EL-CELL®
electrochemical test equipment

User Manual

Release 1.51

ECD-4-nano

Electrochemical test cell

Disclaimer

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The information provided in this documentation includes general descriptions and/or technical characteristics regarding the equipment performance described herein. This documentation cannot properly evaluate the suitability or reliability of the equipment for any specific application by any user. It should not be relied upon as a substitute for such evaluation. It is the responsibility of each such user or installer to conduct an appropriate and complete risk assessment, evaluation and testing of the equipment for their specific application. EL-Cell GmbH cannot be held responsible or liable for misusing the information.

All relevant state, regional, and local safety regulations must always be complied with when installing and using this device. Only the manufacturer is authorized to perform repairs on components for safety reasons and to ensure compliance with the documented system data.

Disregarding this information may result in injury or damage to the equipment.

Manufacturer and Customer Service

EL-Cell GmbH

Tempowerkring 8

21079 Hamburg – Germany

Telephone: +49 40 79012-734

Telefax: +49 40 79012-736

Email: info@el-cell.com

Website: el-cell.com

Technical Support

Telephone: +49 40 79012-734

Email: support@el-cell.com

Website: el-cell.com/support/technical-support/

Please always quote the serial number on the nameplate when contacting customer service.

Shipping Address for Repairs

EL-Cell GmbH

Tempowerkring 8

21079 Hamburg - Germany

Please contact our customer service department before making a return. We will not open or process shipments without a completed decontamination report or RMA.

Content

1 Preamble

1.1 Purpose and Target Audience

This manual covers the device's structure, function, operation, and maintenance. It is intended for end users, who can be any person who interacts directly with the device. The term "end user" usually includes laboratory personnel trained to operate this instrument and familiar with all required laboratory precautions.

Only an authorized, adequately qualified, and experienced person 18 years of age or older may use the device, which:

- has read and understood these installation and operating instructions
- is familiar with the installation and operation of this or a similar device
- is aware of all possible dangers and acts accordingly

1.2 Usage Instructions

Before using this product, ensure you have read and understood all safety information and the complete instructions. Failure to follow these instructions may result in minor or severe injury.

Follow all instructions. This will prevent accidents that could result in property damage or injury. Keep all safety information and instructions for future reference and pass them on to subsequent users of the product.

The manufacturer is not liable for property damage or injuries resulting from incorrect handling or failure to comply with the safety instructions. In such cases, the warranty becomes void.

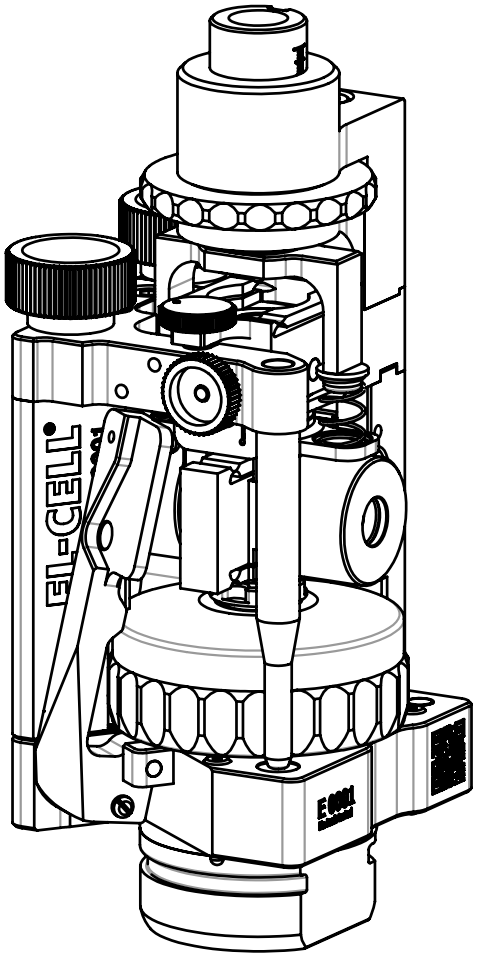
1.3 Obtaining Documents and Information

A current version of the documentation is available on the following website:

https://el-cell.com/support/manuals/

Alternatively, you can scan this QR code to access the website:

2 Product Description



The ECD-4-nano is an electrochemical battery test cell for detecting thickness changes of the individual electrode or the entire cell stack during the electrochemical cycle.

The connection to the required battery tester is established cablelessly via the PAT Socket. This allows the ECD-4-nano to be operated directly in a battery tester, such as the PAT-Tester-x-8 or using a PAT docking station connected to a third-party battery tester.

The ECD-4-nano features several built-in sensors that can measure thickness change, gas pressure, temperature, and electrical parameters.

2.1 Changelog

ECD-4-nano (ECC1-06-0001-E, Rev.00), November 2025

New Features:

- Adjustable Force 1-15 N

Improvements:

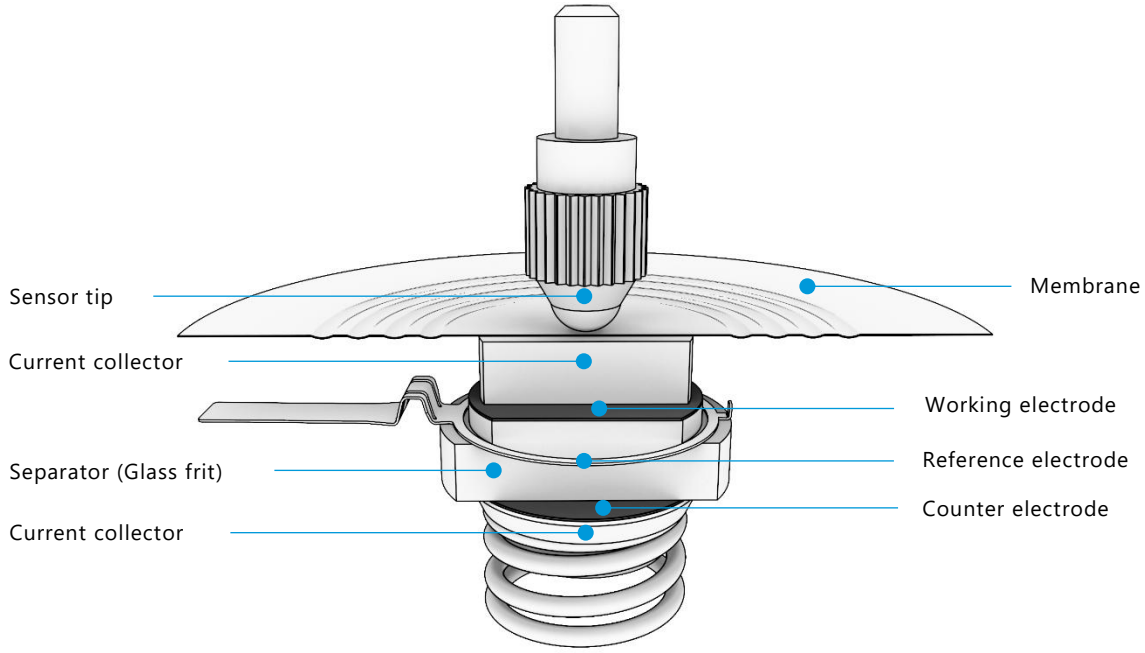
- Adjustment of the sensor head using an LED cable (when using a PAT-Tester-x-8)
- Rotation Lock for Allen wrench
- Frit Flange (improved protection against electrolyte spillage, improved height adjustment, reinforcement against deformation)
- Adjustment of the diameter of the spacer disc

Known Issues:

- Occasional drift in the dilation curves. The drift can be corrected using known data analysis software. Recommendations for measurement scripts are given in chapter 6.

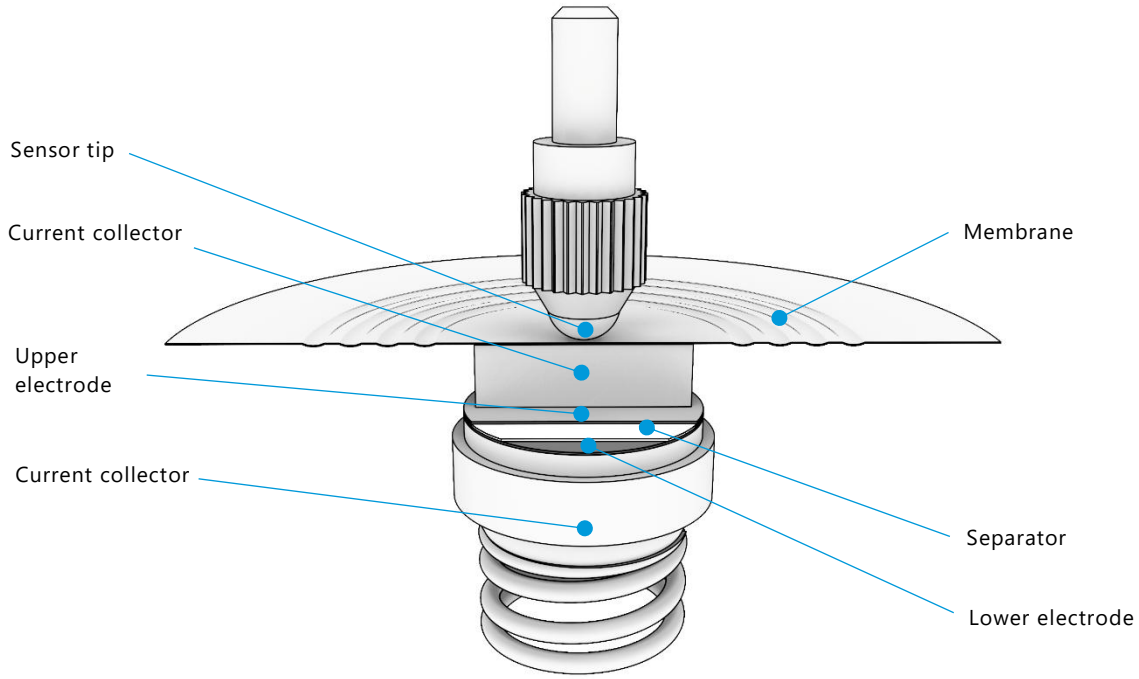
3 Work Principle

3.1 Half Cell Mode



A stiff glass frit, soaked in electrolyte, separates the working electrode (WE) from the counter electrode (CE). The upper WE is sealed using a flexible metal membrane, through which any charge-induced thickness change is transmitted toward the sensor/load unit attached on top. The glass frit's fixation ensures that only the thickness change of the working electrode is detected without interference from the CE.

