

Operating Instructions

Multi optic calibration and verification kit



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1 About this document

1.1 Warnings

Structure of Information	Meaning
⚠ WARNING Causes (/consequences) Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation can result in a fatal or serious injury.
⚠ CAUTION Causes (/consequences) Consequences of non-compliance (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 non-compliance (if applicable) ▶ Action/note	This symbol alerts you to situations which may result in damage to property.

Table 1. Warnings

1.2 Symbols on the device



Symbol	Description
	The Laser Radiation symbol is used to alert the user to the danger of exposure to hazardous visible and invisible laser radiation when using the system.
	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.

Table 2. Symbols

1.3 U.S. export compliance

The policy of Endress+Hauser is in strict compliance with U.S. export control laws as detailed in the website of the [Bureau of Industry and Security](#) at the U.S. Department of Commerce.

The Export Control Classification Number (ECCN) of the multi optic calibration and verification kit is EAR99.

1.4 Glossary

Term	Description
°C	Celsius
CCD	charge coupled device
cm	centimeter
CRS	calibration reference standard
°F	Fahrenheit
in	inches
IP	ingress protection
IPA	isopropyl alcohol
kg	kilogram
lbs	pounds
mm	millimeter
nm	nanometer
SSF	source spectral file
WEEE	Waste Electrical and Electronic Equipment

Table 3. Glossary

2 Basic safety instruction

The safety information in this section is specific to the multi optic calibration and verification kit that is compatible with Raman spectroscopic probes. Refer to the applicable probe operating instructions for additional information related to probe and laser safety.

2.1 Requirements for personnel

- Installation, commissioning, operation, and maintenance of the multi optic calibration and verification kit may be carried out only by specially trained technical personnel.
- Technical personnel must be authorized by the plant operator to carry out the specified activities. Technical personnel must have read and understood these Operating Instructions and must follow the instructions contained herein.
- The facility must designate a laser safety officer who ensures staff are trained on all Class 3B laser operating and safety procedures.
- Faults at the measuring point may only be corrected by authorized trained personnel. Repairs not described in this document must be carried out only directly at the manufacturer's site or by the service organization.

2.2 Designated use

The multi optic calibration and verification kit is used for standardizing Raman instruments and analyzers to give precise spectral intensity measurements.

2.3 Workplace safety

As the user, you are responsible for complying with the following safety conditions:

- Installation guidelines
- Local standards and regulations electromagnetic compatibility

2.4 Operational safety

Before commissioning the entire measuring point:

- Verify that all connections are correct.
- Ensure that electrical cables and optical fiber connections are undamaged.
- Do not operate damaged products, and protect them against unintentional operation.
- Label damaged products as defective.

During operation:

- If faults cannot be rectified, products must be taken out of service and protected against unintentional operation.
- When working with laser devices, always follow all local laser safety protocols which may include the use of personal protective equipment and limiting device access to authorized users.

CAUTION

Activities while the multi optic calibration or verification accessory is in operation introduce risk of exposure to measured materials.

- ▶ Follow standard procedures for limiting exposure to chemical or biological materials.
- ▶ Clean any spills using the appropriate site policies and cleaning procedures.

2.5 Important safeguards

- Do not use the multi optic calibration accessory for anything other than its intended use.
- Do not look directly into the laser beam.
- Do not point a laser at a mirrored surface.
- Do not leave attached and unused probes uncapped or unblocked.
- Always use a laser beam block.

2.6 Product safety

The multi optic calibration and verification kit has been designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. The relevant regulations and international standards have been observed. Devices connected to Raman analyzers must comply with the applicable safety standards.

3 Product description

The multi optic calibration and verification kit contains all the necessary hardware for calibrating and verifying the calibration of the bio multi optic and Raman optic system for single use. The contents include:

- Multi optic calibration accessory
- Multi optic verification accessory
- Temperature display
- Flash drive with calibration files
- Syringe
- Syringe tips (2)

The external and internal views of the multi optic calibration and verification kit are shown below.

