Operating Instructions

Raman RunTime v7.0

Endress+Hauser
People for Process Automation

Table of Contents

1 About this document

1.1 Document function

This manual provides details on configuring and using Raman RunTime for process applications, but it is not intended to replace Raman Rxn system analyzer installation and training from Endress+Hauser representatives.

This Raman RunTime software manual is approved for use with the following analyzer configurations:

- Raman Rxn2 and Raman Rxn4 single-channel and four-channel embedded analyzers with 532, 785, or 1000 nm.
- Raman Rxn2 Starter single-channel and four-channel embedded analyzers with 785 nm.
- Raman Rxn2 Hybrid and Raman Rxn4 Hybrid embedded analyzers with 785 nm.
- RamanRxn2 and RamanRxn4 non-embedded analyzers with 785 nm.
- RamanRxn2 and RamanRxn4 non-embedded analyzers with 1000 nm.
- Raman Rxn5 embedded analyzer with 532nm.

⚠ CAUTION

▶ The performance of procedures, the use of controls, or the adjusting of the analyzer other than as specified in the manual may result in hazardous radiation exposure.

1.2 Symbols

Warnings

Structure of Information	Meaning
⚠ WARNING Causes (/consequences) Consequences of noncompliance (if applicable) ▸ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation can result in a fatal or severe injury.
⚠ CAUTION Causes (/consequences) Consequences of noncompliance (if applicable) ▸ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.
NOTICE Cause/situation Consequences of noncompliance (if applicable) ▸ Action/note	This symbol alerts you to situations which may result in damage to property.

Symbols on the device

Symbol	Description
	The Laser Radiation symbol is used to alert the user to the danger of exposure to hazardous visible laser radiation when using the Raman Rxn system.
	The High Voltage symbol alerts people to the presence of electric potential large enough to cause injury or damage. In certain industries, high voltage refers to voltage above a certain threshold. Equipment and conductors that carry high voltage warrant special safety requirements and procedures.
	The WEEE symbol indicates that the product should not be discarded as unsorted waste but must be sent to separate collection facilities for recovery and recycling.
CE	The CE Marking indicates conformity with health, safety, and environmental protection standards for products sold within the European economic area (EEA).

1.3 Documentation

All documentation is available:

- On the media device supplied (not included in the delivery for all device versions)
- On the Endress+Hauser mobile app: www.endress.com/supporting-tools

- In the Downloads area of the Endress+Hauser website: www.endress.com/downloads

This document is an integral part of the document package, which includes:

Part Number	Document Type	Description
4006019	Raman RunTime Automation OPC v7.0	Current list and history of OPC Tags for Raman RunTime.
4006020	Raman RunTime Automation Modbus v7.0	Current Modbus Map for Raman RunTime.
4006021	HTTPS Automation Interface v7.0	Details on using HTTPS protocol to transfer supported file types to Raman RunTime.
4005963	Raman data library 2.1	Raman data library User Operating Instructions

1.4 Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

SIMCA®
Registered trademark of Sartorius Stedim Biotech.

GRAMS IQ™
Registered trademark of Thermo Fisher Scientific.

PEAXACT
Trademark of S-Pact

Aspen Unscrambler™
Registered trademark of AspenTech

Solo/PLS_Toolbox
Trademark of Eigenvector research, Inc.

2 Safety

2.1 Product safety

⚠ CAUTION

Laser Safety Notice. Endress+Hauser Raman analyzers utilize laser sources as an excitation source.

- ▶ When using the Raman RunTime near an operating instrument, follow all safety requirements outlined in the operating and safety documents of the analyzer and Raman probe(s) being used.

2.2 IT safety

Operators are responsible for implementing IT security measures to protect the device and associated data transfers, in accordance with their own security standards.

2.2.1 Device-specific IT security

In addition to user account creation for password protection, Raman RunTime security safeguards the Raman Rxn system from unauthorized access with these features:

- Customized embedded system provides a unique, non-standard attack surface.
- Purpose-built operational profile prevents unauthorized user actions.
- Network access is restricted to analyzer core services only.
- Only authenticated, digitally signed updates from Endress+Hauser are permitted.
- Non-Endress+Hauser software cannot be executed on the system.
- Unauthorized system changes are automatically removed during reboot.

3 Product description

Endress+Hauser Raman RunTime embedded software serves as the control platform for the Raman Rxn analyzer suite. Raman RunTime is designed for straightforward integration with standard multivariate analysis and automation systems, enabling real-time, in situ process monitoring and control. The software supports Open Platform Communications (OPC) and Modbus interfaces, providing clients with access to analyzer data and control functions.

3.1 Supported analyzers

⚠ CAUTION

- When the main power switch and laser key of the Raman Rxn analyzer are turned ON, ensure that probes are shuttered or covered. Always observe laser safety precautions.

Raman Rxn2 and Raman Rxn4 embedded analyzers

Raman RunTime software is integrated into the following analyzer configurations:

- Raman Rxn2 and Raman Rxn4 as single- or four-channel embedded analyzers (532 nm, 785 nm, or 1000 nm wavelength)
- Raman Rxn2 single-channel embedded analyzer starter configuration (785 nm only)
- Raman Rxn2 or Raman Rxn4 hybrid analyzer configuration (785 nm only)

Raman Rxn5 embedded analyzer

Raman RunTime software is fully embedded in the Raman Rxn5 analyzer (532 nm).

Raman Rxn non-embedded analyzers

Non-embedded Raman Rxn analyzer configurations compatible with Raman RunTime software are listed in the table below. New configurations require Raman RunTime version 6.1 or higher, while older models are compatible with previous versions.

Customers can use Raman RunTime software with existing older Raman Rxn analyzers, including non-embedded four-channel RamanRxn2 and RamanRxn4 analyzers configured with either 785 nm or 1000 nm lasers. The 1000 nm non-embedded configuration includes a single-channel option; the 785 nm configuration does not.

To use Raman RunTime with non-embedded analyzers, operate it as the control platform via an optional external controller, which may be the original HMI or the current HMI. Both controllers offer equivalent functionality. The current HMI is also referred to as HMI2 in Endress+Hauser documentation, as described below.

	Base Unit		Channels		Controller		Version Compatibility		
Analyzer	Rxn2	Rxn4	Four	Single	Embedded	HMI	Embedded	Original HMI	Current HMI
Rxn 532	l	l	l	l	l	l	6.2+	6.2+	6.2+
Rxn Enclosure 532	–	l	l	l	l	l	6.2+	6.2+	6.2+
Rxn 785	l	l	l	l	l	l	6.0+	5.1+	6.2+
Rxn Enclosure 785	–	l	l	l	l	l	6.0+	5.1+	6.2+
Rxn Hybrid 785	l	l	–	–	l	–	6.2+	–	–
Rxn Hybrid Enclosure 785	–	l	–	–	l	–	6.2+	–	–
Rxn Hybrid Transmission 785	l	l	–	–	l	–	6.2+	–	–
Rxn Hybrid Transmission Enclosure 785	–	l	–	–	l	–	6.2+	–	–
Rxn Starter 785	l	–	l	l	l	–	6.2+	–	–
Rxn 1000	l	l	l	l	l	l	6.0+	5.1+	6.2+
Rxn Enclosure 1000	–	l	l	l	l	l	6.0+	5.1+	6.2+
Raman Rxn 1000	l	l	–	l	–	l	n/a	5.1+	6.2+
Raman Rxn Enclosure 1000	–	l	–	l	–	l	n/a	5.1+	6.2+

3.2 User roles and access model

Each user account is assigned a role that defines its level of access to Raman RunTime features. Roles control access to restricted functions such as acquisition settings, model selection, stream settings, diagnostics exports, and calibration activities.

There are three user privilege levels: User, Operator, and Administrator. User is the most basic level, followed by Operator with more privileges. Administrator can perform all actions. The privileges for each level are described below:

User Level	Action
User	▪ Change channel display name ▪ View summary and detail of active batch acquisitions ▪ View calibration information ▪ View diagnostics ▪ Perform exports including basic, diagnostic, and full
Operator	User-level actions plus: ▪ View active batch acquisitions ▪ Perform calibration and view calibration information ▪ Perform verification and view verification results ▪ Start/stop batch acquisitions ▪ Focus ▪ Snapshot ▪ Ad hoc analysis ▪ Select from pre-loaded models and enable/disable prediction on specific channels ▪ Restart
Admin	No Restrictions. Operator-level access plus: ▪ Add/remove models ▪ Configure models including changing the display name, enabling or disabling components, and setting properties ▪ Configure network ▪ Change system display name ▪ Configure date and time ▪ Configure Open platform communications (OPC) ▪ Change security settings and manage users ▪ Apply embedded software updates

4 System integration

This chapter provides essential information for integrating Raman RunTime into automation, data-handling, and plant-level systems. It includes network configuration, automation interfaces (OPC UA, OPC Classic, Modbus, HTTPS), and data-access mechanisms such as SPC exports and batch file handling.

4.1 Network and communication overview

4.1.1 Network prerequisites

Raman RunTime requires an active Ethernet connection for remote access, OPC/Modbus automation, and network-based file handling.

Firewall rules must permit the ports relevant to the features in use (see *Network configuration*).

4.1.2 Logical connectivity

Raman RunTime does not require specific physical wiring instructions within this manual; physical installation guidance is provided in the analyzer's hardware operating instructions. This chapter focuses on logical network communication only.

4.2 Automation interfaces

Raman RunTime supports multiple automation interfaces for data delivery and system integration:

- **OPC UA.** Recommended protocol for all new integrations. Supports full spectral transfer, diagnostics, and secure communication.
- **OPC Classic (DCOM or OPC DA).** Provided for legacy applications only. Requires OS-level configuration and matching Windows credentials.
- **Modbus (TCP or RTU).** Provides measurement, diagnostics, and model-prediction values.
- **HTTPS and remote access.** Allow uploading and downloading supported files (models, spectra, configuration files) through a secure browser connection.

4.2.1 HTTPS and remote access (web browser access)

Raman RunTime is accessible from a remote workstation through a desktop web browser, provided the system meets the specified requirements.

4.2.1.1 Client system requirements

The remote Raman RunTime user interface can be accessed using Google Chrome or Microsoft Edge.

4.2.1.2 Remote access options

- **Standard Access:** Go to http://<IPaddress>:3593 or http://<hostname>:3593.
- **Secure Access:** Go to *https://<hostname>:3594*. The client must be able to resolve the analyzer hostname for secure connections. Refer to the *Network configuration* → 🖹 section for required open ports.

The analyzer's IP address and hostname can be viewed and configured under **Options > System > Network**.

If security is enabled in Raman RunTime, all attempts to access the Standard remote URL are automatically redirected to the Secure remote URL.

For guidance on avoiding privacy warnings, refer to the *Certificates* → 🖹 section for instructions on configuring trust on client workstations.

4.3 Network configuration

Raman RunTime includes network-configuration options tailored to each analyzer platform.

The following firewall ports are used by Raman RunTime features. Ports for OPC Classic are assigned dynamically in the indicated range; fixed-port behavior is only available for OPC UA.

Only open ports for features that will be used.

Protocol	Ports
OPC UA	TCP 4840, 4843, 52601, **62886**
OPC Classic	TCP 135 and 49152-65535
Modbus	TCP **502**
File Sharing	TCP **139** and **445**
Remote Access	TCP **3594**, **4526** (Secure); TCP **3593**, **4525**, 5674 (Standard); UDP 3702

Bold ports are mandatory for the corresponding protocol; other ports enable extended functionality (for example, discovery services).

The **Network** tab in **System Settings** configures communication between the analyzer and host network. Raman analyzers support both dynamic host configuration protocol (DHCP) and static IP addressing.

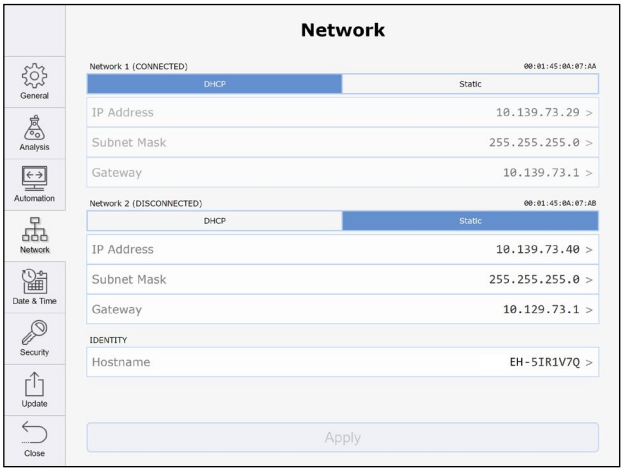

Figure 1. System settings — network tab — DHCP

4.4 Automation connections for Raman Rxn2, Raman Rxn4, and hybrid configurations

Raman RunTime provides network-connected clients with analyzer data and analyzer control functions.

OPC UA is the recommended protocol, offering secure transfer of large datasets (including full spectra), improved diagnostics, and robust connection handling. OPC Classic (DCOM, also called OPC DA) is available for legacy support.

The Raman Rxn system must be connected to a network for OPC functionality. Network settings are available under **Options > System > Network**.

4.4.1 Basic OPC connectivity

Raman RunTime exposes an OPC UA server that can be accessed by UA clients such as Raman data library. This OPC connection allows users to view, control, and collect spectra from Endress+Hauser Raman Rxn analyzer systems within Raman data library.

- Raman RunTime v6.4 or newer is required for OPC UA integration with Raman data library.
- Older versions can instead export spectra using the SPC spectral source mechanism.

4.4.1.1 Authentication

All OPC clients must authenticate with a valid Raman RunTime username and password.

4.4.1.2 OPC server configuration

1. From the dashboard, select **Options** > **System**.
2. Open the **Automation** tab.

   The built-in user **kaiser-opc** is always authorized for OPC access.

   - The default password (opc) can be changed under Options > System > Automation.

- Additional OPC-authorized accounts can be created under Options > System > Security.

3. Configure **OPC UA**. UA clients connect using:

   opc.tcp://<computer-name>

4. The **hostname** can be viewed or updated under **Options** > **System** > **Network**.

4.4.1.3 Supported OPC UA security algorithms

Raman RunTime supports the following algorithm suites for signing and optional encryption of OPC communications:

- Basic128Rsa15
- Basic256
- Basic256Sha256

4.4.1.4 UA Certificates

When a UA client connects to a Raman RunTime system for the first time, the client must accept—or *trust*—the certificate presented by the OPC server. The methods for accepting the server certificate depend on the specific UA client software.

The OPC UA server uses a self-signed certificate. As a result, many UA clients display a warning indicating that the server's identity cannot be verified. This warning is expected. The user must accept the server certificate to establish a connection.

The server certificate is linked to the Raman RunTime system's hostname. If the hostname changes, the system automatically generates a new certificate. UA clients must then trust the new certificate before reconnecting.

4.4.1.5 OPC Classic (deprecated)

OPC Classic clients can access full OPC functionality. However, OPC Classic requires additional configuration, and client-side settings can easily interfere with communication—often in ways that are difficult to diagnose. The underlying technology of OPC Classic can restrict installation flexibility. For these reasons, use OPC UA instead of OPC Classic whenever possible.

The OPC Classic client application must run under credentials that exactly match the username and password of an authorized Raman RunTime user. This requirement means that a corresponding Windows user account must exist on the client workstation, and the Windows and Raman RunTime passwords must remain synchronized.

4.4.1.6 Asynchronous updates for OPC classic

In addition to responding to client polling requests, the OPC server can send asynchronous updates. In this mode, the server notifies clients when the values of subscribed tags change, eliminating the need for continuous polling.

When using OPC classic, clients may fail to connect unless asynchronous updates are enabled. To enable asynchronous updates, the *kaiser-opc* user must exist on the client workstation with a password that matches the password on the Raman RunTime system. This requirement applies even if the client program does not explicitly authenticate by using *kaiser-opc* credentials.

Client workstations must be located on the same TCP/IP subnet as the analyzer, with no network address translation (NAT) between them.

If the *kaiser-opc* password is changed under **Options > System > Automation**, the Raman RunTime system must be restarted under **Options > System > General** for the new password to take effect.

4.4.1.7 OPC tags

See *Raman RunTime Automation OPC v7.0* to view the current list and history of OPC Tags for Raman RunTime.

4.4.2 Modbus map

The Raman Rxn2, Raman Rxn4, and Rxn5 analyzers provide automation data over:

- Modbus TCP (Ethernet)
- Modbus RTU (RS-485 serial)

Model-prediction values can be mapped under **Options > System > Automation > Modbus**. In addition to prediction values, other instrument diagnostic values are available over Modbus.

See *Raman RunTime Automation Modbus v7.0* to view the current Modbus Map for Raman RunTime.

4.4.3 HTTPS automation

See *HTTPS Automation Interface v7.0* to view details on using HTTPS protocol to transfer supported file types to Raman RunTime.

4.5 Automation connections for Raman Rxn5

Select the Automation tab within System Settings to configure:

- OPC UA
- Modbus mappings per channel

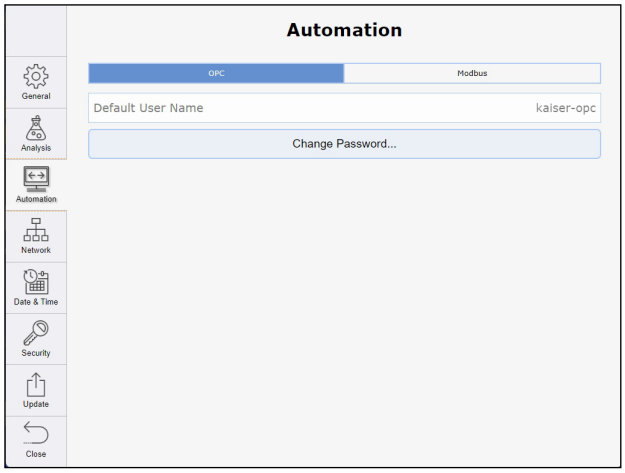

Figure 2. System settings — automation tab — OPC

Modbus output can be configured independently for each channel of the analyzer. Once the components and derived values for a channel have been selected, the channel map provides the details of the assigned Modbus registers for each component.

Figure 3. System settings — automation tab — Modbus (left), System settings — automation tab — Modbus channel map (right)

4.6 Data management

This section describes how Raman RunTime organizes and exposes data for use by external systems, including network file shares, SPC exports, and batch-level data access.

Storage policies including retention, automatic deletion, and Continuous Operation storage behavior are defined in *Commissioning* →.

4.6.1 Data files and formats

Raman RunTime stores spectral data as **.spc** files. The software organizes spectral files by channel, batch, and acquisition time.

When models are active, the software can also generate results files in **.csv** format.

4.6.2 Local data storage and storage indicators

Raman RunTime stores **.spc** files on the analyzer.

On Raman Rxn2 and Raman Rxn4 analyzers, local data files can also be accessed over the network (model and configuration dependent).

To view system memory and free space, open **System settings** and view the **General** tab.

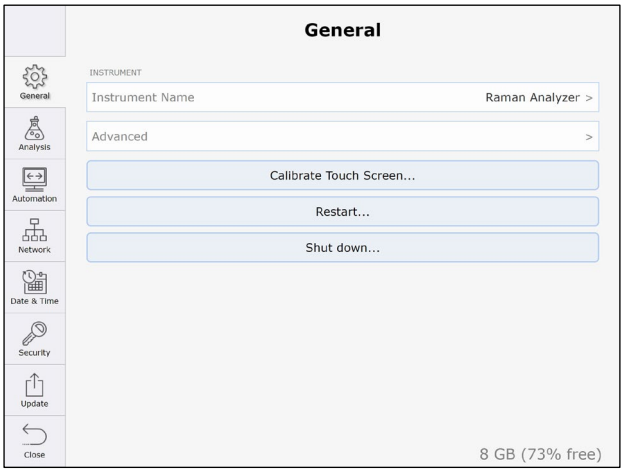

Figure 4. General settings window for the Raman Rxn2 analyzer showing free memory (RAM) available (8 GB–73% free)

4.6.3 Network data access (batch export share)

When the analyzer is connected to a network, Raman RunTime exposes a file share at:

\\<computer-name>\DataLibraryBatchExport

The share contains one subfolder per acquisition batch.

4.6.3.1 Batch folder name format

- Probe<#>_<batch>_<YYYYmmdd-HHmmss>
- **<#>**: acquisition channel
- **<batch>**: user-specified batch name
- **<YYYYmmdd-HHmmss>**: timestamp for when the batch began

4.6.3.2 Spectrum file name format

- <batch>_<YYYYmmdd-HHmmss>.spc
- **<YYYYmmdd-HHmmss>**: the timestamp for when the acquisition finished

4.6.3.3 Automatic export behavior

When the analyzer is connected to a network, Raman RunTime saves **.spc** files automatically to this share. Raman RunTime creates batch folders and manages file naming automatically.

4.6.3.4 Access control

When Raman RunTime security is enabled, access to read or delete data in this share requires authenticated user credentials.

4.6.4 Batch storage management and export

Raman analyzers are not intended for long-term storage. Export data regularly to prevent storage limits from interrupting data collection.

Each channel (stream) shows the storage used by existing spectral batches.

If storage usage interferes with data collection:

- Configure the software to avoid storing spectra locally and transmit spectra through secure **OPC UA** to a PAT system. Refer to *Suppressing on-board spectral storage (OPC UA automation)* →.
- If **OPC UA** and a PAT system are not used, perform periodic offline data offloading.

4.6.4.1 *Suppressing on-board spectral storage (OPC UA automation)*

When storage usage interferes with data collection, configure the OPC UA client/PAT system to acquire spectra without storing them in the local batch history. See *External Raman RunTime Automation OPC v7.0* (4006019).

Use this option when the PAT system collects spectra through OPC UA and the installation is designed to minimize on-board storage growth.

To view batch space use

1. In the stream details pane, select **Edit**.

   The Batch Management window opens.

2. Click the **Pie Chart** .

   The view shows available memory and per-batch usage as a percentage. Batch data can also be exported from this window. See *Batch data export* → .

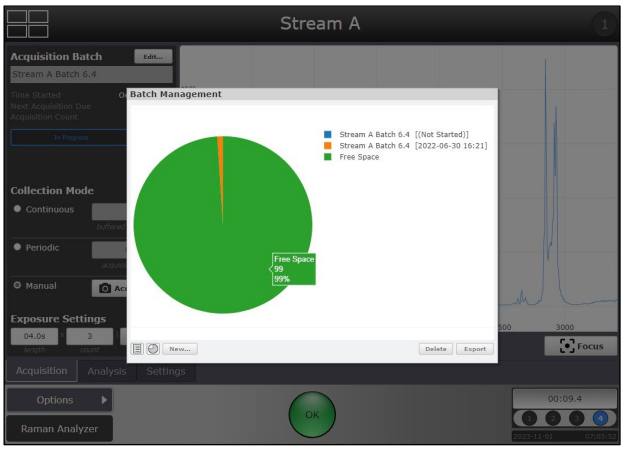

Figure 5. Batch management screen showing batch data storage used and available

4.6.4.2 *Batch data export*

Export batch-level data to removable media (USB drive) or download it through remote access.