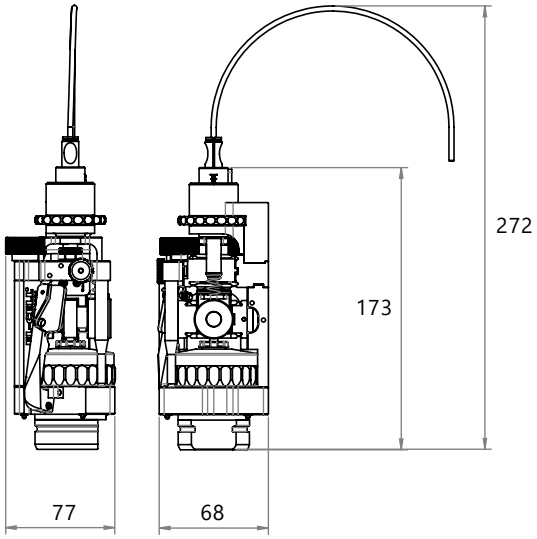
3.2 Full Cell Mode



Both electrodes are separated by a thin (a few 10 microns) separator. The cell stack is sealed at the top by a flexible metal membrane through which any charge-induced change in thickness is transmitted toward the sensor/load unit mounted above. The lower electrode rests on a stainless steel current collector. In this setup, the thickness change of the entire cell stack is recorded.

4 Technical Data

Specifications	
Length	77 mm
Width	68 mm
Height (with sensor cable)	272 mm
Height (without sensor cable)	173 mm
Weight	2 kg
Upper electrode diameter	max. 10 mm
Lower electrode diameter	max. 10 mm
Electrode thickness	Half cell mode: max. 1 mm Full cell mode: max. 1 mm (combined value for electrodes and separator)
Glass T-frit	Diameter 12.5 mm / 10 mm Thickness 3.5 mm
Gas pressure sensor	0 to 3 bar abs.
Chemical compatibility	Aprotic organic electrolytes
Cell electrolyte volume	approx. 240 µl with T-frit (half cell mode)
	approx. 40 µl in full cell mode
Operational temperature range (cell and sensor)	-20 to 80 °C
Operational temperature range (sensor box)	0 to 40 °C
Load on test specimen	approx. 1 to 15 Newton
Displacement sensor type	Capacitive
Displacement range	250 µm
Displacement resolution	≤ 5 nm



4.1 Dilation Sensor System

The dilation sensor system consists of

- ECD-4-nano sensor unit
- ECD-4-nano sensor box
- Cable, sensor to ECD-4-nano sensor box

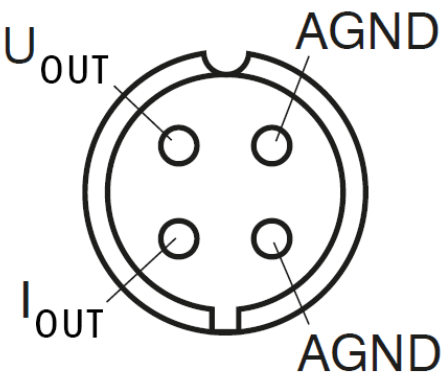
These components have been factory-calibrated and matched. If you have more than one ECD-4-nano device, ensure these components are not interchanged.

4.2 Electrical Connections

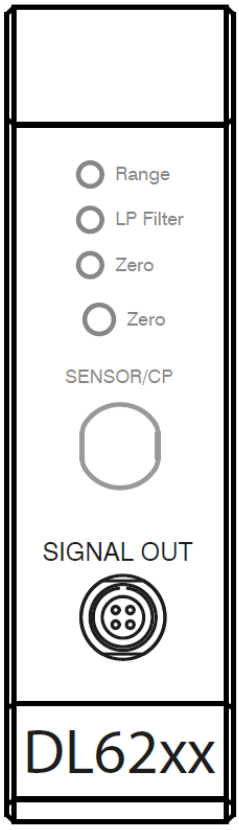
4.2.1 Sensor Box Signal Out: Pin Assignment Analog Output

Pin	Color Sensor Cable	Signal	Description
1	brown	U-OUT	U OUT, (Load min. 10 kOhm), 0V -> +125 µm, 10V -> -125 µm
2	yellow	I-OUT	I OUT, (Load max. 500 Ohm), 4 mA -> 125 µm, 20 mA -> -125 µm
3	gray	AGND	Analog ground
4	white	AGND	Analog ground

Analog grounds are connected internally.

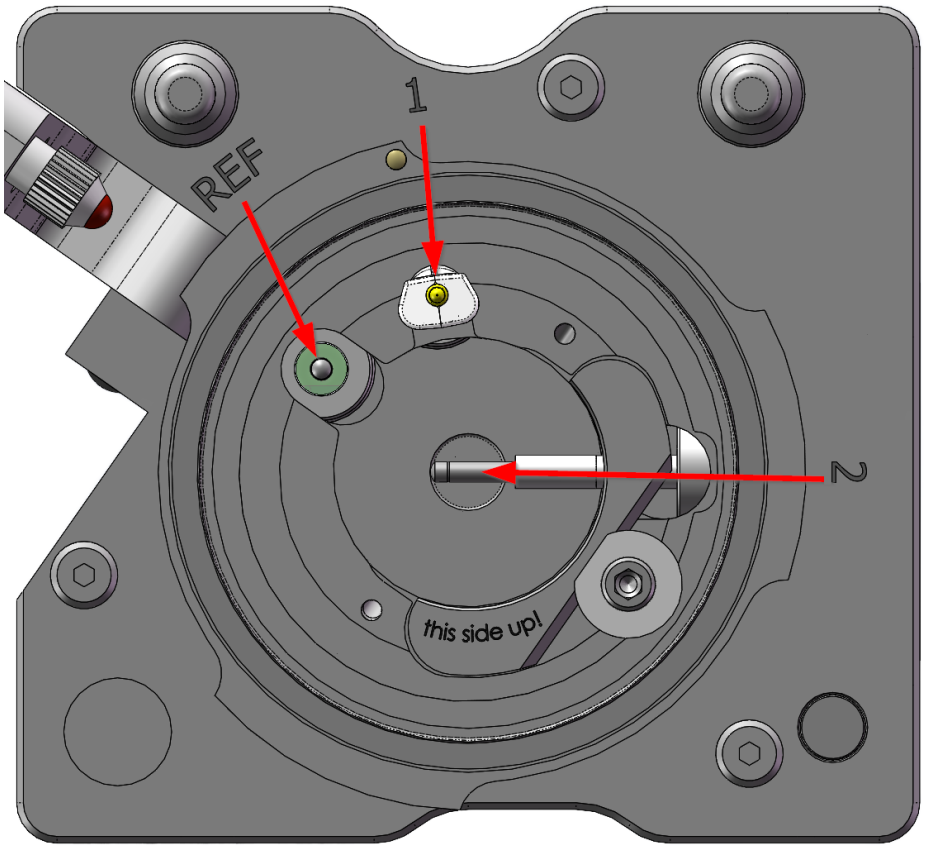


View on solder pin side,
4-pole male cable connector

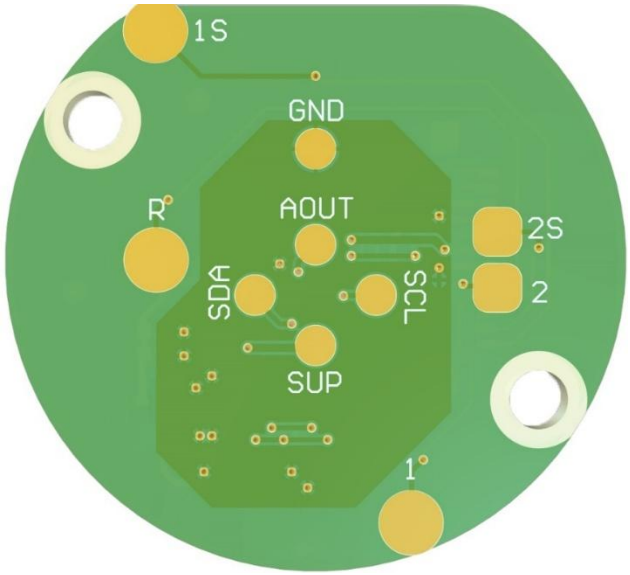


Signal output on controller,
4-pole male cable connector

4.2.2 ECD-4-nano Cell Base Pin Assignment



4.2.3 PAT-Button Signal Out:



I²C Signals:
SCL = Serial clock line
SDA = Serial data line

5 Safety Precautions

Use proper safety precautions when using hazardous electrode materials and electrolytes. Wear protective glasses and gloves to prevent electrolyte leakage during filling and disassembly. Upon cell disassembly, dispose of all materials properly. Metallic lithium and some insertion compounds may decompose vigorously when in contact with water or other solvents, posing a fire hazard.

6 Choosing the Right Measurement Conditions

We recommend operating the ECD-4-nano under the following conditions:

- Setup: Use the ECD-4-nano in a PAT-Stand-1 placed inside a climate chamber (minimum installation height: 330 mm) and connect it to a PAT-Tester-x-8 potentiostat (see Chapter 7.1).
- Sensor head: The sensor head should remain permanently connected to the cable and stay inside the climate chamber;
- Applied force: 15 N
- Electrode diameter (half cell mode):
    - Lower Electrode (Li): 9 mm
    - Upper Electrode: 8 mm
- Electrode and separator diameter (full cell mode):
    - Upper and lower electrode: 9 mm
    - Separator: 10 mm
- Electrolyte volume:
    - Full cell setup: 40 µl
    - Half-cell setup (with T-Frit): 240 µl
- Experiment Setup: Include a 12-hour OCV resting phase at the beginning and at the end of the experiment while recording the dilation signal. This enables detection and subsequent correction of any drift that might occur.

