

# CompreStat 15x11

## User Manual



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rhd instruments GmbH & Co. KG



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# 1 Product description

The CompreStat is a system that allows the user to apply isostatic pressure to a solid, flat sample such as a pouch cell during an electrochemical measurement. It integrates one pressure and three temperature sensors. Their data can be displayed on a connected PC.

The pressure is applied by injecting non-flammable gas from a pressure source e.g. a 300 bar gas cylinder into the pressure chamber. That can be done by using the CompreStat filling set IO. Due to the use of gas as the pressure medium, the sample is pressurized isostatically. This ensures that the sample is exposed to the same homogeneous pressure from all sides. As a result, minor irregularities in the sample surface do not cause local pressure spikes. The pressure chamber is designed to contain up to three pouch cells at once. The pouch cells under test are placed on a pouch cell holder like on a drawer and can be inserted into a sliding system mounted to the lid. Each drawer includes a temperature sensor to monitor the cell temperature individually.

The CompreStat Data Sampler reads the pressure of the integrated pressure sensor as well as the temperature of each of the three temperature sensors. The CompreStat Data Sampler converts the analog sensor data into digital data. The measured data can then be monitored and stored via a connected PC. As a convenient interface between CompreStat Data Sampler and PC, rhd instruments provides the software packages CompreDriveControl and the plugin CompreStatCDCPlugin. The plugin offers an integration option for using the CompreStat with CompreDriveControl, which serves multiple functions including data logging and export, as well as a temperature controller interface.

The sample temperature cannot be controlled directly, but by placing the CompreStat inside a temperature chamber.

Please read this manual carefully in order to learn how to use the CompreStat successfully, safely, and efficiently.

Thank you for choosing the CompreStat system. We wish you joy and success working with it.

## 2 Essential features at a glance

- » High quality pressure chamber for isostatic pressure application to solid samples, typically pouch cells. Maximum pressure: 10 MPa.
- » Simultaneous measurement of three separate samples.
- » Individual temperature measurement for each sample.
- » Pressure can be recorded using the CompreDriveControl software.
- » Universal compatibility with all potentiostats/galvanostats.

### **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](mailto:info@rhd-instruments.de)) or phone (+49-6151-8707187).




### 3 General information

The instructions in this manual were checked carefully 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.

Note: In this manual the main mechanical unit of the CompreStat system will often be referred to as "CompreStat".

**Please note: This particular manual only describes the usage of the CompreStat hardware as well as the usage of the CompreStat Data Sampler and CompreStatCDCPlugin for CompreDriveControl. For instructions about the usage of the CompreStat filling set IO and CompreDriveControl software, please refer to their dedicated user manuals.**

#### Markings in this manual

Marking	Meaning
 <b>WARNING</b>	Indicates a hazardous situation which, if not avoided, could result in serious injury or death.
 <b>ADVICE</b>	Indicates potential physical damages and other important information associated with your device.
 <b>IMPORTANT</b>	Important pieces of information are emphasized in special boxes. Please take special note of these as they may contain safety-critical information.

## 4 Important general safety notes

- » 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 CompreStat system should only be performed by properly trained and experienced members of staff.
- » The setup has been developed for electrochemical measurements of solid samples under pressure-, temperature-, and potential-controlled conditions. It must not be used for any other purpose.
- » Do not exceed the mechanical limits of the system or individual components given in this manual.



**WARNING: Mechanical overload of the system or individual components may lead to catastrophic failure of the parts.**

- » To avoid unstable operating conditions and injury, the CompreStat 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.



**WARNING: Danger of electric shock or fire through short-circuit.**

**A short circuit could be caused by defect cables, and by humidity or moisture. A short circuit may warm up the conductors, so that the insulation will melt. This could lead to serious burns when touched, or fire.**

- » Please only use the original cables included in delivery. They are prepared for your device and guarantee the necessary safety for you and your device.
- » Whenever it is likely that electrical protection has been impaired, the system should be disconnected from any power supply and be secured against reconnection.
- » 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 the hardware manual for cleaning your device.
- » Please follow only the instructions in the hardware manual for maintaining your 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 your device from mechanical impact. In case the device fell down, please contact rhd instruments or a technician authorized by rhd instruments before using it again.
- » If your device shows any visible damage or defect: Disconnect the power supply by pulling out the power cord. 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 loosen nuts or bolts unless this manual specifically tells you otherwise.



**WARNING: All components connected to the interior of the CompreStat pressure chamber are exposed to the internal pressure.**

**Do not loosen any fitting or open any latch while the chamber is under pressure!**

- » Only use original spare parts delivered and approved 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 CompreStat, 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.



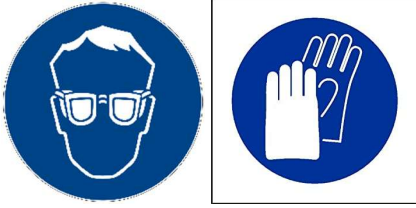
**ADVICE: Sufficient cleaning increases the lifetime of your system.**

- » After using the CompreStat 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.



**ADVICE: Be careful when bringing chemicals in contact with parts of your system.**

- » When operating your CompreStat system please be advised to only use samples that are chemically inert towards the main materials of the system (e.g. aluminium, stainless steel, gold). In general, the CompreStat system is only allowed to be operated under conditions that correspond to the specifications described in this manual and under which the main components of the system are stable.



**Always wear protective gloves and eye protection when working with the system under pressure or with chemicals.**

## 5 Components of the CompreStat

- » Please check if the delivery is complete:
  - 1 x CompreStat
  - 6x Pouch cell holder (3x same side and 3x opposite side)
  - 3x Velcro strap
  - 1x heat conducting compound
  - 1x lubricant (Molykote III)
  - 1x safety cap
  - 2x replacement O-ring
    - 2x replacement backup ring
    - 1x torque knob (mounted to the CompreStat)
  - 1x CompreStat Data Sampler
  - 3x connection cable for the temperature sensors
  - 1x connection cable for the pressure sensor
  - 1 x 24V power supply
  - 1 x USB to serial converter
  - USB flash drive with application software
- » 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](mailto: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 accessories of other manufacturers are used, rhd instruments will accept no liability.