Exported files

- Spectral batch data: ***.spc**
- Model results (when models are active):
- Processvalues.csv
- Allproperties.csv

To export batch data to USB

1. Connect a USB memory device to the analyzer front USB port.
2. In the probe detail view, select **Edit**.
3. Select the batches to export, and then select **Copy**.
4. Browse to the USB drive, and then click **Select folder**.

4.6.5 Legacy export mechanisms (pre-6.4)

For analyzers running Raman RunTime earlier than 6.4, spectra can be exported automatically to Raman data library using the SPC spectral source mechanism.

The mechanism requires:

- an input path monitored for new files
- an output path used after processing

4.6.6 Integration considerations

When embedding Raman RunTime into a PAT, DCS, or SCADA environment:

- Verify that data required by the external system is accessible through OPC UA, Modbus, HTTPS, or SMB shares.
- Validate that spectra, batch data, and model-prediction files remain available as expected over time.
- Confirm automation interfaces are receiving values consistent with operational states.
- OPC UA: suppress on-board storage for acquisitions:
- Parameter: Control.Acquire.ExcludeFromBatch (Boolean)
- Command behavior: Trigger tags are pulses; sibling parameters are read when the trigger is received
- Reference: External Raman RunTime Automation OPC v7.0 (4006019).

5 Commissioning

All Endress+Hauser Raman analyzers use Raman RunTime firmware. Available functions may vary by analyzer model. Product-specific differences are identified in the relevant sections of this manual.

5.1 Preconditions for commissioning

Before commissioning Raman RunTime, verify that the analyzer is correctly installed, powered, and accessible. The analyzer must be in stable operating conditions to ensure that configuration settings, security options, and calibration activities can be performed reliably.

5.1.1 Power-up state

The analyzer must be powered on and fully booted before commissioning begins. Confirm that the Raman RunTime dashboard is displayed and that no system error states prevent access to system settings. If the analyzer has been powered off or restarted, allow the system to complete its startup sequence before proceeding with commissioning tasks.

5.1.2 Environmental stabilization

Allow sufficient time for the analyzer to stabilize after power-up. Environmental stabilization includes thermal equilibration of the analyzer electronics and optical components. Performing commissioning steps before the analyzer has stabilized may result in inconsistent behavior or require settings to be repeated later.

5.2 Initial access

Initial startup covers the basic configuration steps required to prepare Raman RunTime for commissioning. These steps establish system usability, identity, and user interface accuracy before security configuration, calibration, or data collection begins.

All actions in this section are performed locally on the analyzer using the Raman RunTime user interface.

Perform the following steps during first-time setup:

1. Connect power, Ethernet, and probes.
2. Calibrate the touch screen.
3. Configure network settings.
4. Set the date and time.
5. Customize the analyzer and probe names.
6. (Optional) Enable security.

For cabling and probe connection details, refer to the analyzer and probe documentation. Allow the system to stabilize for at least 2 hours before starting calibration.

5.2.1 Calibrating the touch screen

Touch-screen calibration ensures accurate user interaction with the Raman RunTime interface. This step should be performed during initial startup and repeated if touch accuracy degrades or if the display hardware is replaced. Accurate touch input is required to reliably access menus and system settings during commissioning.

To calibrate the touch screen

1. From the dashboard, select **Options > System**.
2. On the General tab, click Calibrate Touch Screen.
3. Follow the on-screen instructions.

For best results, use the edge of your fingernail for touch-point accuracy.

5.2.2 Setting date and time

Set the system date and time to ensure that timestamps for spectra, calibration records, diagnostics, and exported files are accurate. Correct time configuration is essential for traceability and alignment with external systems.

To set the date and time

1. From the dashboard, select **Options > System**.
2. Click Date & Time.
3. Choose one:
   - Manually set the time, date, and time zone.
   - Enable Time synchronization and enter a time server address.
4. Click **Apply**.

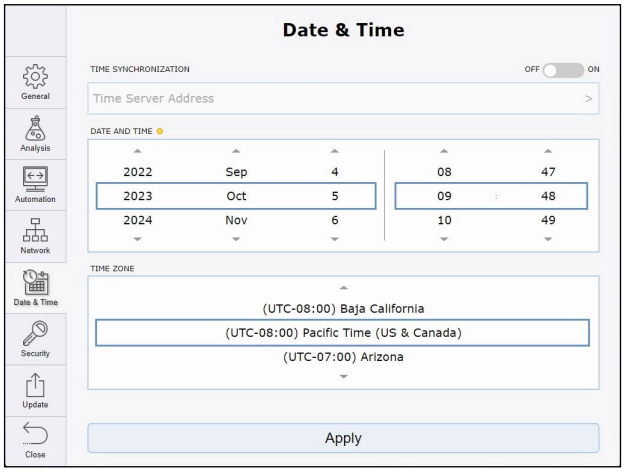

Figure 6. System settings — date & time tab

5.2.3 Configuring network settings

Configure the analyzer's network identity, including hostname and IP addressing, so that the system can be uniquely identified on the network. The hostname is used for remote access, automation interfaces, and file sharing. Network identity must be established before configuring system integration or remote access features.

To customize network settings

1. From the dashboard, select **Options > System**.
2. Click **Network**.

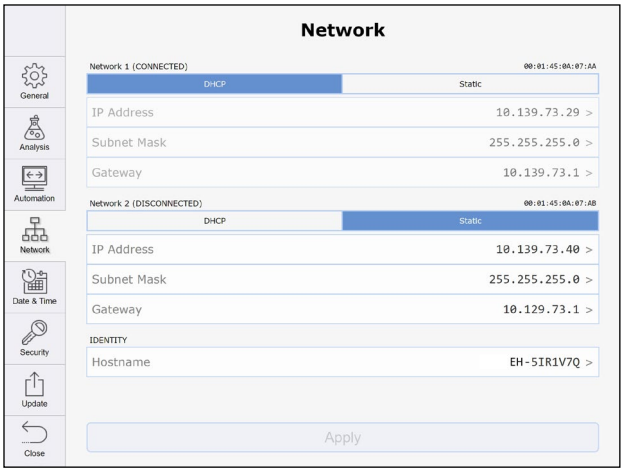

Figure 7. System settings — network tab

3. To assign a custom host name, click the **Hostname** field, enter a new name, and click **Apply**.
4. (Optional) Enter static IP information and click **Apply** or use DHCP for automatic assignment.

5.2.4 Customizing the analyzer and probe names

Assign meaningful names to the analyzer and connected probes or streams. These names are used throughout Raman RunTime, including dashboards, reports, calibration records, diagnostics, and exported data. Clear naming improves usability and helps prevent confusion in multi-channel or multi-analyzer installations.

To customize the analyzer name

1. From the dashboard, select **Options > System**.
2. Click General.
3. Select **Instrument Name**, enter a custom analyzer name, and click **Apply**.

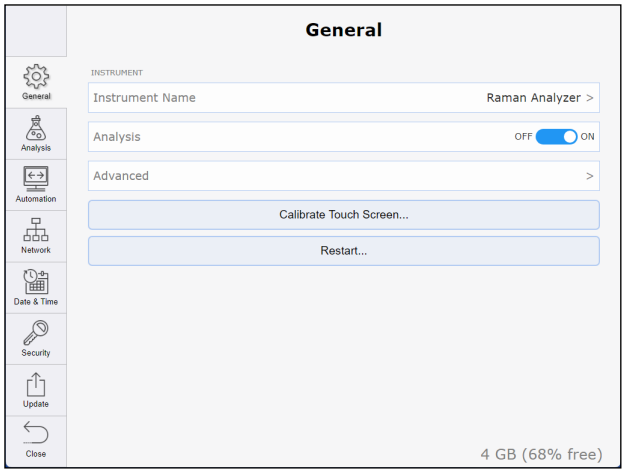

Figure 8. System settings – general page

To specify names for each probe or stream on the dashboard

1. On the dashboard, select the **title bar** of the probe.
2. In the detail view, open the **Settings** tab.
3. Select **Name**, enter a new name, and click **Apply**.

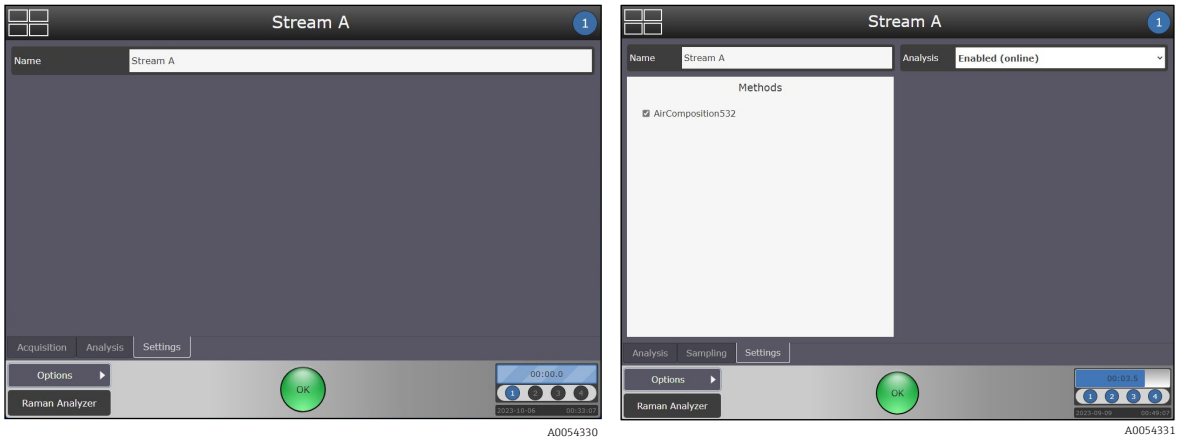

Figure 9. Stream details – settings tab (Raman Rxn2 and Raman Rxn4, left) (Raman Rxn5, right)

5.2.5 Disabling unused channels and probes

In some cases, users may choose not to utilize all available channels on a Raman Rxn analyzer. Unused or uncalibrated channels can issue warnings that place the entire system in a warning state. To ensure a clean system status and avoid unnecessary warnings, disable any channels or probes that will not be used.

To disable an unused channel or probe

1. From the dashboard, navigate to **Options > Calibration**.

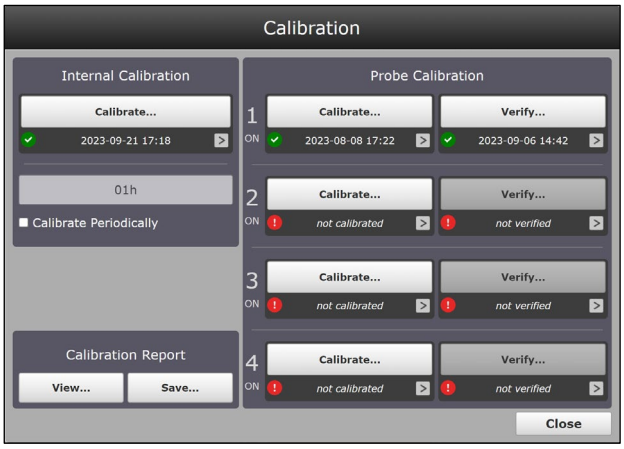

Figure 10. Channels 2, 3 and 4 shown unused/uncalibrated

2. Click the **ON** marker beneath each probe or channel number to toggle it **OFF**.

   A disable channel dialog appears.

Figure 11. Disable channel 3 prompt

3. Click **OK**.

5.2.6 Customizing the X-axis (legacy spectroscopy models only)

For legacy spectroscopy models that support X-axis configuration, adjust the X-axis settings as required for the application. X-axis configuration affects how spectra are displayed and interpreted and should be completed before calibration and routine operation. This setting applies at the system level and does not require frequent adjustment once configured.

This feature supports legacy models created with HoloGRAMS 4.2.0.12 or HoloPro 3.3.0.14.

X-axis changes apply only to real-time analysis. Stored or exported spectra always use standard spacing.

To customize the x-axis

1. From the dashboard, select **Options > System**.
2. Select General > Advanced.
3. Select **X-axis**.
4. Choose a spacing value (0.3 cm-1 or 0.1 cm-1).
5. (Optional) Adjust lower and upper range limits.
6. Click **Apply**.

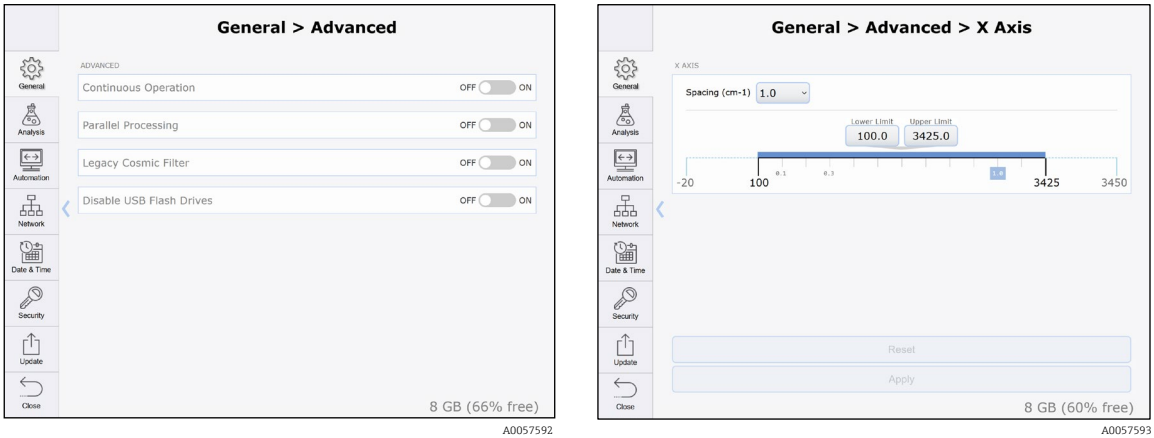

Figure 12. General > Advanced screen (left) and its X-Axis sub-screen (right)

X-axis settings are applied when running any model or collecting a sample spectrum on any analyzer channel. The customized x-axis also appears in real-time spectral data published through OPC. However, the customized x-axis does not appear in on-screen spectral data plots or in spectral data stored on the system for later retrieval.

5.3 Security configuration

Security configuration controls access to Raman RunTime functions and protects system settings from unauthorized changes. Security is optional and is disabled by default. When enabled, access to restricted functionality requires authentication using authorized user credentials. User roles and privilege levels are defined in *User roles and access model*.

5.3.1 Enabling security

Security can be enabled to block non-authorized users from performing Raman RunTime functions. When security is enabled, a system administrator password must be set. This password is required to enable or disable security and to create new user accounts.

When the administrator password is verified, system security is activated. Once enabled, Raman RunTime automatically locks after 10 minutes of inactivity, requiring reauthentication to regain access.

To turn security settings on

1. Navigate to Options > System > Security.
2. Turn on **Security**.

   A notice appears that states that a system administrator password must be set.
3. Click **OK** and enter a password for the system administrator. Verify the password in the second password step.
4. Record the system administrator password. It is required to turn security on and off, and to create new users.

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Figure 13. Setting up security

When the administrator password is verified, system security turns on. Refer to *User interface* → 🖹 for a description of the Raman RunTime dashboard.

5.3.2 Restricting and locking access

When Raman RunTime is locked, access is restricted to the following features and a **blue** lock appears over them:

- Pausing or stopping a batch
- Acquisition settings
- Model selection
- Stream settings
- Focus
- System options
- Exporting a new diagnostics report
- Internal and probe calibration

The system can also be locked by clicking **Lock** in the lower left corner of the dashboard, next to the Raman Analyzer name.

To lock the system after enabling security

1. Click **Lock System Now**.
2. Click **OK** on the confirmation messages.

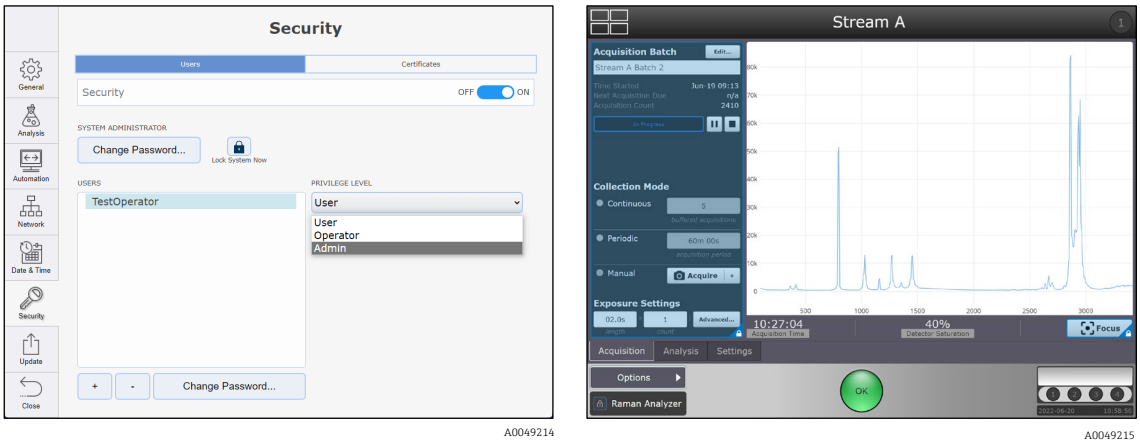

Figure 14. Security settings and restricted access

5.3.3 Adding a new user

When security is enabled, additional user accounts can be created with different access levels. New users are added through the system security settings and are assigned a privilege level that determines which Raman RunTime functions they can access. User accounts are managed locally on the analyzer.

To add a new user

1. On the Raman RunTime dashboard, select **Options**, then select **System**.
2. Select the **Security** tab and turn on **Security**.
3. Click **Add (+)** to create a new user.

Figure 15. Security settings, adding users

4. In the **Add User** prompts:
   - Enter a username, then click **Next**.
   - Create and confirm the user password, then click **Finish**.
5. Specify the **Privilege Level** for the user. For definitions, see User roles and access model.

The privilege level is applied to the new user.

5.3.4 Changing passwords

Users can change their own password from the login screen. To do so, click **Change password** in the lower-left corner of the on-screen keyboard.

Raman RunTime system administrators change their own passwords using the same procedure.

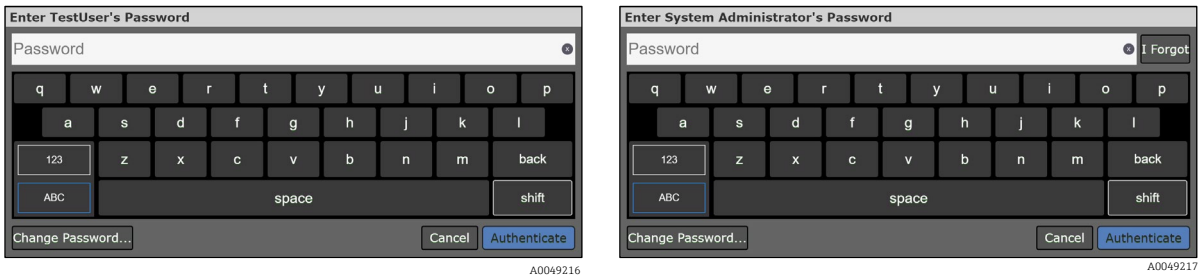

Figure 16. Enter user password dialog box (left) and enter system administrator password dialog box (right)

Recover a lost or forgotten password (user)

If a user forgets their password, they must contact the Raman RunTime system administrator to request a reset. The system administrator resets the password as follows:

1. From the Raman RunTime dashboard, navigate to **Options > System > Security**.
2. Sign in using a system administrator account.
3. Select the user who requested the password reset.
4. Select **Change password** at the bottom of the screen and assign a new password.

Recover a lost or forgotten password (system administrator)

If a system administrator forgets their own password, they can initiate recovery from the administrator login screen:

1. Click **I forgot** in the upper-right corner of the password entry screen.
2. Note the displayed recovery code.
3. Contact Endress+Hauser Support and provide the recovery code.
4. Enter the reset code received from Support when prompted.
5. Select **Authenticate**, then set a new password on the screen that follows.

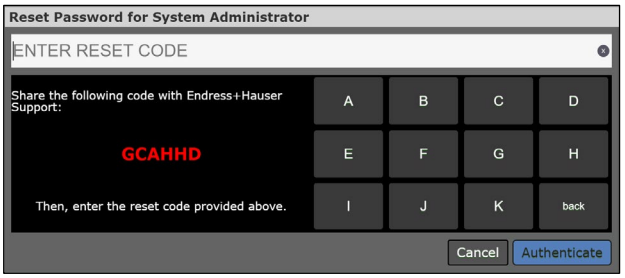

Figure 17. Password recovery screen for a Raman RunTime system administrator

5.3.5 Managing certificates

Raman RunTime manages certificates for secure remote access by using a self-signed root Certificate Authority (CA) certificate to encrypt HTTPS communications. This certificate enables secure connections between a Raman analyzer and remote client workstations.

For managed environments, IT departments can deploy the Raman RunTime root CA certificate to client workstations. Doing so establishes trust automatically and avoids the need for individual workstation configuration each time a secure connection is made.

Each analyzer can use either:

- the **default root certificate** supplied by Raman RunTime, or
- a **custom root certificate** provided by the user.

The default root certificate is available on all analyzers running Raman RunTime v6.5 or later. Custom root certificates can be transferred between analyzers. To simplify administration, it is recommended that all analyzers accessed from the same client workstations use a **single root certificate**.

Both default and custom root certificates are managed in the **Certificates** tab within the **Security** section of the Settings menu.

5.3.5.1 Establishing trust between a workstation and an analyzer

To establish trust between a workstation and a Raman analyzer, first save the root certificate to a file. Then, add the analyzer's root CA certificate to the Trusted Root Certification Authorities store on the workstation.

5.3.5.2 Saving the root certificate

To save the root certificate

1. On the workstation, open a supported web browser and navigate to:

   https://<hostname>:3594

   If the analyzer's certificate is not yet trusted, the browser displays a privacy warning. This is expected in secure environments.

2. Select Advanced, then click Proceed to <hostname>.

   The remote access dashboard appears.

Figure 18. Remote access dashboard

3. Click Options, then Settings.
4. In the **Settings** screen, open the **Security** tab, then select **Certificates**.

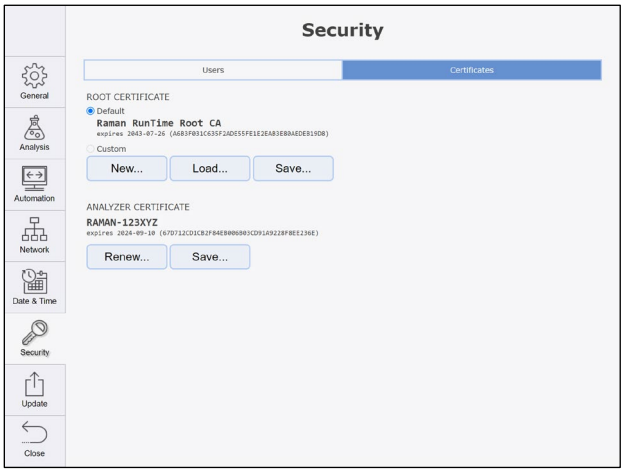

Figure 19. Root certificate options

5. In the root certificate section, click **Save** to export the active root CA certificate.

The certificate can be saved to a locally attached flash drive or downloaded to a remote client.