Operating the ECD-4-nano at lower forces increases the risk of electrode bulging during cycling, potentially leading to the electrodes losing full-surface contact with the frit (or the plunger in the full-cell mode). Such loss of contact can lead to impaired charge kinetics and inaccurate dilation measurements. For this reason, we strongly recommend using the maximum adjustable force of 15 N.

Alternative approaches to mitigate electrode bulging include:

1. Using self-standing electrodes without a current collector bonded to the active layer, or
2. Using smaller electrodes, which increases the effective pressure (force per area).

7 Connection Setups

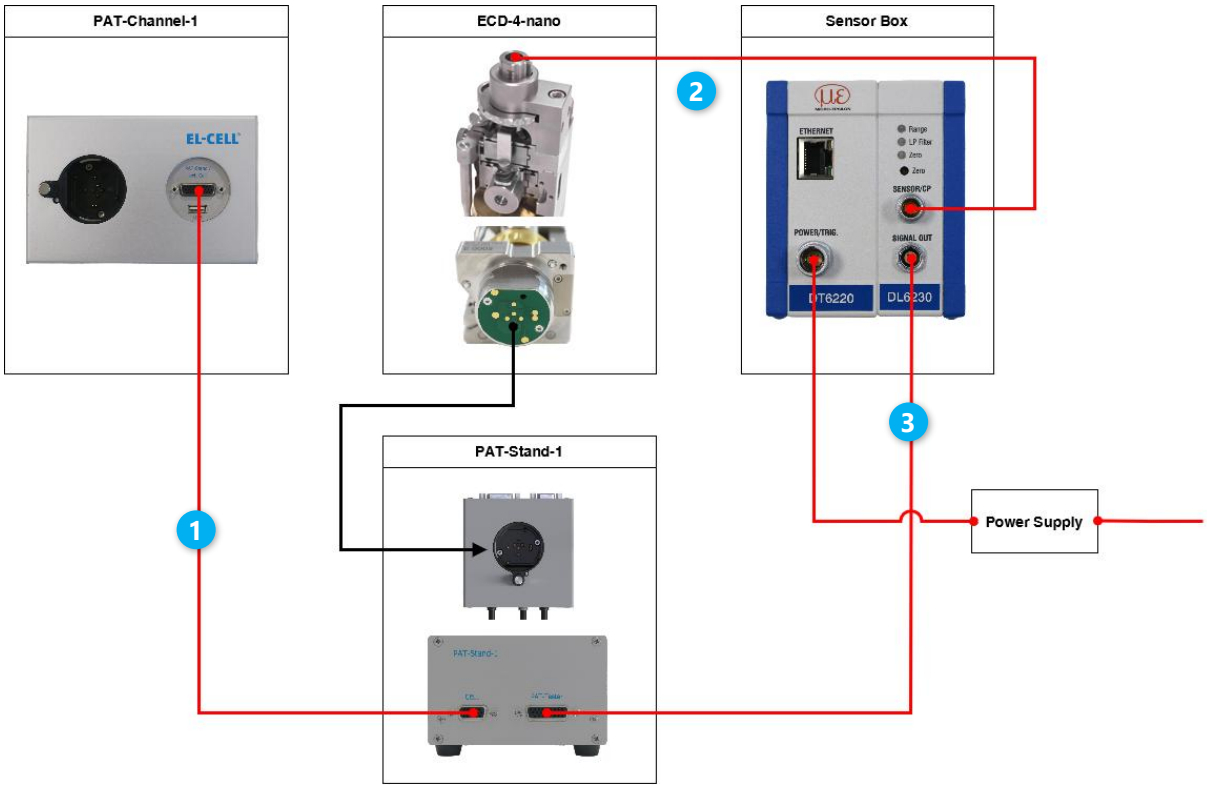
Connect all cables, as shown in the illustration below. We highly recommend operating the dilatometer in a temperature-controlled environment.

IMPORTANT: Safe Handling of the Sensor Cable

Handling: Avoid kinking the sensor cable by all means. Do not wind it too tightly; we recommend maintaining a 20 cm radius.

Connecting: Ensure that the sensor box is always disconnected from the power supply before connecting or disconnecting the sensor cable from the ECD-4-nano. Otherwise, the sensor may be damaged.

7.1 Operation in a PAT-Stand-1 and Connected to a PAT-Tester-x Potentiostat (recommended)

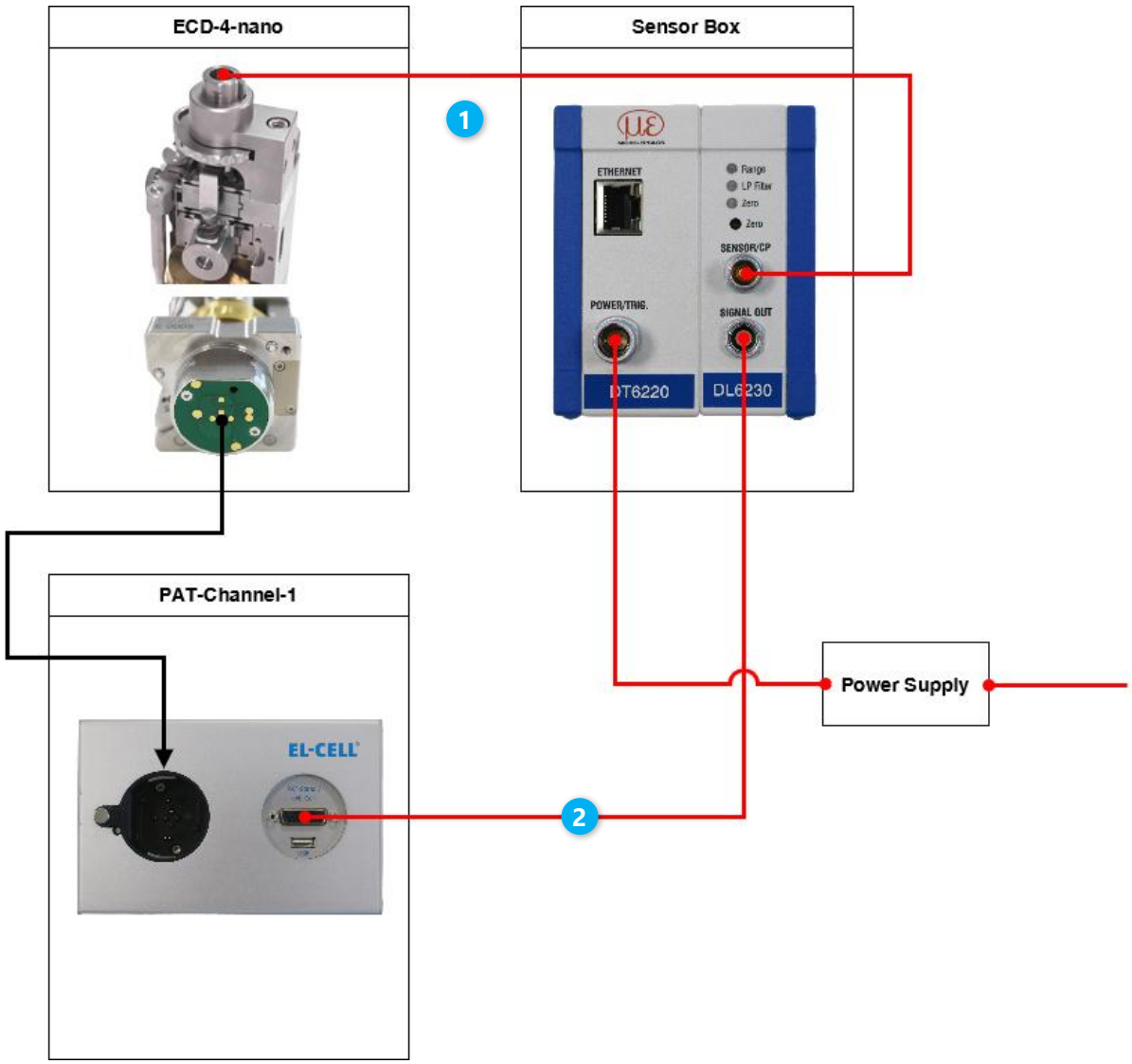


1. Cable, PAT-Channel-1 to PAT-Stand-1, ECE1-00-0297-A
   (not included in the scope of delivery, available as an accessory)

2. Cable, Sensor to ECD-4-nano Sensor Box, SEN9044

3. Cable, PAT-Channel to ECD-4-nano Sensor Box, ECE1-00-0368-A
   (not included in the scope of delivery, available as an accessory)