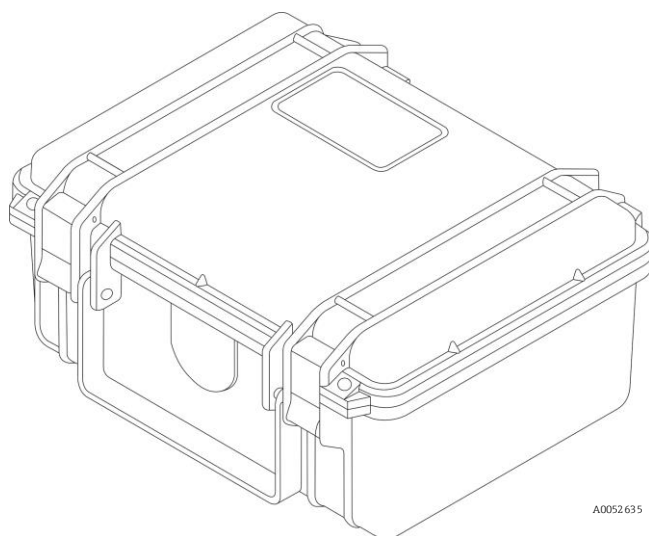


Figure 1. External view of the multi optic calibration and verification kit

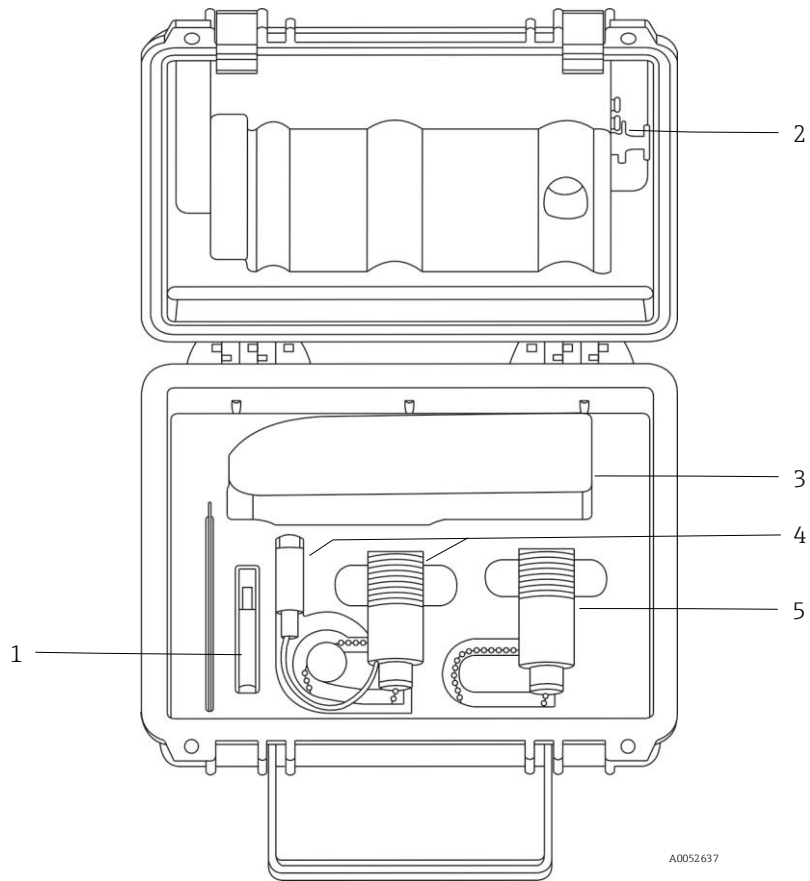


Figure 2. Internal view of the multi optic calibration and verification kit

#	Description
1	Flash drive
2	Syringe and tips
3	Temperature display
4	Multi optic calibration accessory and temperature sensor connector
5	Multi optic verification accessory

3.1 Multi optic calibration accessory

The multi optic calibration accessory is used for standardizing Raman instruments and analyzers to give precise spectral intensity measurements. When used with the calibration protocol in this manual, the calibration accessory ensures different instruments generate similar spectra when measuring a given sample. The multi optic calibration accessory was created specifically for use with Raman instruments and analyzers manufactured by Endress+Hauser.

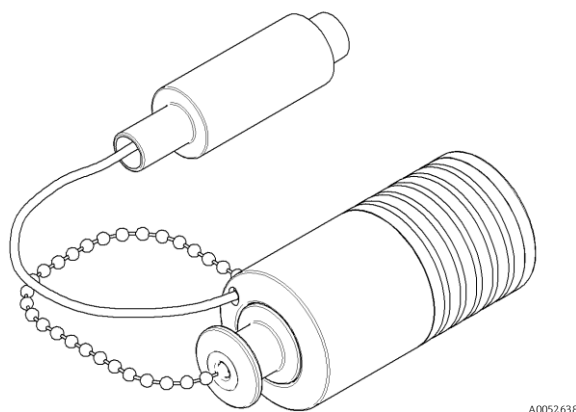


Figure 3. Multi optic calibration accessory

All Endress+Hauser Raman analyzers have built-in wavelength and laser wavelength calibration. In addition, the multi optic calibration accessory includes signal from the analyzer's specific fiber, probe, and optic to standardize the integrated system. This reduces variation between other instruments by producing a standardized spectral response.