5.3.5.3 Adding the root CA certificate to a workstation

To add the analyzer Root CA Certificate to the workstation's Trusted Root Certification Authorities Store

1. Double-click the exported certificate file.
2. In the Certificate dialog, select the **General** tab and click **Install Certificate**.
3. In the Certificate Import Wizard, choose **Current User** and click **Next**.
   a. Select **Place all certificates in the following store** then click **Browse**.
   b. Select **Trusted Root Certification Authorities**, then click **OK**.
   c. Click **Next**, then **Finish**.
4. When prompted with a security warning displaying the analyzer's hostname, click **Yes** to complete the installation.
5. Restart your web browser. When you navigate again to *https://<hostname>:3594*, the certificate should now be recognized as installed and trusted.

Granting trust to the analyzer's certificate is now complete.

5.3.6 Disabling USB flash drives

Raman RunTime provides the ability to disable USB flash drive usage as part of an overall security policy.

When USB flash drives are disabled:

- External USB storage devices cannot be used to import or export data.
- Model files, configuration files, and diagnostics cannot be transferred using USB media.
- Network-based transfer methods remain available, subject to system configuration and security settings.

Disabling USB flash drives is typically used in environments with strict cybersecurity or data-integrity requirements. This setting persists across system restarts and is managed through system configuration rather than operational controls.

To disable USB drives

1. From the dashboard, select **Options > System**.
2. Select General > Advanced.
3. Select Disable USB Drives.
4. Click **Apply**.

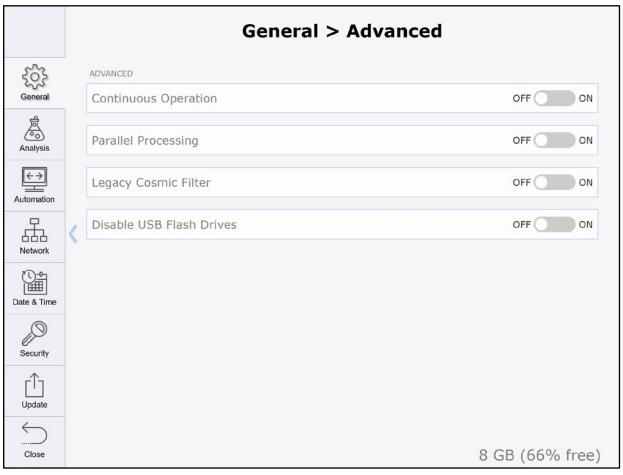

Figure 20. Advanced settings screen

5.4 Advanced system behavior

The functions described in this section control persistent firmware behavior of Raman RunTime. These settings affect how the system behaves across restarts and are not operational actions performed during normal analyzer use.

Advanced system behavior settings are typically configured during commissioning and are not changed during routine operation.

5.4.1 Continuous Operation

Continuous Operation is a firmware behavior mode that configures Raman RunTime for uninterrupted data collection without batch-based workflows.

When Continuous Operation is enabled:

- Raman RunTime operates without explicit batch start and stop actions.
- The user interface presents a **batch-free experience**, optimized for long-running or always-on process monitoring applications.
- Data storage and retention behavior follow the system's configured storage policy.

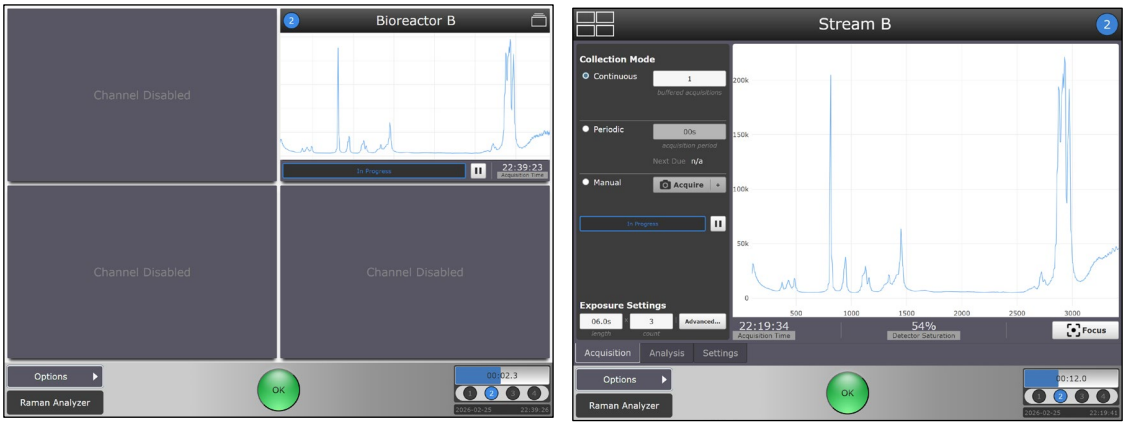

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Figure 21. Raman RunTime without batch start and stop actions

Because Continuous Operation changes how data is stored and managed, a destructive reset may be required when enabling or disabling this mode. A destructive reset clears existing batch data to ensure that data structures remain consistent with the selected operating mode.

Continuous Operation is intended for applications where the analyzer is expected to run continuously and where batch demarcation is not required.

To configure Continuous Operation

1. From the dashboard, select **Options > System**.
2. Select **General > Advanced**.
3. Select **Continuous Operation**.
4. Click **Apply**.

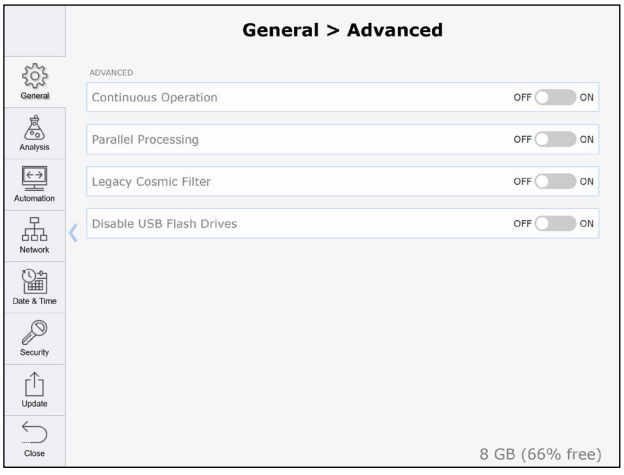

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Figure 22. General > Advanced screen

5.4.2 Parallel Processing

Parallel Processing is a system setting that allows Raman RunTime to analyze one measurement while the analyzer is collecting the next measurement. This behavior is consistent with the active collection mode.

When Parallel Processing is enabled:

- The analyzer proceeds immediately from one measurement to the next without waiting for analysis to complete.
- Spectral analysis and model processing occur in parallel with the next measurement.
- Model results are recorded and published to the user interface and automation interfaces (OPC, Modbus) when processing is complete.
- Analyzer duty cycle is improved by increasing the fraction of time spent actively measuring the process.
- Cycle times become more consistent and predictable.

For example, when collection of a spectrum on one channel is complete, the analyzer can begin collecting a spectrum on the next channel while the previous spectrum is analyzed in parallel.

Parallel Processing is intended to improve system responsiveness and throughput in multi-channel or time-sensitive applications.

Enabling Parallel Processing may change the timing relationship between measurement completion and result publication. Existing integrations that assume analytical results are published before a measurement is reported as complete may require validation or adjustment.

To configure Parallel Processing

1. From the dashboard, select **Options > System**.
2. Select **General > Advanced**.
3. Select **Parallel Processing**.
4. Click **Apply**.

Figure 23. Advanced settings screen

5.4.3 Legacy Cosmic Filter

The Legacy Cosmic Filter is an optional spectral processing feature available in Raman RunTime v6.4 and later. It enables the use of the original cosmic ray removal algorithm employed in pre-v6.4 systems, providing compatibility for users validating historical data or calibration models developed using earlier software versions.

When enabled, the Legacy Cosmic Filter identifies and removes spurious high-intensity spikes caused by cosmic ray interactions with the CCD detector. It operates by comparing multiple co-added exposures (accumulations) and selectively averaging accumulations to suppress transient artifacts that appear in only one acquisition. This method is effective for reducing false spectral features while preserving genuine Raman peaks.

By default, Raman RunTime applies an enhanced cosmic ray filtering algorithm that offers improved performance, including real-time spike detection during single-scan acquisitions. The Legacy Cosmic Filter is disabled by default and should only be activated when backward compatibility is required.

To enable the Legacy Cosmic Filter:

1. From the dashboard, select **Options > System**.
2. Select **General > Advanced**.
3. Select **Legacy Cosmic Ray Filtering**.
4. Click **Apply**.

- The Legacy Cosmic Filter requires at least two accumulations per acquisition to function effectively. Use this feature only when reproducing legacy results or troubleshooting model discrepancies.

Supported on all Raman Rxn2, Rxn4, and Rxn5 embedded analyzers running Raman RunTime v6.4 or later.

6 Calibration and verification

Raman RunTime requires all internal and probe calibrations to pass before any spectra can be collected. Verification is optional but is strongly recommended as part of routine performance checks.

6.1 Calibration and verification overview

Internal calibration (Rxn2/Rxn4/hybrid) ensures the analyzer's spectrograph and laser wavelengths meet specifications. Probe calibration (all analyzers) ensures each probe's intensity and wavelength response is aligned with a known reference.

Calibration is required:

- at initial startup
- after service or physical relocation
- when verification fails
- when diagnostics indicate calibration is invalid

6.1.1.1 Analyzer-specific behavior

Raman Rxn2, Raman Rxn4, and hybrid configurations support user-initiated internal calibration plus probe calibration and verification.

Raman Rxn5 performs internal calibration automatically with every analysis. The Calibration screen displays probe-related calibration and verification only.

6.2 Calibration screen

The Calibration screen shows the most recent verification status. Navigate to **Options > Calibration**.

Calibration windows differ by configuration:

- **Four-channel analyzer,** see Figure 24.
- **Single-channel analyzer** and **Hybrid configuration,** see Figure 25.

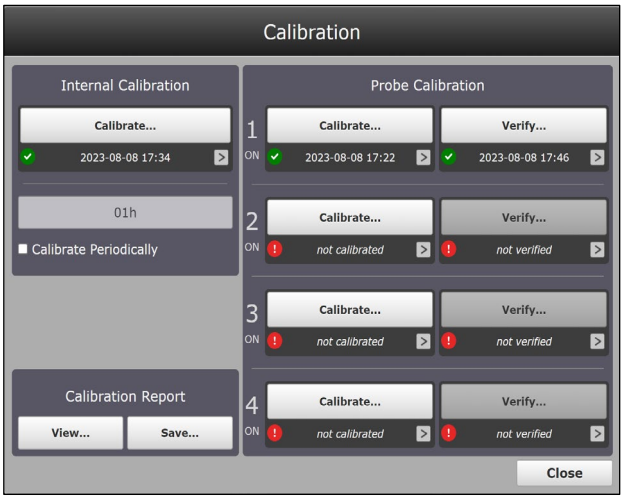


Figure 24. Calibration window for a Raman Rxn four-channel analyzer

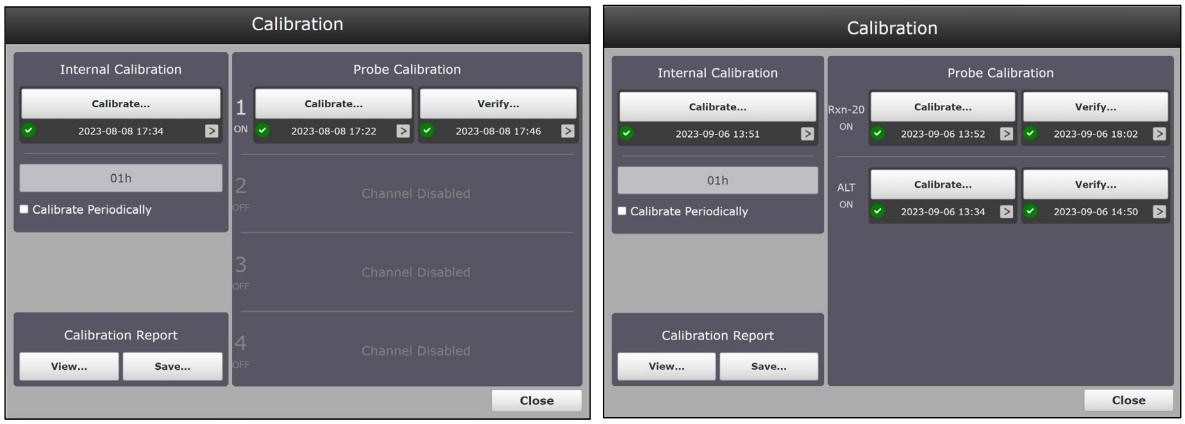


Figure 25. Calibration window for a Raman Rxn single-channel analyzer (left), Raman Rxn analyzer with hybrid configuration (right)

Probe-specific calibration devices differ. If your probe does not use the Raman Calibration Accessory (HCA), the Intensity Calibration dialog will vary. Refer to the corresponding probe or optics documentation.

6.3 Internal calibration (Raman Rxn2, RamanRxn4, and hybrid analyzers)

Raman Rxn2 and Raman Rxn4 analyzers contain internal standards for spectrograph and laser wavelength calibration. Three calibration modes are available:

Automatic

- If already calibrated, this mode compares the analyzer response to specifications and applies a minor algorithmic correction if slightly out of specification.
- If either the spectrograph wavelength, the laser wavelength, or both are out of specification, the analyzer performs a full recalibration.
- If uncalibrated, the analyzer performs an alignment calibration followed by full spectrograph wavelength and full laser wavelength calibrations.

Recalibrate X Axis

Performs full wavelength and laser calibrations without checking whether the analyzer is within specification.

Recalibrate All

Performs:

- Alignment calibration
- Full spectrograph wavelength calibration
- Full laser wavelength calibrations

Afterwards, all probe intensity calibrations and verifications become invalid and must be repeated.

Recommendation: Perform internal calibration at least once per day (1 day 00:00 hours).

6.3.1 Performing internal calibration

CAUTION

▶ Before calibration, ensure all probes are capped.

To perform internal calibration

1. Under Internal Calibration, click **Calibrate**.

   The Calibrate Instrument dialog appears.

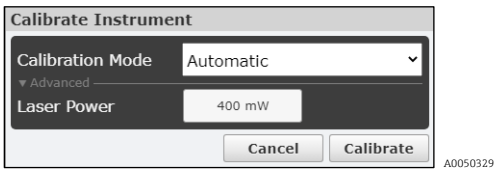


Figure 26. Internal calibration standards for spectrograph and wavelength

2. Choose one of the following:
   - **Initial startup:** From the **Calibration Mode** list, select **Recalibrate All**, then click **Calibrate**. Use **Recalibrate All** only during initial start-up or after the analyzer is moved or serviced.
   - **Routine calibration:** From the **Calibration Mode** list, and select **Automatic**, then click **Calibrate**.
3. (Optional) To adjust the laser power setpoint, expand the **Advanced** list, enter the desired value for **Laser Power**, and click **Calibrate**.

6.3.2 Configuring periodic internal calibration

1. Under Internal Calibration, click **Calibrate**.
2. On the Calibration screen, select **Calibrate Periodically**.
3. Use the time control above the periodic calibration setting to configure the frequency in one-hour increments.

6.4 Probe calibration

Probe calibration uses:

- the Raman Calibration Accessory (HCA), or
- a probe-specific calibration and verification kit using a Calibration Reference Standard (CRS).

Refer to probe documentation for approved calibration devices. Follow the calibration device manual for detailed calibration procedures.

Important: When calibrating a channel, pause all other channels to prevent ambient or white light from entering a probe and affecting measurements.

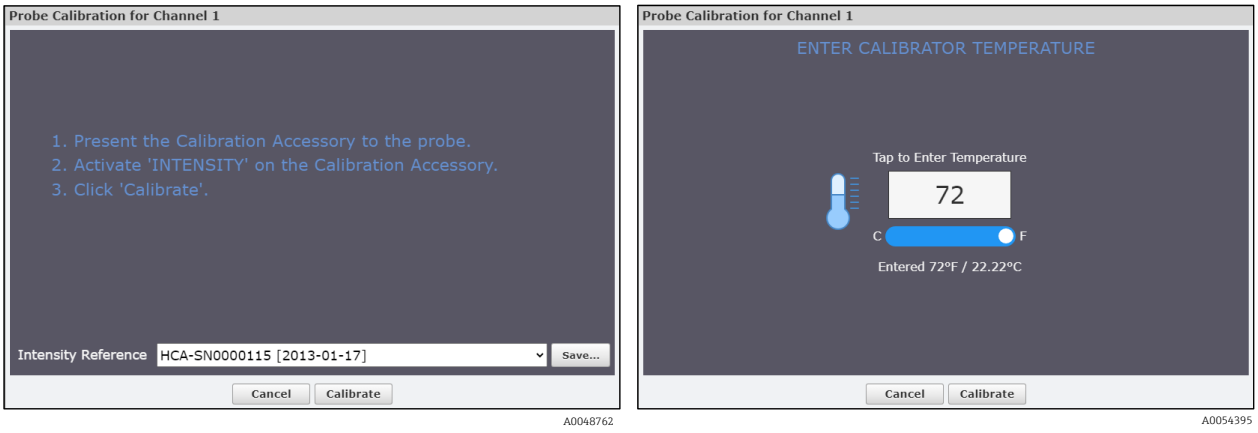


Figure 27. Probe calibration, HCA standard (left) and probe calibrator temperature (right)

6.5 Probe verification

Probe verification checks calibration performance against a known standard sample such as:

- 70% isopropanol (IPA)
- Cyclohexane
- Acetone (LNG only)

Passing verification confirms that the system meets baseline operational criteria. Verification is intended to identify major issues or significant performance changes.

For application-critical validation, customers must also verify performance using application-specific models or representative samples.

NOTICE

▶ Some standard reference samples can damage specific probes. Consult probe operating instructions for approved verification materials and procedures.

Figure 28. Verification timer

6.6 Raman Rxn5 calibration and verification

The Raman Rxn5 gas analyzer automatically performs internal calibrations with each analysis. Therefore, the **Calibration** screen displays only probe-related calibration and verification functions.

The **Calibration** screen lists:

- The most recent calibration and verification date and time
- Pass or fail status
- Calibration and verification details

Use the **Calibrate** and **Verify** buttons at the top of each channel to perform a new calibration or verification. A new calibration is typically required only when verification fails.

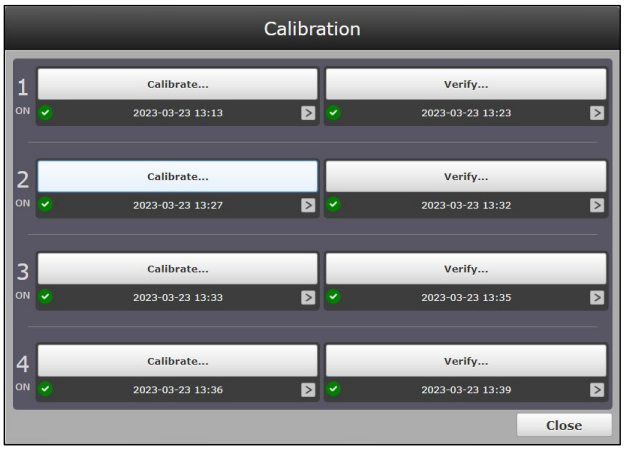


Figure 29. Calibration window for a Raman Rxn5 analyzer

Before verifying any channel, disable the analysis for all channels as described in *Data collection for the Rxn5* → 🖹.

To calibrate or verify a channel, select **Options > Calibration** from the dashboard.

6.6.1 Viewing calibration or verification details

To view internal calibration or verification details

1. Click the date beneath **Calibrate** or **Verify**.

   The calibrations screen displays the most recent calibrations or verifications displays for each method.

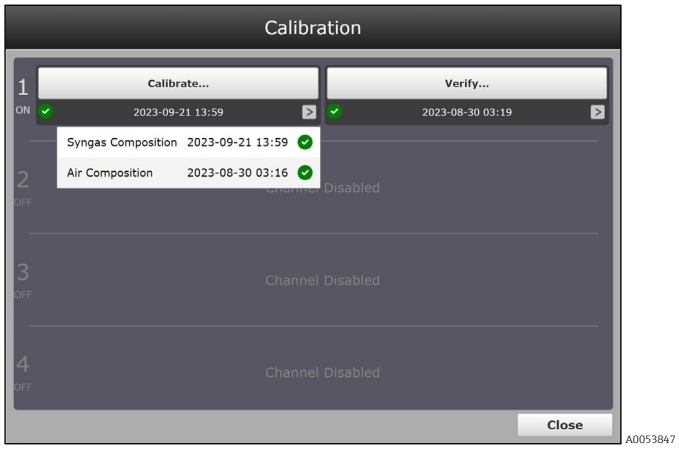


Figure 30. Calibration reports for multiple methods on a Raman Rxn5 analyzer

2. Select the entry to open the spectrum details view.

   A detailed view of the associated spectrum displays.

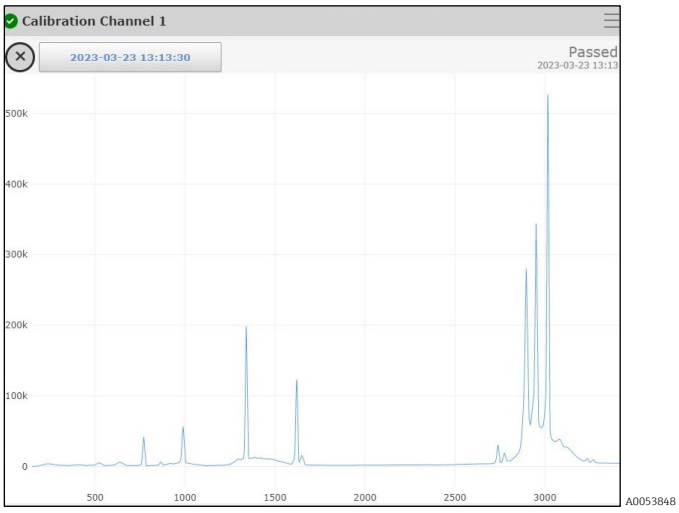


Figure 31. Calibration spectrum details

3. In the details screen, you can:
   - Click the **date** button (upper-left corner) to export or add spectra.
   - Click the ☰ menu (upper-right corner) to view calibration or verification details, including method and reference.
4. Click outside the details window to return to the **Calibration** screen.

6.6.2 Verifying a channel

Verification functions as a calibration reference and is used to score the method's performance against the known composition of the reference gas.

To verify a channel

1. In the **Calibration** screen, click **Verify**.

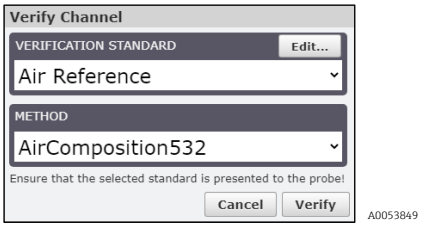


Figure 32. Verify channel selections

2. Select:
   - Verification standard
   - **Method (analytical).** Required for gas standards.
3. Click **Verify**.

   The Verifying progress screen displays.