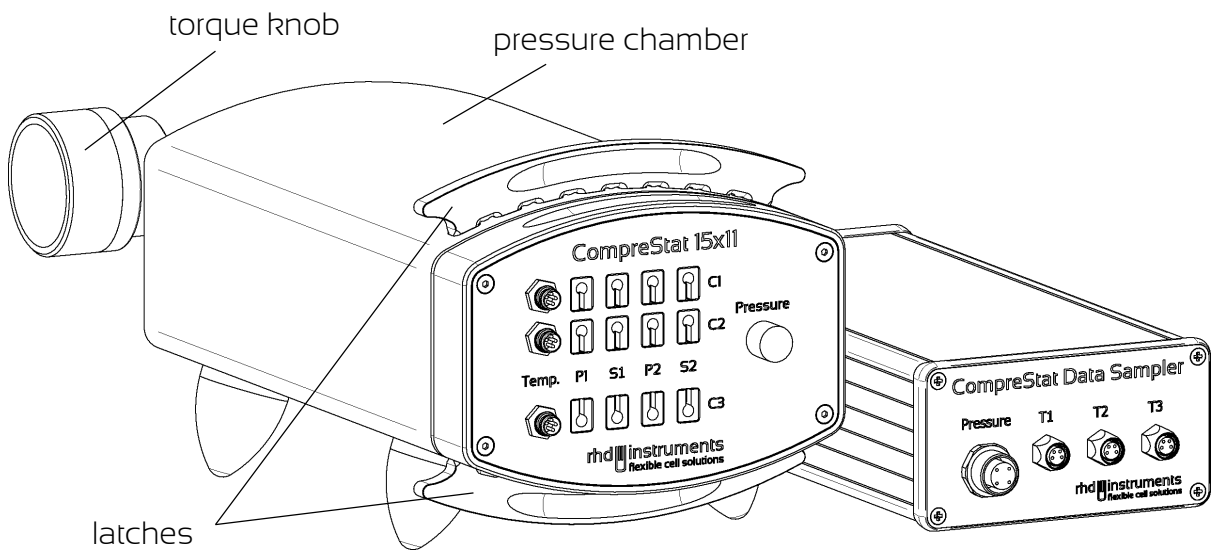


Figure 1: Components of the CompreStat

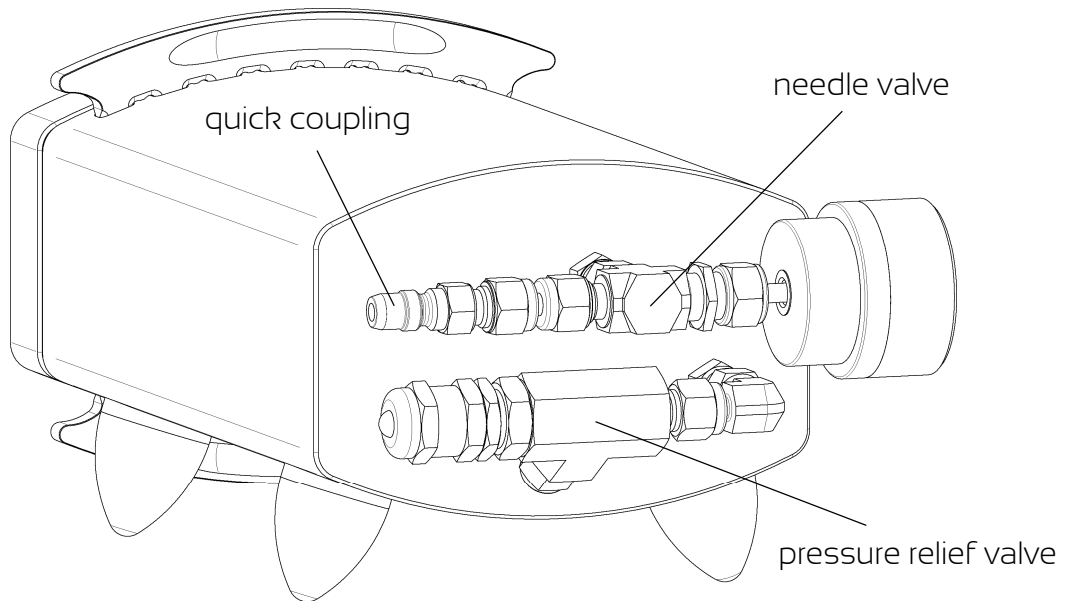
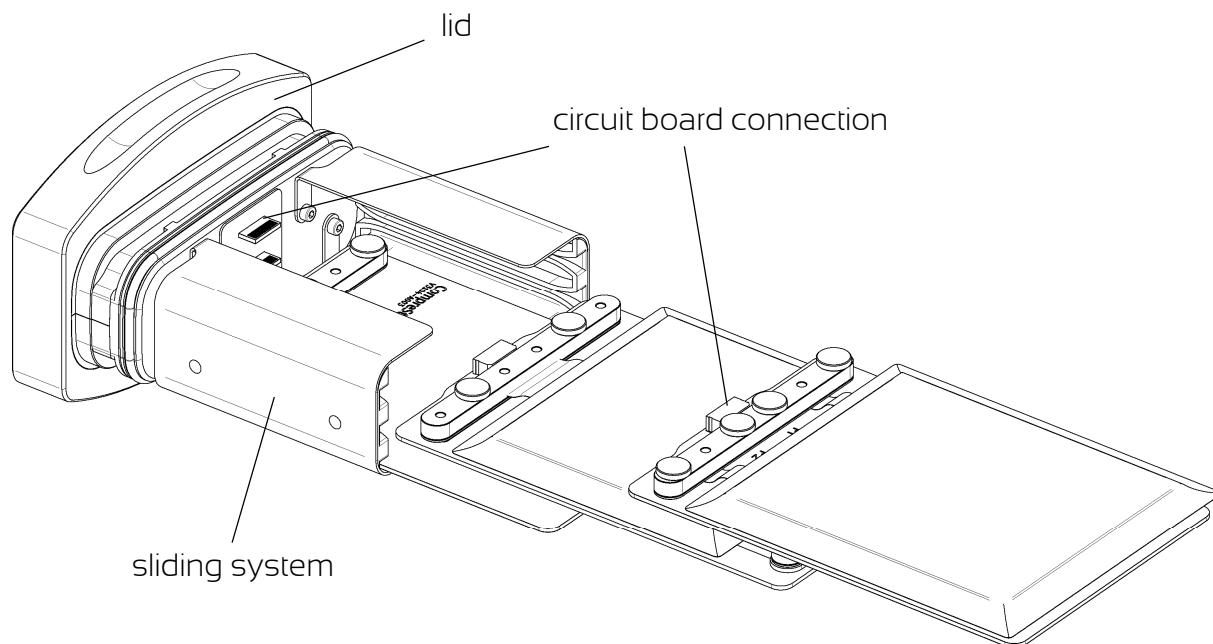
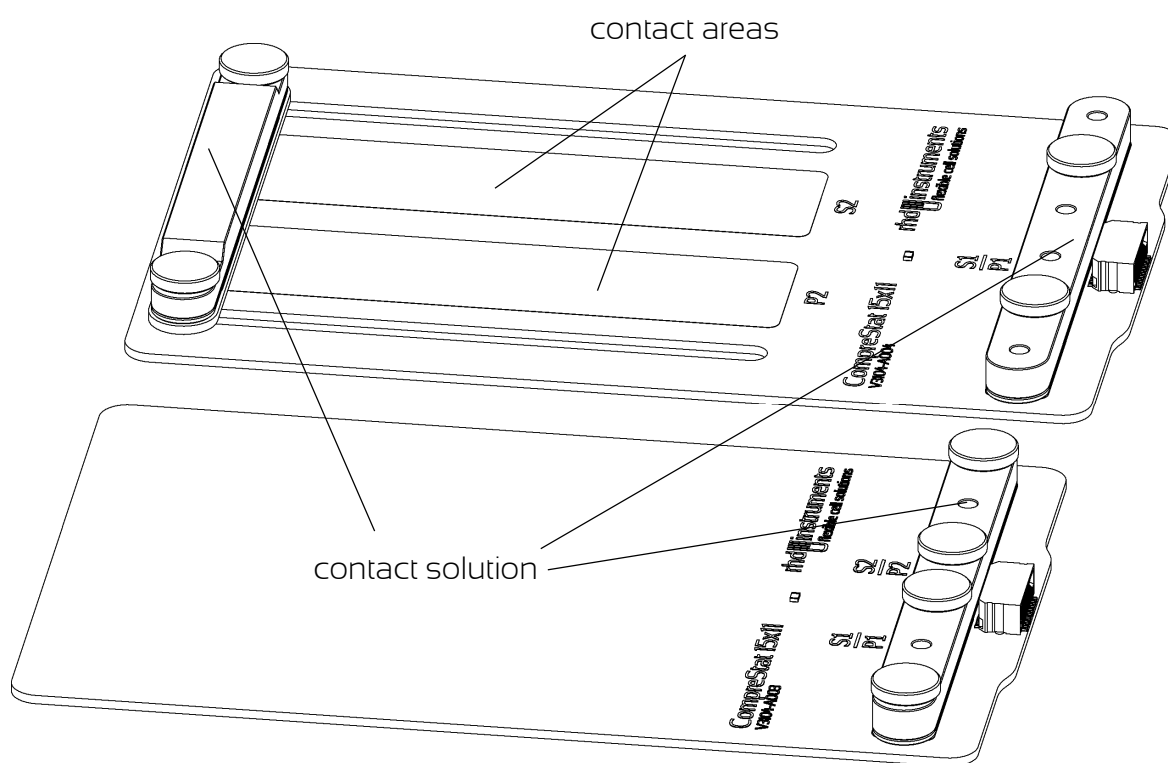