For intensity standardization, a calibration reference standard (CRS) provides a factory-characterized spectral output. A wavelength specific CRS is required for each Raman excitation wavelength.

3.2 Multi optic verification accessory

The multi optic verification accessory is used to confirm that the calibration process has resulted in standardizing the instrument back to factory specifications. This is accomplished by collecting a Raman spectrum of the reference sample contained within the verification accessory and comparing it to preset criteria for the expected spectral response. If the analyzer passes verification, the instrument is properly standardized. If the analyzer fails verification, this could indicate recalibration of the analyzer and probe is needed. Regular performance of the verification step is recommended to ensure the instrument is properly calibrated and standardized.

The multi optic verification accessory was created specifically for use with Raman instruments and analyzers manufactured by Endress+Hauser.

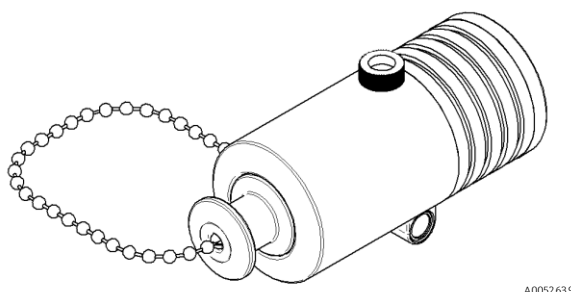


Figure 4. Multi optic verification accessory

The standard sample initially provided and required for use with the multi optic verification accessory is 70 % isopropyl alcohol (IPA).

NOTICE**Only 70 % IPA should be used for optical verification.**

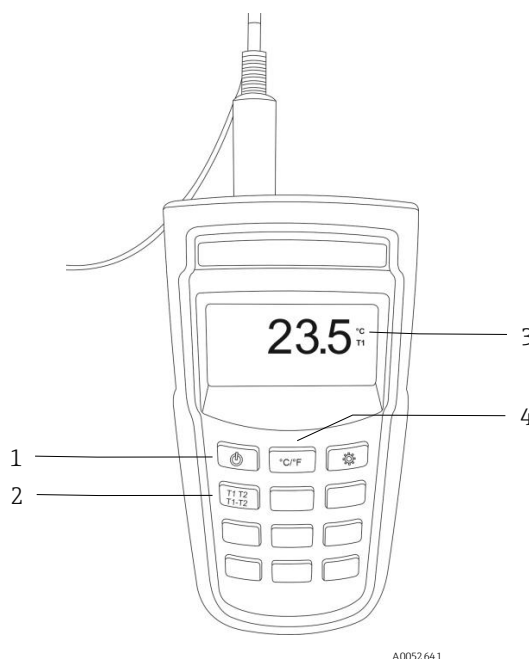
- ▶ Only 70 percent by volume (%v/v) will work. Endress+Hauser recommends using CiDehol 70 by Decon Laboratories.
- ▶ Use of any other liquid for verification will result in a failed verification and may result in damage to both the verification accessory and the Raman probe.

3.3 Temperature display

A temperature display with the recommended precision and accuracy is provided with the calibration kit and connects to the temperature measurement sensor contained within the multi optic calibration accessory.

To ensure proper results during probe calibration, the multi optic calibration accessory temperature must be entered into the Raman RunTime software when prompted. This requires a Raman analyzer with Raman RunTime 6.2.2+ embedded software.

Failure to enter an acceptable temperature value may result in an improperly calibrated probe. Refer to the Raman RunTime software manual for instructions to input the temperature value.



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Figure 5. Temperature display

#	Description
1	Power button
2	Probe input selection (T1 probe, T2 probe, or difference between the two probes)
3	Main display showing temperature reading, temperature units, and selected probe input
4	Temperature unit selection (°C or °F)

3.4 Flash drive with calibration files


A software file detailing the spectral characteristics of the specific multi optic calibration accessory, as well as an electronic certificate, is provided with each unit on a flash drive when new and when recertified.