Figure 33. Verification progress

   When verification is complete, the **Calibration** screen displays the results.
4. Click **Close** to return to sampling.

6.6.3 Calibrating a channel

Before calibrating a channel for the first time, select the correct **method** and **reference gas**.

To calibrate a channel

1. On the Calibration screen, click **Calibrate**.

   The **Calibration** dialog appears.

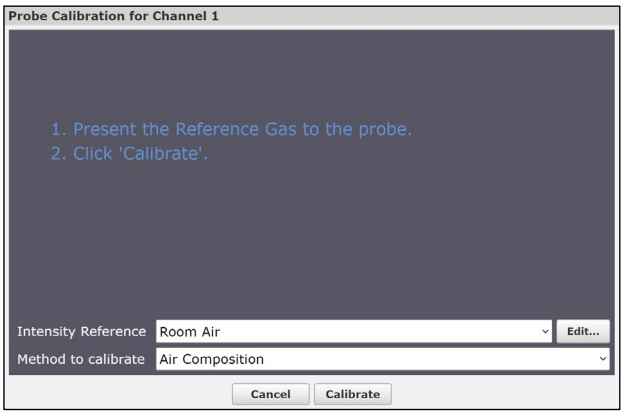


Figure 34. Calibration dialog

2. Select:
   - **Intensity reference.** For gas-phase applications, the intensity reference is the calibration gas associated with the method.
   - **Method to calibrate**:
     - When the intensity reference is a gas, select the analytical method to which the calibration applies.
     - When the intensity reference is a broadband calibrator (such as the Raman calibration accessory (HCA)), no method selection is required.
     - If the selected reference gas composition does not contain the correct components for the method, an error message appears. Select the correct reference to clear the error.
3. Click **Calibrate**.

   The Calibration progress screen displays.

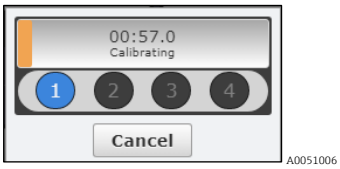


Figure 35. Calibration progress

   The channel enters the **Unverified** state until verification completes. When calibration finishes, the **Calibration** screen displays the results.
4. (Optional) Click **>** for a channel to view its calibration scores, the verification spectrum, or calibration spectrum. Click outside of the window to return to the **Calibration** screen.
5. From the Calibration screen, click the **Close** button to return to the dashboard.

To resume sampling, re-enable the system as described in *Restarting the system* → 🖹.

6.6.4 Adding and replacing calibration gas

When adding a new method to a channel, create a compatible reference gas for that method.

To add a new calibration gas

1. Select the appropriate channel and click **Calibrate...**
2. From the Intensity Reference list, select New Reference Gas....

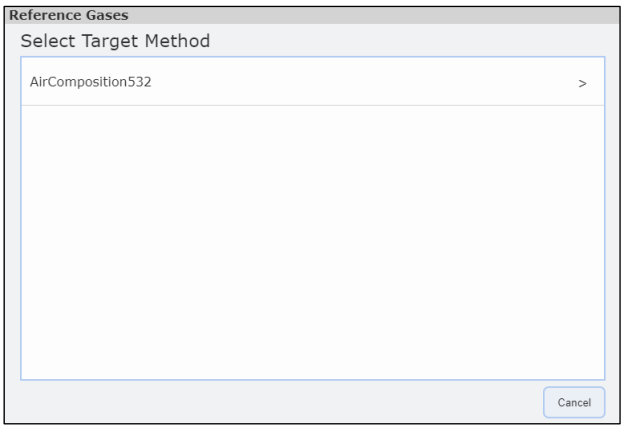


Figure 36. Select target method

3. Choose a target method.

   The Set Composition dialog opens with a component list based on the selected method. All composition values default to 0.000 mol %.

4. In the composition dialog, enter:
   - Reference gas name
   - Composition values (must sum to 100%)

5. Click **Save**.

The new reference gas appears in the Gas References dialog and in the Reference list within the Calibration Parameters dialog.

To replace a calibration bottle

Use the **Calibration** screen to update the calibration gas composition when replacing an existing bottle.

1. On the Calibration screen, click **Calibrate** for the desired channel.

   The probe calibration screen displays.

2. From the **Intensity Reference** list, select the gas to update.
3. Click **Edit**.

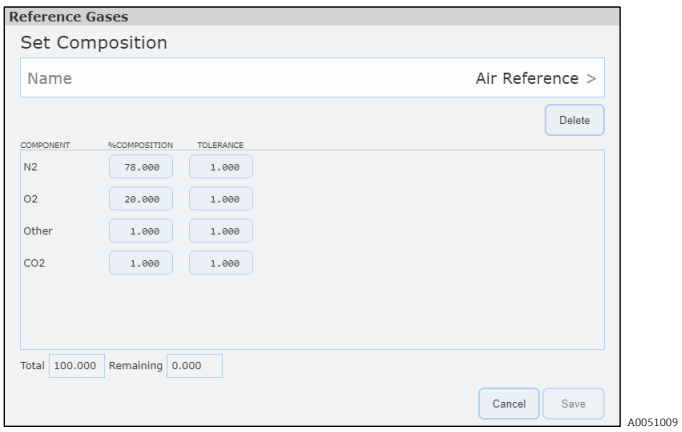


Figure 37. Set reference gas composition

4. Update composition values (must total 100%).
5. Click **Save**.

6.7 Calibration and verification reports

To view reports

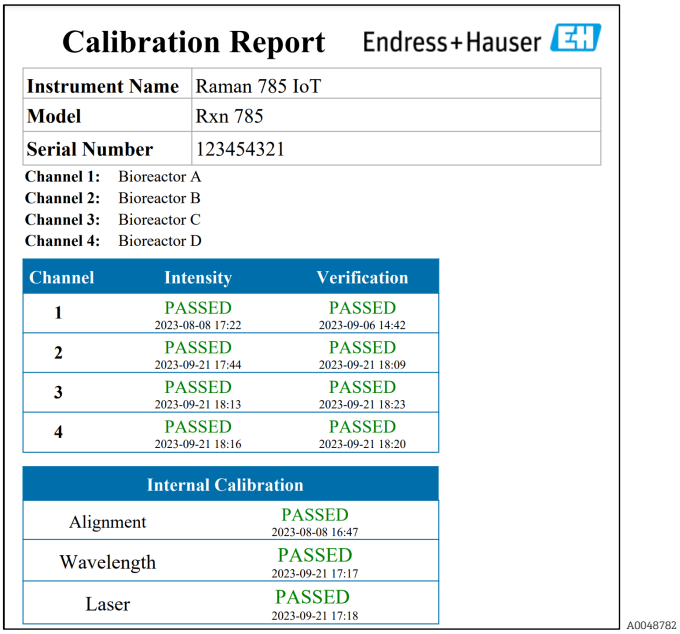
1. In the lower-left corner of the Calibration screen, click **View**.

   The summary section of the internal calibration report appears at the top of the screen.

2. Scroll through the report.
3. Click **Close** to exit.

To export reports

- On the **Calibration** screen, click **Save** to export the report as a .pdf file to a USB memory stick.
- Reports can also be accessed remotely through a network Raman RunTime connection or via OPC.



Calibration Report Endress+Hauser

Instrument Name	Raman 785 IoT
Model	Rxn 785
Serial Number	123454321

Channel 1: Bioreactor A
Channel 2: Bioreactor B
Channel 3: Bioreactor C
Channel 4: Bioreactor D

Channel	Intensity	Verification
1	PASSED 2023-08-08 17:22	PASSED 2023-09-06 14:42
2	PASSED 2023-09-21 17:44	PASSED 2023-09-21 18:09
3	PASSED 2023-09-21 18:13	PASSED 2023-09-21 18:23
4	PASSED 2023-09-21 18:16	PASSED 2023-09-21 18:20

Internal Calibration	
Alignment	PASSED 2023-08-08 16:47
Wavelength	PASSED 2023-09-21 17:17
Laser	PASSED 2023-09-21 17:18

A0048782

Figure 38. Calibration and verification report

To view probe verification results

1. Select Options > Calibration.
2. Under **Verify**, click the status field to open the probe verification report.

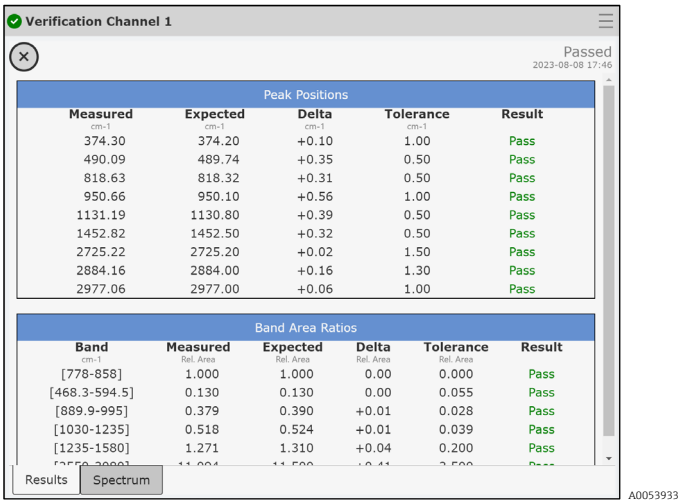


Figure 39. Probe verification report

3. Select the **Spectrum** tab.

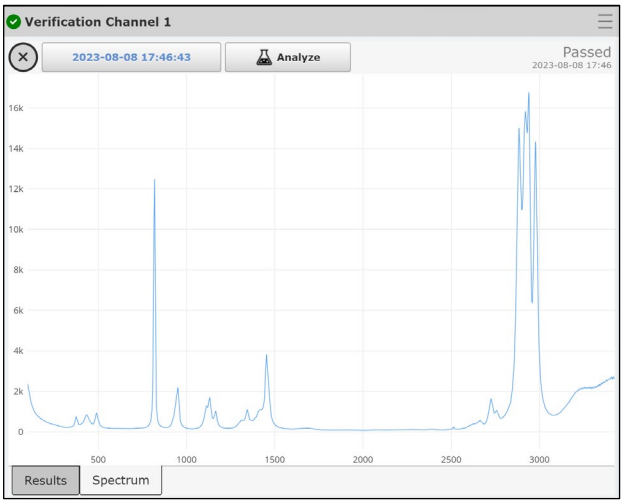


Figure 40. Probe verification spectrum viewer

4. Choose one of the following:
   - Click the date/timestamp button in the upper-left corner to add a spectrum or to export the verification spectrum. Adding a spectrum allows you to overlay and analyze differences between spectra.
   - Use **Export** to save the verification spectrum to a USB memory stick connected to the front and rear USB ports. You may also export to a network-connected drive as an **.spc** file.
   - Click **Analyze** to view or apply a model.

7 Operation

All Endress+Hauser Raman analyzers use Raman RunTime firmware. Available functions may vary by analyzer model. Product-specific differences are identified in the relevant sections of this manual.

This chapter discusses methods for collecting and viewing data through Raman RunTime. It is divided into two sections:

- Data collection for Raman Rxn2, Raman Rxn4, and hybrid configurations
- Stream details for the Raman Rxn5

This chapter also provides instructions on loading and managing analytical models and methods in Raman RunTime. Raman Rxn2, Raman Rxn4, and hybrid configuration systems enable the use of models outlined in the section below. Raman Rxn5 analyzers use methods created in the Endress+Hauser Raman Method Designer (RMD).

7.1 User interface overview

The Raman RunTime dashboard is divided into quadrants based on the analyzer configuration:

- **Four-channel analyzers** display four quadrants. Each quadrant represents a probe or stream and includes a status bar that provides a quick view of warnings and acquisition status.
- **Single-channel analyzers** display one main channel or probe window.
- **Hybrid analyzers** display two windows—one for the Rxn-20 probe channel and one for the alternate (ALT) probe.

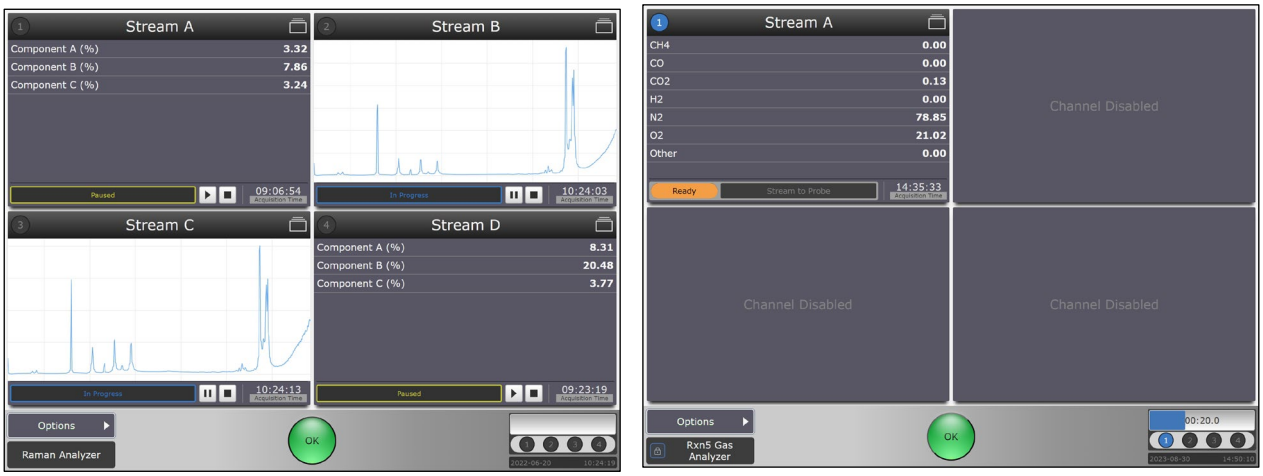


Figure 41. Raman RunTime dashboard in a Raman Rxn2 or Raman Rxn4 four-channel analyzer (left) and Raman Rxn5 analyzer (right)

You can view analysis details directly from each probe or stream window. To switch between the dashboard and batch detail views, click the **title bar** of the probe or stream. To toggle between **current spectrum** and **process values** (model results), click the **stream window**.

System settings, calibration tools, and diagnostics are available under **Options**.

7.1.1 Analyzer status indicators

The circular **Status** button at the bottom center of the main screen indicates analyzer health. It has three states:

- **Green (OK).** Indicates normal operation with no detected issues.

Figure 42. Green OK status indicator

- **Yellow (Warning).** Indicates a caution condition. Select the **Warning** indicator to view details.
  If unused channels or probes are present, the yellow status indicates uncalibrated channels. Disable unused channels to remove this warning. Refer to *Unused channels and probes* → 🖹.

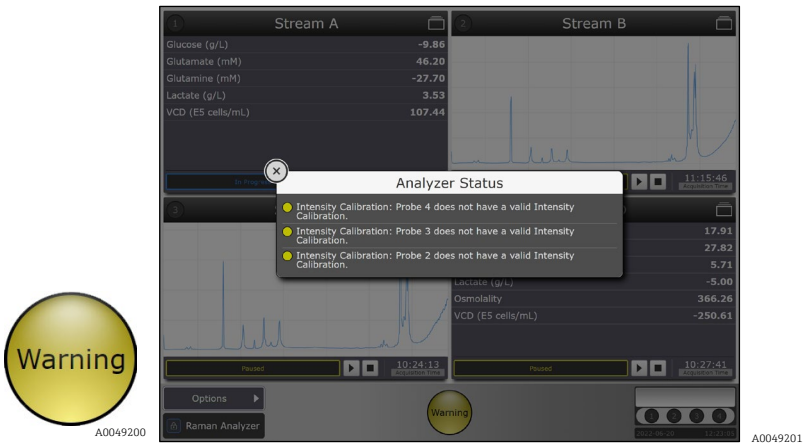


Figure 43. Explanation for yellow warning

- **Red (Error).** Indicates a serious condition requiring immediate attention. Select the **Error** indicator to view the error description. The error message clears automatically after the issue is resolved.

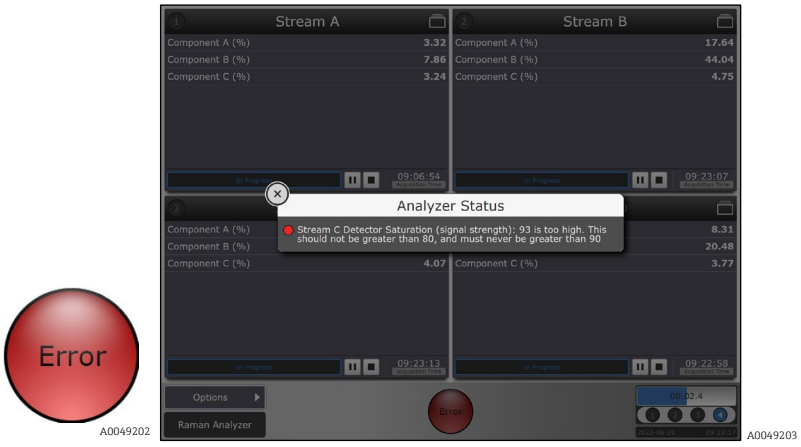


Figure 44. Explanation for red error

Raman analyzer progress bar

The progress bar appears in the lower-right corner of the dashboard and detailed views. It updates continuously with the remaining acquisition time. The lower portion of the bar displays the current system date and time.

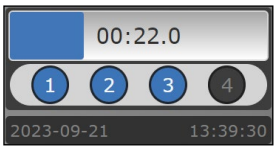


Figure 45. Progress bar

7.2 Data collection for Raman Rxn2, Raman Rxn4, and hybrid analyzers

In Raman Rxn analysis, a batch is a collection of data acquired over a defined time period with a clear start and end. Batches are commonly used for applications such as reaction monitoring and process analysis.

During an active batch, data collection can be paused or stopped at any time:

- **Pause** temporarily suspends data collection without ending the batch. The batch can be resumed later.
- **Stop** ends the batch permanently. A stopped batch cannot be resumed.

When data collection is paused or stopped, Raman RunTime automatically advances to the next probe in the sequence or waits until the next scheduled acquisition, depending on the selected collection mode.

Data collected in continuous, focus, snapshot, or manual collection modes are not considered part of a batch. Batch names can contain up to 60 characters.

7.2.1 Collection modes

Raman RunTime supports the following data collection modes: Manual, Continuous, and Periodic. Batch settings for collection and exposure parameters are saved to simplify the setup of future batches.

Collection behavior may differ between probes. Mode-specific behavior and the impact on probe sampling sequences are described in the following sections.

Exposure parameters must be specified for all batch-based collection modes.

- **Exposure length**: Duration of a single laser exposure
- **Count**: Number of exposures combined to generate one spectrum (also referred to as accumulations)

Select the exposure length to avoid detector saturation. Increasing the count improves the signal-to-noise ratio but increases the total acquisition time. Determine the optimal count by balancing data quality with the required acquisition time per analysis.

- Recommended detector saturation range: 40 % to 70 %
- Avoid saturation below 10 % or above 80 %

Exposure settings can be changed during an active experiment. Pausing the batch is not required; updated settings take effect with the next acquisition.

Focus and Snapshot collections are available as diagnostic and setup tools.

7.2.1.1 Manual mode

Manual mode is used when sample timing is controlled by the operator rather than by a fixed schedule.

Use Manual collection mode to acquire spectra by selecting **Acquire**. You can assign a batch (experiment) name to group manually acquired spectra for storage. You can also assign an optional sample name to each spectrum.

To acquire spectra manually

1. Navigate to the **Probe Details** screen.
2. Click **Edit** to create a new acquisition batch.
3. In the batch management window, click **New.**

   The enter batch name dialog appears.
4. Enter a unique batch name and click **Apply**.

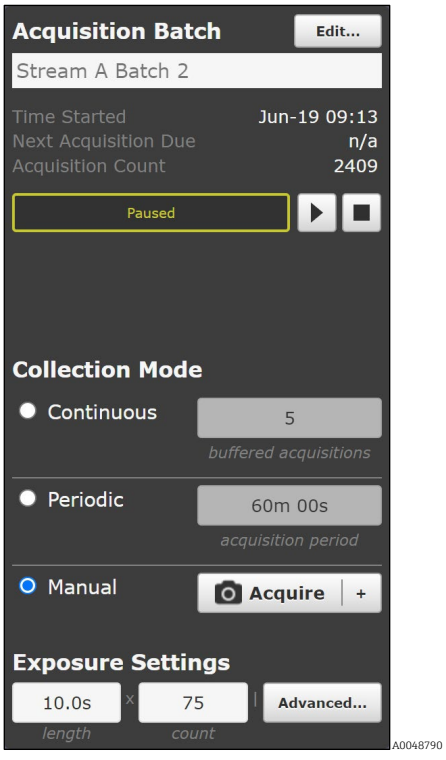


Figure 46. Manual collect mode options

5. Enter the manual collection mode settings:
   a. Under Collection mode, select **Manual**.
   b. Click **Play**  .
6. Adjust acquisition settings and collect spectra:
   a. Adjust the **Length** and **Count** values under **Exposure Settings**.

Figure 47. Exposure settings as described with length (left) and count (right)

   b. (Optional) Click **+** next to **Acquire** and enter a sample name.

Figure 48. Keyboard that pops up to rename the sample

7. Click **Acquire** to collect a spectrum.
8. Click **Stop**  to end the sequence of manual samples stored together.

To collect another spectrum, specify a new sample name (if desired), change Exposure Settings as needed, then click **Acquire** again.

7.2.1.2 Continuous mode

Continuous collection mode cycles through each active probe as quickly as possible. It is recommended for method development when collecting frequent reference samples and for monitoring and control when models are active.

In Continuous mode:

- Spectra are collected repeatedly for each active probe.
- The probe sampling sequence may be affected by pausing, stopping, or restarting the system.
- If the order of probe sampling is critical, Periodic mode is recommended.

Buffered acquisition

Buffered acquisition allows spectra and model results to update more frequently without reducing accuracy or repeatability. The following examples illustrate how buffered acquisition affects update frequency without changing the total acquisition time:

- With exposure settings of 10 s × 60 and 1 buffered acquisition, spectra and model results update only after the full acquisition cycle, approximately every 10 minutes.
- With exposure settings of 10 s × 6 and 10 buffered acquisitions, spectra and model results update approximately every 1 minute.
- In both cases, each reported spectrum represents 10 minutes of total acquisition time, because each update combines ten acquisitions of 10 s × 6.

The Buffered acquisitions setting defines how many consecutive acquisition cycles are combined to produce each reported spectrum. When buffered acquisition is enabled:

- Individual acquisition spectra are added together to form a single, combined spectrum.
- The combined spectrum and associated model results are updated at the end of each acquisition cycle.
- Only the combined spectrum is reported; individual acquisition spectra are not reported.
- Active models operate on the combined spectrum rather than on individual acquisitions.

Buffered acquisition is not recommended for applications that require long collection intervals when more than one probe is active. As acquisition alternates between probes, combining consecutive acquisitions for a single probe can include outdated process data if other probes have long acquisition intervals.

To achieve the same total acquisition time as non-buffered acquisition, reduce the Count setting and increase the Buffered acquisitions setting while keeping the product of the two values constant.

