852 3568 7586	**MBE AG** Bolstrasse 7, CH-8620 Wetzikon, Switzerland +41 (0)44 931 22 88 contact@mbe.ch

Distributors: Please see our webpage at www.gasmet.com

Appendix B: LASER SAFETY INFORMATION

GT6000 Mobilis user should be aware that the apparatus contains a potentially harmful laser device. GT6000 Mobilis fulfils the requirements for Laser Class 1 according to the standard EN 60825-2014 (IEC 60825-2014). The laser device, included into the GT6000 Mobilis, is fully enclosed and only trained service personnel should open the enclosure in case of service of the analyzer. Please, read carefully the following remarks:

CLASS 1 LASER PRODUCT

EN 60825-1:2014

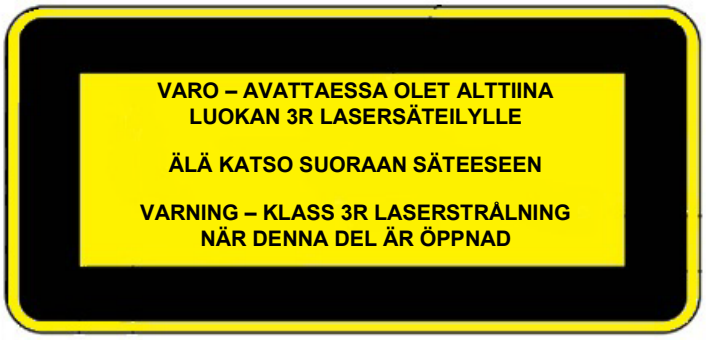
CAUTION – CLASS 3R LASER RADIATION WHEN OPEN

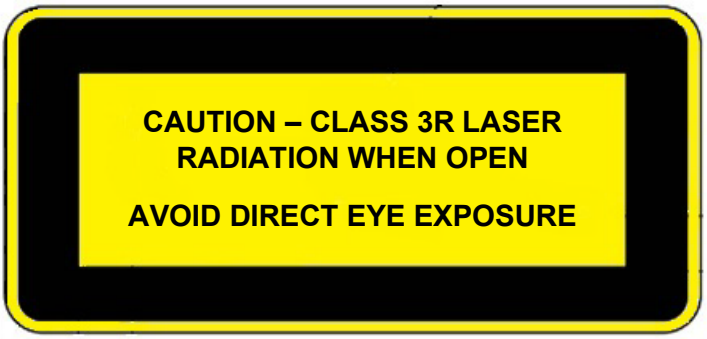
AVOID DIRECT EYE EXPOSURE

Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Label on the analyzer:

Label on the interferometer:





Appendix C: CERTIFICATION

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.