Figure 2: Components of the CompreStat back side



**Figure 3: Components of the CompreStat - Details**



**Figure 4: Components of the CompreStat - Pouch cell holders for opposite side (up) and same side (down) pouch cells.**

## 6 Operation conditions, storage and rated values

### 6.1 CompreStat

Maximum sample outer dimensions excl. tabs (for same side pouch cells)	150 x 110 x 10 mm
Maximum sample outer dimensions excl. tabs (for opposite side pouch cells)	135 x 110 x 10 mm
Temperature range during operation (CompreStat)	$T_{\text{operation}} = -23\text{ °C to }+80\text{ °C}$
Filling medium	Gas
Pressure range during operation	0 ... 10 MPa (relative to ambient pressure)
Built-in pressure sensor:	
Measuring range	0 ... 12 MPa
Pressure resolution	0,01 MPa between 0 and 10 MPa
Reference pressure	Relative to ambient pressure
Characteristic deviation according to IEC 61298-2	+/- 0.05 MPa between 0 and 10 MPa
Temperature range during operation (electronics + accessories):	$T_{\text{operation}} = +10\text{ °C to }+40\text{ °C}$
<b>Note:</b> See chapter 7.10 for usage of the CompreStat in a temperature chamber	
Maximum measurement potential	40 V ac/dc
Maximum measurement current (using supplied contact solution)	10 A
Temperature range during long-term storage:	$T_{\text{storage}} = +10\text{ °C to }+40\text{ °C}$
Relative humidity (RH) for working and storage area:	(non-condensing) 0 to 80% RH
Atmosphere during storage	Non-corrosive
Rated dimensions	CompreStat: 309 x 140 x 135 mm CompreStat Data Sampler: 140 x 106 x 60 mm
Typical weight:	CompreStat: 6,0 kg

### Materials:

**Part**

Pressure chamber, Lid, Latches  
Lid housing  
Pouch cell holder - PCB  
  
Contact solution - plastic blocks  
Contact solution - metal bars  
Contact solution - Screws  
Sliding system  
Pressure fitting  
Feet  
O-ring  
Other Screws, nuts and bolts

**Material**

Aluminium  
Polyoxymethylene (POM)  
Glass fiber epoxy laminate, gold, polyamide, gold plated bronze  
PC-ABS 3D-printed  
Aluminium  
Stainless steel  
Stainless steel, PC-ABS 3D-printed  
Stainless steel  
Rubber  
EPDM 85  
Stainless steel

**Temperature transducer**

Input signal	PT100
Output signal	0 V to +10 V
Temperature range	-50 to +100 °C
Accuracy	$\leq \pm 0,1 \% \text{ FS}$

# 7 General operation

## 7.1 Typical order of operations

A typical order of operations would be:

1. Drag the upper latch up and pull the lower latch down.
2. Carefully pull the lid out of the pressure chamber.
3. Separate the pouch cell holder from the sliding system.
4. Loosen the screws at the contact solution and take off the clamp block.
5. Place your sample pouch cell on the pouch cell holder so that each tab lays on one of the contact fields of the pouch cell holder.



**ADVICE: Be careful to not short-circuit your cell by placing the tabs on the same contact field.**

6. Place the clamp block back onto the contact fields with the insulated side first.



**ADVICE: Be careful to not short-circuit your cell by placing the clamp block down with the metal side facing downwards.**

7. Tighten the clamp block with the screws to ensure optimal contact between the tabs and the contact areas.
8. Secure your cell to the pouch cell holder with the Velcro strap.
9. Slide the prepared pouch cell holder into one of the grooves of the sliding system on the lid, socket first. Ensure that the socket clicks into place in the circuit board connection.
10. Repeat this as necessary with the other two pouch cell holders.
11. If necessary, re-grease the O-ring and backup ring, see chapter 8.2.
12. Push the prepared lid all the way into the pressure chamber.
13. Pull the lower latch up and the upper latch down to secure the lid.



**WARNING: Always close both latches, otherwise the pressure chamber won't be sealed and could potentially be damaged.**

14. Connect the pressure sensor to the CompreStat Data Sampler and connect that to a PC.
15. Start CompreDriveControl with the CompreStatCDCPlugin installed, tare the pressure sensor and open up the pressure display.
16. Connect the CompreStat to any pressure source with the quick coupling at the back and open the needle valve.
17. Set the CompreStat to the desired pressure. Be aware that some temperature-related pressure deviations may occur inside the chamber after the pressure build-up is complete. It could take some time to achieve stable pressure.
18. Close the needle valve with the given torque knob. Do not overtighten the needle valve.
19. Relieve the pressure from the supply system.
20. Disconnect the quick coupling from the CompreStat.
21. Connect your battery cycler or potentiostat as well as the temperature sensors.
22. Start your measurement.

In the following chapters, different aspects of using the CompreStat will be described in detail.

## 7.2 Setting up the pouch cell holders

The CompreStat is designed to perform measurements with a maximum of three samples simultaneously. The samples need to be placed onto a pouch cell holder to be electrically connected and to be placed inside the pressure chamber. There are two versions of pouch cell holders, see Figure 4. One is designed to connect samples with connections on one side, the other is designed to connect samples with connections on opposite sides. Once all pouch cell holders are prepared, they can be slid into each of the grooves of the sliding system on the lid, socket first. Ensure that the socket clicks into place in the circuit board connection.

The pouch cell holders feature separate power and sense lines for both electrodes. For best results, make sure that the tabs make contact with the large contact areas labeled "P" for power line. For a two-electrode configuration, use only the power connections. For improved potential measurements, connect the "Working Sense", "Counter Sense", and/or "Reference" lines to the sense connectors labeled with "S" instead. Note: The exact naming of the lines may vary depending on the potentiostat used.

### 7.2.1 Pouch cells with same side tabs

To connect a sample, loosen the screws at the contact solution and take off the clamp block.

Place your sample on the pouch cell holder so that each tab lays on one of the contact fields of the pouch cell holder.



**ADVICE: Be careful to not short-circuit your cell by placing the tabs on the same contact field.**

**The little nose between the contact fields only helps you to prevent short-circuiting your cell, but does not automatically prevent it.**

Place the clamp block back onto the contact fields with the insulated side first.



**ADVICE: Be careful to not short-circuit your cell by placing the clamp block down with the metal side facing downwards.**

Four screws are provided with this pouch cell holder. It is recommended to place two of them on each side of both tabs. Place them as close as possible to the tabs so good

contact is ensured. Tighten the screws to press the clamp block onto the tabs onto the contact fields to ensure optimal contact.

Secure your cell to the pouch cell holder with the Velcro strap so it cannot move freely inside the pressure chamber, which could damage the tabs of the sample.

## 7.2.2 Pouch cells with opposite side tabs

To connect a sample, loosen the screws at the contact solution in the front and back and take of the clamp blocks.

Place your sample on the pouch cell holder so that one tab lays on the contact field labeled with "S1/P1". Place the other tab onto the transfer pcb that was mounted above the "S2" and "P2" contact fields. This transfer pcb is placed here so that the sensing line always has its contact point closer to the cell than the power line. See Figure 5 for the correct orientation of the transfer pcb.