Setting Buffered acquisitions to the default value of 1 disables buffered acquisition. In this case, Raman RunTime performs conventional acquisition, and each spectrum is independent of previous spectra.

To set up a continuous collection

1. Create a batch under **Edit > New** and specify a new batch name.
2. Set the collection mode to **Continuous**.
3. Enter the exposure and buffer settings. For information on buffered acquisitions, see *buffered acquisition* → 🗎, below.

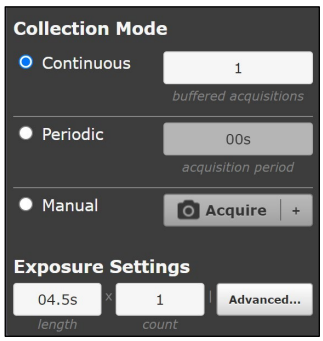


Figure 49. Collection mode details for continuous mode

4. Repeat for all active probes and click **Play** in the desired probe sequence.

7.2.1.3 Periodic mode

Periodic mode acquires spectra at defined time intervals. It is typically used during method development or process monitoring when acquisitions must align with samples drawn from reactors or other timed process events. Buffered acquisition is not available in Periodic mode.

To set up a periodic batch

1. Create a batch under **Edit > New** and specify a new name.
2. Set the collection mode to **Periodic**.

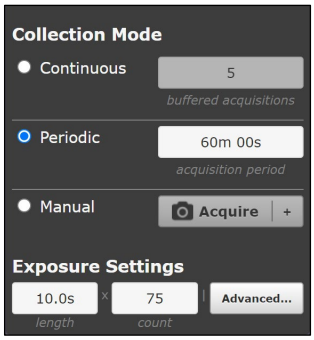


Figure 50. Periodic mode batch details

- In the example shown here, periodic acquisition is scheduled for 60 min.
- The batch details show when the next acquisition is due and how many counts of spectra have been collected for the current batch.
- If spectral acquisition is active in Periodic mode, the Next Acquisition Due reads “now.”

3. Set the exposure settings and acquisition period.
4. Repeat for all active probes and click **Play** in the desired probe cycle order, for example, 1, 2, 3, 4 or 1, 3, 2, 4.

7.2.2 Setup and diagnostic acquisition tools

The following functions are provided for diagnostic and setup purposes. These tools do not collect batch data, and the spectra acquired using these functions are not stored. They are intended for system setup, probe alignment, verification activities, and quick checks.

7.2.2.1 Focus mode

Focus mode is used to position non-contact optical probes and to determine appropriate collection settings for a specific sample or process. Spectra acquired in Focus mode are not stored; they are intended for visual evaluation only. Before using Focus mode, consult the probe documentation to ensure the probe is configured correctly.

While Focus mode is active, the spectrum and current signal value update continuously on the screen. The update rate is controlled by the blue **Detail** slider, providing dynamic feedback on signal level during probe alignment.

Focus mode does not require exposure settings because it is used to determine an appropriate exposure length.

To use Focus mode

1. Position the probe at the sample and click **Focus** in the probe details view.

   A suggested exposure range displays. The example below shows 1.7s to 3.0s for a sample of 70 % IPA.

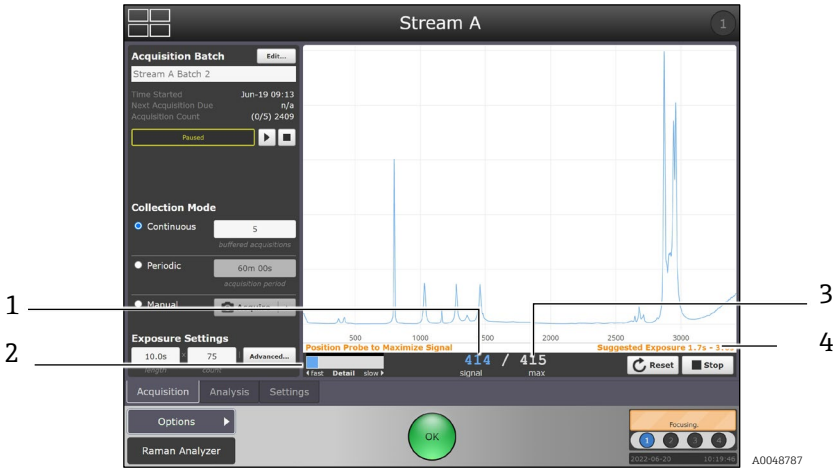


Figure 51. Focus mode example

#	Description
1	Current signal
2	Detail slider

#	Description
3	Maximum signal
4	Suggested exposure display

2. Move the blue **Detail** slider to adjust the focus time as needed.

   Samples with weak signals may provide more information with slower focus settings.

3. Using feedback from the **signal** and **max** values, reposition the sample or probe to achieve the highest signal level.
   - The **signal** and **max** values compare the current signal level with the highest signal measured during the current focus session.
   - The **current signal** changes as the probe or sample is repositioned. When the current signal exceeds the previous maximum, the **max** value is updated.
   - When the current signal equals or is close to the **max** value, the system is at optimal focus and produces the highest signal-to-noise ratio.
4. Click **Reset** to reset the maximum signal.
5. Click **Stop** to exit focus mode.

7.2.2.2 Snapshot mode

Snapshot mode functions similarly to Focus mode in that spectra are not stored. It enables quick, single-spectrum acquisitions to measure laser power, test exposure length and count settings, or rapidly assess spectral quality, either visually or by applying a model.

Snapshot mode is recommended for in situ verification of starting materials, particularly during long-duration experiments such as bioprocesses. It allows rapid verification without modifying batch exposure settings.

To access Snapshot mode

1. From the dashboard, click a probe title bar to open the probe detail view.

The probe detail view with spectral plot displays.

2. Click anywhere within the spectral plot.

   The spectra overlay plot appears.

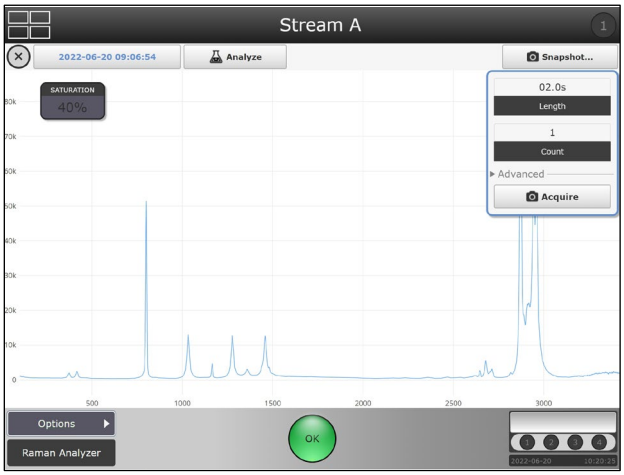


Figure 52. Snapshot mode options

3. Click Snapshot.
4. Select an exposure length and count, then click **Acquire**.

If an experiment is in progress, the snapshot spectrum overlays the most recent spectrum. Snapshot spectra are not saved as part of the current batch; they are for on-screen evaluation only.

To overlay the snapshot spectrum over spectra from previous batches or experiments

1. In Snapshot mode, click the spectrum name displayed as a **blue** date and time in the top right header.

   Clicking the spectrum name located to the left of Analyze button displays the selected spectra drop-down list.

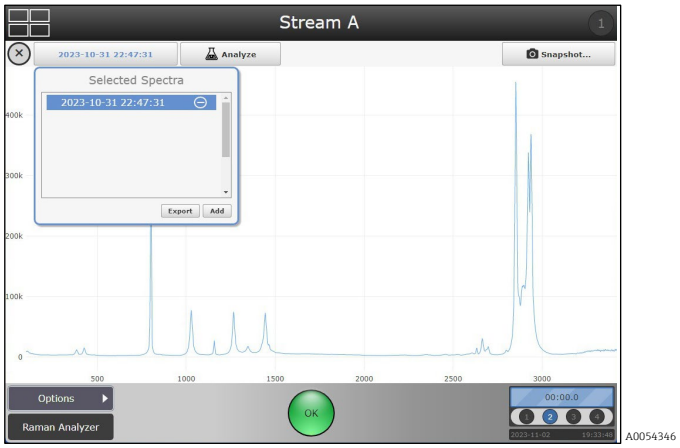


Figure 53. Select spectra in Snapshot mode

2. Click **Add** and browse to select the reference spectra.

   The select batch dialog displays.

3. Select the batch you wish to overlay.

   The select spectrum dialog displays.

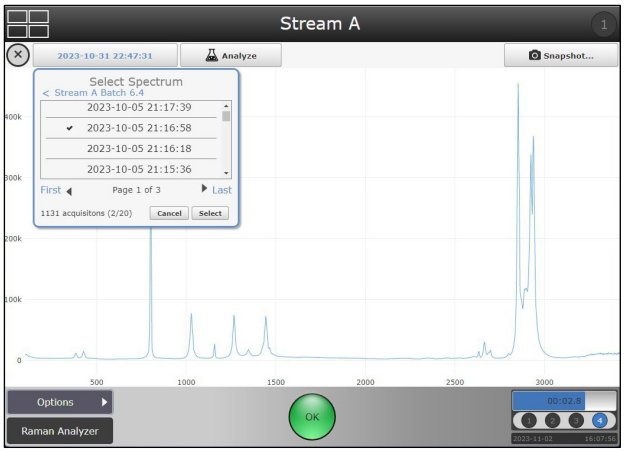


Figure 54. Select spectrum in snapshot mode

4. Select the spectrum you wish to compare. Click **Select**.

When a new snapshot is collected, it automatically becomes active and is displayed in blue. The snapshot displays the principal spectrum, which can be changed by selecting/highlighting it in the spectrum list.

Multiple spectra can be added to the overlay, but only a single spectrum is distinguished as the active spectrum. The active spectrum is always blue and listed by name in the header.

To apply a model in Snapshot mode

Applying a model in Snapshot mode is ad hoc analysis. During ad hoc analysis, only the principal spectrum will be processed by the selected model.

1. In Snapshot mode, click **Analyze.**

   Available models are listed in a Models dialog.

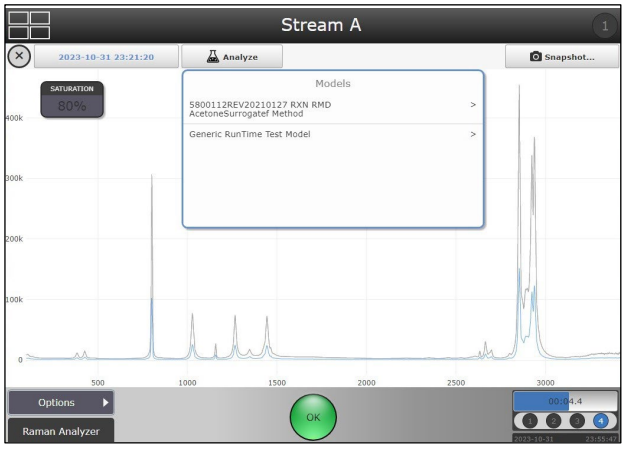


Figure 55. Analyze function in snapshot mode

2. Select a model.

   The model dialog lists its components.

3. Expand or collapse sections to view component attributes.

   To exit the spectra overlay view, click anywhere on the quadrant name or click **Exit** ⊗.

7.2.3 Dark exposures

Dark exposures remove non-sample signal contributions from the measurement. The detector wavelength determines how you should handle dark exposures.

Detectors operating at 532 nm and 785 nm have stable dark levels, so dark exposure handling is minimal and largely automatic. 1000 nm detectors exhibit less stable dark levels and require additional dark-exposure management.

Allow the analyzer to stabilize before collecting dark exposures:

- After startup, allow 2 hours of stabilization before collecting a dark exposure.
- After relocation, allow at least 24 hours for stabilization with the laser power on before collecting a new dark exposure.
- (This does not apply to short cart relocations for Raman Rxn2 systems.)

To collect a dark exposure for routine reuse, ensure the analyzer and laser remain on for 2 hours if the laser has previously been turned off.

7.2.3.1 Dark exposures for Raman Rxn2 (532 nm and 785 nm analyzers)

These systems use a single, user-initiated dark exposure configuration available under Exposure Settings > Advanced.

The Status indicator shows whether a dark exposure is active and how much time remains.

- Leave **Force New Dark** cleared. This is the default and recommended configuration.
- Selecting **Force New Dark** collects a new dark exposure for every spectrum. This is not recommended because it doubles the acquisition time.

Dark exposures are automatically collected at the start of acquisition whenever the exposure length or count setting changes.

- If a stored dark exposure exists for the same exposure length and count, Raman RunTime reuses it.
- To expire a stored dark exposure and force a new one, enable **Force New Dark** for one interval, then disable it.

In Continuous or Periodic mode, Raman RunTime collects the dark exposure at the start of the first acquisition and reuses it for subsequent spectra. As a result, the first acquisition interval takes approximately twice as long as subsequent intervals.

7.2.3.2 Dark handling for Raman Rxn (1000 nm analyzers)

For 1000 nm systems, dark exposures are collected automatically at the end of every acquisition. The number of dark exposures is configured under **Exposure Settings > Advanced**.

Dark subtraction removes non-sample contributions caused by detector dark current when the number of dark exposures is approximately half of the count setting.

- Trailing dark exposures (collected after the sample) are combined with leading dark exposures (collected before the sample).
- Trailing dark exposures from one acquisition become leading dark exposures for the next acquisition to reduce dark-collection time.

New leading dark exposures are collected when:

- The exposure length has changed since the most recent dark exposure.
- More than 10 minutes have elapsed since the most recent dark exposure.
- **Force New Dark** is selected.

Because leading dark exposures are conditional, acquisition times may vary, particularly:

- At the start of a new experiment
- After rebooting the analyzer
- When using Manual or Periodic collection modes

Use **Force New Dark** when consistent acquisition timing is more important than minimizing total acquisition time.

7.3 Data collection for Raman Rxn5 analyzers

The RunTime dashboard for Rxn5 displays the most recent results for each of the four streams. Each stream's data is displayed in a separate quadrant.

The quadrant display for a given stream shows the percent of each component in that stream as determined from the last analysis of that stream, as well as optional derived values such as Gross Heating Value and Wobbe Index. The time stamp of the last sample is also displayed. The Options menu provides access to system settings, diagnostics, and calibration.

Finally, a large indicator in the lower left corner of each quadrant displays the current sampling status of that stream. The indicator displays **Ready** with an orange background when a stream is ready to collect data, **Disabled** when a stream has been disabled, and **Prepare** when the Raman Rxn5 analyzer is preparing a sample for acquisition.

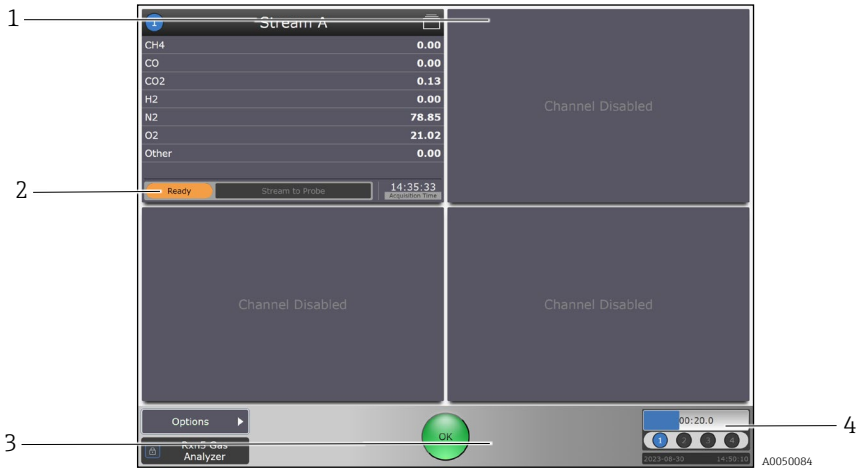


Figure 56. Raman Rxn5 dashboard

#	Description
1	Details icon
2	Sampling status indicator

#	Description
3	Status button
4	Progress bar

For the Raman Rxn5, global data collection settings are found on the system settings screen. Detailed settings can also be set based on the channel.

The Analysis setting allows an advanced user to enable or disable analysis for all channels of the instrument.

To turn analysis on or off

1. From the dashboard, click **Options** then click **System** to view the System Settings screen.

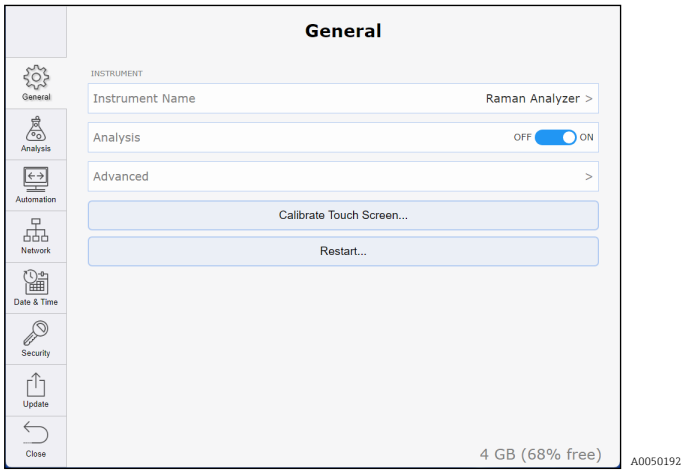


Figure 57. System settings – general page

2. Click the **Off – On** toggle to enable or disable analysis for all channels of the instrument.

7.3.1 Stream detail view

The Stream detail view displays additional information for a particular stream. Each section of the stream detail view is discussed below. The stream detail view has three tabs: Analysis, Sampling, and Settings, which are described in the following sections.

To access the stream detail view, click the **Details** icon from the dashboard. To return to the dashboard, click the **Quadrants** icon in the upper left corner of the Stream Detail View.

7.3.2 Analysis tab

The **Analysis** tab displays the analysis and spectrum from the most recent acquisition. It also shows the average temperature and pressure from that acquisition. These values update at the end of the acquisition cycle, together with the other data.

The tab also displays detector saturation. In the gas phase, detector saturation increases as sample pressure increases. Use detector saturation to optimize analyzer performance.

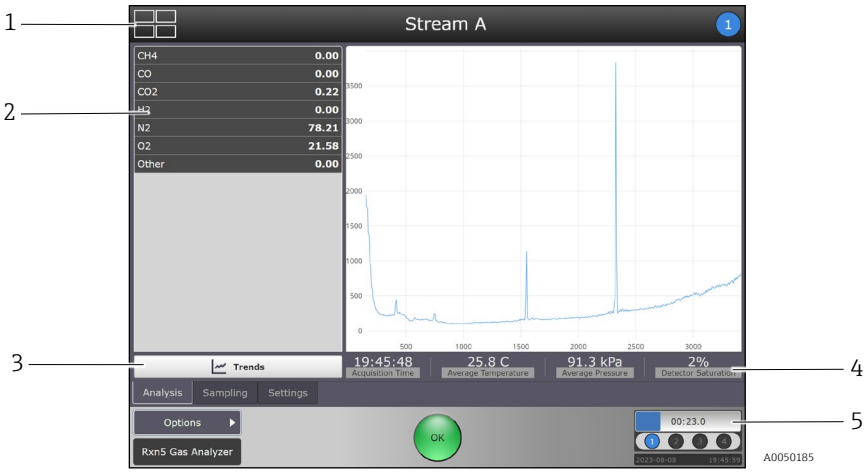


Figure 58. Stream detail – analysis tab

#	Description
1	Quadrants icon
2	Components measurement
3	Trends

#	Description
4	Average probe temperature, pressure, and detector saturation
5	Progress bar

7.3.3 Trends

The Trends window displays a trend chart of the stream components for a selected time period.

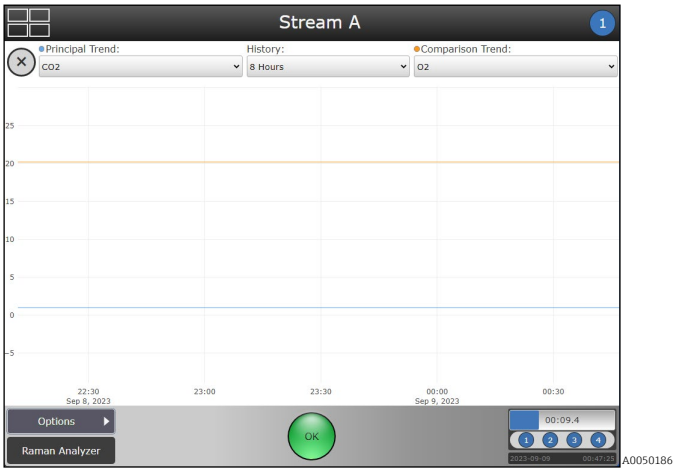


Figure 59. Stream detail – trends tab

Select a principal trend, a time frame, and a comparison trend on this screen:

- **Principal trend.** Select the component you want to view as a principal measurement trend.
- **History.** Select the time period to display on the graph, from 8 hours up to 10 days.
- **(Optional) Comparison trend.** Select the comparison trend you want to view. This option can only be selected if a Principal trend has been selected.

7.3.4 Sampling states and sequences

The sampling tab enables operators to coordinate the Raman Rxn5 analyzer with the sampling system. You can define individual sampling states and set up analysis sampling sequences using those states. Each stream is configured independently.

7.3.4.1 Creating sampling states

Users with operator permissions can create, modify, and delete Sampling States as well as Sampling Output signals within the states. Sampling States are mutually exclusive. The Sampling States sub-tab is shown below.

Each Sampling State consists of one or more Sampling Output signals. Each Sampling Output signal consists of a **Signal to Send**, which is True or False, and the **Time to Wait**, which is the pause in seconds or minutes before sending the next signal, for up to four digital outputs.

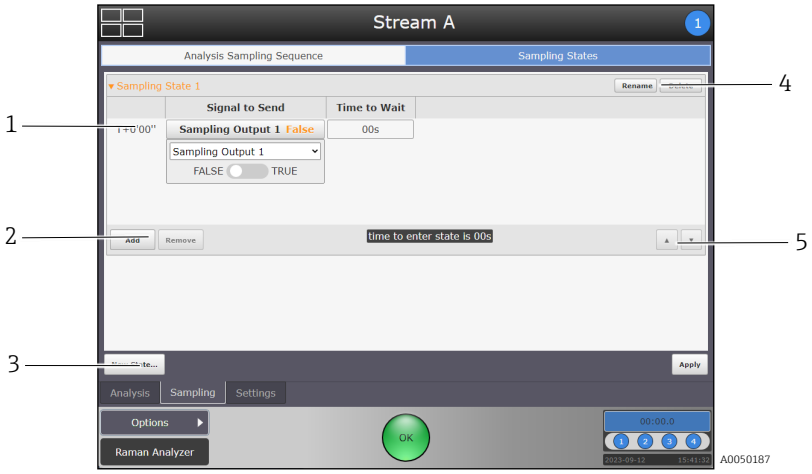


Figure 60. Sampling states tab showing states sub-tab

#	Description
1	Sampling outputs
2	Add or remove sampling output
3	New state button

#	Description
4	Rename or delete sampling state
5	Arrows to move sampling outputs up or down

To create a new sampling state

1. Navigate to the **Sampling States** tab from the **Stream Details** screen.
2. Click the **New State** button.
3. Using the on-screen keyboard, enter a meaningful name for the new state, for example, “Stream to Bypass”.
4. Click **Apply**.

