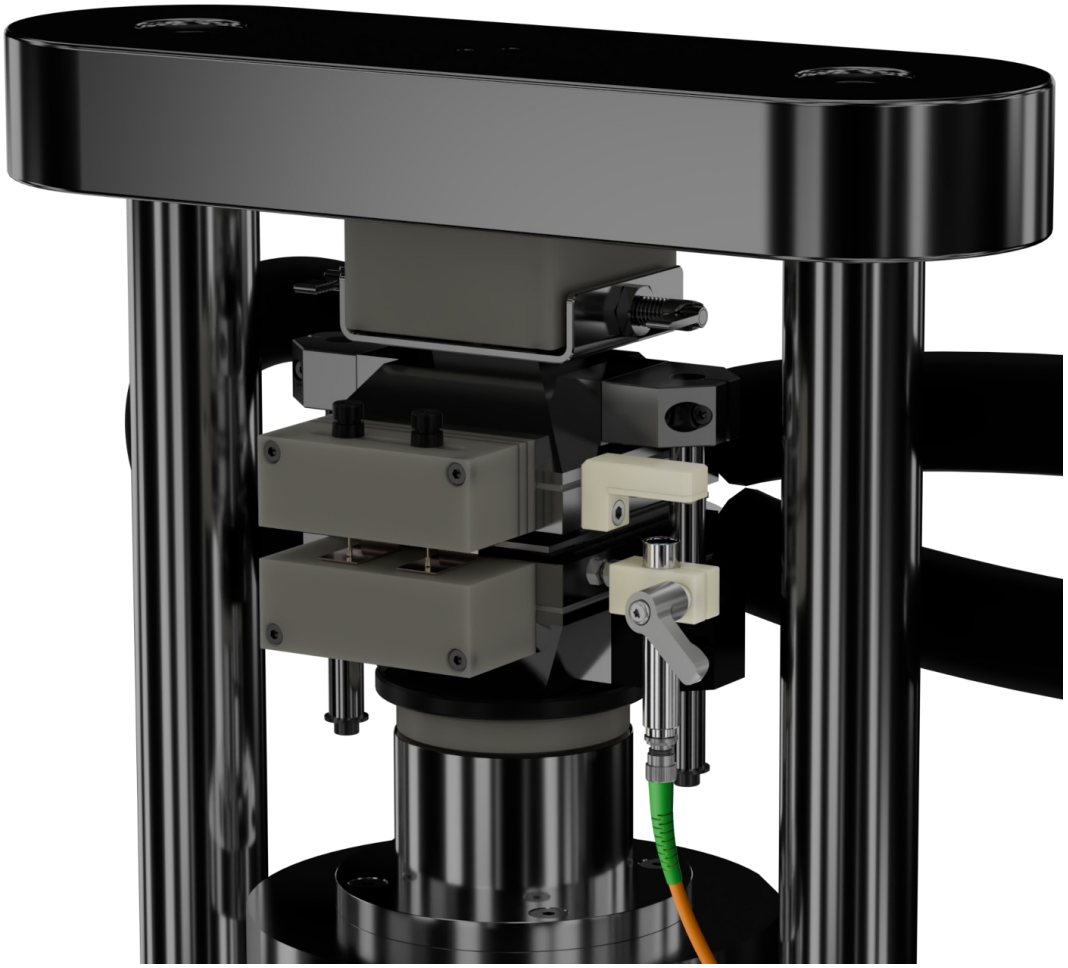
rhd instruments
flexible cell solutions

Confocal Distance Add-on for CompreCell Pouch

User Manual



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rhd instruments GmbH & Co. KG

Contents

1 Product description

The Confocal Distance Add-on for CompreCell Pouch is designed to enable the electrochemical characterization of pouch cells while precisely monitoring the thickness changes of the sample during the measurement. The product is designed to be used only in combination with the corresponding measuring cells (CompreCell Pouch) and the CompreDrive or CompreFrame setup.

The CompreDrive Distance add-on provides an optical confocal distance sensor which can be directly mounted on the CompreCell Pouch. The small and light-weight optical sensor is connected via an optical cable to the confocal analysis unit. This unit can be directly attached to the CompreDrive main frame, where power is supplied. The data is transferred via an ethernet interface and can directly be recorded alongside with all other data using CompreDriveControl software.

The optical sensor offers a total measuring range of 2 mm with a resolution of 40 nm and a linearity of 1 µm over the whole range.

2 General information

Thank you for your confidence in our products and services. We wish you pleasure and success with your new CompreDrive Distance add-on system. It has been especially been developed for professional electrochemical material characterization.

» **To avoid physical injuries and damages, please read this instruction manual carefully before using the device for the first time.**

» **Please pay attention to all safety notes in this instruction manual.**

» **Please keep this manual safe. In case of selling or leaving the device to third parties, please do not forget to hand this manual over as well.**

» **The operation of the CompreDrive Distance add-on should only be performed by properly trained and experienced members of staff.**

» **The setup is developed to measure sample thickness changes in your CompreCell electrochemical measuring cells and must not be used for any other purpose.**

» **To avoid unstable operating conditions and injury, the CompreDrive Distance setup as well as the individual components should not be used if**

- **they show noticeable damage,**
- **they were stored or operated under unapproved conditions (see operational condition, storage and rated values),**
- **they were exposed to high mechanical stress, exceeding normal usage,**
- **they were altered by members of staff not authorized by rhd instruments.**

The instructions in this manual were carefully checked for correctness. However, liability for any mistakes in form and content will not be assumed. Additionally, rhd instruments GmbH & Co. KG (in the following declared as rhd instruments) reserves the right to change the setup and design of the products presented and described within this manual. Such changes are necessary to guarantee the continuous development of the products and, thus, the improvement of product quality and reliability.

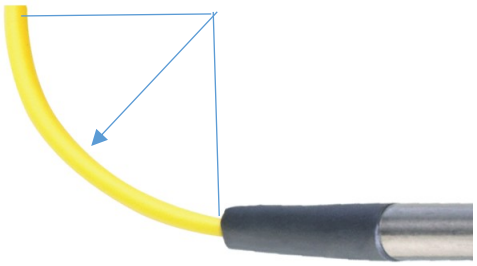
Markings in this manual

Marking	Meaning
 **WARNING**	Indicates a hazardous situation which, if not avoided, could result in a serious injury or death.
 **ADVICE**	Indicates potential physical damages and other important information associated with your device.

3 Important general safety notes

WARNING: Do not bend or kink optical fibres

If the optical cable between sensor and controller is kinked or bended in tight radii, there will be irreversible damage to the cable. Minimum radius is 40 mm.



» Connect the power supply and the display/output device according to the safety regulations for electrical equipment. Otherwise, there is risk of injury, damage to or destruction of the sensor and/or the controller

» The supply voltage must not exceed the specified limits to avoid damage to or destruction of the sensor and/or the controller

» Protect the ends of the optical fibre against contamination (use protective caps).

» Only use the original parts included in delivery. They are prepared for your device and guarantee the necessary safety for operator and device.

» Do not operate the device with wet hands. Operate the device only in dry rooms.

» Do not operate the device outdoors.

» Please follow only the instructions in this manual for cleaning the device.

» Make sure that cables and conductors are not damaged. Damage could be caused by heat, impact, contact with chemicals, or mechanical impacts like rubbing, bending, tearing, and rolling-over.

» Prevent the device from mechanical impact. In case the device fell down, please contact rhd instruments or a technician authorized by rhd instruments before switching it on again.

» If your device shows any visible damage or defect: Disconnect the power supply by pulling out the power connector. Never operate your device in a damaged state. Never repair the device on your own. The device should only be repaired by either rhd instruments or by a technician authorized by rhd instruments.

» Do not open the device. There are no user-serviceable parts inside.

» Please follow this instruction manual for maintaining your device.

» Only use original spare parts delivered by rhd instruments.

ADVICE: Connect and disconnect any cable connection carefully.

ADVICE: Handle chemicals with care.