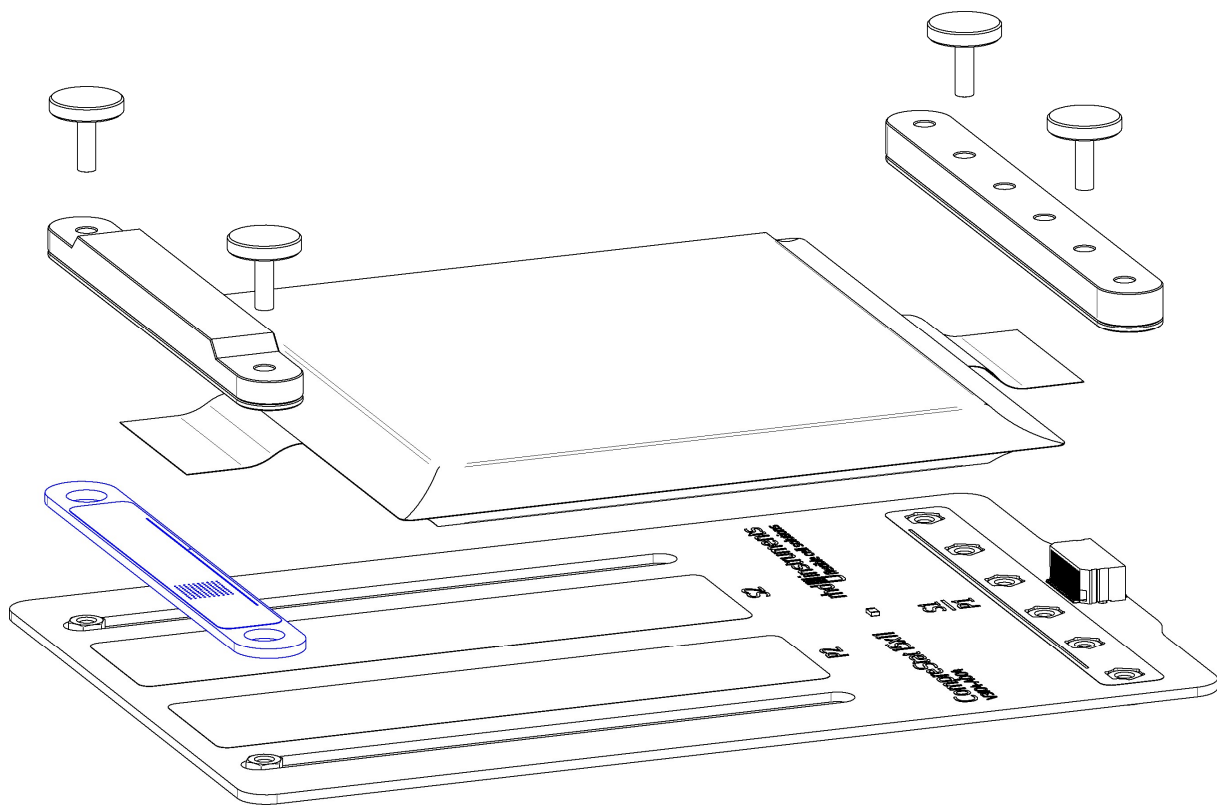


Figure 5: correct orientation of the transfer pcb



**ADVICE:** The transfer pcb has to be oriented in a way that the thinner sensing line faces the sample. In case of incorrect orientation, lines could melt. This is because the sensing line cannot carry high currents.



**ADVICE: Be careful to not short-circuit your cell by placing the tabs on the same contact field.**

Use Kapton tape to insulate the parts of the contact surfaces as necessary.

Place the clamp blocks onto the contact fields with the insulated side first.



**ADVICE: Be careful to not short-circuit your cell by placing the clamp block down with the metal side facing downwards.**

Four screws are provided with this pouch cell holder. It is recommended to place two of them on each side of both tabs. Place them as close as possible to the tabs so good contact is ensured. Tighten the screws to press the clamp block onto the tabs and onto the contact fields to ensure optimal contact.

Secure your cell to the pouch cell holder with the Velcro strap so it cannot move freely inside the pressure chamber, which could damage the tabs of the sample.

### **7.3 Temperature measurement**

The setup is designed to measure the cell temperature of each of the three samples. There is a temperature sensor placed on each pouch cell holder to fulfill that purpose. It was placed in a location so that both large and small pouch cells can contact the temperature sensor. Please be aware that this sensor only measures the surface temperature of the cell. To improve thermal conductivity, place a little bit of heat conducting compound onto the sensor before placing the pouch cell on top.

In case you want to measure the temperature at any other location of your sample, rhd instruments offers pouch cell holders without a temperature sensor pre-assembled. With that you can connect any PT100 temperature sensor to the connection points on the front of the pouch cell holder highlighted in Figure 6.

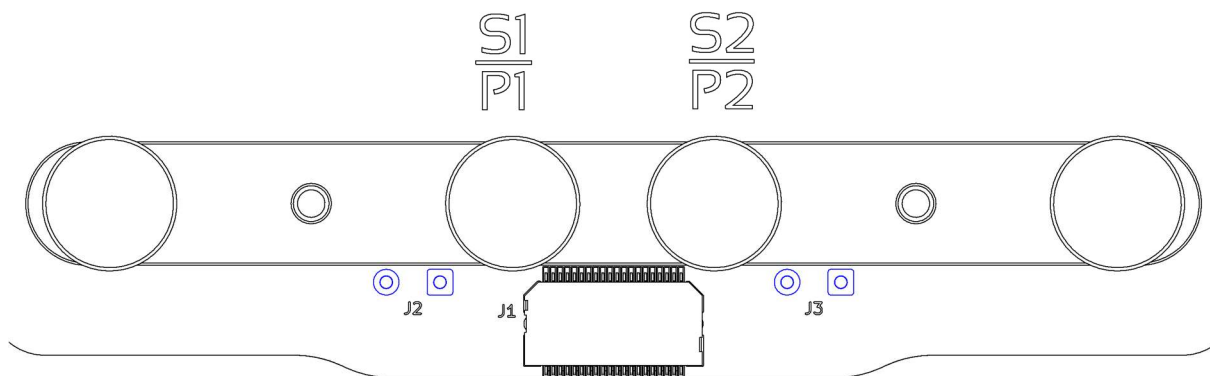


Figure 6: Connection points for a custom PT100 temperature sensor

The sensor lines are then transferred to the outside of the pressure chamber to the front of the lid. Here each layer has its own row of connections one of which is the temperature sensor. The pin assignment of the M8 4-pin connector is such that pins 1 and 2 are connected to one side of the temperature sensor, while pins 3 and 4 are connected to the opposite side. The arrangement of the pins in the connector can be seen in Figure 7.

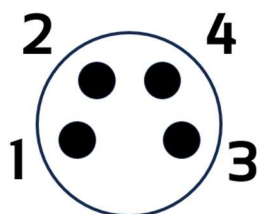


Figure 7: Pin assignment of the M8 4-pin male connector mounted to the front panel

## 7.4 Opening and closing the CompreStat



**WARNING: Always release all pressure from the CompreStat before attempting to open it.**

The CompreStat has a lid that is sealed with a lateral O-ring. The lid can be pulled out to open the pressure chamber. To do that you need to open the latches first that lock the lid in place. Therefore, pull the upper latch up and push the lower latch down. The latches have two snap points one of which is open and the other is closed. Once both latches are open you can gently pull out the lid.