To rename or delete a state, select it by tapping its row and then clicking the **Rename** button or the **Delete** button.

To create a new sampling output signal for a particular state

1. On the Sampling States screen, select the sampling state you want to modify.
2. Click **Add**.
3. Select the following for each sampling output signal:
   - Select either **True** or **False**.
   - Select a Time to Wait.
4. Click **Apply**.

To remove a sampling output signal

1. Select the signal you want to remove.
2. Click the **Remove** button.

   A confirmation dialog appears.

3. Click **OK**.

7.3.4.2 Creating sampling sequences

The **Analysis Sampling Sequence** tab enables operators to configure the sampling sequences, including determining the order of the sampling states and the amount of time for the sampling system to remain in a given state.

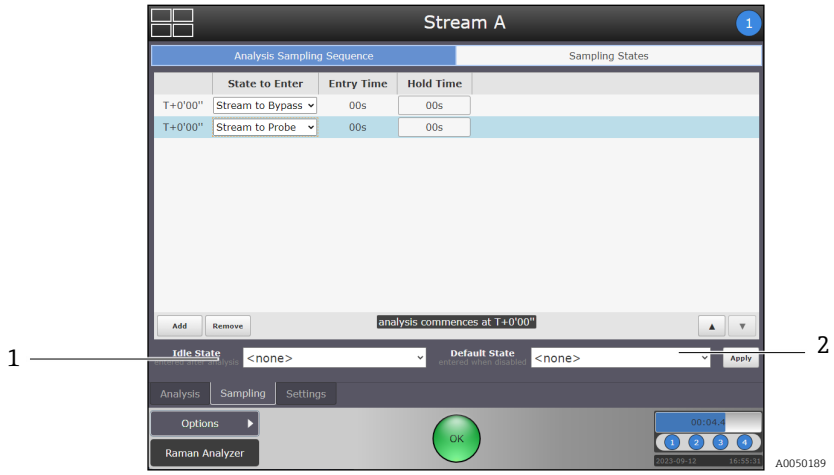


Figure 61. Analysis sampling sequence tab

#	Name	Description
1	Idle state	The state between one cycle and the next during live analysis. For the Rxn5 analyzer analysis is continuous, and you do not need to change the Idle State setting from its default state of <none>. If you do need to set the Idle State, click the drop-down list to select the desired state. States are created on the **Sampling States** tab.
2	Default state	The state a stream goes into when it is disabled. Click the drop-down list to select the Default State. Consult best practice guidelines to select the Default State, for example, to best conserve the product when the stream is disabled.

7.3.5 Stream settings

The **Settings** tab shows settings for analysis states and parameters for a stream.

Methods

All methods available for this stream are displayed on the left half of the **Stream Detail** screen. Selecting the check box next to a method enables that method to process collected data and present results.

Analysis

The **Analysis** list allows the advanced user to set the analysis state of each stream. Options include:

- **Disabled**. Stops analysis from occurring for that stream.
- **Enabled (online)**. Starts analysis for the stream. The enabled option means results are available to an external DCS if it has been configured.
- **Enabled (offline)**. Starts analysis for the stream. Enabled offline does not send results to an external DCS. The enabled offline feature is used while servicing an instrument.

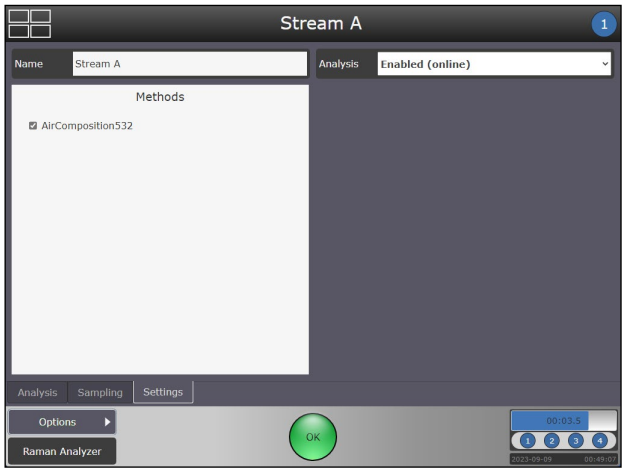


Figure 62. Stream detail settings tab

7.4 Model configuration and results

The following sections describe how analytical models and process values are configured and used in Raman RunTime. These concepts apply to all supported analyzers and are required for viewing, exporting, and integrating model results.

7.4.1 Naming model and process values

Model titles and y-variable names, called process values in Raman RunTime, should be changed in the final models to reflect the desired display names and OPC tags. For OPC communication, it is important to use a consistent naming scheme because each time a model title or assay name is changed, the OPC tags change accordingly (and need to be reconfigured for OPC communication).

Use the following recommendations for process values:

- Include units, for example g/L or mM. Model outputs within Raman RunTime do not automatically display units.
- Avoid using periods and commas in model titles and assay names.
- Special characters such as “&” and “%” work with some OPC configurations but should always be tested and removed from model or process value names as needed.
- Multiple models can exist for each process value type. This supports model comparisons during development and validation, as well as the use of multiple process value models per batch. For example, Gluc M1 and Gluc M2, or VCD Day 1-6 and VCD Day 7-14.

Raman data library can be used to ensure consistent process value naming. For more information, refer to *Data Fields* in *Raman data library User Operating Instructions* (BA02367C).

7.4.2 Defining parameters

If the selected model or method supports parameters, define and manage them on the **Parameters** tab in the **Analysis** screen. Available parameters are specific to the model or method and are determined by the developer.

Many parameters have default values. For parameters without default values, enter a valid value. Parameters without default values are identified by a **Trash** icon next to the parameter.

Example:

Sample temperature is typically provided by an external sensor and stored with the acquisition.

- If no value is entered for **Manual Sample Temperature**, the system uses the temperature stored with the acquisition to calculate temperature-corrected results.
- If a value is entered, it overrides the stored temperature.
- To use the external sample temperature again, delete the **Manual Sample Temperature** parameter.

For parameters without default values:

- The value can be modified after entry.
- The value cannot be cleared.

To revert to the system setting, delete the parameter by clicking the **Trash** icon.

7.4.2.1 *Default parameters*

Parameters shown with a default value cannot be deleted. Default Raman RunTime parameters are set at the factory and can be changed as needed. The **Reset** icon to the right of the field restores the default value. If these parameters are not changed from their defaults, the method works but the results may not be as intended.

RunTime can be configured to ignore any value by using the **Parameters** list under Analysis settings.

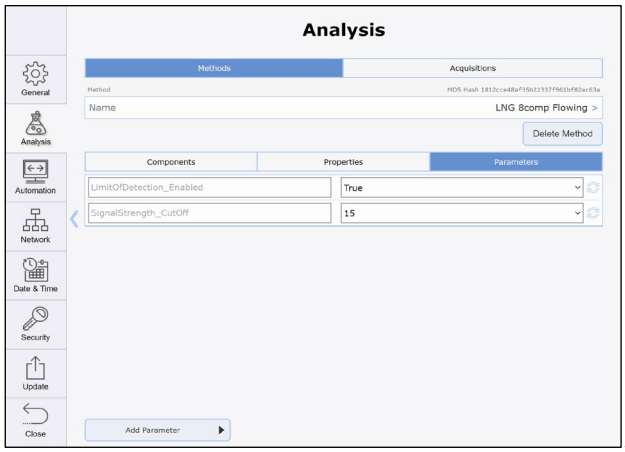


Figure 63. Default parameters

7.4.2.2 *Limited parameters*

A drop-down list of the possible values is displayed when the parameter has a fixed number of valid entries.

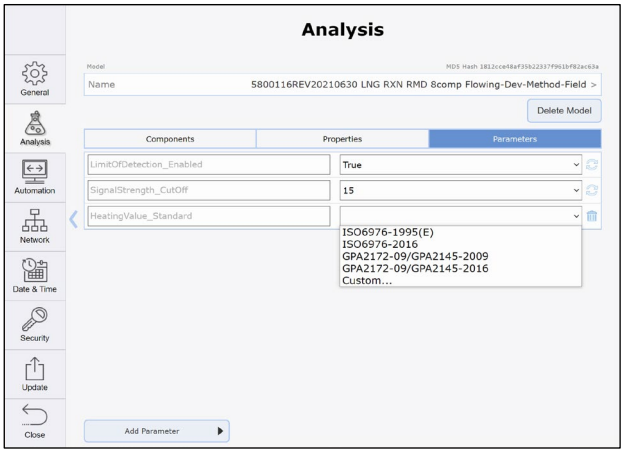


Figure 64. Limited parameters

7.4.2.3 *Default parameters for LNG applications (Raman Rxn4 analyzer)*

The following parameters are applicable to Raman Rxn4-based LNG applications only. For a list of parameters that apply to your application, review the parameters listed in your method or model.

Limit of Detection (LOD) enable	
Key Name	LimitOfDetection_Enabled
Description	Set this value to **True** to report component values as zero when they are below the detection limit.
Possible Values	▪ True ▪ False
Default	True
Recommended	True

Signal strength cutoff

Key Name	SignalStrength_Cutoff
Description	Signal strength is a scaled sum of Raman peak areas and is used to distinguish between a full pipe and an empty pipe. Set the cutoff value between the signal strength of an empty pipe and a full pipe. If the signal strength drops below the cutoff, all outputs are reported as zero. Signal strength is not a measure of instrument performance. The signal strength of a full pipe varies by installation and sample composition. Typical values: ▪ Empty pipe: 0 to 3 ▪ Full pipe: typically 30 to 150
Possible Values	Numeric (typically 5 to 25)
Default	15
Recommended	About 2/3 between empty and full pipe values

Other concentration

Key Name	OtherConcentration
Description	Mass balance by normalization is a standard part of the quantitative method. It forces the sum of the measured component concentrations to equal 100 %, assuming no unmeasured components. “Invisible” components do not generate a Raman signal or cannot be measured under the analysis conditions. If their total concentration is known, enter it as the **Other** concentration. The mass balance calculation uses **100 minus the Other concentration**, which can improve result accuracy. This feature is rarely used for LNG measurements.
Default	None (interpreted as zero)

Manual sample temperature

Key Name	TemperatureCompensation_SampleTemperatureC
Description	During normal operation, the sample temperature for compensation is read from the acquisition data (MODBUS, OPC, or a direct sensor). If a manual temperature is entered, it overrides the acquisition value. Delete the manual temperature (Trash icon) to revert to the acquisition temperature.
Default	None (allows key deletion). Values are in ˚C.
Recommended	-20 ˚C to +50 ˚C

Heating value standard

Key Name	HeatingValue_Standard
Description	The heating value standard defines the data and calculation methods used to determine heating values and related quantities. Calculations are based on composition and base temperature. Some quantities also require metering temperature and pressure. Each standard requires specific temperature and pressure values. Select the standard carefully and ensure all related parameters are set correctly.
Possible Values	▪ GPA2172-09 / GPA2145-2009 ▪ GPA2172-09 / GPA2145-2016 ▪ ISO6976-1995E ▪ ISO6976-2016
Default	None
Recommended	ISO6976-2016

Heating value units

Key Name: HeatingValue_Units

Description: Heating value units depend on the selected standard. The predictor can convert between units.

However, different standards can produce slightly different results. Converting values between standards may not match results calculated directly using those standards.

The numerator and denominator are evaluated independently to determine whether conversion is applied.

Allowed Values:
- MJ/m^3
- kJ/ m^3
- Btu/ft^3

Default: None

Heating value base temperature

Key Name: HeatingValue_BaseTemperature

Description: Each standard defines combustion data tables based on specific calorimeter base temperatures. The selected base temperature determines which table is used.

ISO standards support multiple base temperatures. GPA standards support one base temperature.

Allowed Values:

GPA
- 60 °F

ISO
- 0 °C
- 15 °C
- 20 °C
- 25 °C
- 288.15 K (equivalent to 15 °C)
- 15.55 °C

Default: None

Heating value metering temperature

Key Name: HeatingValue_MeteringTemperature

Description: This parameter is used to calculate compressibility, which enables conversion from ideal gas conditions to real (extended) gas conditions.

Only specific values are allowed for each standard.

Allowed Values:

GPA
- 60 °F

ISO
- 0 °C
- 15 °C
- 20 °C
- 25 °C

Default: None

Heating value metering pressure

Key Name: HeatingValue_MeteringPressure

Description: This parameter complements the metering temperature and is used to convert heating values from ideal to real gas conditions.

Only specific values are allowed for each standard.

Allowed Values:

GPA
- 14.65 psi
- 14.696 psi
- 14.73 psi

ISO
- 101.325 kPa

Default: None

Heating value output values	
Key Name	HeatingValue_OutputValues
Description	Heating value output values are calculated by the method and made available to RunTime. For LNG applications, the full list of values is available. For surrogate models, only the Wobbe Index is available, because other values are not required. Not all available values need to be used or displayed.
Allowed Values	▪ Ideal Wobbe Index (for surrogate models)

7.4.2.4 Adding parameters

To add a new parameter to the list of default parameters

1. Click **Add Parameter**.

   The parameter name is case sensitive.

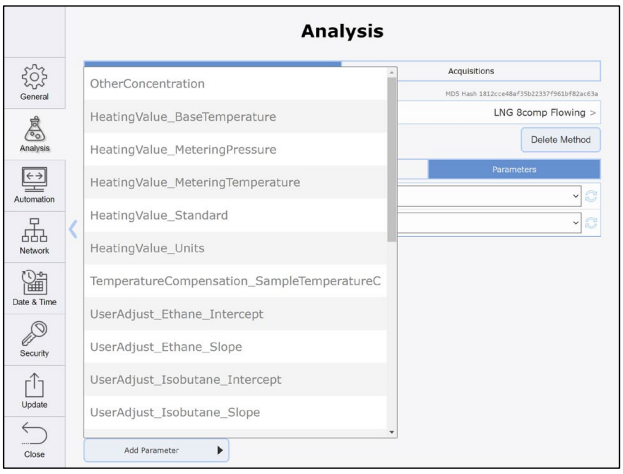


Figure 65. Adding a parameter

2. Choose a valid parameter from the list.

When a parameter is not needed, it delete it using the **Trash** icon.

7.4.2.5 Modifying parameter outputs

Use the **Components** tab on the **Analysis** screen to enable or disable parameter outputs. This function allows you to select which outputs you want to see.

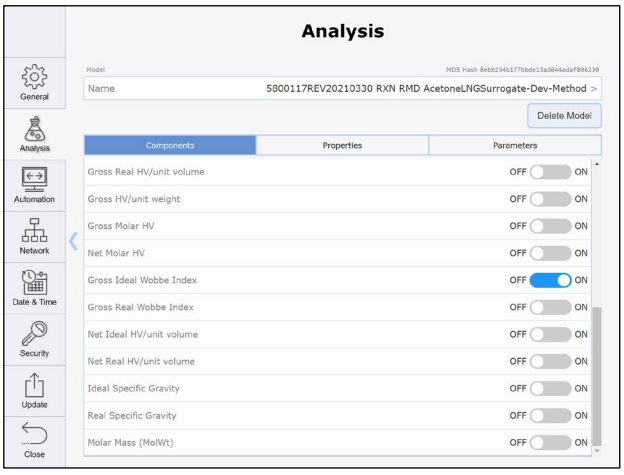


Figure 66. Enabling and disabling a parameter

7.4.3 Configuring models (Raman Rxn2, Raman Rxn4, and hybrid analyzers)

Raman RunTime supports models created with the following software: Raman data library, SIMCA® (Sartorius), GRAMS IQ™ (Thermo Fisher Scientific), PEAXACT (S-Pact), Aspen Unscrambler™ (AspenTech), and Solo/PLS_Toolbox (Eigenvector).

These multivariate models typically correlate in-line Raman spectra with off-line analytical measurements. They convert raw spectra into process values in real time. Model results can be displayed on-screen and communicated via OPC and Modbus.

Raman RunTime supports the following model file versions:

- Raman data library 2.x
- SIMCA® versions 13 through 18
- GRAMS IQ™ versions 9.3 and previous
- PEAXACT version 4, 5, 5.4, 5.6, 5.7, 5.9, and 6.0
- Aspen Unscrambler™ version 11
- Solo/PLS_Toolbox version 8.9, 9.0, and 9.3

7.4.3.1 Loading models into Raman RunTime

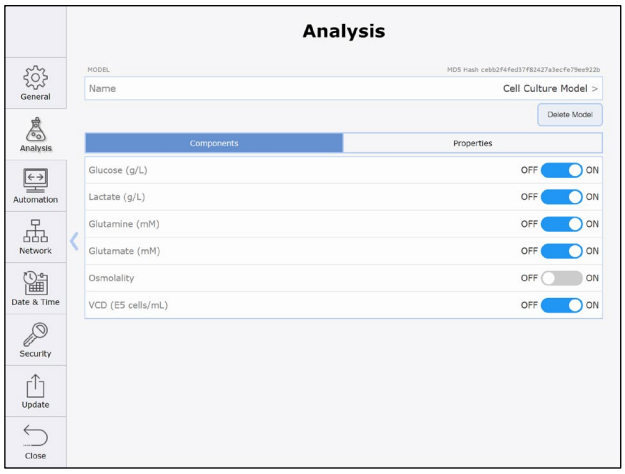
To load and select a new analysis model

1. Copy the model files from the modeling package to a USB memory stick and connect it to the analyzer USB port.

   When loading a model via remote access, select the model file from any location accessible from the remote workstation.

2. From the dashboard, select **Options > System > Analysis > Add Model**.
3. Browse to the model file location:
   - Select the USB drive if loading from a USB memory stick.
   - Select the network folder if loading via remote access.
4. Select the desired model file and add it. Repeat this step to add additional model files as needed.

   The file names appear in the **Analysis** window.



5. In the **Analysis** window, select a model file to enable or disable its components and properties. Repeat as required.
6. Return to the dashboard and open the **Details** screen for a probe.
7. Select the **Analysis** tab, then enable or disable the loaded model files for that probe. Repeat for additional probes as required.

7.4.4 Configuring methods and acquisition (Raman Rxn5)

The **Methods** tab on the system settings **Analysis** screen is used to manage the installed methods and configure associated settings. The **Acquisitions** tab is used to adjust sampling, calibration, and verification timing for a sample stream.

7.4.4.1 *Loading and selecting methods*

In the Methods tab, selecting a method displays its components. From this page, you can rename the method, delete it, or enable or disable reporting for individual components.

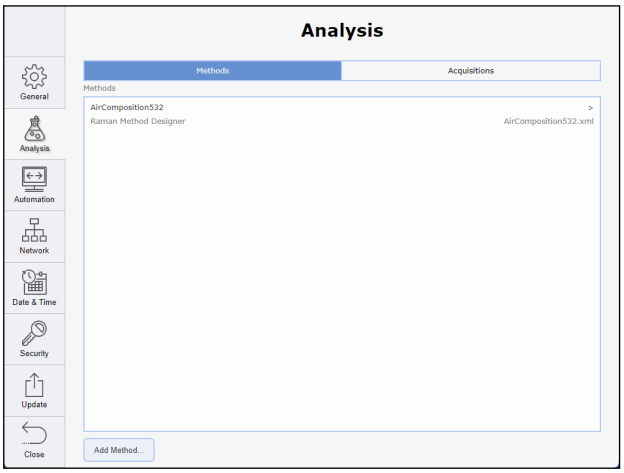


Figure 67. Analysis – method page

To load and select a new analysis method

1. Copy the project files from the method package to a USB memory stick and connect it to the analyzer USB port. Alternatively, load methods via remote access from a network connected folder. See *Remote access* → 🗎.
2. Select **Options > System > Analysis > Add Method**, then browse to the method file. Repeat to add additional files.

   The file names display in the Analysis window.

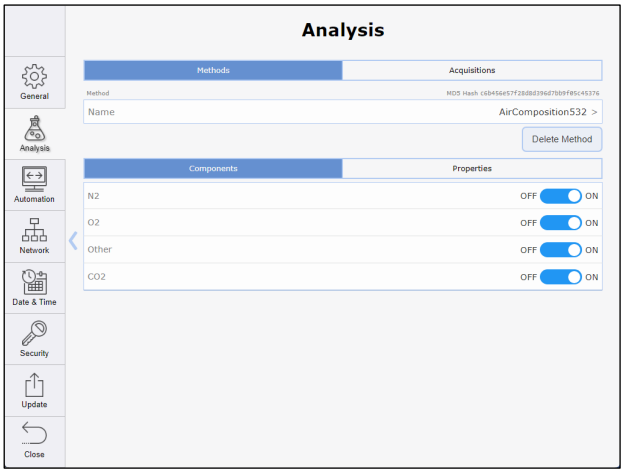


Figure 68. Analysis screen to select methods

3. Select a file name to enable or disable method components and properties. Repeat as required.
4. Select **Close** to return to the dashboard, then open the Details screen for one stream.
5. Select **Settings**, then enable or disable the method files for that stream. Repeat for additional streams.

7.4.4.2 *Managing acquisition time*

In the **Acquisitions** tab, adjust the total acquisition time for sampling, calibration, and verification. Automatic exposure control adjusts hardware settings as needed during operation.

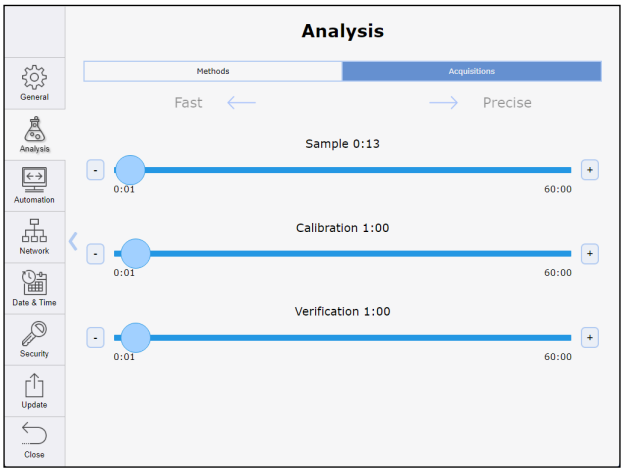
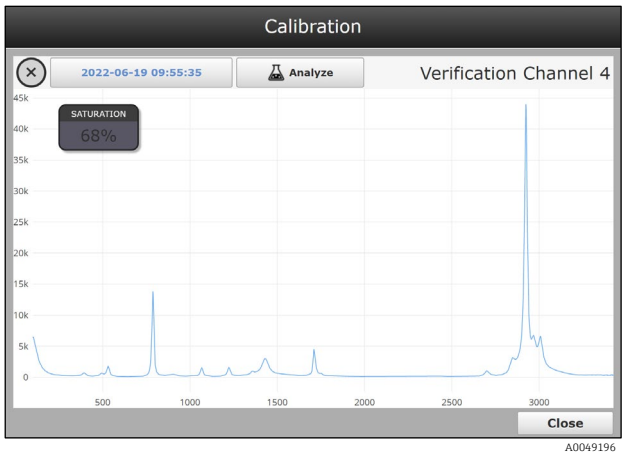


Figure 69. Analysis – acquisitions page

7.4.5 Viewing model and method results

During active experiments, process values are displayed automatically on the dashboard instead of the current spectra.