» When handling chemicals during preparation and execution of measurements with the CompreDrive HC add-on, the usual safety advice in accordance with the H, EUH, and P statements (in the European Union: rating principles according to the CLP regulation) and appropriate safety measures have to be observed. This applies to subsequent cleaning and decontamination as well.

ADVICE: Sufficient cleaning increases the lifetime of your system.

» After using the CompreDrive add-on for electrochemical measurements, all components in contact with chemicals need to be thoroughly cleaned. Insufficient cleaning, decontamination, and drying of the components may result in damage due to corrosion and, thus, may affect the quality of your measurement results.

4 Components of the CompreDrive Distance add-on system

» Please unpack your device carefully.

» Please check if the delivery is complete:

- 1x confocal controller unit with support plate
- 1x optical sensor with optical cable and holder
- 1x power cable 24 V (Y-cable) or power supply
- 1x ethernet cable
- 1x ethernet to USB adapter
- 1x hex screw driver (4 mm)
- 1x wrench 8 mm
- 1x sensor mount
- 1x mirror mount

» Please check if the delivered items are undamaged.

ADVICE: If the delivered items are incomplete or damaged, please contact rhd instruments via e-mail (info@rhd-instruments.de) or via phone (+49-6151-8707187).

rhd instruments will reject any claims for warranty or responsibility in case damaged equipment is used.

In case any accessory of other manufacturers is used, rhd instruments will accept no liability.

Figure 1: Overview CompreDrive Distance add-on for CompreCell Pouch. Latest version of the add-on is shipped with a new, smaller controller (top right). All steps in the manual are completely analogous to the legacy controller (top left).

5 Operation conditions, storage and rated values

» Power supply	24 VDC 15%, Imax < 1 A
» Temperature range during operation Sensor:	$T_{env.\ operation}$ = -20 °C to +70 °C
» Temperature range during operation Controller:	$T_{env.\ operation}$ = +5 °C to +50 °C
» Temperature range during storage:	$T_{storage}$ = +10 °C to +50 °C
» Relative humidity (RH) for working and storage area:	(non-condensing) 0 to 80% RH
» Atmosphere during storage:	Non-corrosive

Confocal sensor characteristics

Measuring range	2 mm
Start of measuring range approx.	14 mm
Lateral resolution*	40 nm
Light spot diameter	10 µm
Linearity (displacement and distance measurement)	1 µm

* Average from 512 values at 1kHz, near to the midrange

6 Essential features at a glance

» High-precision distance measuring system for CompreCell Pouch.

» Measurement of sample thickness changes during electrochemical experiments.

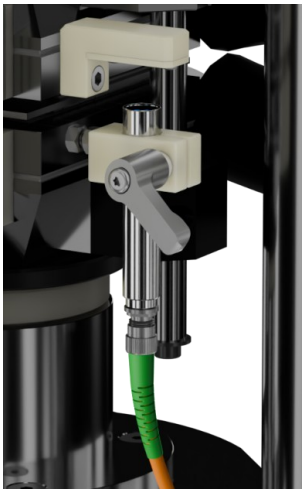
» Measuring points as close to the sample as technically possible, to exclude influences from the main frame.

» Fast and comfortable assembly and handling.

» Fully included data handling and processing into CompreDriveControl software.

» Retrofittable to all CompreDrive systems.

» Compatible with HC temperature control option.



Note:

If you have any questions, for example with regard to the compatibility of your measurement devices, do not hesitate to contact us via email (info@rhd-instruments.de) or phone (+49-6151-8707187).

7 Getting started

7.1 Retrofitting the CompreDrive Distance add on

If your CompreDrive was not delivered with the CompreDrive Distance option by default, it needs to be installed as described in the following:

Switch the CompreDrive off at the main switch!

Figure 2: Confocal controller on support plate with aligned sliding blocks.

If the confocal controller is not yet mounted on the support plate, click it onto the top hat rail. Then make sure, that the pre-installed sliding blocks are aligned as shown.

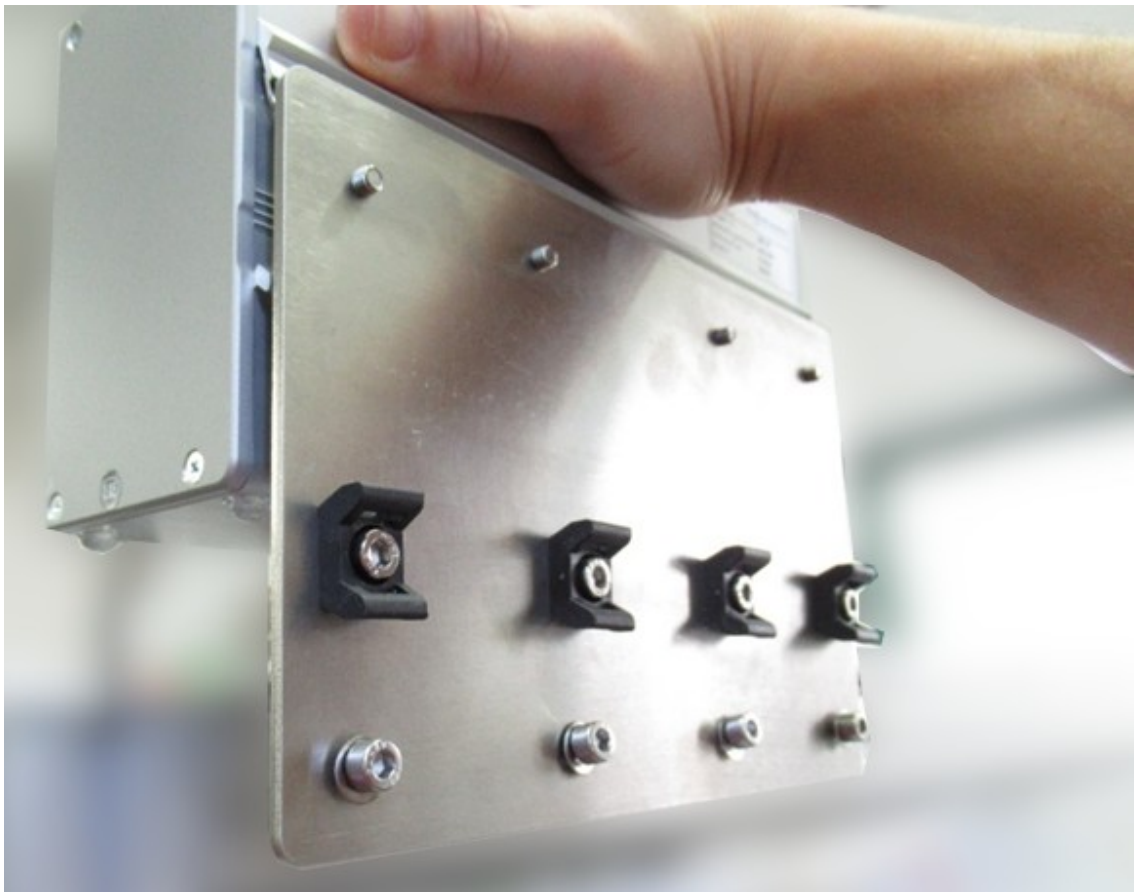


Figure 3: Mounting position of confocal controller

The unit is fixed at the top left corner of the back-side of the CompreDrive. Push the sliding blocks into the aluminium profile and use a 4 mm hex screw driver to fix the plate.