A spectral data file (.spc format) containing the spectral output of the calibrator is provided on the flash drive and is also stored internally on the hard drive of the analyzer after the first time the probe is calibrated.

The software provided with the analyzer requires the calibration accessory source spectral file (SSF) as part of the instrument standardization process. Instrument intensity standardization corrects for instrument-to-instrument response variations. Ensure that the serial number for the multi optic calibration accessory used matches the serial number for the SSF on the flash drive or hard drive any time a probe calibration is executed. Because the SSF is relative, use of this accessory corrects only the normalized shape of measured spectra, not the absolute magnitude.

Standardization refers to the process of using calibrated radiometric profiles to normalize the relevant performance of individual analyzers so that spectral, and hence chemical, models can be transferred to multiple analyzers.

3.5 Syringe and tips

A syringe with leur lock tips (2) is included in the kit for servicing the multi optic verification accessory. Refer to Replacing the verification sample →  for maintenance instructions.

4 Incoming product acceptance and product identification

4.1 Incoming acceptance

- Verify that the packaging is undamaged. Notify the supplier of any damage to the packaging. Keep the damaged packaging until the issue has been resolved.
- Verify that the contents are undamaged. Notify the supplier of any damage to the delivery contents. Keep the damaged goods until the issue has been resolved.
- Check that the delivery is complete and nothing is missing. Compare the shipping documents with your order.
- Pack the product for storage and transportation in such a way that it is protected against impact and moisture. The original packaging offers the best protection. Make sure to comply with the permitted ambient conditions.

If you have any questions, please contact your supplier or your local sales center.

4.2 Product identification

4.2.1 Label

At a minimum, the multi optic calibration and verification kit is labeled with the following information:

- Endress+Hauser branding
- Extended order code
- Product description

The multi optic calibration and verification accessories are labeled with the following information:

- Endress+Hauser branding
- Extended order code
- Serial number (calibration accessory only)
- Calibration sticker (calibration accessory only)
- Safety warnings, as applicable

4.2.2 Manufacturer address

Endress+Hauser
371 Parkland Plaza
Ann Arbor, MI 48103 USA

4.3 Scope of delivery

The scope of delivery comprises:

- Multi optic calibration and verification kit in the configuration ordered
- *Multi optic calibration and verification kit Operating Instructions* manual
- Multi optic calibration and verification kit Certificate of Product Performance
- Local declarations of conformity, if applicable
- Multi optic calibration and verification kit optional accessories, if applicable


If you have any questions, please contact your supplier or local sales center.

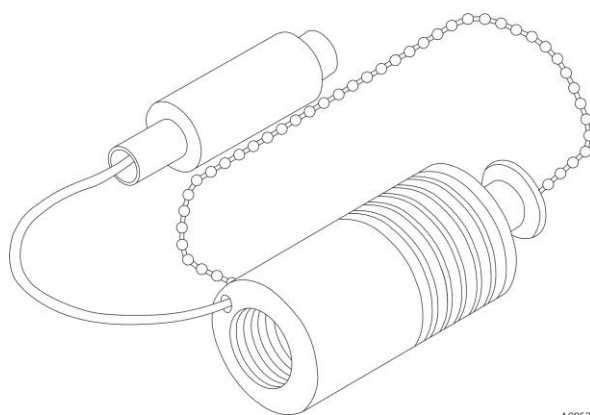
5 Installation

5.1 Multi optic calibration accessory

This section describes the installation of the multi optic calibration accessory onto an optic. The optic and probe are attached to the analyzer. Refer to the applicable Raman probe or analyzer operating instructions for additional installation information.

To install the multi optic calibration accessory onto an optic:

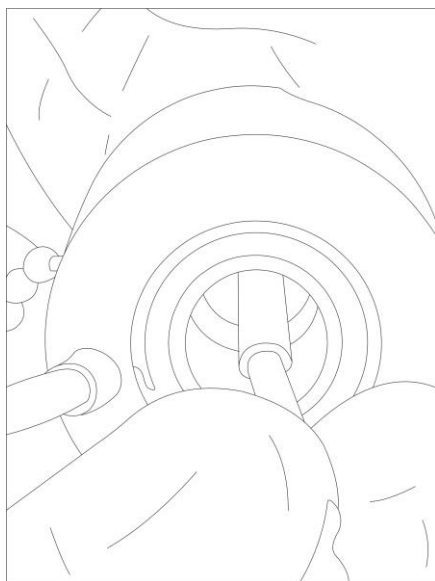
1. Ensure the probe is at ambient temperature when using the multi optic calibration accessory.
 - See Technical data →  for more information.
 - Failure to operate at ambient temperature can cause incorrect calibrations and possible damage to the multi optic calibration accessory.
2. Before installing the multi optic calibration accessory onto the optic to be calibrated, move the dust cover from the front end to the back as shown below.