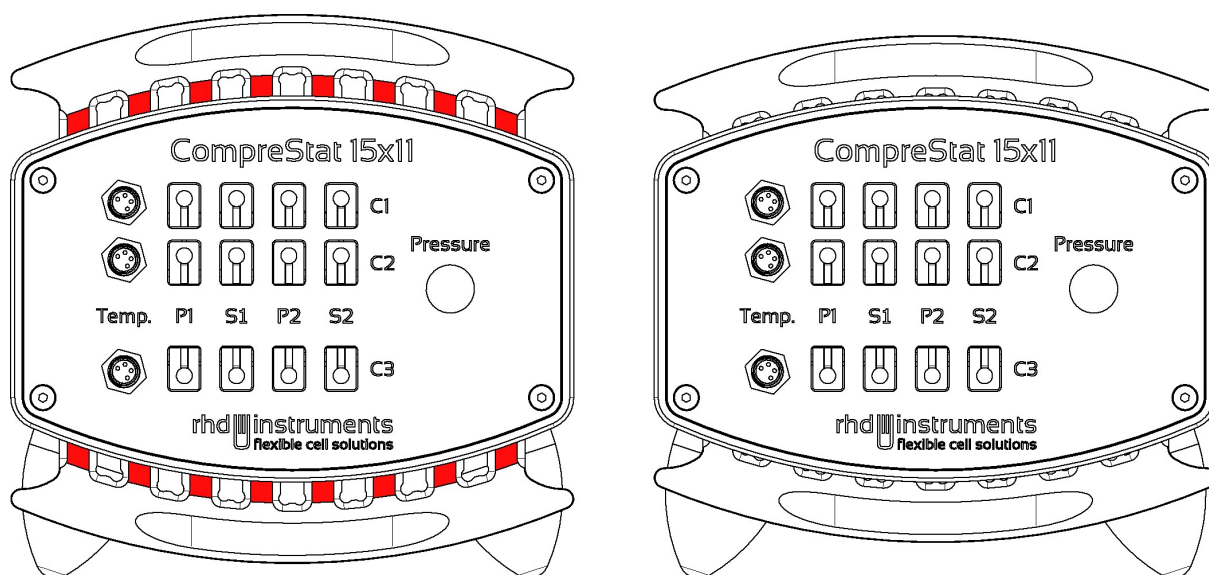
After long term measurements, the O-ring and grease can get stuck. If that happens, the lid needs to be pushed inwards a little bit first. To easily apply enough force to do that, place the palm of your hands onto the lid and grab the latches with your fingers. Then push the lid into the chamber. After that you should be able to pull the lid out.



**WARNING: Before applying any pressure to the system make perfectly sure that both latches are closed.**

To close the lid, perform the above steps in reversed order. The latches are closed once the red surfaces of both latches are no longer visible as shown in Figure 8.

If the lid is difficult to insert, it must be re-lubricated, see chapter 8.2 for details.



**Figure 8: Latches in open (left) and closed (right) position**

## 7.5 Setting up the CompreStat Data Sampler

Place the CompreStat Data Sampler next to the CompreStat.

Connect the necessary sensor cables as well as the connection cable to a PC and the power supply. Use the USB-Serial adapter if the computer does not have a native serial port.

Switch the device on using the switch at the back of the device.

The green status LED at the back turns on to indicate operation.

For more information on the CompreStat Data Sampler, please refer to the Multi Data Sampler User Manual. The only difference is that the CompreStat Data Sampler already

internally converts the PT100 resistance measurement into a voltage signal ranging from 0 to 10 V.

## 7.6 Setting up the CompreStatCDCPlugin

### 7.6.1 Plugin installation

For information on installing the CompreStatCDCPlugin, see the CompreDriveControl User Manual under “Installing plugins”. After installation there should appear the Buttons shown in Figure 9.

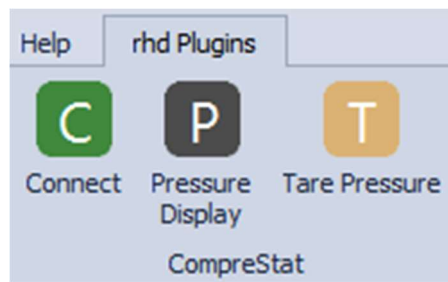


Figure 9: Buttons of the CompreStatCDCPlugin

### 7.6.2 Connect the CompreStat

To connect the CompreStat click on “Connect”. The button should turn blue and now be manual “Disconnect”.

This plugin adds five new data channels into CompreDriveControl. They are listed in Figure 10. There are two pressure channels and three temperature channels.

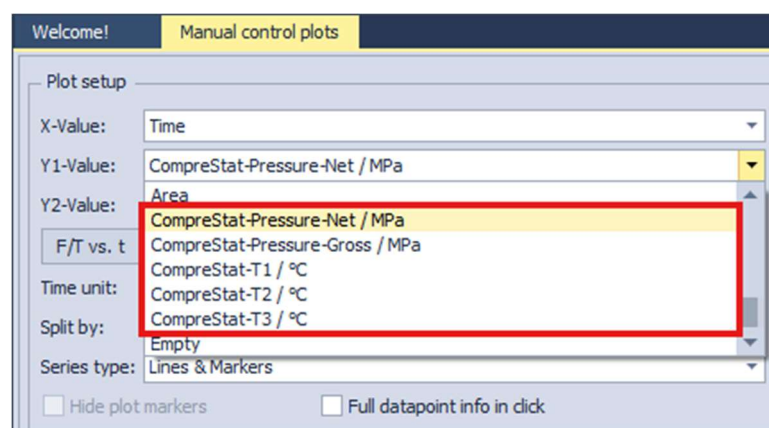


Figure 10: Added data channels by the CompreStatCDCPlugin

### 7.6.3 Tare Pressure

The two pressure channels are net-pressure and gross-pressure. Gross-pressure is the plain sensor output. You can click “Tare Pressure” to zero the sensor value. This value is then contained in the net-pressure channel.

## 7.6.4 Pressure Display

The pressure display shown in Figure 11 makes it easier to read the current pressure even from a distance. It also allows you to switch between different units.

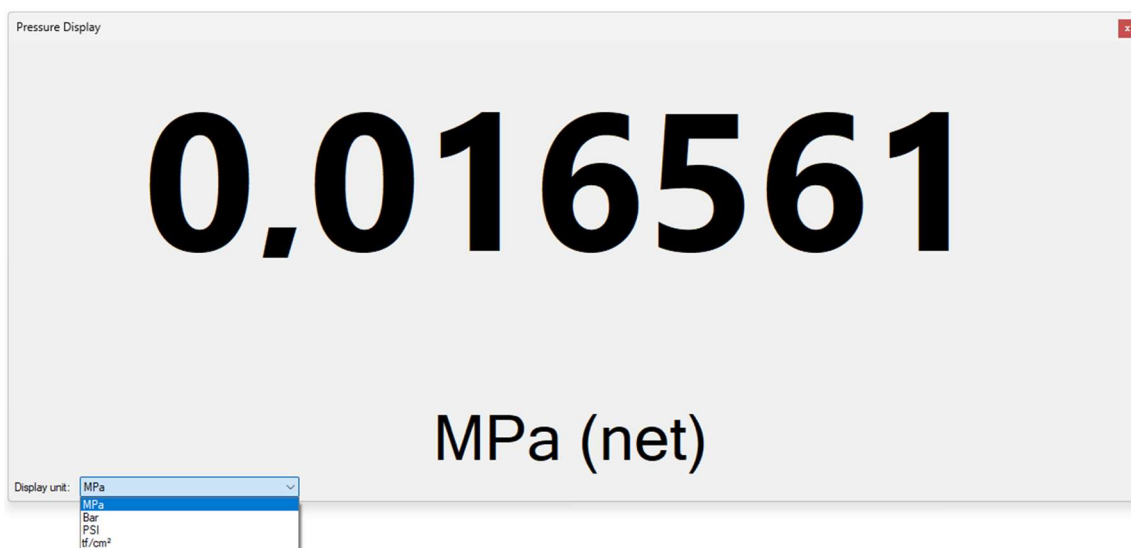


Figure 11: Pressure Display

## 7.7 Battery cycler connection

The CompreStat is designed to facilitate connection of a battery cycler or potentiostat to the sample. The connection of the tabs of your pouch cells is described in chapter 7.2. These connections are fed through the lid to the front panel and terminate in 4 mm sockets. They are labeled "P" for power line, "S" for sensing line and "C" for the three separate channels for each pouch cell holder.