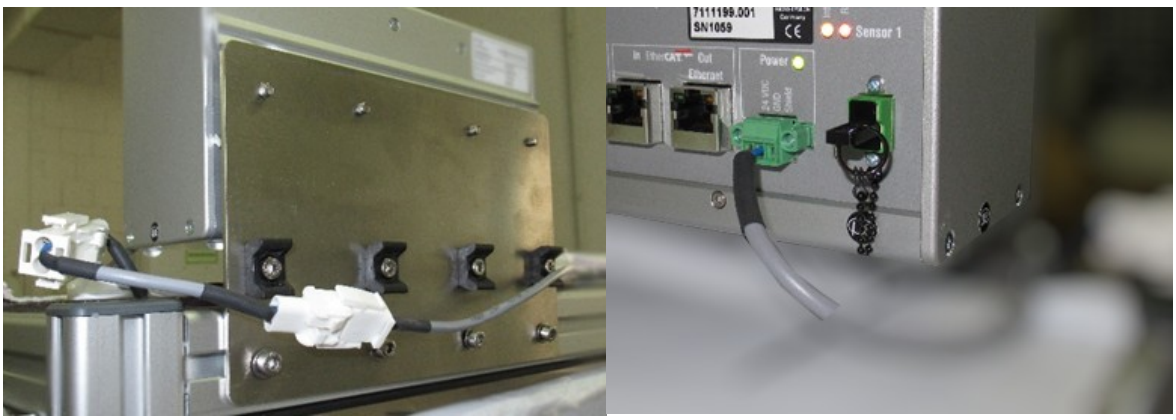


Figure 4: Left: Y-cable connected to 24 supply and to the fan, right: Connection to controller.

Figure 5: Sensor cable inserted into the sensor port of the controller

Put the optical cable through the opening in the back panel. Then remove the black protecting plug from the sensor port of the controller and insert the sensor connector. It must fully engage.

Now, all cables can be fixed to the back side of the sensor support plate. Use cable ties.

7.2 Replacement of the lower drip pan with the Distance Add-On version

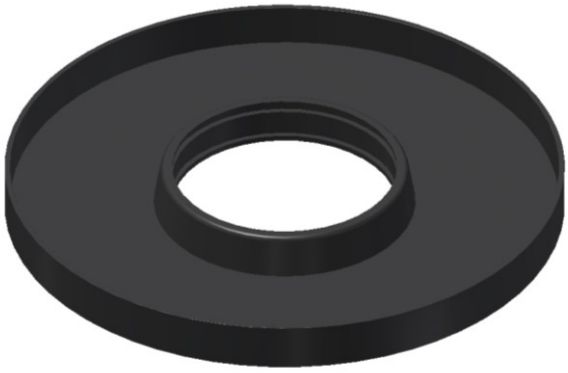


Figure 6: Old standard drip pan

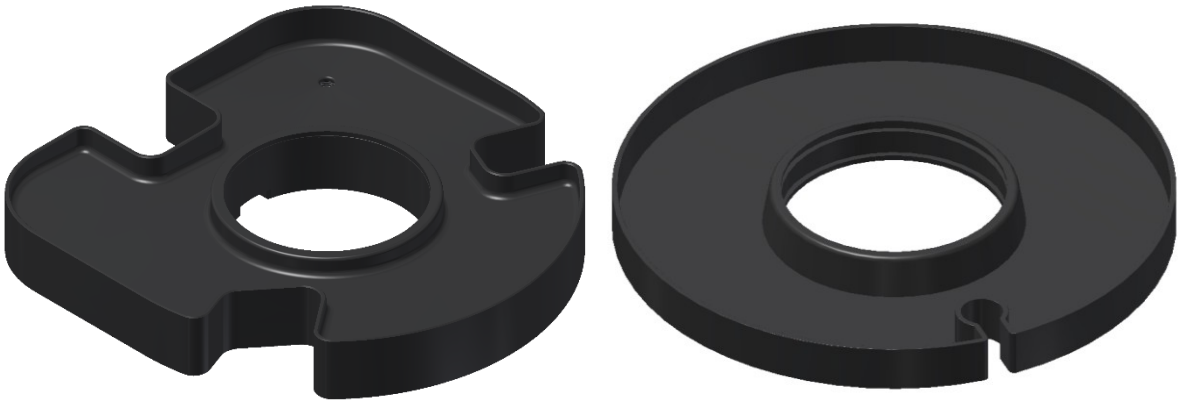


Figure 7 Drip pans compatible with Distance Add-On

A suitable drip pan must be installed in the CompreDrive. The actual design of the drip pan might differ from the pictures above; the important feature is space for the optical cable.

For instructions on how to remove and place the drip pan see CompreCell Pouch 10S HC manual.

7.3 Sensor and mirror mount assembly

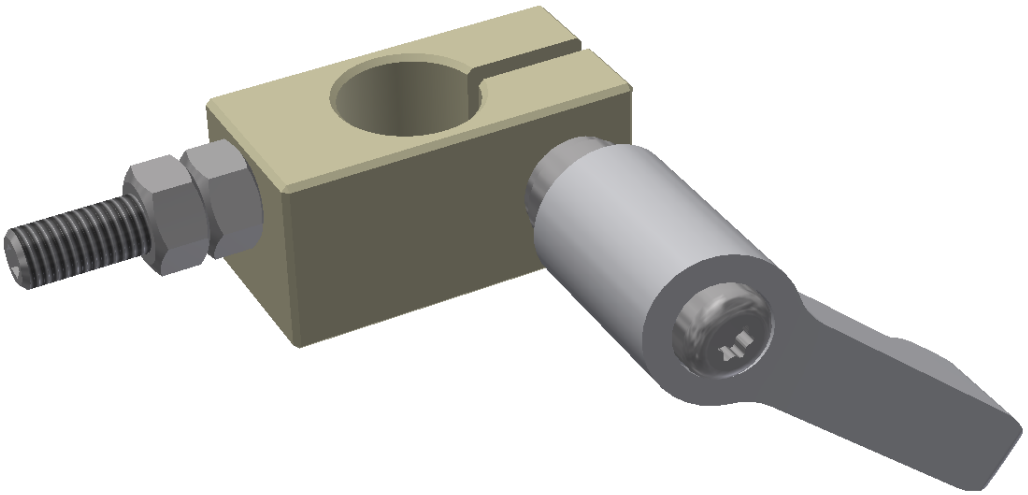


Figure 8: Sensor mount

Make sure that the two nuts are screwed towards the PEEK part of the sensor mount as far as possible.

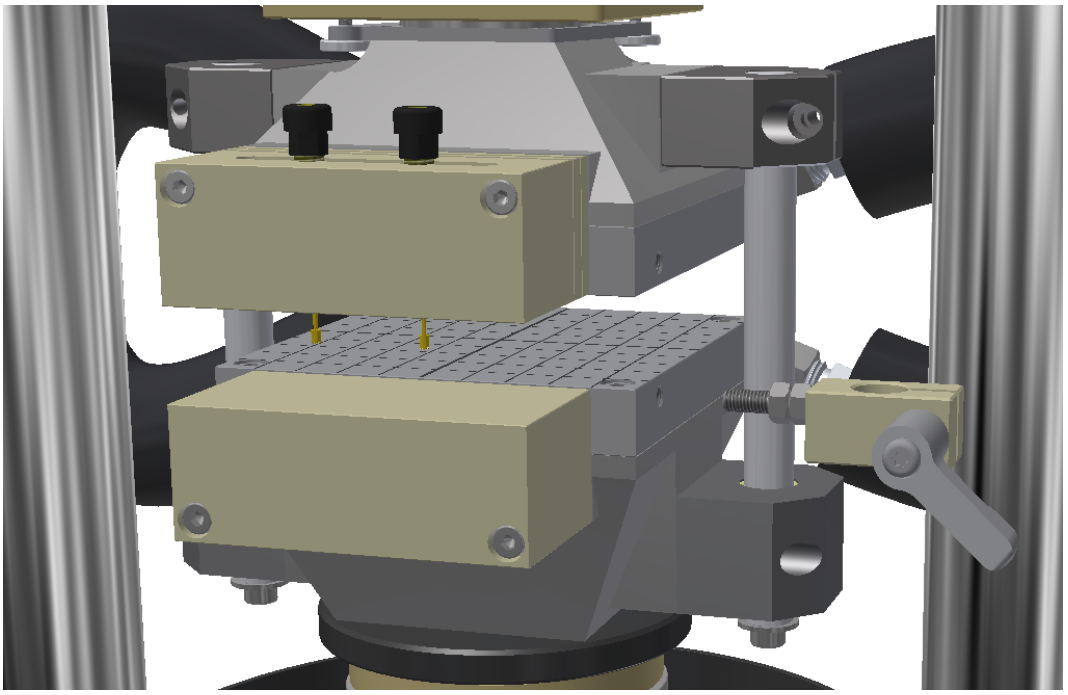


Figure 9: Attaching the sensor mount to the CompreCell Pouch

Attach the sensor mount to the CompreCell Pouch by screwing it into the lower, right screw hole shown in **Figure 9**.