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Figure 6. Multi optic calibration accessory with cap in position for loading optic

3. Ensure the optic lens and multi optic calibration accessory are clean. Endress+Hauser recommends the following cleaning process:
 - Optic lens: Blow off the surface with clean, dry air.
 - Multi optic calibration accessory: Remove any dust by gently wiping the window with a small, lint-free swab lightly dampened with acetone. Refer to the figure below.



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Figure 7. Cleaning the multi optic calibration accessory window with a swab

- To install the multi optic calibration accessory onto the optic, slide the accessory over the tip of the optic.
To reach the full insertion depth, there are two distinct areas of resistance that need to be overcome before reaching the hard stop. The figure below shows the multi optic calibration accessory fully mounted onto the optic.

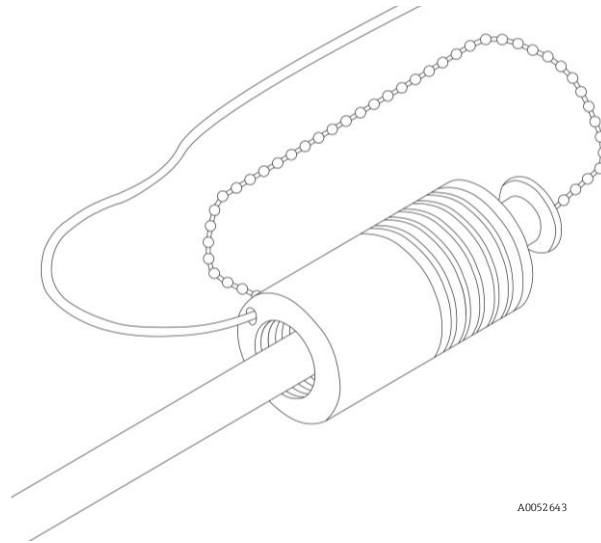


Figure 8. Multi optic calibration accessory mounted on optic

⚠ WARNING

Do not remove the optic from the multi optic calibration accessory while the laser is on.

- ▶ Serious injury can result from exposure to the laser.

5.2 Multi optic verification accessory

To install the multi optic verification accessory onto an optic:

- Before installing the multi optic verification accessory onto the optic to be tested, move the dust cover from the front end to the back as shown below.

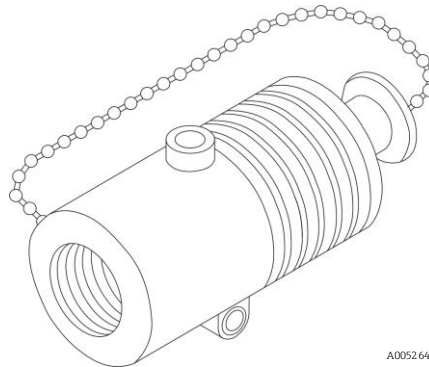


Figure 9. Multi optic verification accessory with cap in position for loading optic

2. Ensure the multi optic verification accessory is clean.

- Remove any dust by gently wiping the front end window with a small, lint-free swab lightly dampened with acetone.
- Then open the verification accessory at the hinge to access and clean the additional window.
- Refer to the figure below.