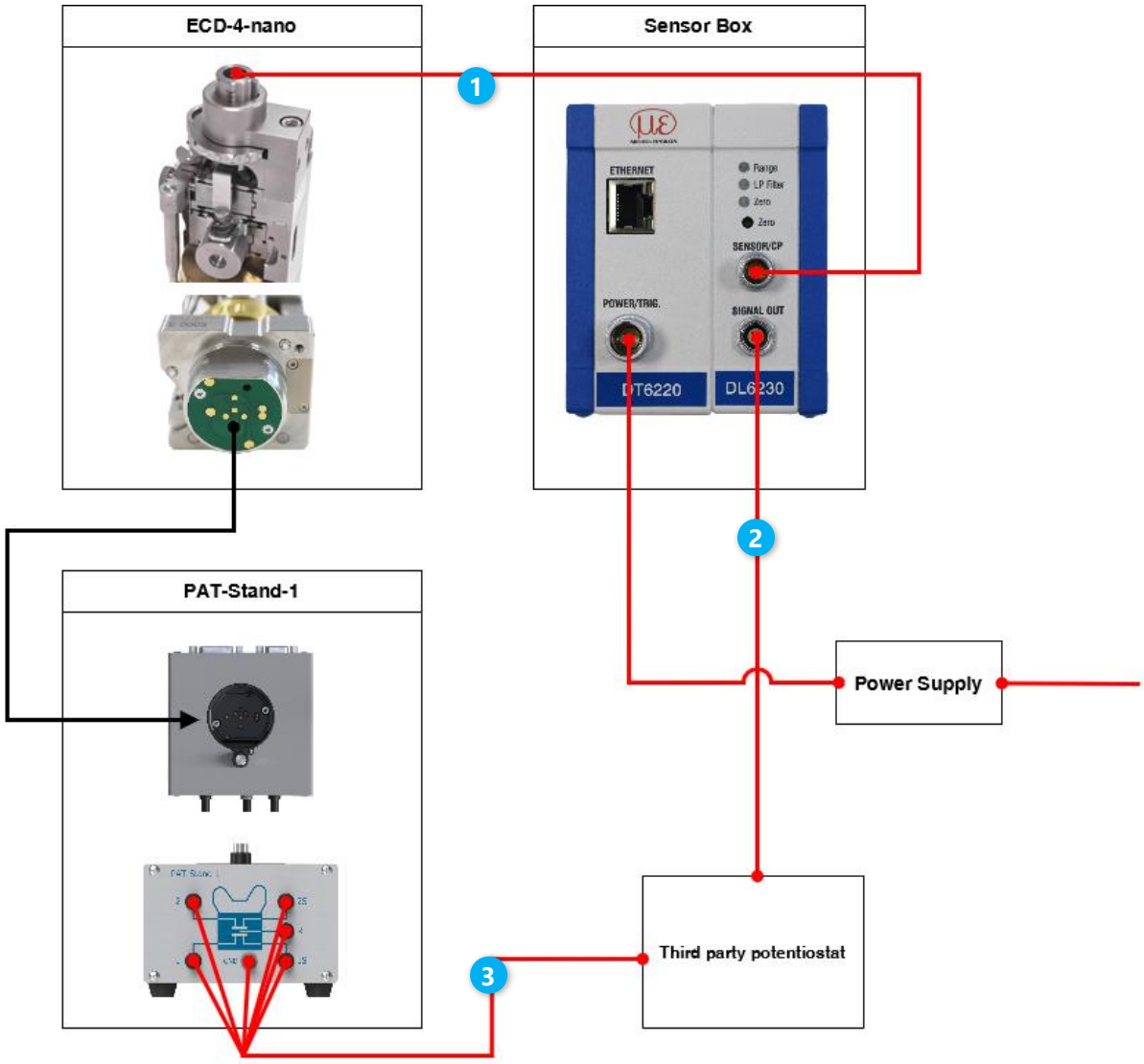
7.2 Direct Operation in a PAT-Tester-x



1. Cable, Sensor to ECD-4-nano Sensor Box, SEN9044

2. Cable, PAT-Channel to ECD-4-nano Sensor Box, ECE1-00-0368-A
   (not included in the scope of delivery, available as an accessory)

7.3 Operation in a PAT-Stand-1 and Connected to a Third-Party Potentiostat



1. Cable, Sensor to ECD-4-nano Sensor Box, SEN9044
2. Sensor cable (not included; different options available upon request)
3. Cell cables 2/4mm banana plugs (not provided)

NOTICE

Please note that the electrodes of the ECD-4-nano are connected differently than shown in the pictogram on the PAT-Stand-1! The upper electrode (working electrode in half-cell mode) of the ECD-4-nano is contacted via connection 1 of the PAT-Stand-1, and the lower electrode via connection 2.

8 Unpacking

Please check the contents of the packages against the list below to verify that you have received all components. If anything is missing or damaged, contact the factory.

NOTICE
Damaged shipments must remain in their original packaging for inspection by the freight company.

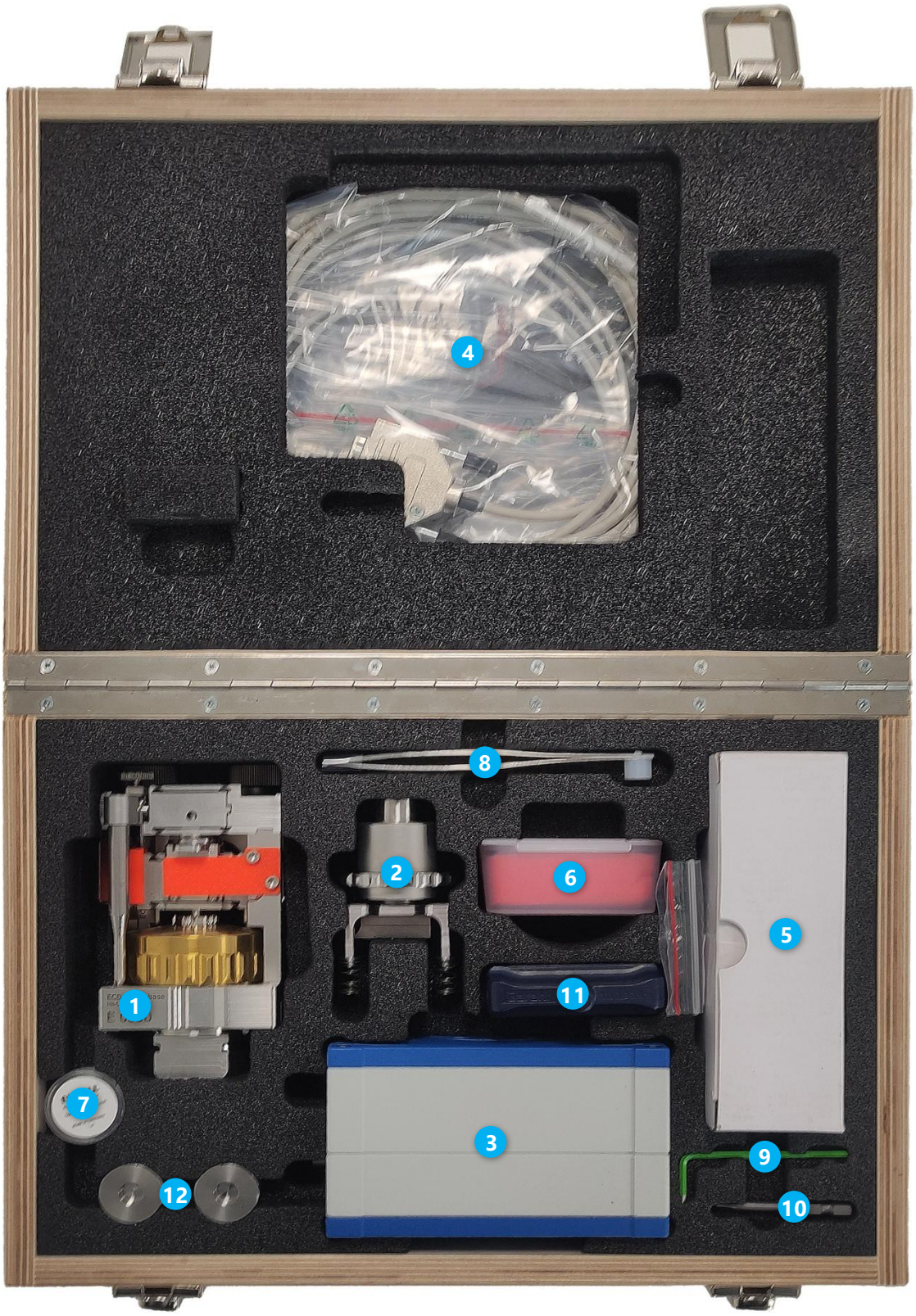
List of Components:

Included in the wooden transport box:

1. **ECD-4-nano** test cell
2. Load Unit
3. ECD-4-nano Sensor-Box, ECE1-00-0373-A
4. Cable, Sensor to ECD-4-nano Sensor Box, SEN9044
   Allen wrench 5mm, WZG9070
5. Power supply ECD-4-nano, ECE1-00-0370-A
6. Membrane unit, ECC1-06-0030-A
7. Spacer disc 2.7 mm, ECC1-00-0018-U
8. Loading tweezer, ECC1-09-2010-B
9. Allen wrench 2.5 mm, WZG9059
10. Bit, 1/4 inch, HEX 2 mm (long), WZG9061
11. Torque screwdriver, 0.38 Nm, cross handle, WZG9023
12. Add-on Weight, ECC1-06-0127-A

Separately enclosed articles:

13. Power cable (country-specific)
14. PE Sealing, 10 pcs, ECC1-06-0043-A/X
15. Ref-ring II, Li coated, 10 pcs, ECC1-01-0078-B/X
16. T-Frit 10 mm/12.5 mm/3.5 mm, 5 pcs, ECC1-06-0041-A/V

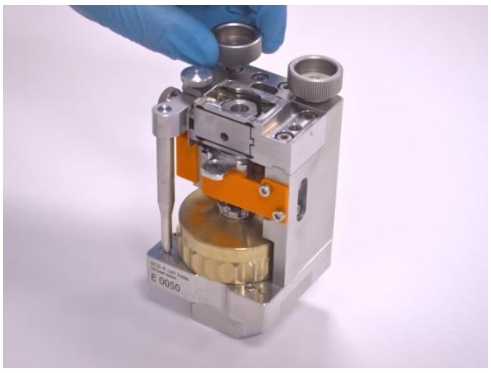


Wooden transport box

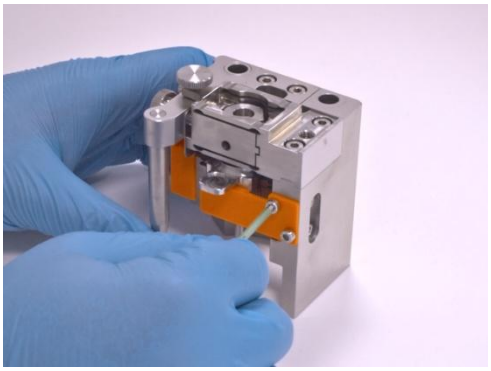
9 Commissioning of the ECD-4-nano

These steps are only necessary after unpacking and before the instrument's very first use.