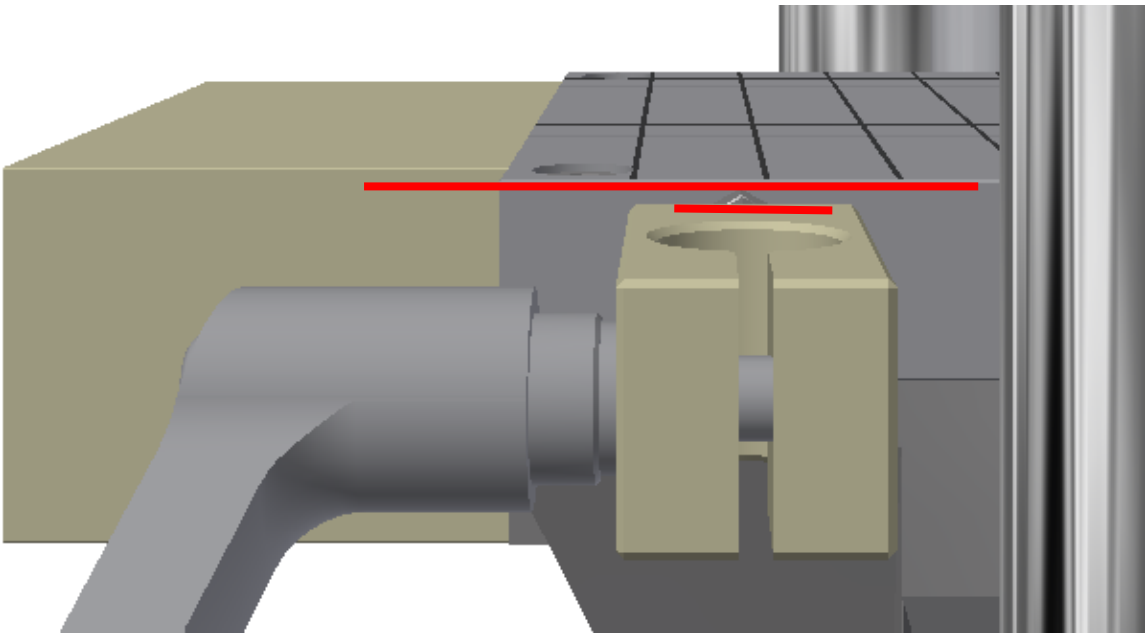


Figure 10: Aligning the sensor mount

Screw the sensor mount in as far as possible, then turn it back so that the upper surface of the PEEK part is parallel to the ground surface on your CompreCell Pouch.

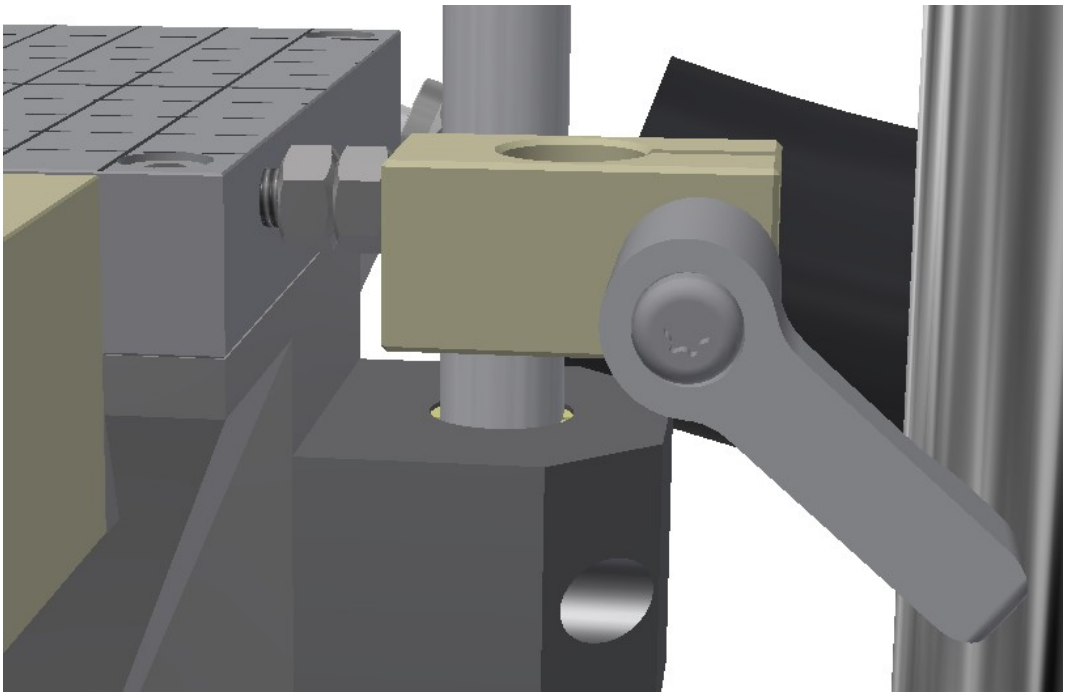


Figure 11: Nuts to be tightened

Lock the sensor mount in place by screwing the nut closer to your CompreCell Pouch against the corresponding surface with an 8 mm wrench while holding the sensor mount in its desired position.

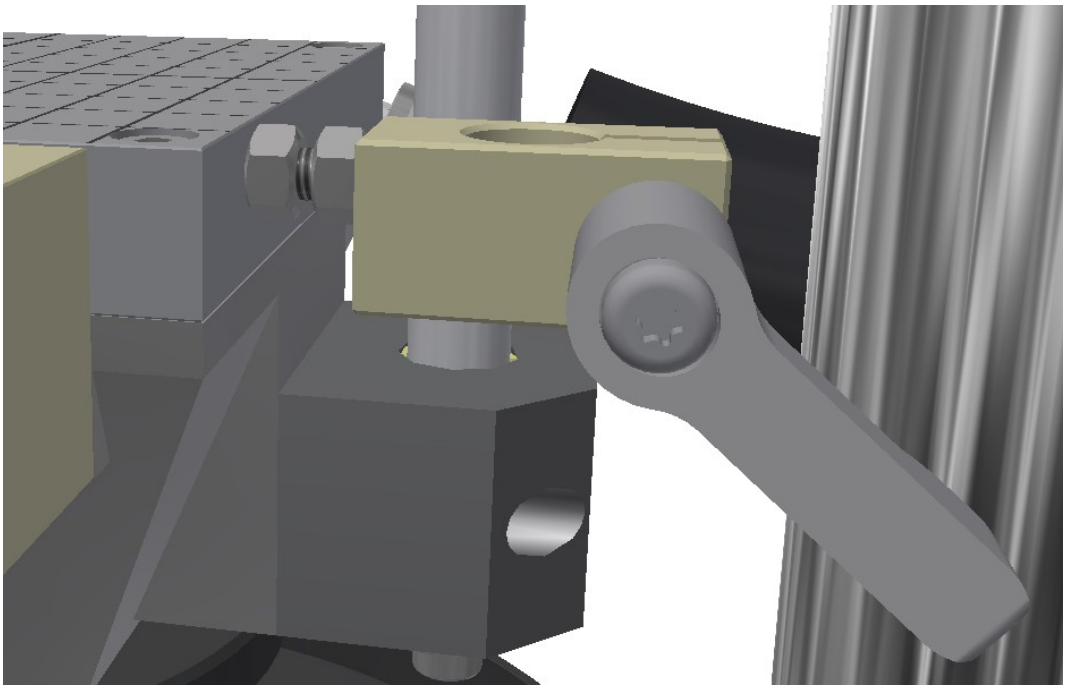


Figure 12: locked sensor mount

The sensor mount should now be locked in place securely.