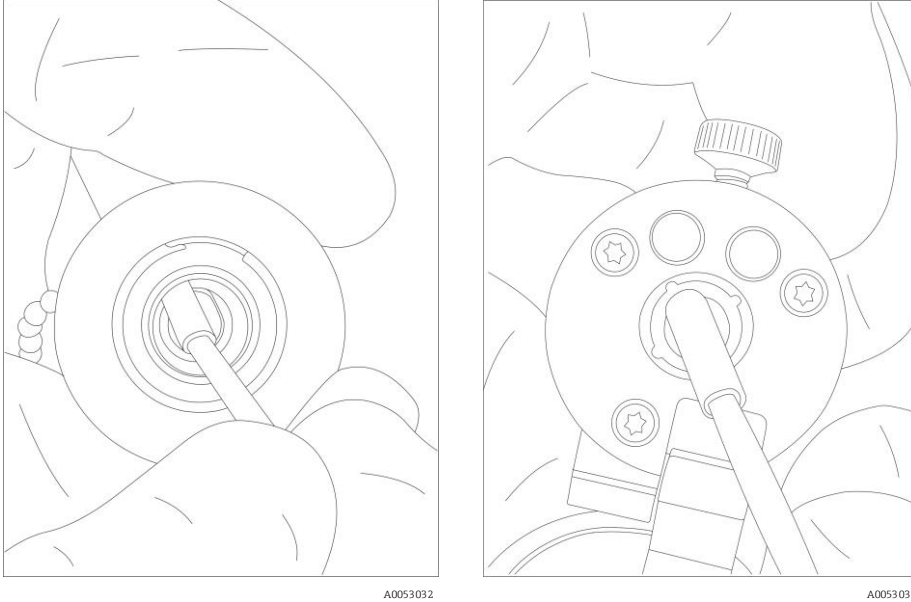


Figure 10. Cleaning the multi optic verification accessory windows with a swab

3. To install the multi optic verification accessory onto the optic to be tested, slide the accessory over the tip of the optic.

To reach the full insertion depth there are two distinct areas of resistance that need to be overcome before reaching the hard stop. The figure below shows the multi optic verification accessory fully mounted onto the optic.

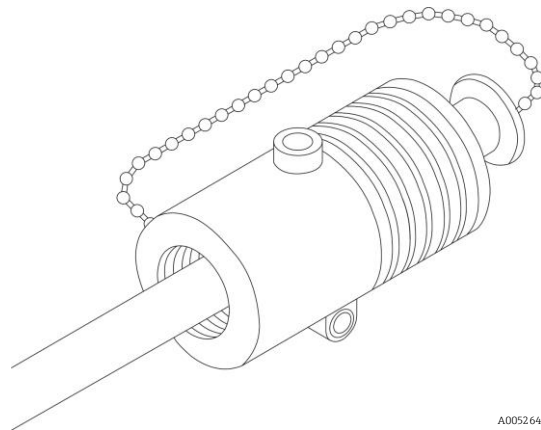


Figure 11. Multi optic verification accessory mounted on optic

⚠ WARNING

Do not remove the optic from the multi optic verification accessory while the laser is on.

- ▶ Serious injury can result from exposure to the laser.

6 Operation

6.1 Measure the multi optic calibration accessory temperature

During the calibration process, the multi optic calibration accessory temperature is measured and entered into the Raman RunTime 6.2.2+ embedded software on the Raman analyzer.

To obtain the multi optic calibration accessory temperature:

1. Attach the temperature sensor connector to the temperature display port marked channel 1.
2. Turn on the temperature display using the red power button.
3. Verify the display reads T1 to the right of the main temperature reading. Toggle to T1 if needed.
4. Read the temperature shown on the display and enter it into the Raman RunTime software on the analyzer.
 - Make sure the temperature units selected on the display (°C or °F) match the units selected in Raman RunTime.
 - Refer to the Raman RunTime software manual for instructions to input the temperature value.



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Figure 12. Thermometer inserted into the temperature measurement port

6.2 Accessory calibration data file

Each multi optic calibration accessory is supplied with a source spectral file on a flash drive. The file describes the relative spectral output of the device as measured with the probe tip in contact with the glass. The software used to operate analyzers is configured to directly read the device's SSF in the instrument standardization process. The data provided in this file are specifically for use with analyzers and are not intended for general radiometric purposes.

6.3 Raman calibration and verification protocol

Refer to the applicable Raman analyzer operating instructions for steps to:

- Perform internal analyzer calibration. This may include alignment calibration, full wavelength calibration or full laser wavelength calibration depending on the status of the analyzer.
- Perform probe calibration using the multi optic calibration accessory.
- Perform probe verification using the multi optic verification accessory to verify the calibration results.
- View calibration and verification reports.

The Raman RunTime software will not allow spectra to be collected without passing internal and probe calibrations. Passing the probe verification step is not required but is highly recommended.

Raman analyzer operating instructions are available by searching the Downloads area of the Endress+Hauser web site: <https://endress.com/downloads>.