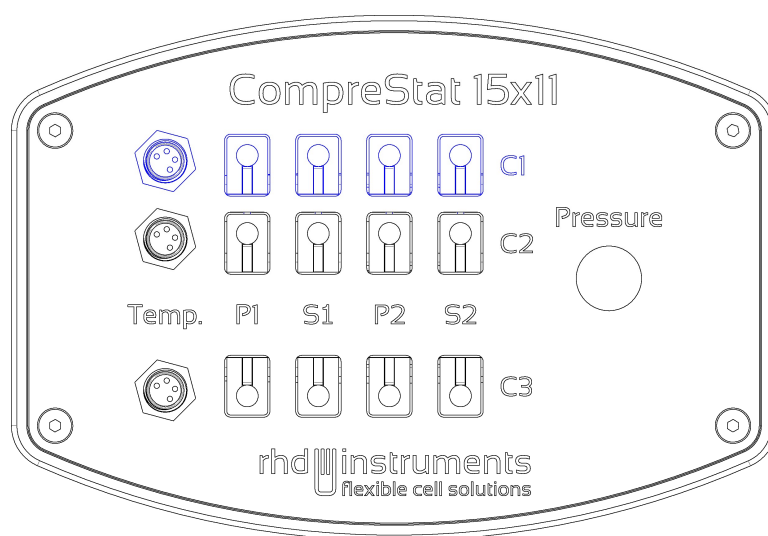


Figure 12: Connection points at the front panel with one channel highlighted

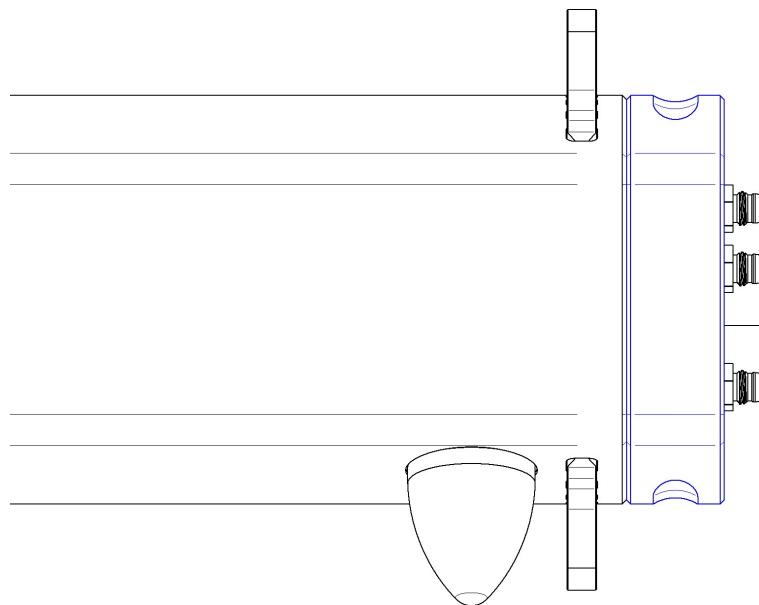
To establish the connection to your battery cycler or potentiostat, simply plug in the cables in the corresponding sockets on the front panel.

## 7.8 Applying pressure / safety measurements



**WARNING:** The CompreStat is designed for operation at pressures up to 10 MPa. Pressurized systems can be dangerous and, if used improperly, can cause serious injury, death, or damage. Installation, operation, and maintenance must only be performed by qualified personnel in compliance with all applicable safety instructions.

Before pressurizing the system, make perfectly sure that the lid is pushed all the way into the opening of the pressure chamber as you can see in Figure 13. Ensure that both latches are closed. That can be verified by checking whether the red areas of the lower and upper latch have disappeared into the housing as you can see in Figure 8.



**Figure 13:** The lid is pushed all the way into the pressure chamber once there is no gap left.

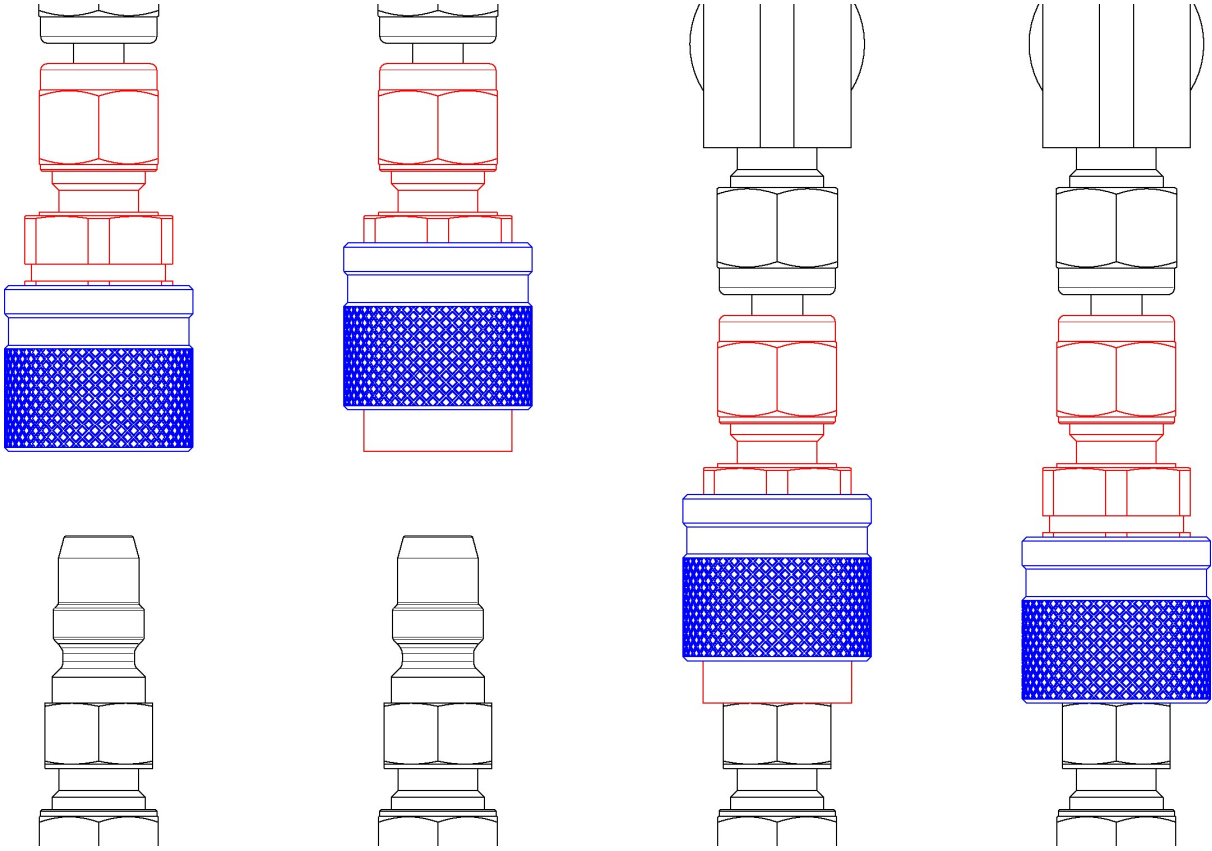


**IMPORTANT:** If a latch is not closed, the lid is designed to leak rather than allow pressure to build up. If such a leak occurred, the device must not be used until rhd instruments has been consulted.

You can then connect the CompreStat to a pressure source. The CompreStat is equipped with pressure fittings at the back. This includes the quick coupling, needle valve and the pressure relief valve. The quick coupling of the CompreStat is from Hy-

Lok with the part number QFINH-6M. You can also use any other pressure source by connecting the counterpart to the connection. This manual focuses on the usage of the CompreStat filling set 10 which uses a 300 bar pressure cylinder as pressure source that already comes with the right connections.

The quick coupling uses a push-pull mechanism to connect the plug and socket, see Figure 14. The ring with the knurled pattern must first be pulled back. Then the socket can be pushed over the plug. To open the connection again, simply pull the ring with the knurled pattern.



**Figure 14: Order of operations to connect the quick coupling (from left to right) and to release it (from right to left)**



**WARNING: The CompreStat is designed exclusively for filling with non-flammable gaseous fluids! Never pour liquids into the CompreStat! Not even to improve thermal conductivity.**

Once the pressure source is connected, make sure the needle valve is opened. You can open it by turning the torque knob counterclockwise a few turns.