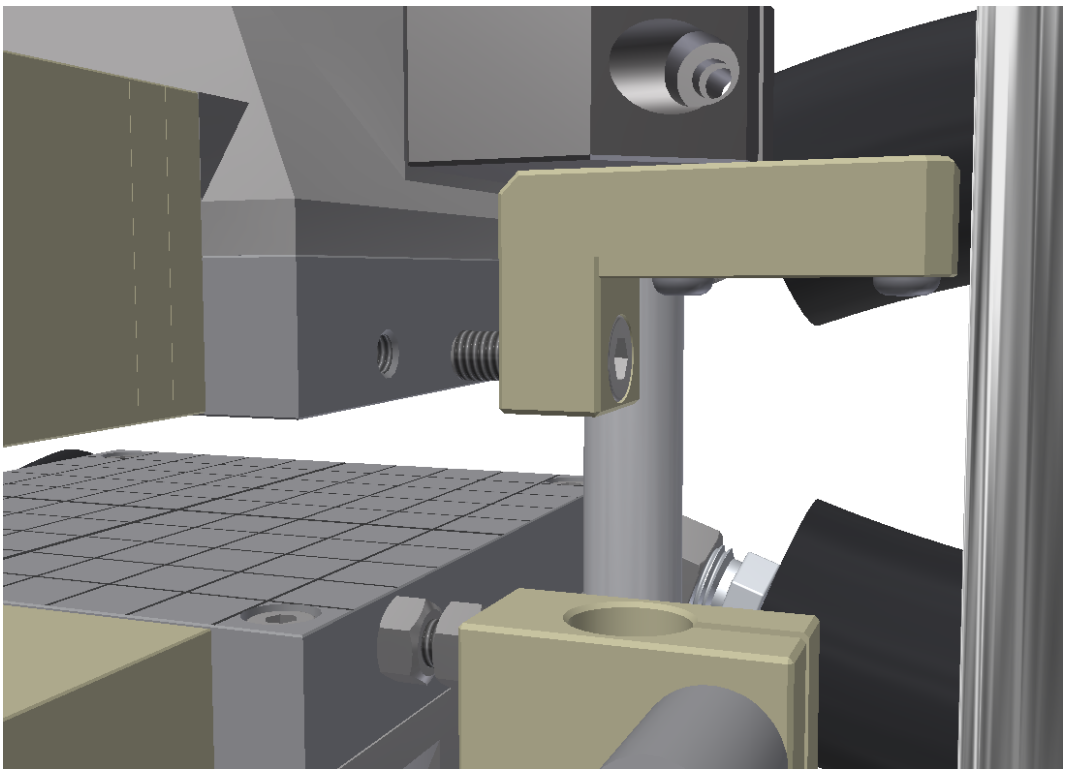


Figure 13: Attaching the mirror mount

Attach the mirror mount to your CompreCell Pouch with the included M5 screw and a 4 mm hex key.

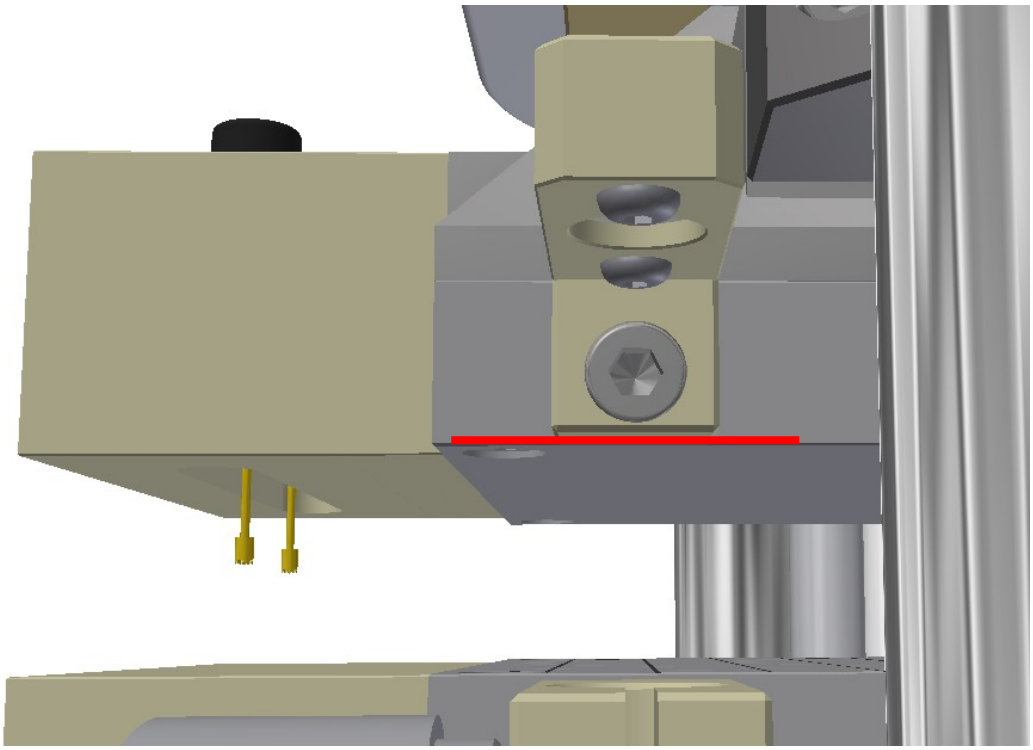


Figure 14: Aligning the sensor mount

Make sure that the bottom part of the sensor mount is parallel to the upper plate of the CompreCell Pouch. It must be even with the surface of the upper plate, not protruding.

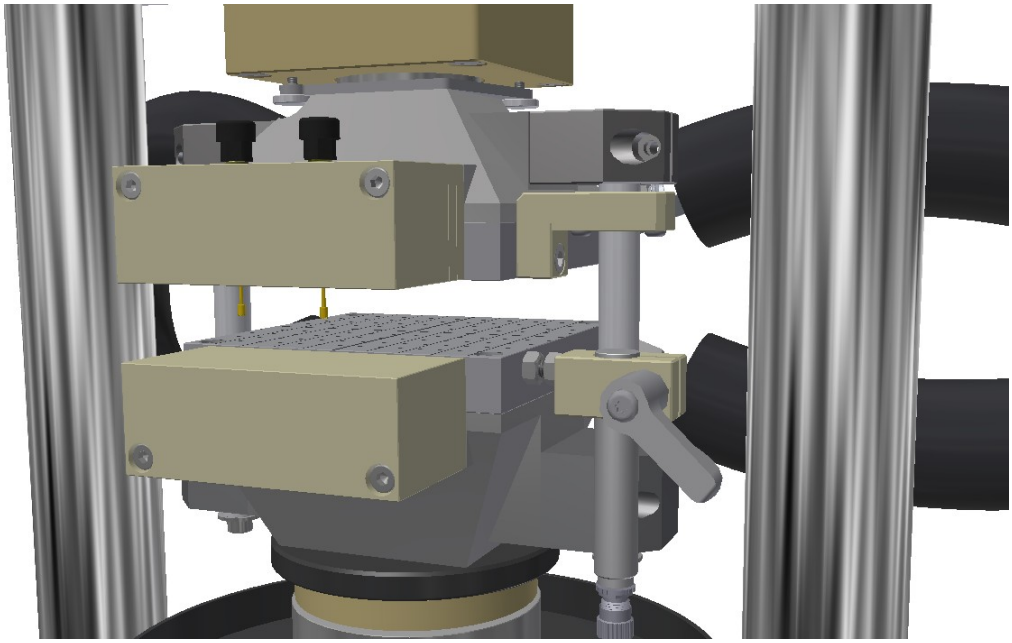


Figure 15: Inserting the confocal sensor

Insert the confocal sensor into the sensor mount and lock it in place by turning the lever on the sensor mount. The sensor should barely protrude the PEEK of the sensor holder at this point.