6.4 Storing the multi optic calibration accessory

When stored or not in use, the multi optic calibration accessory dust cover must be in the position shown below. This protects and maintains the cleanliness of the accessory.

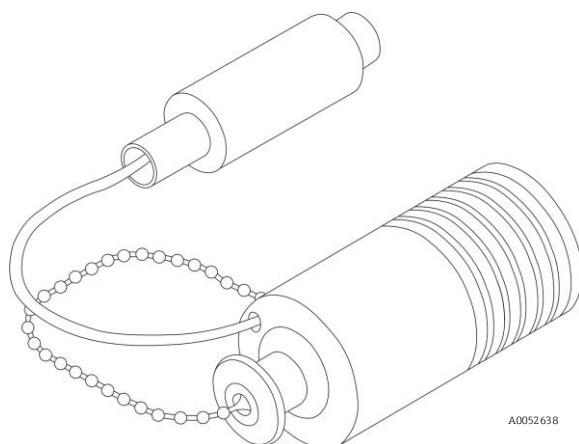


Figure 13. Multi optic calibration accessory with cap in position for storage

6.5 Storing the multi optic verification accessory

When stored or not in use, the multi optic verification accessory dust cover must be in the position shown below. This protects and maintains the cleanliness of the accessory.

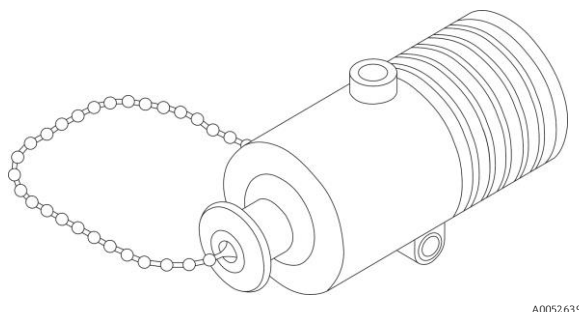


Figure 14. Multi optic verification accessory with cap in position for storage

7 Maintenance

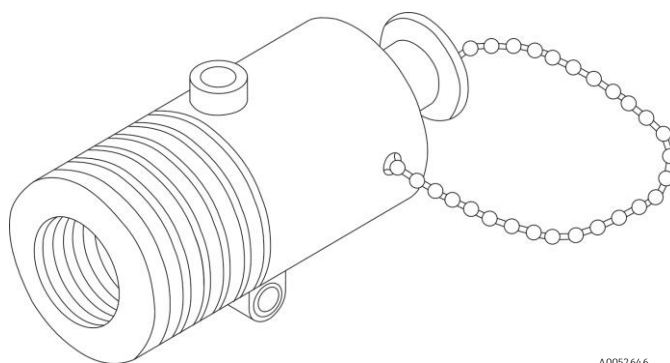
7.1 Replacing the verification sample

The multi optic verification accessory houses the verification sample. The standard sample initially provided and required for use with the accessory is 70 % isopropyl alcohol (IPA).

NOTICE

Only 70 % IPA should be used for optical verification.

- ▶ Only 70 percent by volume (%v/v) will work. Endress+Hauser recommends using CiDehol 70 by Decon Laboratories.
- ▶ Use of any other liquid for verification will result in a failed verification and may result in damage to both the verification accessory and the Raman probe.



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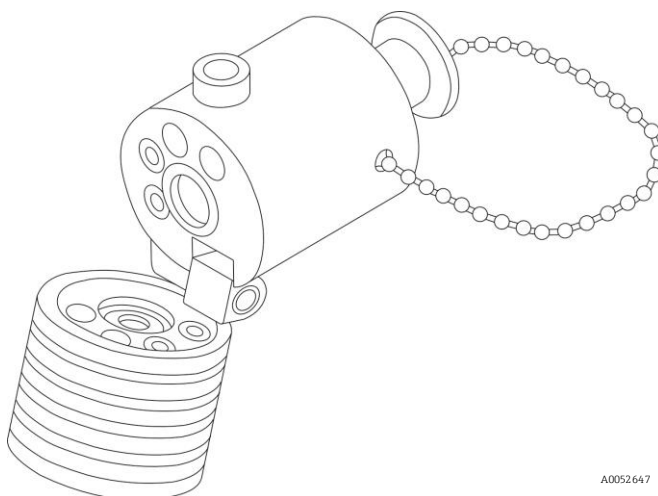
Figure 15. Multi optic verification accessory

It is recommended that the verification sample is replaced when:

- there is noticeable sample evaporation
- air bubbles are present
- probe verification fails

To replace the verification sample:

1. Open the grip section of the multi optic verification accessory at the hinge to expose the containment window.



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Figure 16. Multi optic verification accessory, partially opened

2. Unscrew the sample plug by turning it counterclockwise. Set aside the sample plug.

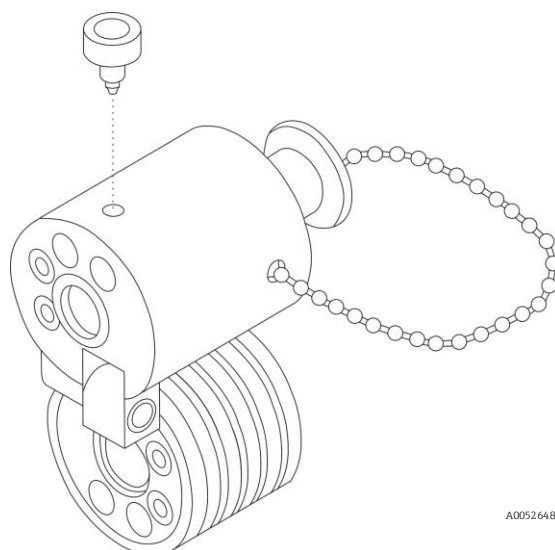


Figure 17. Multi optic verification accessory opened, and sample plug removed

3. Remove the syringe and leur lock tip from the kit lid storage location, and install the leur lock tip onto the syringe.
4. Extract the existing verification sample from the verification accessory.
 - Feed the leur lock tip into the fill port hole (where the plug was removed).
 - Extend the needle to the bottom of the vial. This can be viewed when looking into the containment window.
 - Extract the sample and discard it.
5. Add the new verification sample to the verification accessory.
 - Draw 70 % IPA into the syringe and discard. Repeat a few times to flush potential contaminants out of the syringe and tip.
 - Draw the new 70 % IPA verification sample into the syringe.
 - Hold the syringe vertically with the tip pointing up and expel all air bubbles.
 - Hold the multi optic verification accessory with the fill port facing up to prevent any bubbles from getting trapped while filling.
 - Feed the leur lock tip down into the fill port hole and inject the fresh verification sample into the sample space.
6. Replace the sample plug and turn clockwise until finger tight. Do not strip the threads on the plug.

7.2 Recertifying the multi optic calibration accessory

Unless noted differently for a specific application, Endress+Hauser recommends recertification of the multi optic calibration accessory after 12 months to ensure that degradation to moisture has not occurred.

A new SSF is provided with the recertified accessory. Reference the new SSF when calibrating the system from that point forward.

For Technical Service, refer to our website (<https://endress.com/contact>) for the list of local sales channels in your area.

8 Repair

8.1 Repairing the multi optic calibration and verification kit

Repairs not described in this document must be carried out only directly at the manufacturer's site or by the service organization. For Technical Service, refer to our website (<https://endress.com/contact>) for the list of local sales channels in your area.

8.2 Replacement parts

For product and spare parts ordering information, please visit www.endress.com or contact your local sales center.

9 Technical data

The specifications for the calibration kit are listed below.

Item	Description
Spectral intensity reference	calibration reference standard (CRS)
Data file spectral range	CRS-785: 790.7 to 1074.5 nm
Spectral intensity output	< ±2 %
Total long term spectral uncertainty (at any wavelength)	CRS-785: ±6.05 %
Dimensions	kit: 235 x 192 x 85 mm (9.3 x 7.6 x 3.4 in) calibration accessory: 27 x 67 mm (1.1 x 2.6 in) verification accessory: 35 x 67 mm (1.4 x 2.6 in)
Calibration kit weight	1.5 kg (3.3 lbs)
IP rating	IP20
Operating conditions	0 to 40 °C (32 to 104 °F) < 80 % humidity, non-condensing
Recommended storage conditions	-15 to 50 °C (5 to 122 °F) < 80 % humidity, non-condensing

Table 4. Specifications

10 Supplementary documentation

All documentation is available:

- On the Endress+Hauser Operations App for smartphone/tablet
- In the Downloads area of the Endress+Hauser website: <https://endress.com/downloads>

Part number	Document type	Document title
TI01719C	Technical Information	Multi optic calibration and verification kit Technical Information

Table 5. Supplementary documentation

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