On the dashboard, select the quadrant display to toggle between the most recent spectrum and the process values.



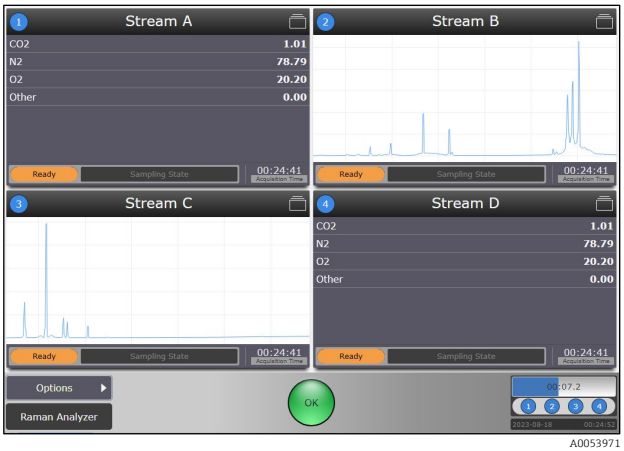


Figure 70. View of spectrum for Raman Rxn2, Raman Rxn4 probe 1 (left) and Raman Rxn5 stream (right)

- In hybrid analyzer configurations, the spectrum and process values are displayed simultaneously. No user action is required.
- In single-channel analyzers, a quadrant view is not available. Process values are displayed on the **Analysis** tab.
- Model and method results update each time a new spectrum is completed, or after each buffer cycle in continuous mode.
- If no models are active for a probe or batch, **No Analysis** is displayed when the spectral plot is selected.

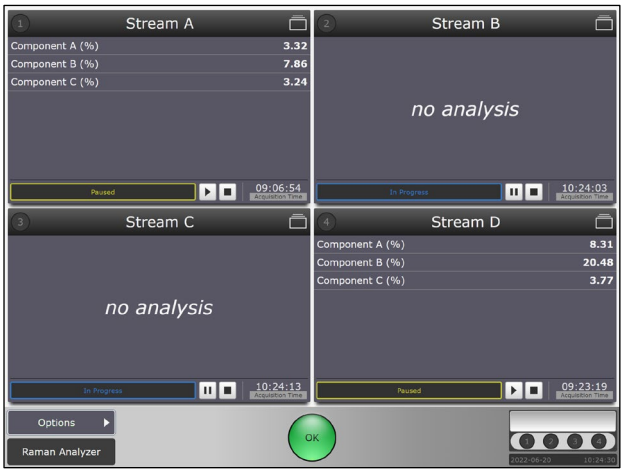


Figure 71. Results for a Raman Rxn2 four-channel analyzer with models active for probe 1 and probe 4

To access additional model result information

This procedure is also required to view model results on single-channel analyzers.

1. From a **Probe Details** view, select the **Analysis** tab.
2. Select **Expand** or **Collapse** to show or hide model details.

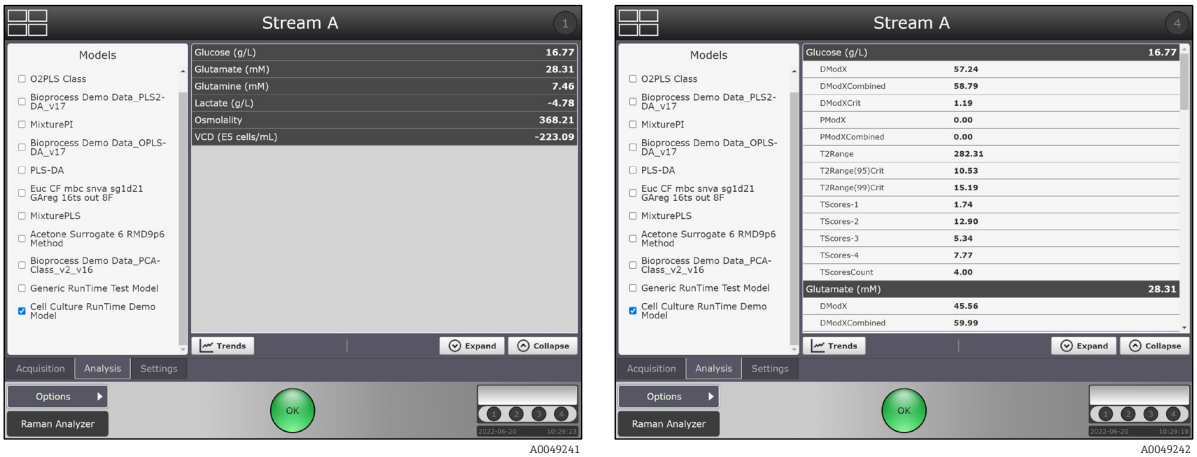


Figure 72. Probe details view of model process values and properties

3. Select **Trends** to open the trend viewer.
4. Select a **Principal Trend** and, if required, a **Comparison Trend**.

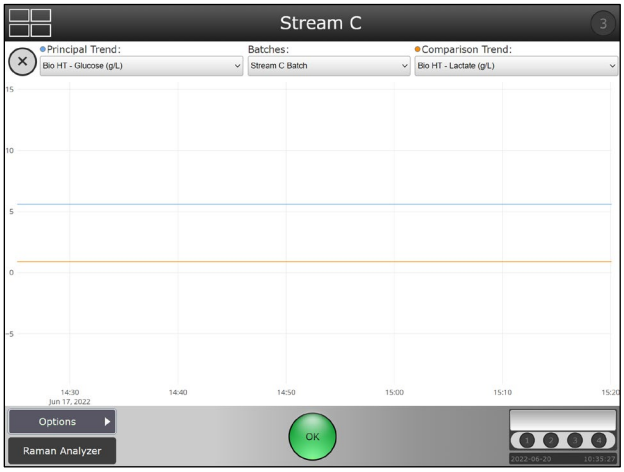


Figure 73. Model results in the trend view

7.4.6 Saving model results

Stored model results are included when exporting spectral batch data as a *.csv file. Real-time prediction results are also available via OPC or Modbus when client connections are established.

8 Troubleshooting and maintenance

8.1 OPC connection troubleshooting

Endress+Hauser does not support connections to user-specific OPC UA clients. UaExpert is used to test server-to-client connections. An Endress+Hauser service engineer can provide instructions for running Raman RunTime OPC UA server tests in UaExpert.

If problems persist, check the following:

- Confirm that the installed version of Raman RunTime is operating.
- Verify that **Options > System > Network** shows the status **Connected**.

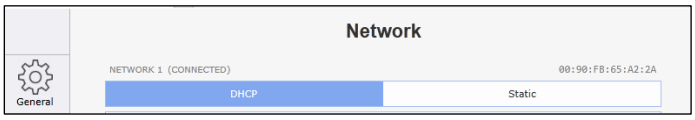


Figure 74. Network screen showing connected

- Verify that the correct Ethernet port is used.
- Check the Ethernet port link/activity lights.
- Verify that a valid IP address is displayed.
- Ping the analyzer from a directly connected laptop.
- Validate OPC UA communication by using a test client such as UaExpert.
- Verify the port configuration in the OPC UA client.
- Verify the analyzer date/time settings.

  Raman RunTime reports time values through OPC UA (for example, **SystemTime** uses the instrument time zone and **SystemStartTimeUTC** reports the most recent start-up time in UTC)

8.2 Diagnostic environment data

View system diagnostics at **Options > Diagnostics > Environment**.

From the **Diagnostics** screen, you can:

- View system environment data
- Trend historical environment data
- Export system data for backup or restore

Perform system exports regularly to back up configurations and calibrations.

System exports are intended for Endress+Hauser Support to investigate issues or restore analyzers. Export contents may change with new RunTime versions and are not intended for direct user access.

A full export is recommended for regular archiving and is required for system restore. Note that full exports can be large.

8.2.1 Diagnostic value trends

To display trends of diagnostic values

1. Select **Options > Diagnostics** from the main Raman RunTime menu.

   The **Environment** tab of the **Systems Diagnostics** dialog box appears. System data is displayed.

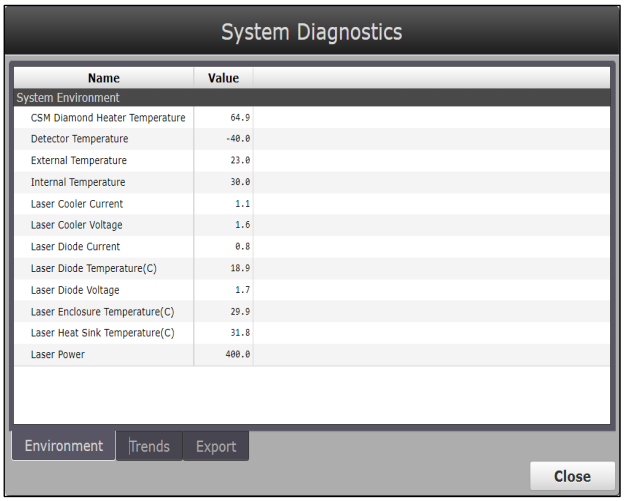


Figure 75. Environment tab to view system data

2. Select the **Trends** tab.

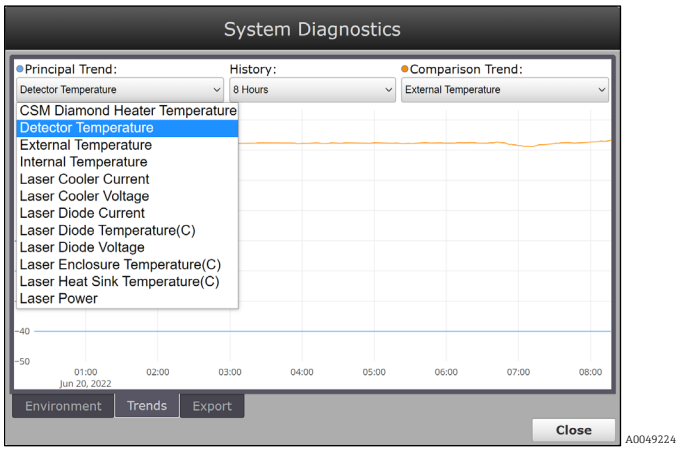


Figure 76. Principal trend options

3. In the **Trends** tab, select the **Principal Trend**, **History**, or **Comparison Trend** as shown below.

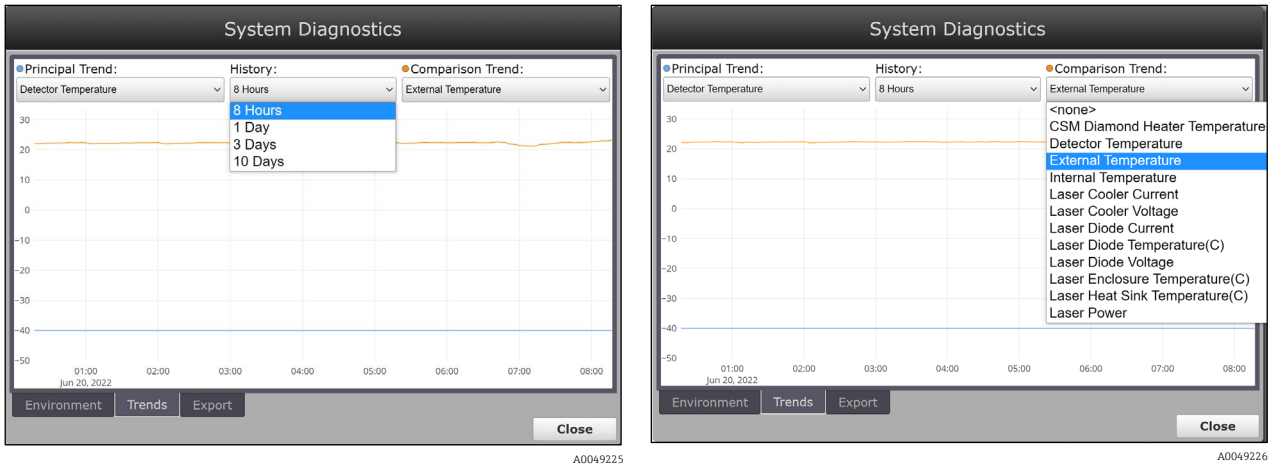


Figure 77. History and comparison trend options

8.3 System Export

Endress+Hauser recommends performing full system exports to back up user data, spectral data, custom settings, and configurations. Save export files to external media. Include export procedures in the local site standard operating procedure (SOP).

To create a new export file

1. From the RunTime dashboard, select **Options > Diagnostics > Export**.
2. Select **New**.
3. Select the export type:
   - **Basic**. Includes configuration and calibration information.
   - **Diagnostic**. Includes logs for troubleshooting with Endress+Hauser.
   - **Full**. Includes acquisition and analysis data, plus all Basic and Diagnostic data. Full exports are large files, often several gigabytes (GB) in size. They are recommended for archiving and may be required by Endress+Hauser Support.
4. Select **Export** to create the file.

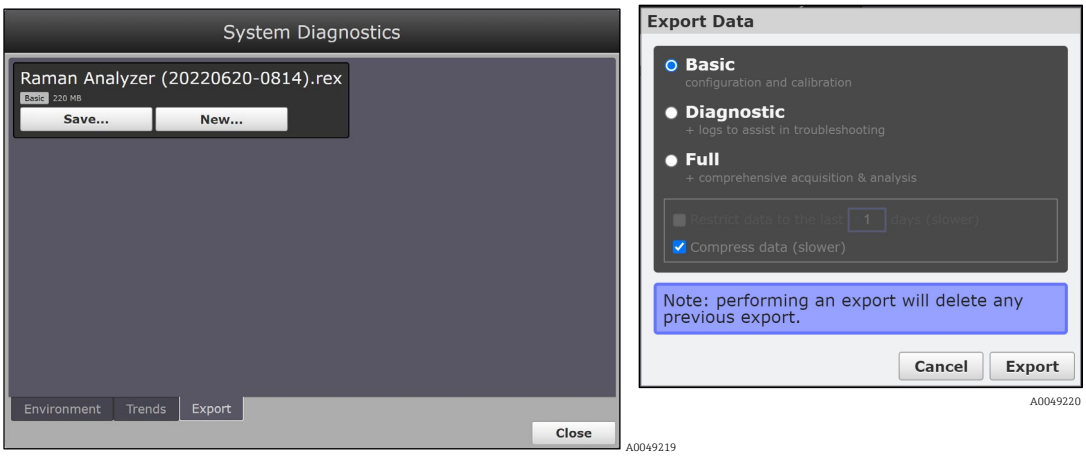


Figure 78. Steps to create a new export file

5. After the export is generated, click **Save** to store the file on a USB drive or download it to the network computer used for remote access.

The analyzer stores only the most recent export file. When a new export file is created, the previous file is overwritten. To prevent data loss, back up export files regularly to external media.

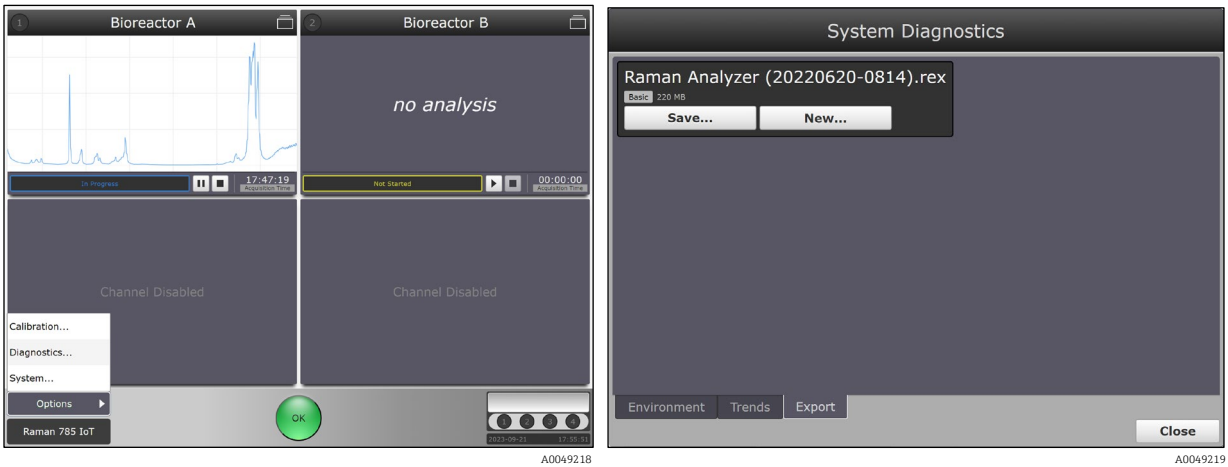


Figure 79. Steps to save an export file

The **Save** option allows you to store the export file on a USB drive or download it to the network computer used to access the Raman RunTime interface.

8.4 System warnings and errors

When the system is calibrated and operating correctly, the status indicator in the center of the dashboard displays **OK** in green.

Figure 80. Status bar

Symbol	Description
 A0049200	If a system warning occurs, a yellow warning indicator is displayed. A warning should be acknowledged, but immediate action may not be required. The indicator pulses until the condition is resolved. Select **Warning** to view details.
 A0049202	If a system error occurs, a red error indicator is displayed. An error requires immediate action to restore normal operation. Click **Error** to view details.

8.4.1 Resolving system warning and error states

If a system error occurs, a red status indicator is displayed.

To resolve a warning or error state

1. Select the yellow or red status indicator to view details.

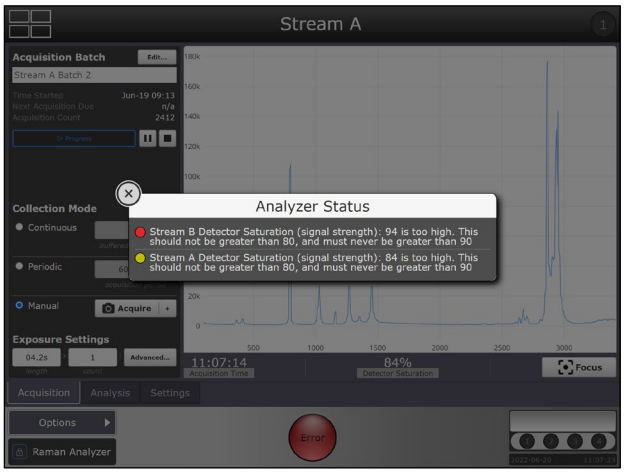


Figure 81. Analyzer status details

2. Resolve the error or warning using the appropriate corrective action.

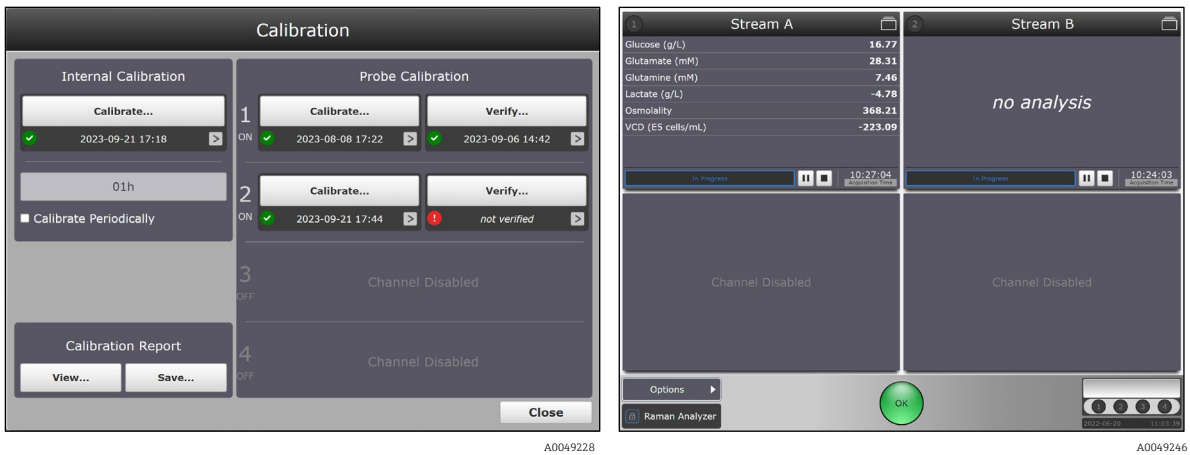


Figure 82. Channels 3 and 4 shown disabled and warning indicators resolved to green OK state

If the analyzer stops communicating with the dashboard, select **Options > System > Restart**. The analyzer restarts and communication is restored.

8.4.2 Raman Rxn2 and Raman Rxn4 analyzer diagnostics, warnings, and operating limits

Diagnostic messages for Raman Rxn2 and Raman Rxn4 analyzers, and the conditions under which faults occur are listed below.

Diagnostic	Faults when...
Internal Calibration	Internal calibration is missing on a multi-channel instrument.
Wavelength Calibration	Wavelength calibration is missing on a single-channel instrument.
Laser Calibration	Laser calibration is missing on a single-channel instrument.
Intensity Calibration	Intensity calibration is missing on the channel.
Detector Temperature	Camera temperature is out of tolerance.
Detector Locked	Camera temperature is not stable.
Detector Saturation	Camera saturation is < 2 % or > 80 %.
CSM Diamond Heater Temperature	Laser calibration standard temperature is out of tolerance.
CSM Laser Interlock Alarm	Laser interlock was interrupted, e.g., probe cable broken or improperly connected.
Laser Interlock Status	Laser is disabled, e.g., due to being turned off.
Laser Diode Current	Laser diode drive current approaches maximum.
Laser Cooler Open Circuit	An error was received from the laser module.
Laser Diode Current Error	An error was received from the laser module.
Laser Diode Temp Error	An error was received from the laser module.
Laser Diode Temp Startup	An error was received from the laser module.
Laser Diode Temp Warning	An error was received from the laser module.
Laser Power Feedback	An error was received from the laser module.
Laser Power Feedback Error	An error was received from the laser module.
Laser Unit Temp Error	An error was received from the laser module.
Laser Unit Temp Startup	An error was received from the laser module.

Warnings, error thresholds, and the expected operating ranges for key parameters are listed below.

Diagnostic	Warning Threshold	Error Threshold	Expected Value
CSM Diamond Heater Temperature	<50 ˚C (122 ˚F) or >100 ˚C (212 ˚F)	n/a	55 ˚C (131 ˚F) to 75 ˚C (167 ˚F)
Detector Temperature	<–42 ˚C (–43.6 ˚F) or >–38 ˚C (36.4 ˚F)	<–45 ˚C (–49˚F) or >–35 ˚C (–31 ˚F)	Anything in range
External Temperature	<0 ˚C (32 ˚F) or >35 ˚C (95 ˚F)	n/a	Anything in range
Internal Temperature	<0 ˚C (23 ˚F) or >40 ˚C (104 ˚F)	n/a	Anything in range
Laser Cooler Current	n/a	n/a	–5 A to 5 A
Laser Cooler Voltage	n/a	n/a	–12 V to 12 V
Laser Diode Current	1.8 A	n/a	1.0 A to 2.0 A
Laser Diode Temperature(C)	n/a	n/a	20 ˚C to 25 ˚C
Laser Diode Voltage	n/a	n/a	2.0 V to 2.5 V
Laser Enclosure Temperature(C)	n/a	n/a	0 ˚C (32 ˚F) to 35 ˚C (95 ˚F)

Diagnostic	Warning Threshold	Error Threshold	Expected Value
Laser Heat Sink Temperature(C)	n/a	n/a	0 ℃ (23 ℉) to 40 ℃ (104 ℉)
Laser Power	n/a	n/a	Setpoint ±5 mW

8.4.3 Raman Rxn5 analyzer system warnings and errors

Warning and error thresholds, and the expected operating ranges for key Raman Rxn5 analyzer parameters are listed below.