8 Rough adjustment of the sensor height

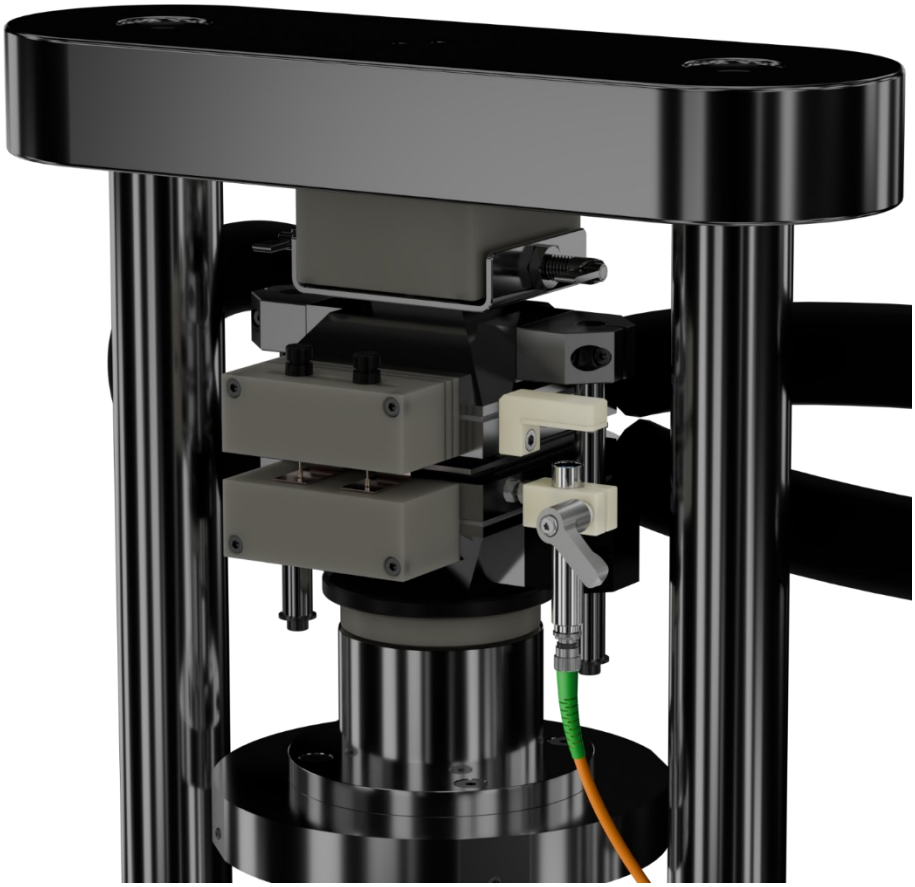


Figure 16: Distance add-on mounted completely

The distance between sensor and mirror has to be adjusted according to the height of the pouch cell in use. To do so, start by approaching the CompreDrive via CompreDrive-Control with your sample in place.

WARNING: Make sure the sensor is not protruding the PEEK sensor holder significantly more than your sample height. Failure to do so might cause a crash between sensor and mirror mount during the approach procedure, irreversibly damaging your system.

Open the door after the approach has finished. Note: For safety reasons, the door can only be opened if the applied force is below 0.5 kN.

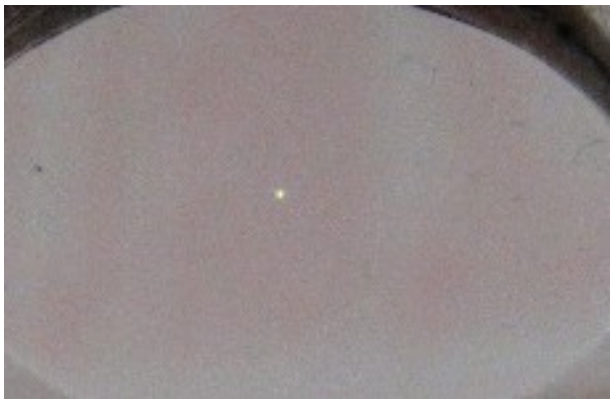


Figure 17: Sensor spot visible on the mirror.

Move the sensor until a small sharp light spot becomes visible on the mirror. **Hint:** The focal distance of the confocal sensor is 14 mm. Since the mirror is recessed about 2 mm in the mirror mount, the distance between the sensor and the mirror mount should be roughly 12 mm.

Make sure that both sensor LEDs on the confocal sensor controller are green at the same time.

Figure 18: Sensor LEDs on the sensor controller.

Fine tuning of the sensor position and measuring range is done using the RHD-DistanceServer software, see next chapters.

9 Software

9.1 Explanation

The CompreDriveControl software can be used to establish automated electrochemical measurements including the communication with the confocal sensor system.

The RHD.DistanceServer connects to the Confocal Controller and translates the data continuously so that CompreDriveControl can process it. For reading and recording the distance values, this is sufficient.

For the constant distance mode, the distance data needs to be integrated deeper into CompreDriveControl, which is achieved via the Distance Provider Plugin (preinstalled in current versions of CompreDriveControl).

9.2 Initial setup

Install the latest version of CompreDriveControl.

Unpack the Distance Server archive provided with the Confocal Addon and install the RHD Distance Server using rhd-ds-<*version*>.exe. Afterwards the distance server can be launched from the windows start menu.

The following window opens:

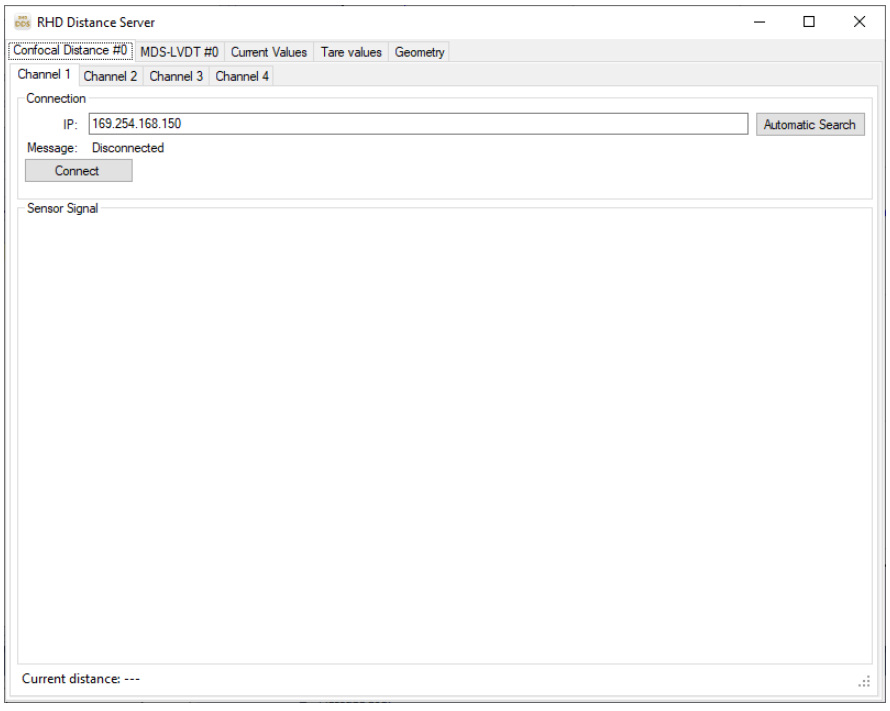


Figure 19: Startup window of RHD Distance Server

Navigate to the Confocal Distance Ribbon. The default IP address of the controller is **169.254.168.150** (static). It is recommended to use the provided USB-to-ethernet adapter to create a direct connection between the controller and the PC. The adapter should already be configured to use the same subnet as the controller.