9.1 Removing the Transport Lock



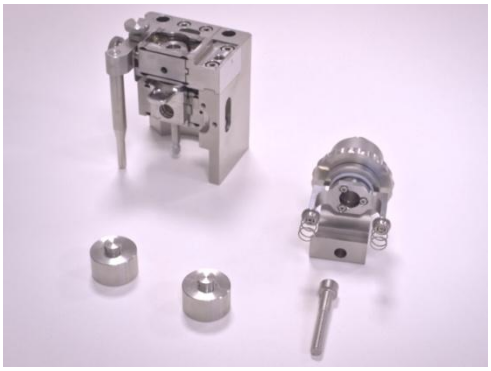
1. Put the device on an even surface and screw off the two knurled nuts.



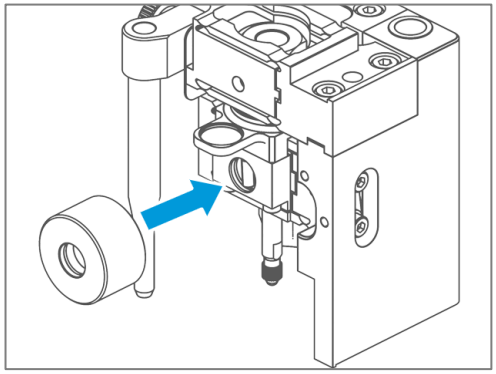
2. Lift the Sensor unit from the cell base. Remove the two orange transportation locks from the Sensor unit by releasing the screws with the provided Allen key.

3. Now, the Sensor unit is ready for its first use. Proceed with the next steps.

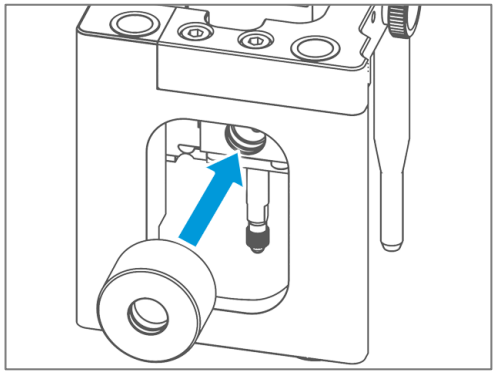
9.2 Preparing the Sensor Unit



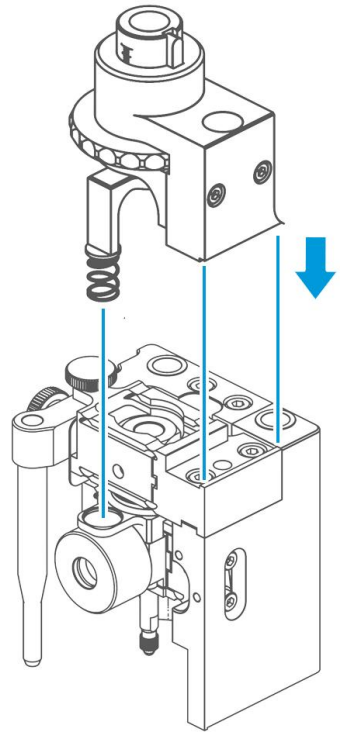
1. In the following steps, we will attach the Add-on Weights and the Load unit to the Sensor unit.



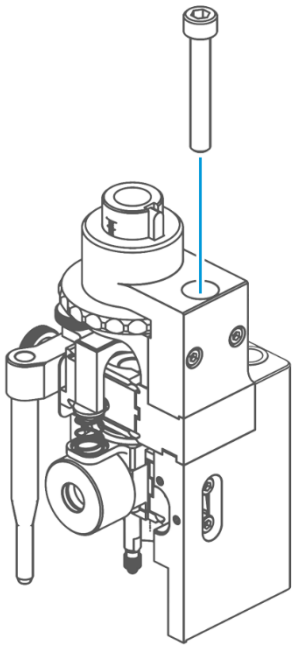
2. Attach the Add-on weight to the corresponding holder at the front as shown.



3. Attach the weight to the holder at the back.



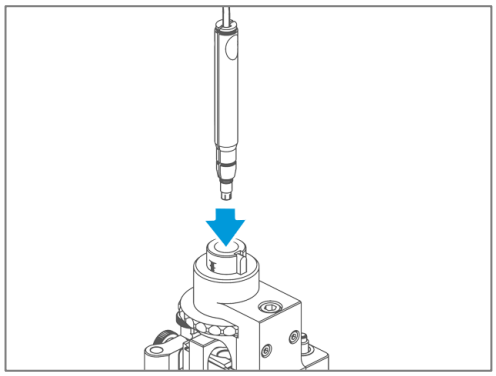
4. Attach the Load unit to the Sensor unit. The springs must rest on the corresponding plates on the front and back.



5. Insert the provided screw. Use the Allen key 2.5mm to secure the Load unit finger-tight.

9.3 Performing the Sensor Health Check

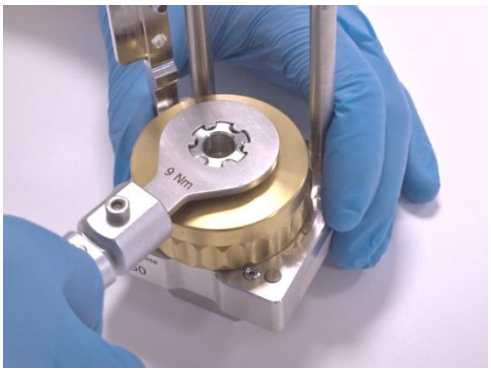
This test checks the sensor's functionality. To perform it, you need a ready-to-use measurement setup, as described in the chapter "Connection Setups," and access to a PC running EL-Software or the control software for your third-party potentiostat to check the dilation sensor value.



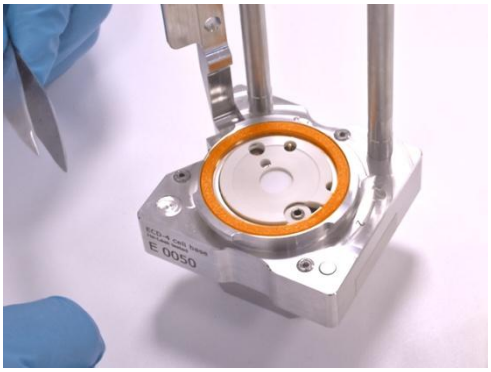
1. Connect all devices accordingly.

   Insert the sensor cable into the ECD-4-nano until you hear a clicking sound.

   Then connect the power cable to the sensor box.



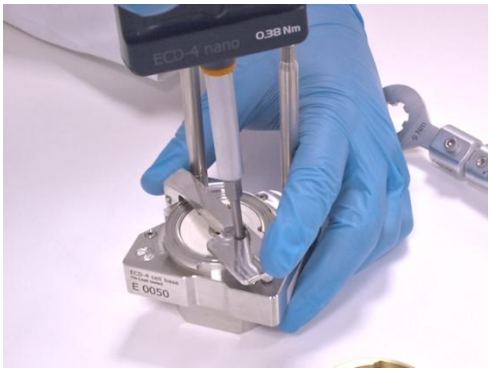
2. Loosen the thrust screw by using the provided tool and remove the screw cap.



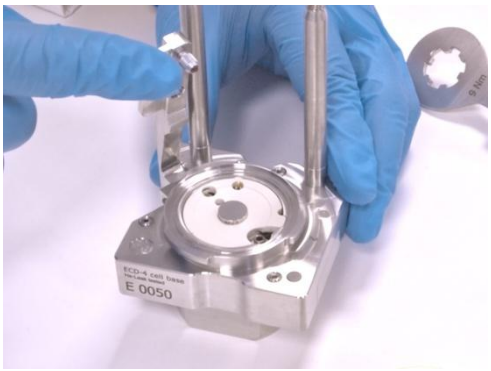
3. Dispose of the orange transport dummy ring.

4. Insert the spacer disc.

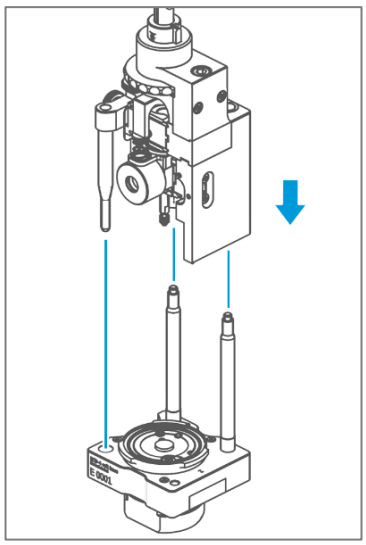
5. Fold the lever down to the stop and hold it in this position.



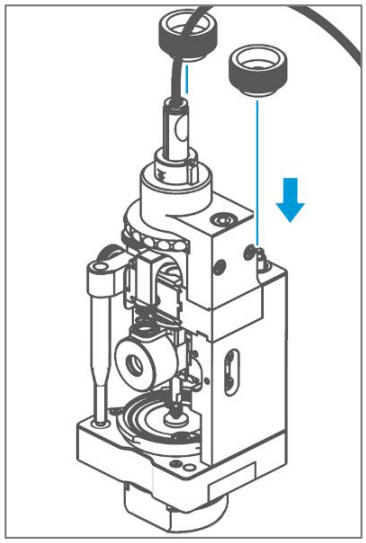
6. Continue to hold the lever in this position and gently tighten the clamping screw using the torque wrench supplied. Pay attention to the low tightening torque.