There are two ways to see what pressure is in the chamber during filling. One is to rely on the manometer at the pressure reducer on the filling set 10, the other is to read out the built-in pressure sensor of the CompreStat. To do so, you must connect the pressure sensor to the CompreStat Data Sampler and connect it to a PC as described in chapter 7.5. Open up CompreDriveControl software with the CompreStatCDCPlugin installed, see chapter 7.6. Under Plugins click "Connect". Once the connection is established, open the "Pressure Display". This opens a window (see Figure 11) where you can see the current pressure in the CompreStat, even if you are a few steps away at the pressure reducer.

Now you can apply pressure. Be aware that some temperature-related pressure deviations may occur inside the chamber after the pressure build-up is complete. It could take some time to achieve stable pressure. Once the pressure is stable at the desired value you can close the needle valve. To close it turn the torque knob clockwise carefully until it slips once. Repeat this until it slips again. The valve is then closed. If the torque knob is missing, the valve can also be turned using a standard torque screwdriver. This must be set to 0,8 Nm.



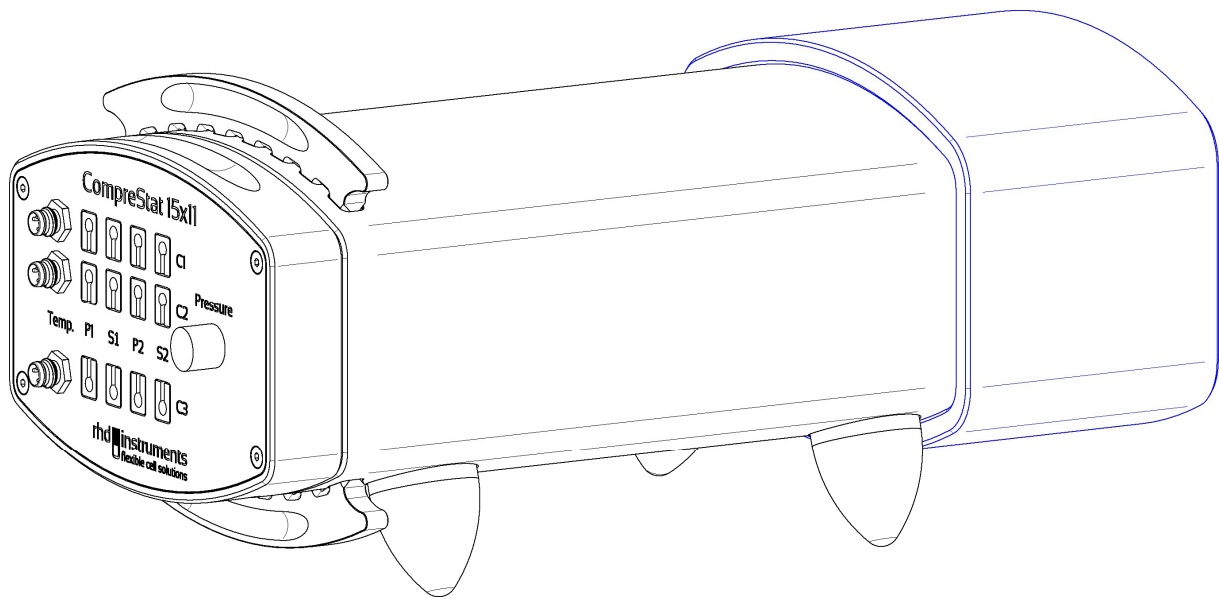
**ADVICE: To close the valve, use only the torque knob to avoid overtightening, which could potentially destroy the valve.**

Release the pressure from the pressure supply then open the quick coupling.



**WARNING: Do never open the quick coupling while the pressure supply is under pressure!**

If you want to transport the CompreStat while it is under pressure, always put on the safety cap how it is shown in Figure 15 to prevent damage to the fittings in the event of a drop. The safety cap is designed to absorb the impact and protect the fittings from it.



**Figure 15: Safety cap mounted**

Depending on the type of measurement performed in the CompreStat, there is a risk of overpressure in the pressure chamber. The CompreStat is designed to withstand some amount of overpressure. Once the pressure exceeds 11 MPa, the relief valve opens and releases the excess gas. It closes again once the pressure is under a certain value. Due to valve hysteresis and flow effects, the valve typically does not reseat at the opening pressure but closes properly only at a lower pressure.

In the highly unlikely event of a few ten MPa of excess pressure, the O-ring in the lid is the component that will leak first by design. Excess gas will then be forced through the gap between the lid and the chamber.

To enable the simultaneous measurement of three pouch cells with a maximum capacity of 10 Ah, the CompreStat was designed to withstand simultaneous thermal runaway at a pressure of 10 MPa and 80 °C.



**ADVICE: In case the relief valve opens or the O-ring fails, all fluids being in the pressure chamber at that moment will be discharged. Therefore, consider which substances may potentially escape from the samples being measured and take appropriate safety precautions.**

The built-in relief valve is manufactured by Hy-Lok, part number RV2 H-4T-C. The drain side provides a connection to a piping system.



**WARNING: The flow rates for the relief valve apply when venting into an open space. If the valve is connected to a pipe or other system, the flow rates may change. In this case, the specifications regarding resistance to thermal runaway no longer apply.**

## 7.9 Release pressure

To release the pressure from the CompreStat gently open the needle valve counter-clockwise. The airflow can be adjusted very precisely. Releasing pressure can be very loud. Therefore, either wear appropriate hearing protection or open the valve only enough to maintain a comfortable volume. Wait until the pressure has been completely equalized before opening the CompreStat.

## 7.10 Usage of the CompreStat in a temperature chamber

The complete CompreStat system including the delivered connection cables to the CompreStat Data Sampler is suitable for use in a temperature chamber (temperature limits see chapter 6).

The cables and rubber feet limit the temperature range to 80 °C regarding the upper limit. If you use more suitable cables and remove the feet, the system can be heated up to 85 °C.

However, the CompreStat Data Sampler and other included cables are designed for use at room temperature only! They need to be placed outside the chamber.

If the CompreStat is too long to fit into your temperature chamber there are two things you can try to get it in. First you can use angled cables to connect the CompreStat. Second you can dismantle the torque knob screwed to the needle valve by loosening the setscrew. For reassembly simply push it back onto the rod of the needle valve and tighten the setscrew again. If the torque knob is missing, the valve can also be turned using a standard torque screwdriver. This must be set to 0,8 Nm.

## 7.11 Transporting or shipping the CompreStat

To avoid loose parts moving uncontrolled, remove any sample from the CompreStat, insert the lid into the pressure chamber and close the latches before transporting or shipping it.

If you want to transport the CompreStat while it is under pressure, always put on the safety cap like it is shown in Figure 15 to prevent damage to the fittings in the event of a drop. The safety cap is designed to absorb the impact and protect the fittings from it.

# 8 Maintenance

## 8.1 Cleaning



**ADVICE: The sealing surfaces and seal components are lubricated. These surfaces and parts should not be contaminated with dust or particles. If they are cleaned, they have to be re-lubricated.**

All parts can be cleaned with isopropanol or water.

Thoroughly clean the gold contacts before each use. Contaminants, powder or dust could be pressed into the plate during use, causing damage to the gold surface.