Diagnostic	Warning Threshold	Error Threshold	Expected Value
Air Temp External	48 ℃ (118 ℉)	50 ℃ (122 ℉)	-20 ℃ to 50 ℃ (-4 ℉ to 122 ℉)
Air Temp Internal	50 ℃ (122 ℉)	55 ℃ (131 ℉)	0 ℃ to 55 ℃ (32 ℉ to 133 ℉)
Grating Temperature	53 ℃ (127 ℉)	55 ℃ (131 ℉)	0 ℃ to 55 ℃ (32 ℉ to 133 ℉)
Heatsink HVAC 1 (left) Inside	N/A	N/A	At external > 30 ℃ (86 ℉) Plenum minus 15 ℃ to 20 ℃ (59 ℉ to 68 ℉)
Heatsink HVAC 1 (left) Plenum	73 ℃ (163 ℉)	75 ℃ (167 ℉)	At external < 25 ℃ (77 ℉) Inside minus 15 ℃ to 20 ℃ (59 ℉ to 68 ℉)
Heatsink HVAC 2 (left) Inside	N/A	N/A	At external > 35 ℃ (95 ℉) Plenum minus 15 ℃ to 20 ℃ (59 ℉ to 68 ℉)
Heatsink HVAC 2 (left) Plenum	73 ℃ (163 ℉)	75 ℃ (167 ℉)	At external < 25 ℃ (77 ℉) Inside minus 15 ℃ to 20 ℃ (59 ℉ to 68 ℉)
Heatsink Power Supply	73 ℃ (163 ℉)		5 ℃ to 20 ℃ (41 ℉ to 68 ℉) over external
Heatsink Spectrograph	58 ℃ (136 ℉)	60 ℃ (140 ℉)	5 ℃ to 8 ℃ (41 ℉ to 46 ℉) over external
Relative Humidity	65 %	85 %	—
Channel <ch> Laser Diode Current	2.1 A	N/A	1.0 A to 2.1 A
Channel <ch> Laser Heatsink	63 ℃ (145 ℉)	65 ℃ (149 ℉)	2 ℃ to 5 ℃ (36 ℉ to 41 ℉) over external
Channel <ch> Laser Power Out	N/A	N/A	130 mW to 170 mW [1]
Channel <ch> Sample Pressure	N/A	N/A	—
Channel <ch> Sample Temperature	N/A	N/A	—

Additional diagnostic warnings may be generated during operation:

Diagnostic	Warning Threshold	Error Threshold	Expected Value
Detector Temperature too High	> -40 ℃ (-40 ℉)	> -38 ℃ (-36 ℉)	Not shown unless warning or error
Detector Temperature too Low	< -40 ℃ (-40 ℉)	< -42 ℃ (-44 ℉)	Not shown unless warning or error
Detector Saturation (Signal Strength) too High	> 80 %	> 90 %	30 % — 80 %
Detector Saturation (Signal Strength) too Low	NA	< 2 %	30 % — 80 %
Warnings			

[1] Depends on the selected power setting. For example, when used in an IIC gas environment, the configured power setting may be limited to 35 mW, which is within acceptable operating limits.

Blower Alarm: The cooling fan is not working properly. The analyzer might overheat.
Inline Wavelength Calibration Warning. Neon pixel fill below warning level.
Channel <ch> Inline wavelength calibration failed. Using default wavelength calibration.
Channel <ch> Inline laser calibration failed. Using default laser wavelength.
Channel <ch>: <analysis> calibration does not perform within tolerance.
Channel <ch>: <analysis> calibration has not been verified in more than <x> days.
System analysis is disabled.

8.4.4 Diagnostic fault codes for automation

Automation systems (DCS, control room, or on-site teams) can monitor analyzer status using OPC tags and Modbus registers that indicate diagnostic faults.

For details, refer to:

- *Raman RunTime Automation OPC v7.0* (OPC Tags)
- *Raman RunTime Automation Modbus v7.0* (Modbus map)
- *HTTPS Automation Interface v7.0* (file transfer)

Diagnostic fault codes include:

Code	Description
Sensor (1xx)	
100	Unspecified fault
101	No laser
102	Laser power limit exceeded
103	Signal out of range
104	Component temperature out of specification
Electronic (3xx)	
300	Unspecified fault
301	Service Alert - Laser
302	Service Alert - Neon
303	Malfunction - cooling fan
304	Malfunction - calibration/switching module (CSM)
305	Malfunction - power supply
306	Malfunction - communication
307	Calibration failure
308	Component temperature out of specification
Configuration (5xx)	
500	Unspecified fault
501	System disabled
502	Calibration invalid
503	Configuration invalid
504	Low storage space
Process/Environment (9xx)	

Code	Description
900	Unspecified fault
901	Environmental conditions out of specification

For detailed matrices by instrument type, contact Endress+Hauser Support.

8.4.5 Unused channels and probes

Unused or uncalibrated channels may generate warnings that place the system in a warning state.

To prevent unnecessary warnings, disable unused probes or channels. Refer to *Disabling unused channels and probes* →.

8.5 Restarting the system

To restart the system, select **Options > System > General**, then click **Restart**.

Only users with administrative privileges can restart the device when security is enabled.

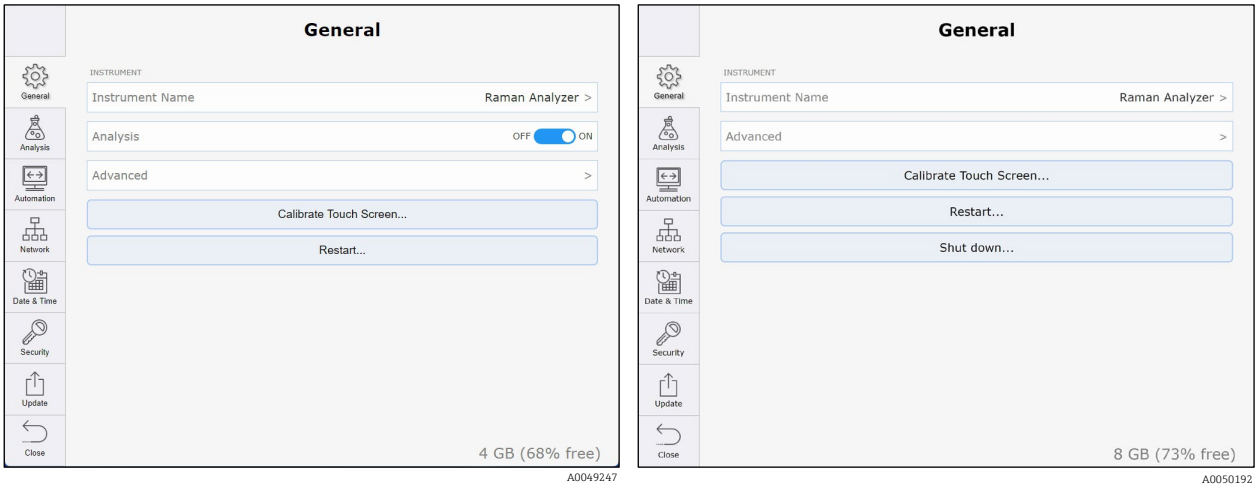


Figure 83. Raman Rxn2 and Raman Rxn4 restart screen (left) Raman Rxn5 restart screen (right)

8.6 Turning off the Raman Rxn2 or Raman Rxn4 analyzer

The procedures in this section apply only to embedded analyzers. They do not apply to:

- Non-embedded analyzers with an HMI
- Raman Rxn4 analyzers with an enclosure
- Raman Rxn5 analyzers

For a Raman Rxn4 with enclosure, use the main power switch on the right side of the enclosure.

The Raman Rxn5 is hard-wired. The method for removing power depends on the installation. A circuit breaker inside the analyzer provides power isolation and is accessible only when the door is open.

8.6.1 Turning off the analyzer

Use one of the following methods. Use these methods unless the system is unresponsive.

- **Method 1 (software)**

  Select **Options > System > General**, then select **Shut Down**. The analyzer turns off after approximately 5 seconds.

Figure 84. Shut down

- **Method two (hardware)**

  Press and hold the power push button for 2 seconds until it starts to blink. Release the button. The analyzer turns off after approximately 5 seconds.

8.6.2 Performing a hard shut down

Use a hard shutdown only if Raman RunTime is unresponsive. These methods use hardware controls and are not available through the software.

- **Method one**

  Press and hold the power push button for at least 12 seconds until the analyzer powers down. Continue to hold the button even if the indicator begins to blink. Release the button after the analyzer powers off.

- **Method two**

  Disconnect power from the analyzer.

8.7 Recovery console

The Recovery console appears if Raman RunTime fails to start. The system prompts entry to the recovery console after five unsuccessful startup attempts.

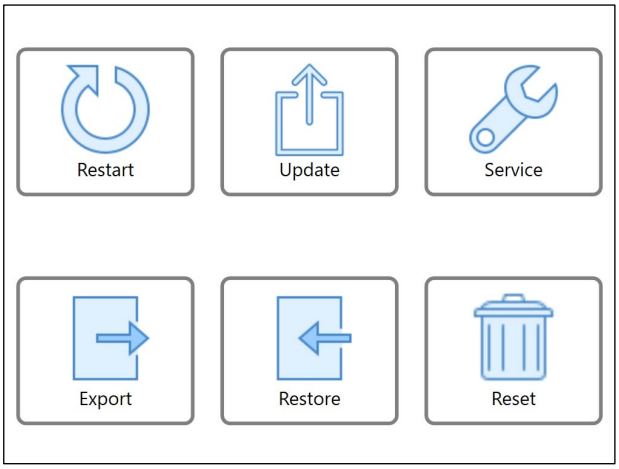


Figure 85. Recovery console menu

The recovery console includes the following functions:

- **Restart.** Restarts the system.
- **Update.** Updates the embedded Raman RunTime software using factory-provided files on a USB drive.
- **Service.** Enables service mode (available only to qualified service personnel; contact Endress+Hauser Support).
- **Export.** Downloads data, settings, or configurations when the analyzer is in an error state.
- **Restore.** Restores the system from a previously saved file (local or USB drive).

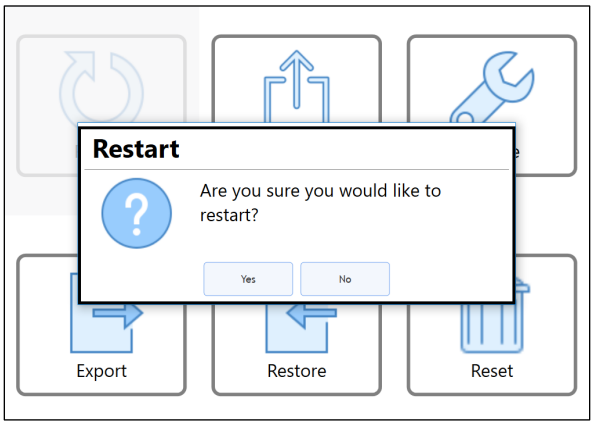
- **Reset.** Reboots the system and deletes all calibrations, models, acquisitions, logs, and other data.

Refer to the following sections for instructions on these features.

8.7.1 Restarting Raman RunTime

To restart the system, click **Restart**, then confirm by clicking **Yes**.

Figure 86. Restart warning



8.7.2 Updating Raman RunTime

The **Update** function installs embedded Raman RunTime software using factory-provided files on a USB drive.

Insert the USB drive into the analyzer USB port (front panel for Raman Rxn2/Raman Rxn4/hybrid; internal port for Raman Rxn5). Follow the on-screen prompts to locate and install the update file.

NOTICE

- ▶ Only Endress+Hauser factory-trained personnel should perform software updates.
- ▶ Install update files in the specified order.
- ▶ Verify all prerequisites before starting the update.
- ▶ Contact Endress+Hauser Support before performing updates.
- ▶ Failure to follow these instructions may render the analyzer inoperable.

To update the embedded software

1. Select **Options > System > Update**.
2. Select the information icon (ⓘ) to view the current software version and update history.
3. Select **Choose Update**.

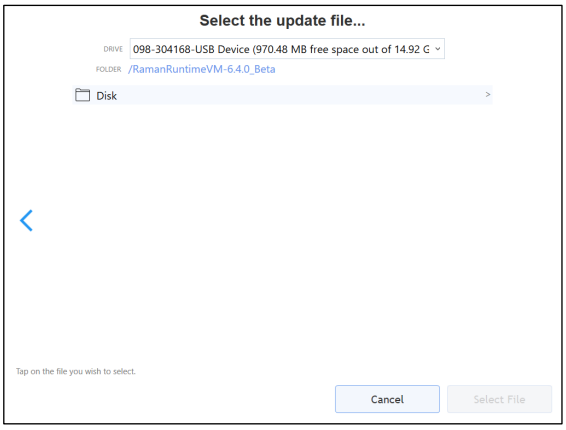


Figure 87. Update mode menu

4. Select the update file. Install files one at a time and in the required order.

8.7.3 Using service tools

Select **Service** to place the analyzer in service mode.

Service mode is available only to qualified service personnel. Contact Endress+Hauser Support for more information.

Figure 88. Service mode menu

8.7.4 Exporting system data

Select **Export** to download data, settings, or configurations. Use this function only when the analyzer is in an error state.

To restore the analyzer, use an export file previously generated in Raman RunTime and saved to a USB drive. The most recent export file is also stored on the analyzer.

Exports created from the recovery console are intended for troubleshooting by Endress+Hauser Support. These files cannot be used to restore the analyzer.

Figure 89. Exporting a file

8.7.5 Restoring Raman RunTime

Select **Restore** to return Raman RunTime to a previously saved state. Use this function to restore normal operation.

Restore can use any export type (Basic, Diagnostic, or Full). A Full export also restores acquisition data and analysis results, in addition to configuration and calibration data.

To use **Restore**, ensure that:

- A valid export file created in RunTime is available
- The file is stored locally or on a USB drive connected to the analyzer

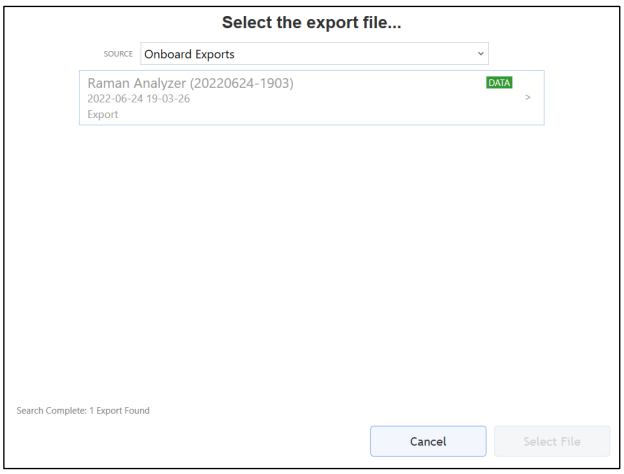


Figure 90. Restoring Raman RunTime to an earlier version using export stored on the analyzer storage

To restore Raman RunTime

1. Select an export file. Use a Full export to restore the settings, configuration, models, and data.
   If an export supports full restore, a green DATA tag is displayed.

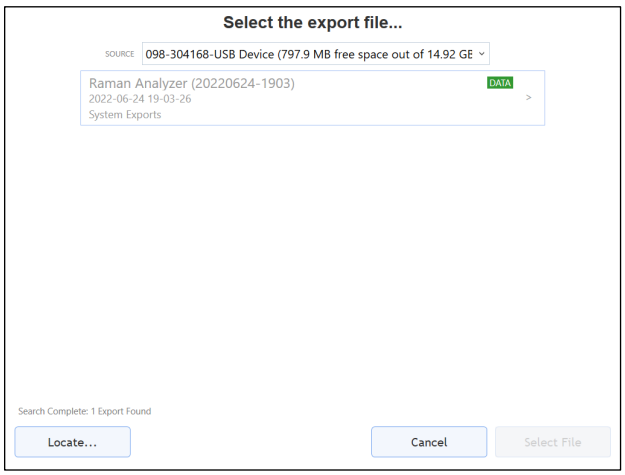


Figure 91. Restoring Raman RunTime to an earlier version using export stored on a USB drive

2. Select the file to begin the restore process.

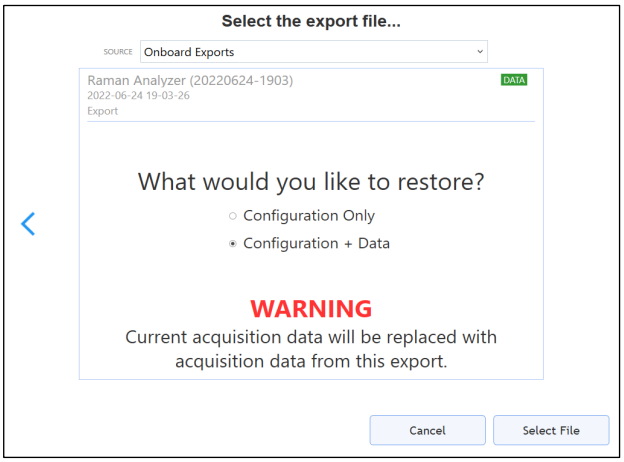


Figure 92. Warning menu to select level of restore for Raman RunTime

Figure 93. Confirm restore dialog

3. Confirm the action when prompted.

The system restarts and performs the restore. This process may take several minutes. Do not turn off the analyzer during the restore.

The USB drive must remain connected during the process.

After completion, the analyzer restarts and Raman RunTime launches.

8.7.6 Resetting Raman RunTime

Select **Reset**, then click **Continue** to restart the system and delete all calibrations, models, acquisitions, logs, and data.

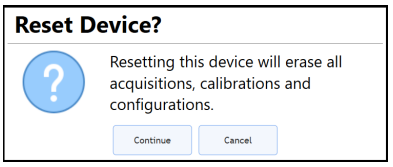


Figure 94. Confirm resetting the device

9 Software updates

9.1 Updating Raman RunTime

Use the **Update** tab in **System Settings** to install software updates. Update files must be stored on a USB drive or on a local or remote workstation drive.

Before performing an update, review the following notice.

NOTICE

Failure to follow these instructions may render the analyzer inoperable. The user assumes responsibility for self-installation.

- Only Endress+Hauser factory-trained personnel should perform software updates.
- Install update files in the specified order.
- Verify all prerequisite requirements before updating Raman RunTime.
- Contact Endress+Hauser Support before attempting an update.

Before starting the update, perform a full system export and save it to external media. Refer to *Export* → 🖹.

To update Raman RunTime software

1. Save the update file(s) to a USB drive or a workstation drive.
2. From the dashboard, select **Options > System**.
3. Select the **Update** tab, then click **Choose Update**.

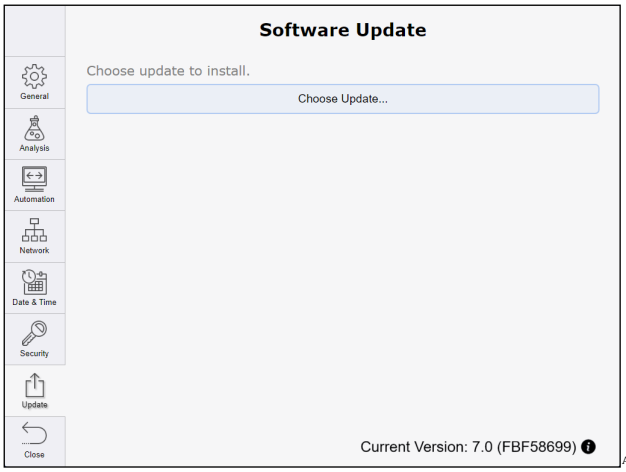


Figure 95. System settings – update tab

4. Browse to the folder containing the update file(s).
5. Select the required update file and install it in the specified order. Click **Select File**.

   The system installs the update and restarts the dashboard upon completion.

   The update process may take up to 20 minutes.
6. Repeat steps 2-5 if multiple update files are required.
7. Select the information icon (ⓘ) to view the installed software version and update history. Confirm that the correct version is installed.

9.2 Support

Provide diagnostic export files and the current Raman RunTime version number when contacting Endress+Hauser Support.

To view version information, select **Options > System > Update**. The current version is displayed in the lower-right corner of the screen.

Select **Information** (ⓘ) to view details about installed versions and update history.

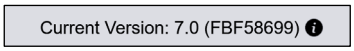


Figure 96. Current version

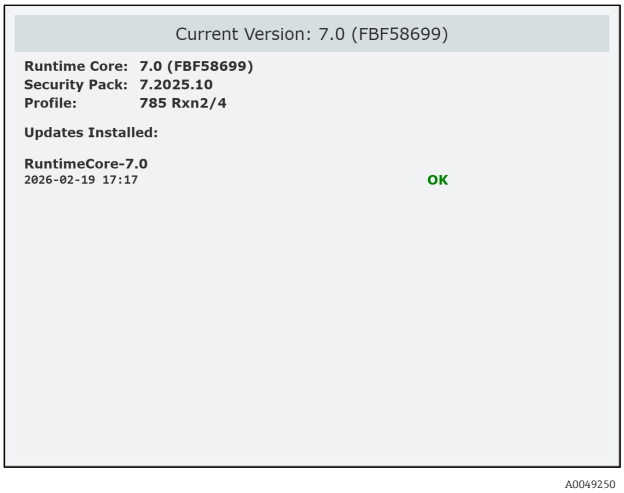


Figure 97. Update history

9.3 Contact information

For technical service, refer to the Endress+Hauser website: https://endress.com/contact

The website provides contact information for local sales and service channels.

10 Copyright information

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5.2. No modification of this Agreement shall be binding unless it is in writing and is signed by an authorized representative of the party against whom enforcement of the modification is sought.

5.3. Any notices required or permitted under this Agreement shall be in writing and delivered in person or sent by registered or certified mail, return receipt requested, with proper postage affixed.

5.4. In the event that any of the terms of this Agreement is or becomes or is declared to be invalid or void by any court or tribunal of competent jurisdiction, such term or terms shall be null and void and shall be deemed severed from this Agreement and all the remaining terms of this Agreement shall remain in full force and effect.

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Information contained in this document is deemed to be accurate at the time of writing. Endress+Hauser reserves the right to change the information contained within without notice.

Support

Endress+Hauser will provide telephone consultation for this product during normal U.S. East Coast business hours 8:00 AM to 5:00 PM. Under no circumstances does telephone consultation affect the terms of any warranty agreement.

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