7. Flip the lever back up again.

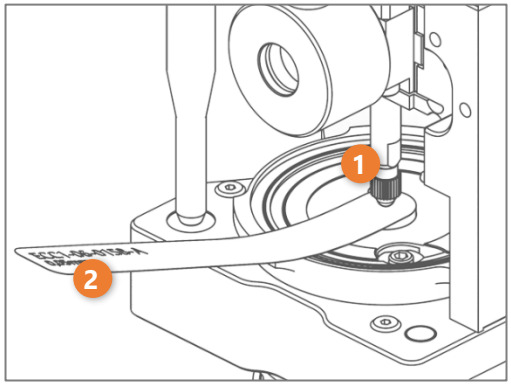


8. Attach the Sensor unit to the cell base.



9. Fix the Sensor unit with the two knurled nuts.

   Now check the dilation value in your control software and note it down.

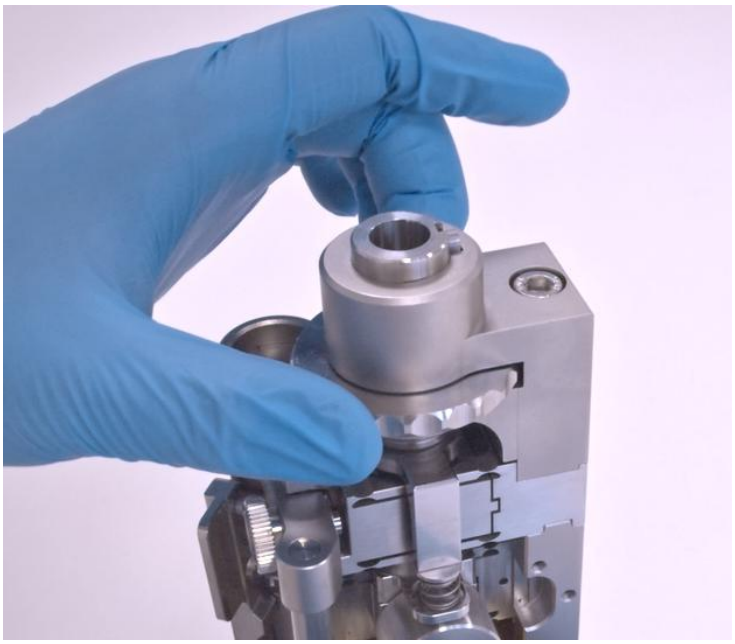


10. Lift the sensor tip 1 gently and slide the measuring plate 2 between the sensor and spacer disc.
    Lower the sensor back onto the measuring plate and check the new dilation value in your software.
    The value should be increased by 50 µm.

10 Adjusting the Applied Force

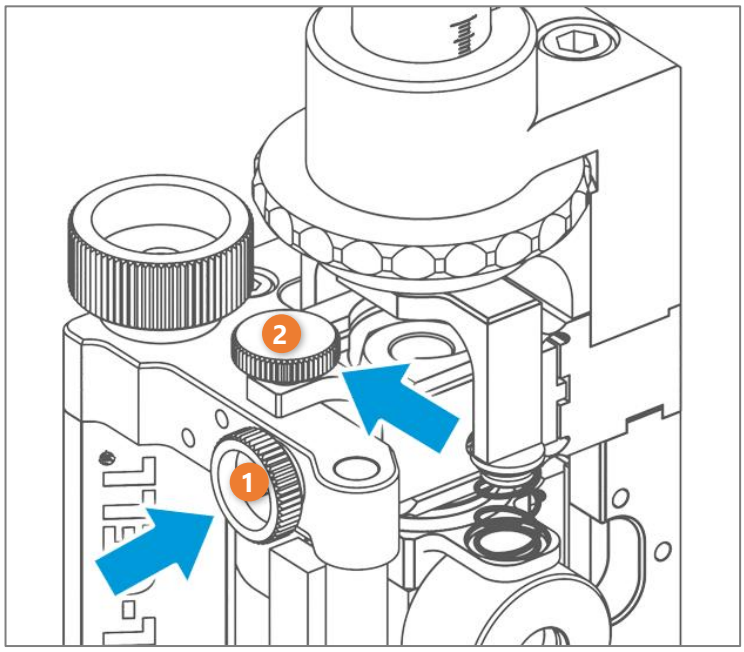
The force applied to the cell stack can be continuously adjusted between 1 and 15 N.

Turn the adjustment wheel 1 to change the force. You can read the approximate setting on the scale 2. When the lowest line on the scale is visible, the set force is approximately 1 N.



When the top line on the scale is reached, the set force is approximately 15 N.

11 Calibrating the Dilation Sensor



You can manually adjust the sensor position to set the zero point. To do this, you must first release the lock 1.

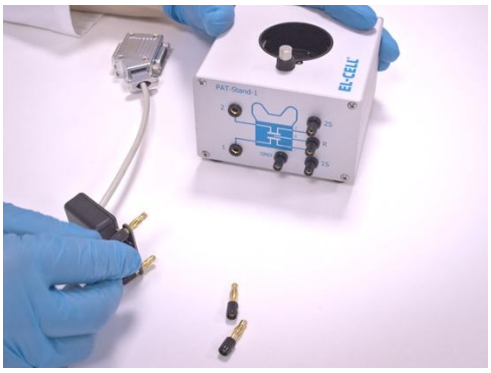
Then use the adjustment wheel 2 to change the zero point.
After adjustment, the lock must be reengaged.

We recommend two options for displaying the sensor signal, which are explained on the following pages.

11.1 Calibrating the Dilation Sensor using the ECD-4 Centering Device

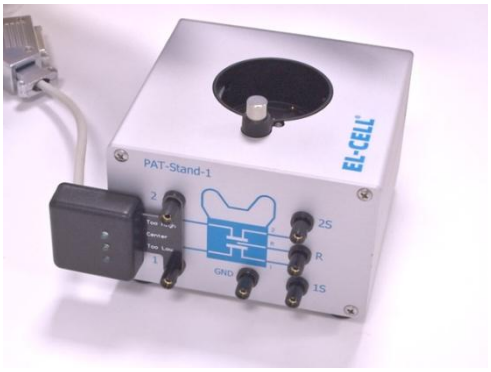
The ECD-4 Centering Device is an optional accessory that can be mounted on the PAT-Stand-1. It provides direct visual feedback on the set sensor position. To use this device, you must use the recommended measurement setup with a PAT-tester-x-8 potentiostat and PAT-Stand-1 docking station. The Centering device can remain permanently connected to the PAT-Stand-1.

11.1.1 Attaching the ECD-4 Centering Device to the PAT-Stand-1



1. Remove the two jack plug adapters from ports 1 and 2 on the PAT-Stand-1.

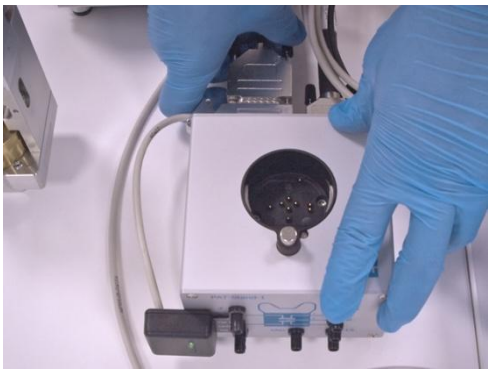
2. Attach the Centering device by plugging the connectors on the display into ports 1 and 2.



3. Plug the male connector into the Aux-in port of the PAT-Stand-1.

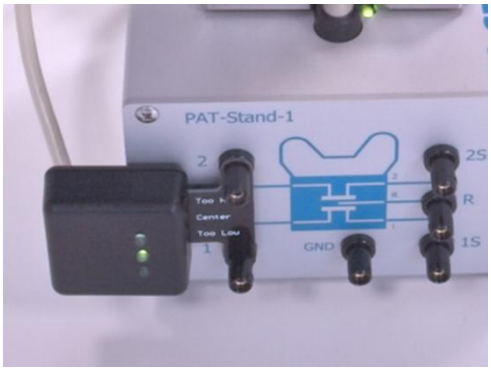
11.1.2 Perform sensor adjustment using the ECD-4 Centering Device

Connect your setup as shown in chapter 6.1.



1. Plug the sensor cable (PAT-Channel to ECD-4-nano Sensor Box) into the female port of the ECD-4 Centering device.

2. Insert the ECD-4-nano with attached sensor cable into the PAT-Stand-1.
   Connect the PAT Tester-x-8, then the sensor box, to the power supply.