In case a connection to the default IP address does not work, click the **Automatic Search** button. Here, the software will automatically scan the current subnet for controllers. If the controller can't be found, please check the following steps:

- Connect the sensor directly via the supplied USB-Ethernet dongle
- Ensure in the Windows network settings, that the USB-Ethernet dongle has a static IP of 169.254.168.10 assigned
- Ensure that TCP/IP communication via port 1024 is not blocked by a firewall
- After plugging in the cable, make sure the two LEDs on the controller connector light up (green and yellow)
  → If not, it means that the connection is not established correctly. Check the cable for damage.

After entering the IP address of the controller, click on "Connect". If the controller is switched on, connected to the network, and the right IP is set, connection is established. As soon as the connection works, data from the controller is transferred and displayed. Data is automatically transferred to CompreDriveControl in the background as long as the Distance Server program is running.

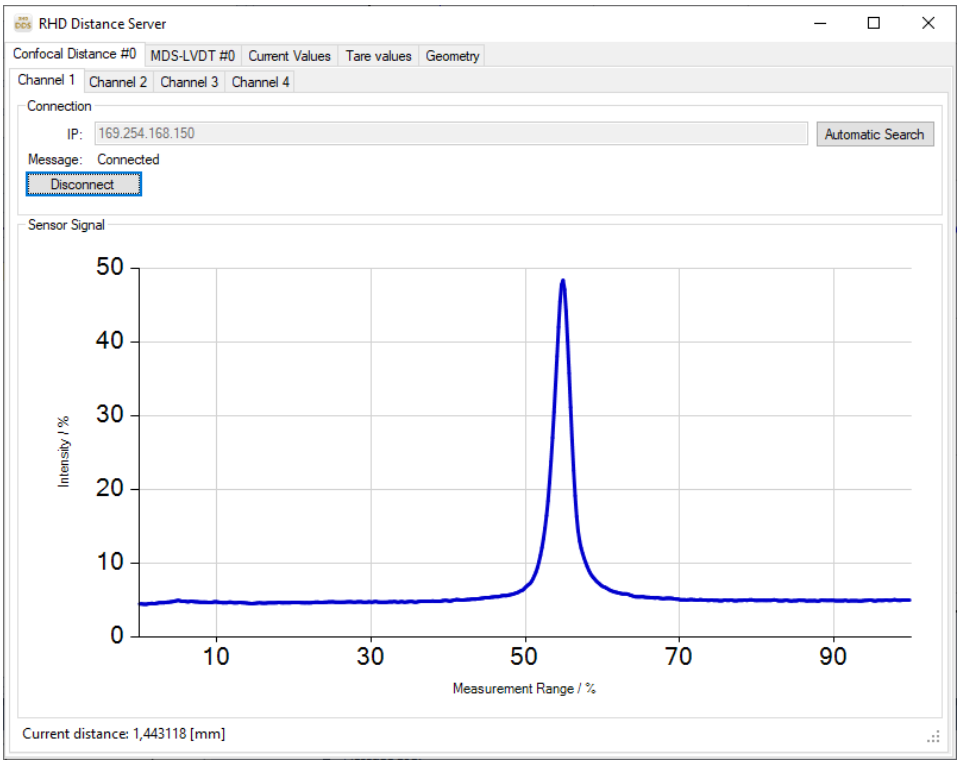


Figure 20: Distance Server connected to confocal controller.

Start CompreDriveControl and check the status of the Distance Provider Plugin via Main->Setup->Manage Plugins. It should be marked as active.

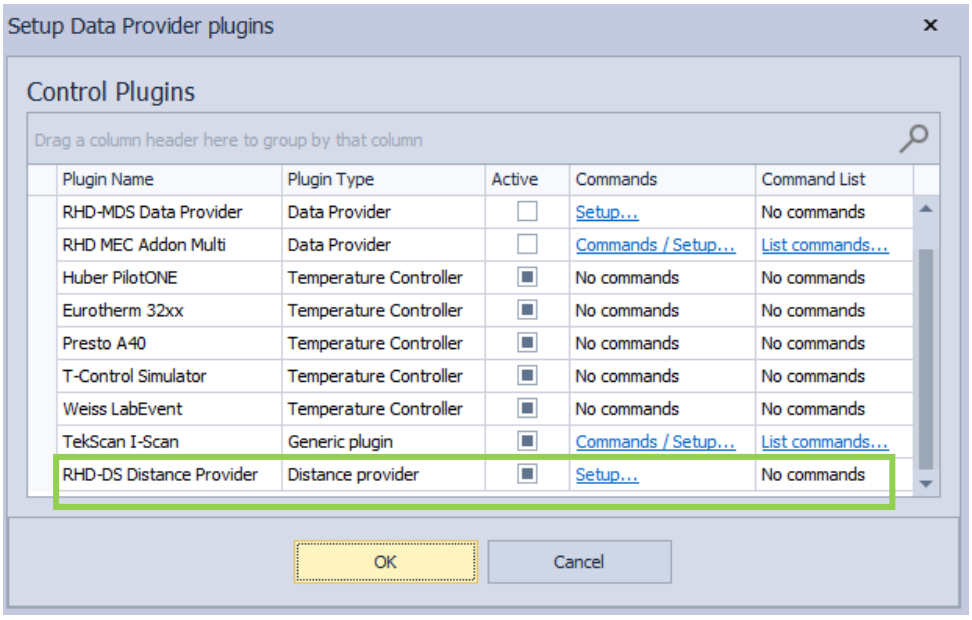


Figure 21: Selection of data providers, distance server plugin is installed.

Data from the confocal system should now be available in CompreDriveControl.

For further details please refer to the CompreDriveControl user manual as well as the manual of the confocal controller.

10 Fine adjustment of the sensor height

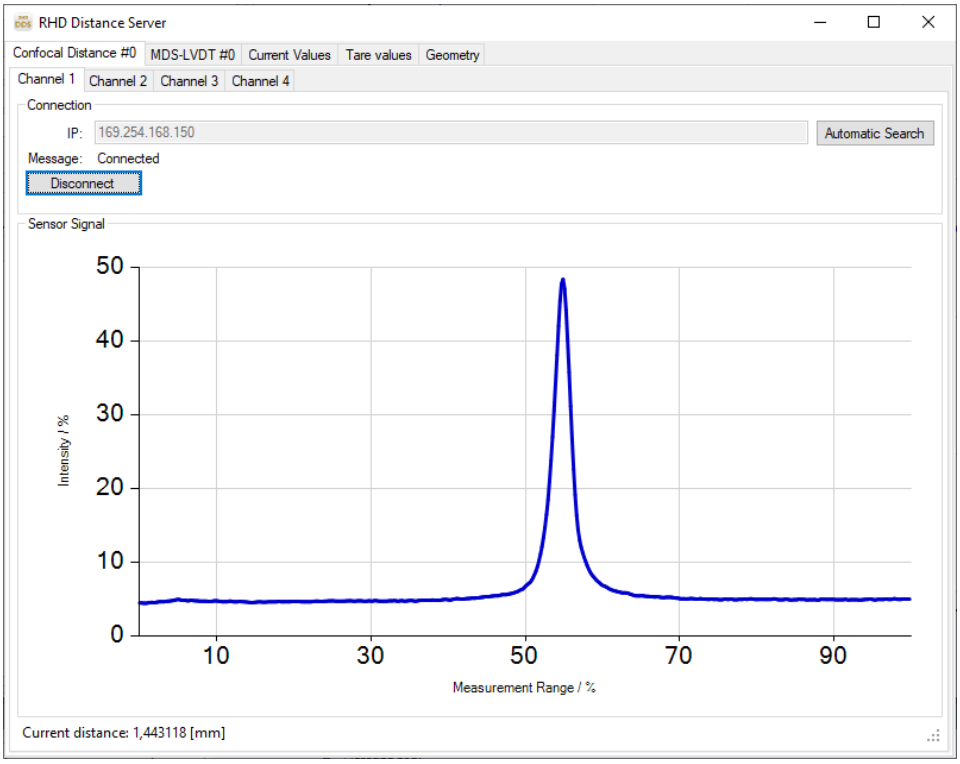


Figure 22: Desired sensor signal.