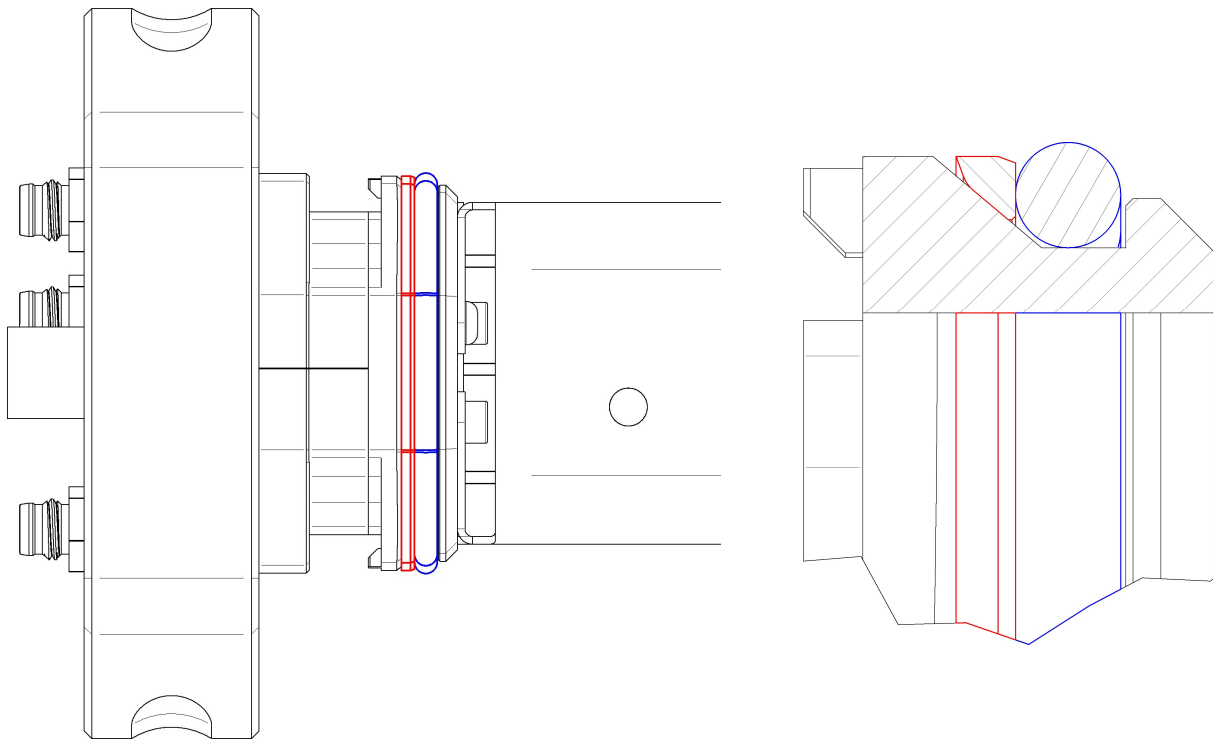
Occasionally clean the remaining surfaces of the CompreStat of dust using a plain cloth and deionized water or isopropanol. Do not use other solvents.

## 8.2 Lubrication

The CompreStat pressure chamber is sealed by a lubricated O-ring. The reliability of the seal depends heavily on the lubrication of the O-ring. We therefore recommend relubricating the O-ring after approx. 10 open/close cycles, as soon as the friction increases during opening and closing, or always after a long-term measurement.

To re-lubricate the O-ring carry out these steps (refer to Figure 16 for guidance):

- Wear protective gloves.
- Remove the O-ring from the lid by dragging it over the sliding system mounted to the lid.
- Put a little drop of Molykote III (a silicone-based lubricant) on a cloth. Enclose the O-ring with it and spread the grease all over the O-ring. The goal is to achieve an evenly distributed thin layer of lubricant over the entire O-ring.
- Place the O-ring back into the groove in the lid by dragging it over the sliding system again. Ensure that the order of the O-ring and backup ring is as shown in Figure 16. The O-ring must be closer to the pressure chamber than the backup ring.
- Use the cloth with the rest of the lubricant to re-lubricate the backup ring as well by simply rubbing the cloth over it.



**Figure 16: Correctly mounted backup ring (red, left) and O-ring (blue, right)**

As soon as the latches start to become difficult to move, they need to be lubricated as well. To do that carry out these steps for both latches:

- Pull the latch out of the housing.
- Put a little drop of Molykote III (a silicone-based lubricant) on a cloth
- Apply a very small amount of lubricant to all bars on all four sides.
- Move the latch in and out at least 10 times.
- Push the latch into the housing.
- Wipe off any excess lubricant from the surfaces of the latches and the housing in this position with some isopropanol.

### **8.3 Seal component replacement**

Replace the sealing components, consisting of the O-ring and backup ring, completely from time to time. Perform the steps for lubrication for both the O-ring and backup ring described in chapter 8.2 before mounting the new once.

Ordering part number 840409.

## 9 Troubleshooting

Generally, if something seems to be wrong with your CompreStat and you are unsure how to fix it or a problem persists despite your attempts of fixing the issue, please contact rhd instruments.

### 9.1 CompreStat is not closing

First make sure there are no loose parts left in the pressure chamber, then try to re-lubricate the O-ring as described in chapter 8.2. If that doesn't help, replace the seal components as described in chapter 8.3.

### 9.2 CompreStat is not opening

After long term measurements, the O-ring and grease can get stuck. If that happens, the lid needs to be pushed inwards a little bit first. To easily apply enough force to do that, place the palm of your hands onto the lid and grab the latches with your fingers. Then push the lid into the chamber. After that you should be able to pull the lid out.

After an O-ring extrusion and leakage, it could be that the backup ring is stuck between the lid and the housing. In that case you need to contact rhd instruments for help.

### 9.3 CompreStat is leaking

If you see any pressure loss over time, the CompreStat pressure chamber is not sufficiently sealed. Every CompreStat undergoes our internal quality assurance process, during which the tightness of each chamber is tested. So, there are only two points where the chamber can leak. First is the needle valve, second is the O-ring. Try to re-tighten the needle valve and re-lubricate the O-ring or replace the seal components.

If the pressure loss still occurs, please contact rhd instruments for help.

### 9.4 Damaged backup ring or O-ring

Immediately replace the seal components as described in chapter 8.3.

# 10 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 (such as, for example, insulation sleeves, hard metal parts, electrodes in general, and all sealing materials). These components are regarded as consumables.

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.

# EU-Konformitätserklärung EU Declaration of conformity



Wir, die rhd instruments GmbH & Co. KG,  
We, rhd instruments GmbH & Co. KG,

**rhd instruments GmbH & Co. KG**  
**Otto-Hesse-Str. 19 / T3**  
**64293 Darmstadt**  
**Germany**

erklären, dass der CompreStat Data Sampler in Konzeption und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den grundlegenden Anforderungen der zutreffenden, aufgeführten EU-Richtlinien entspricht. Bei einer mit uns nicht abgestimmten Änderung an dem Gerät verliert diese Erklärung ihre Gültigkeit.

hereby declare, that the CompreStat Data Sampler is in compliance with the basic requirements of all applicable EC-directives stated below with regard to design, type of model sold and manufactured by us. This certificate will be invalid if the product is modified without the prior written consent and agreement of the manufacturer.

Niederspannungsrichtlinie 2014/35/EU / Low-Voltage Directive 2014/35/EU

EMV Richtlinie 2014/30/EU / EMC Directive 2014/30/EU

RoHS-II Richtlinie 2011/65/EU / RoHS-II Directive 2011/65/EU

Angewandte (harmonisierte) Normen / (Harmonized) Standards applied:

DIN EN 61010-1: Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte, Teil 1: Allgemeine Anforderungen (IEC 61010-1:2010 + Cor.:2011)

Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

DIN EN 61326-1:2013: Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 1: Allgemeine Anforderungen (IEC 61326-1:2012)

Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

Darmstadt, 12. Dezember 2024

Dr. Benedikt Huber      Dr. Marcel Druschler  
(Geschäftsführer rhd instruments Verwaltungs GmbH)

# 11 Contact and Technical Support

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

info@rhd-instruments.de

Phone: +49 6151 8707187

Fax: +49 6151 8707189

Web: <https://www.rhd-instruments.com>

rhd instruments GmbH & Co. KG

Otto-Hesse-Straße 19 / T3

64293 Darmstadt

Germany

Sitz der Gesellschaft: Darmstadt

Amtsgericht Darmstadt HRA 85824

WEEE-Reg.-Nr. DE 54715752

Haftende Gesellschafterin: rhd instruments Verwaltungs GmbH

(Sitz: Darmstadt, Amtsgericht Darmstadt HRB 96374)

Geschäftsführer: Dr. Benedikt Huber und Dr. Marcel Drüscher