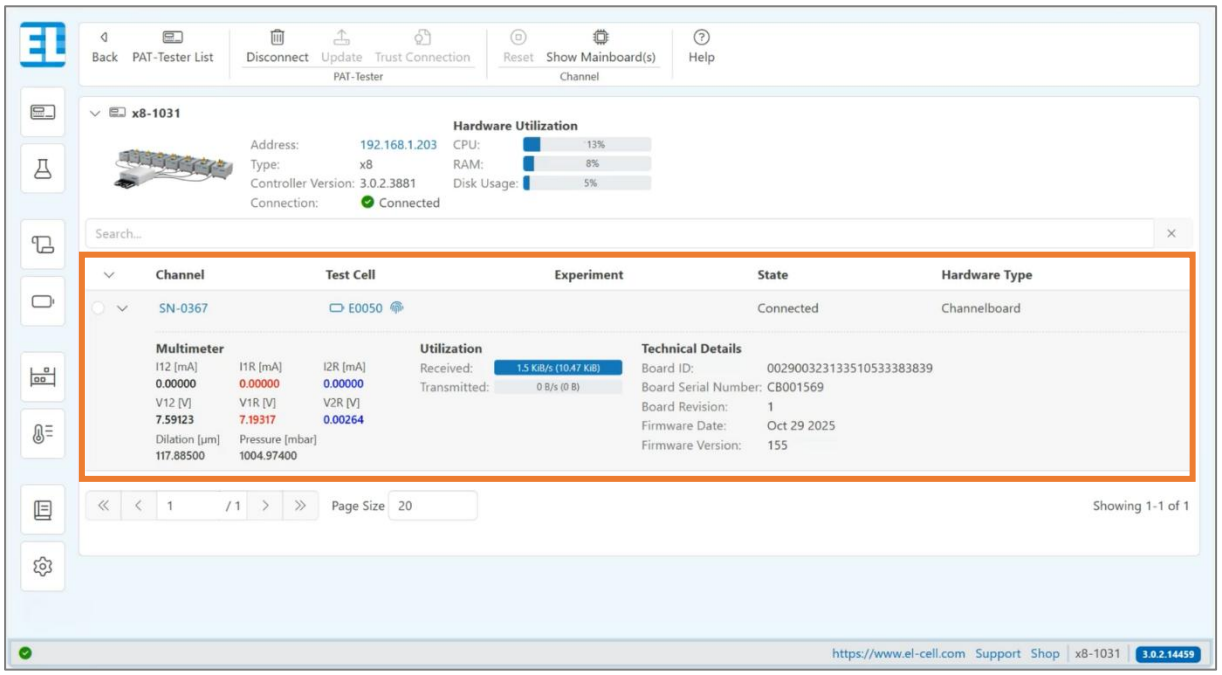


3. Change the sensor setting on the ECD-4-nano as explained at the beginning of this chapter.
   As soon as the middle LED on the Centering device lights up, the sensor is in the correct zero position (+/-20 µm) .
   Lock the adjustment wheel. The ECD-4-nano is now calibrated.

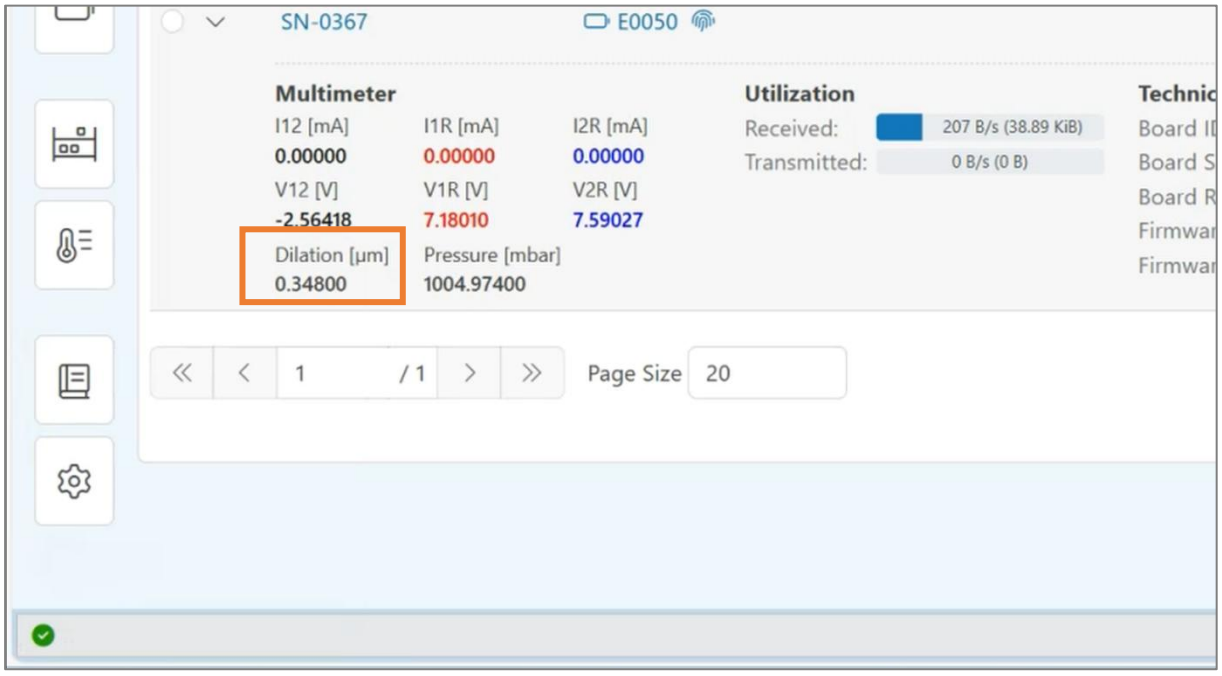
11.2 Calibrating the Dilation Sensor using EL-Software

If you are operating the ECD-4-nano with a PAT-Tester-x-8 potentiostat, you can use EL-Software to set the sensor zero point.

17. Insert the ECD-4-nano into a connected PAT-Channel-1 or PAT-Stand-1. In EL-Software, open the PAT-Tester-x-8 in the PAT-Tester section. The dilatometer is now displayed with its sensor values in the corresponding test channel.



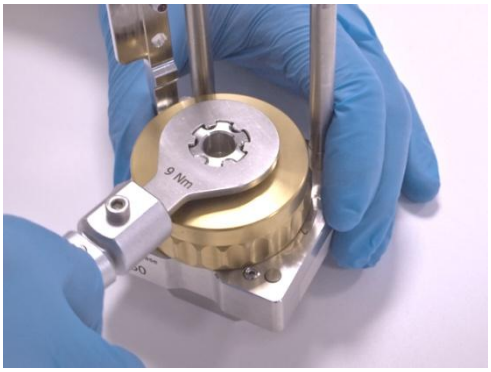
18. Change the sensor position on the ECD-4-nano as described in Chapter 8 to set the desired zero point. Observe the dilation value in the EL software. Once the value is close to 0, you can lock the adjustment wheel. The ECD-4-nano is now calibrated.



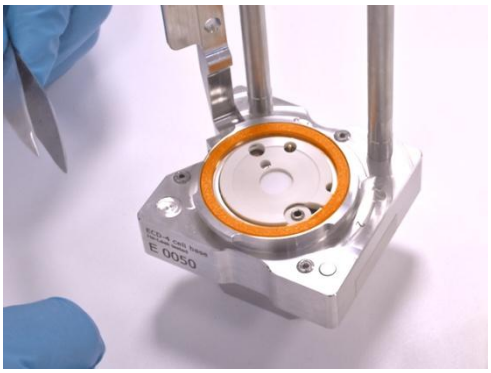
12 Assembly

12.1 Disassembly Steps Before Insertion into the Glovebox

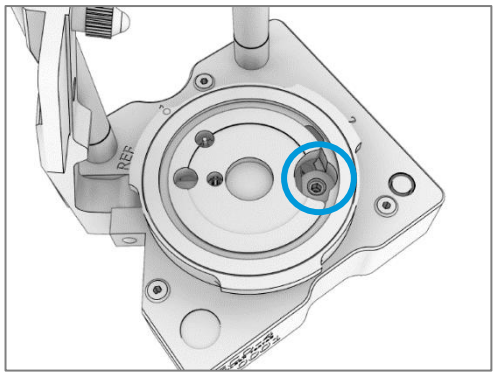
The following steps describe the disassembly of the cell base unit before inserting the parts into the glove box.



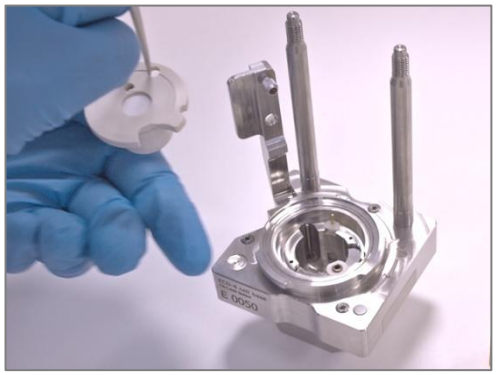
4. Loosen the thrust screw by using the provided tool and remove the screw cap.



5. Dispose of the used sealing ring or, if you are disassembling the dilatometer for the first time, the orange transport dummy.



6. Use the provided tweezers to lift the frit flange out of the cell base.



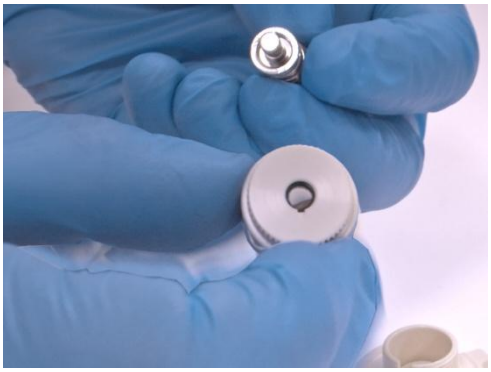
7. Use the provided tweezers to lift the frit flange out of the cell base.

8. Turn the frit flange around and unscrew it.

9. Remove the sleeve from the frit flange unit.

10. Remove the glass frit.

11. Remove the reference ring. If you are disassembling the dilatometer for the first time, this ring is an uncoated dummy.