A single sharp peak is visible in a range between 10 % and 90 % of the measurement range is visible, if the sensor is within its working limits (**Figure 22**). This is also indicated by two green LEDs on the controller panel.

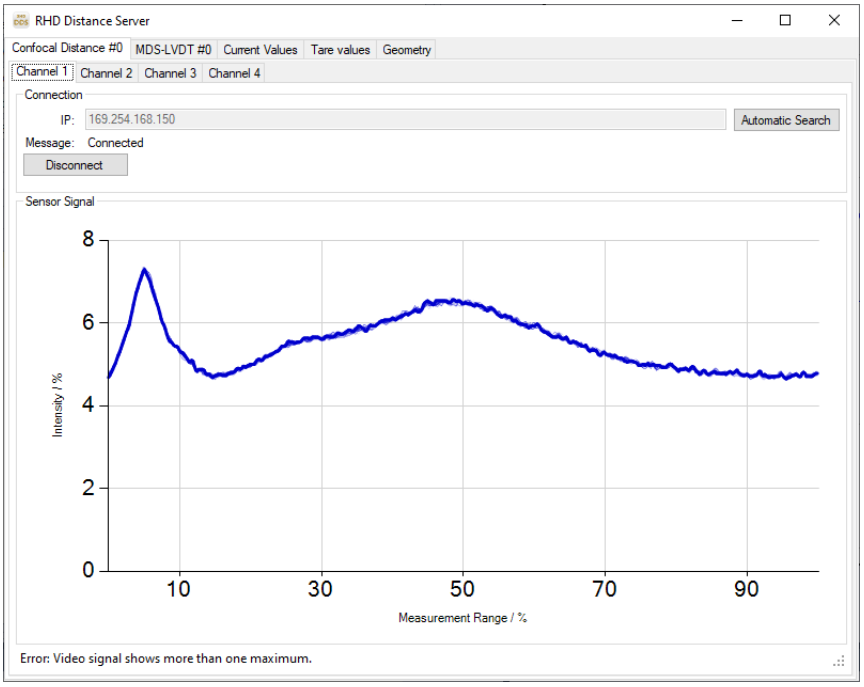


Figure 23: Sensor signal out of range.

If the sensor is out of range (protective cap in place, out of distance or not fully plugged into the controller), a result like in the above picture is visible (**Figure 23**).

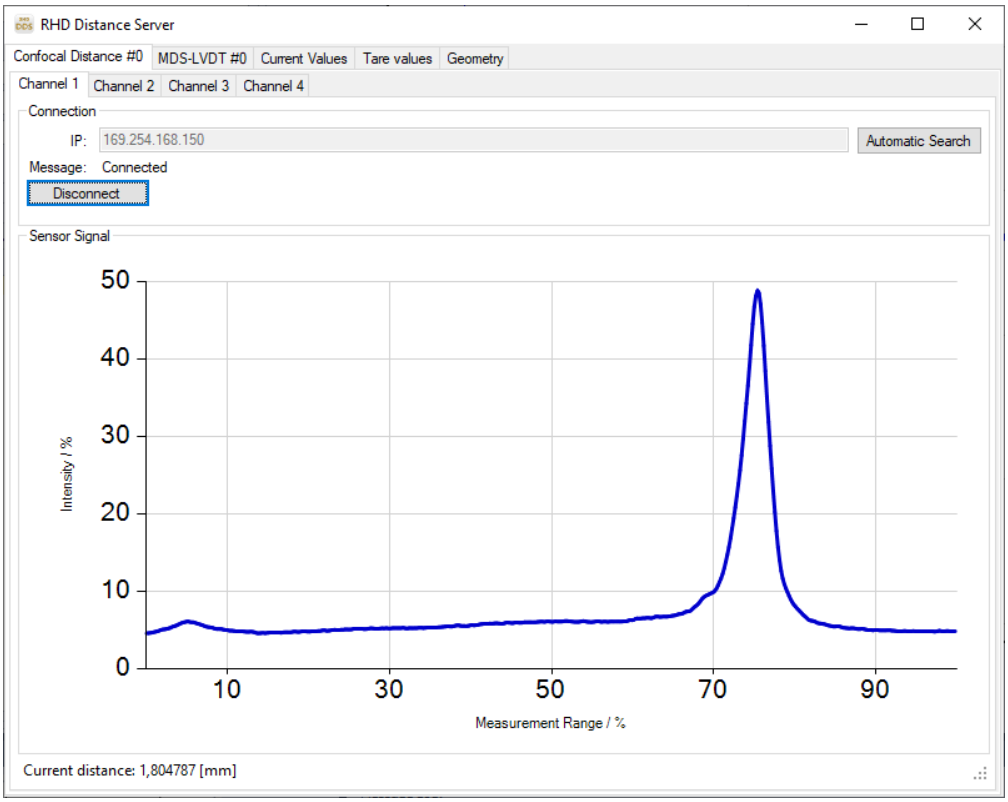


Figure 24: Setting the sensor to the uppermost limit to use full range of compression.

If a highly compressive sample is loaded, make sure to use the whole range by adjusting the sensor to the uppermost limit prior to measurement, as shown in the picture above (**Figure 24**).

If the initial thickness of the sample is known, tara can also be set. Approach your CompreDrive, do the fine adjustment and proceed with your measurements.

When using a HC-Add-On make sure that the temperature sensor is inserted into one of the corresponding holes and close the door of your CompreDrive.

11 Troubleshooting

11.1 No Connection to confocal system, system not found

Make sure the IP is correctly set in the confocal controller. Please also refer to the controller manual.

The correct IP has to be set in the connection dialog of RHD.DistanceServer.

Please also check the following points:

- Connect the sensor directly via the supplied USB-Ethernet dongle.
- Ensure in the Windows network settings, that the USB-Ethernet dongle has a static IP of 169.254.168.10 assigned
- Ensure that TCP/IP communication via port 1024 is not blocked by a firewall
- After plugging in the cable, make sure the two LEDs on the controller connector light up (green and yellow)
  → If not, it means that the connection is not established correctly. Check the cable for damage.
- Check that the Confocal and LVDT sensor tabs in the RHD.Distance Server are not mixed up.

11.2 Confocal system connected, but no data in CompreDriveControl

Make sure the sensor is within its working range, and the light spot is visible on the mirror.

11.3 Data is only present at the start of a measurement

Make sure to use the full accessible measuring range. If the sensor is out of range due to sample compression, no data is transferred anymore.

11.4 CompreDrive door cannot be opened after approach

Make sure the applied force is below 0,5 kN.

Make sure you have installed the latest version of CompreDriveControl on your computer and the corresponding firmware on the CompreDrive.

12 Settlement

Warranty will be granted for a period of 2 years starting at the date of delivery.

Explicitly left out from warranty are parts that are subject to premature wear and tear due to use or other natural wear and tear. These components are regarded as consumables. Damage on the optical cable is excluded from warranty.

The costs for sending repaired or exchanged goods to the costumer will be paid for by rhd instruments.

rhd instruments has to be notified of apparent defects and damages which occurred during production or delivery within 14 days after receiving the delivery. If a notification of apparent defects and damages does not occur within this period of time, the goods shall be deemed to have been accepted; as a result, the order will be assumed to be completed and approved.

Please note: Only workshops authorized by rhd instruments are allowed to perform repairs on the devices. If any mechanical or electronic components of the products are altered by customers themselves or by unauthorized workshops, a claim for warranty against rhd instruments is forfeited.

In case of a claim or sending back goods for repairs to be performed, please ask for the decontamination form beforehand. In general, rhd instruments must be contacted via e-mail or phone prior to any shipping of damaged goods.

13 Contact and Technical Support

For any questions with regard to our products, orders, or request for repairs please contact rhd instruments:

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