12. Remove the spring-loaded plunger.

All components of the cell base unit must now be dried in a vacuum oven at 80°C for at least 12 hours. The following parts must be dried at different temperatures:

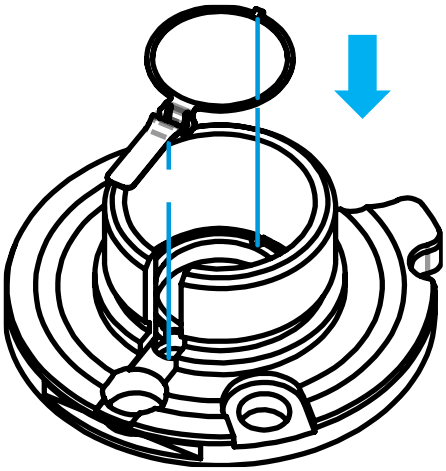
1. Frit flange: 120°C
2. Thrust screw: 120°C
3. Frit sleeve: 120°C
4. Glass frit: 180°C

-

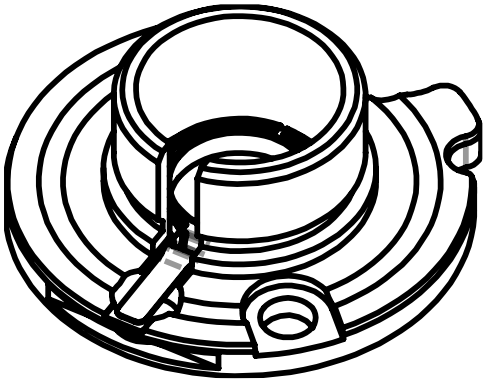
12.2 Assembling the Cell Inside the Glovebox (Half-Cell Mode)

NOTICE

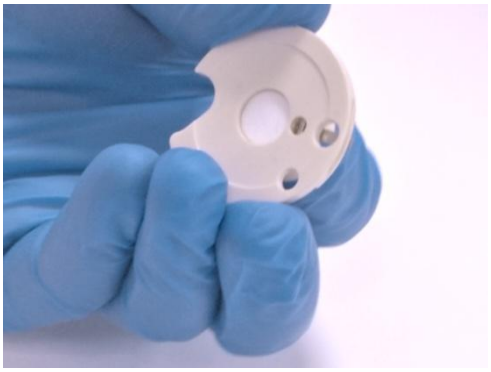
All assembly steps will be carried out in an inert glove box atmosphere.



1. Insert the new reference ring into the frit flange.



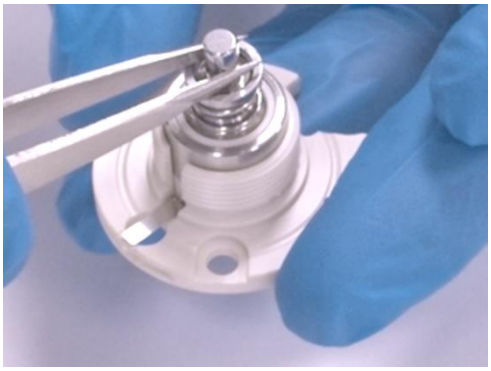
2. Add the glass frit with the narrow end facing downwards.



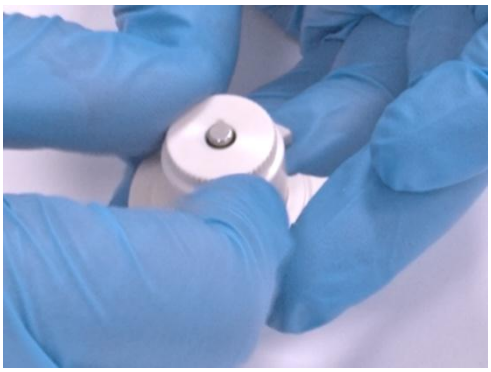
3. Turn the frit flange around to verify the proper placement of the glass frit.

4. Insert the frit sleeve.

5. Put the counter (lower) electrode on top of the plunger. This is usually a Li or Na metal disc.
We recommend using a diameter of 9 mm (max. 10 mm) and a thickness of 0.3 mm (or thinner).



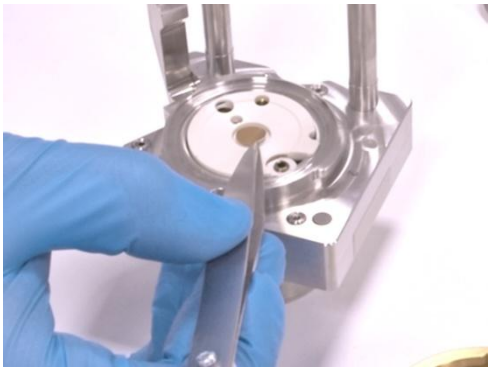
6. Insert the piston.



7. Now put on the thrust screw and tighten it by hand.

8. Insert the unit into the cell base. When properly aligned, the unit will slide into position easily. As a test, you should now be able to press the unit down with light force, and it should pop back a bit.

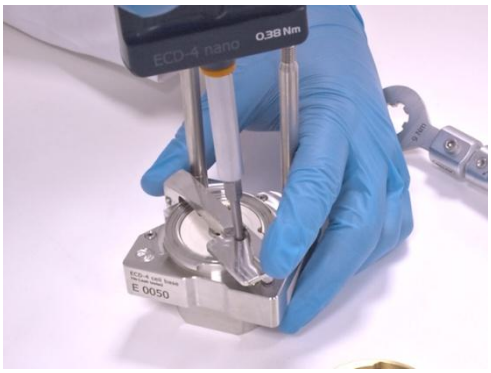
9. Add approx 240 µl electrolyte with a pipette.
Important: Never use more than 250 µl of electrolyte, as this can lead to spillage and severe contamination of the cell base.



10. Place the working (upper) electrode on top of the glass frit. The active layer must point downwards.

11. Insert the spacer disc. The spacer disc should completely cover the working electrode.

12. Fold the lever down to the stop and hold it in this position.

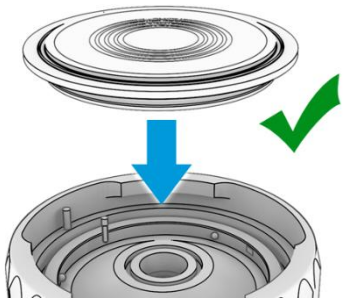


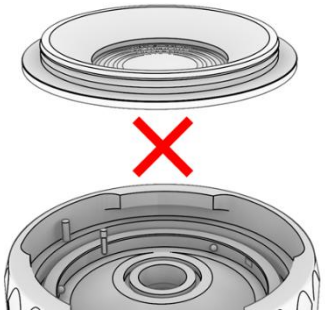
13. Continue to hold the lever in this position and gently tighten the clamping screw using the torque wrench supplied. Pay attention to the low tightening torque.

14. Flip the lever back up and insert a new PE sealing ring.

15. Insert the membrane into the screw cap. Be careful to touch the membrane only at the edge, not the center area.-

    Pay attention to the membrane's correct orientation. (see images below).





16. Press the membrane down slightly until it snaps into place. Be careful to touch the membrane only at the edge, not the center area. It should not fall out when you turn the lid upside down.

17. Put the screw cap on and tighten the centering thrust screw with the torque wrench until the tool releases.

We recommend fixing the dilatometer in the assembly block (ECC1-02-0045-A) to achieve the necessary torque.

Remove the assembly from the glove box.

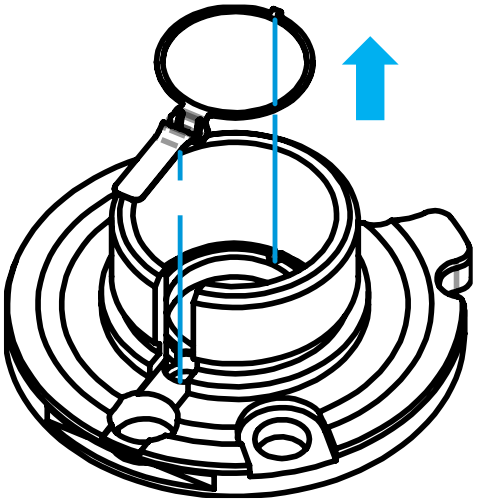
Proceed with chapter 12.4

12.3 Assembling the Cell Inside the Glovebox (Full Cell Mode)

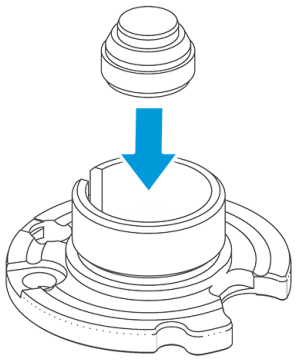
NOTICE

All assembly steps will be carried out in an inert glove box atmosphere.

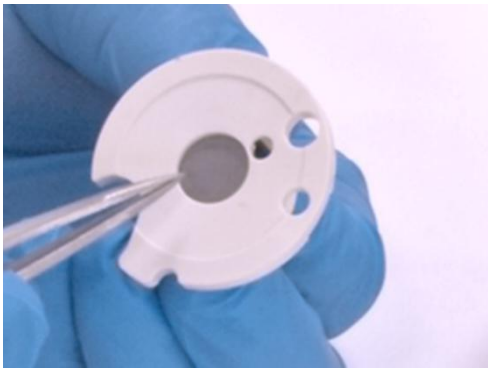
This setup requires the **ECD-4 full-cell kit**. For more information, see Chapter 10: Available Accessories.



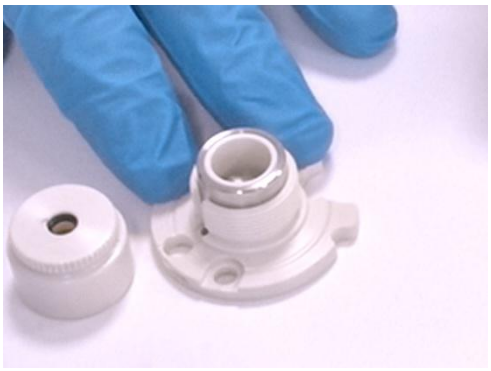
1. If mounted, remove the reference ring from the frit flange.



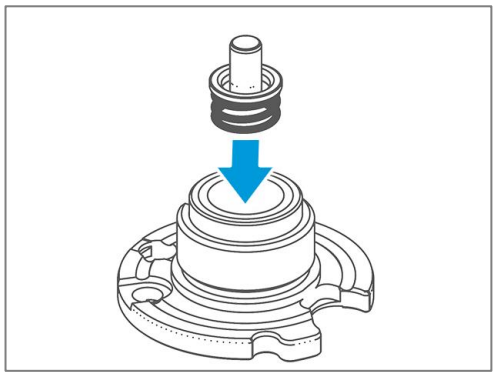
2. Insert the plunger for the **ECD-4 full-cell kit** into the frit flange. Mind the proper orientation of the plunger as shown.



3. Turn the frit flange around and verify that the plunger is seated correctly.

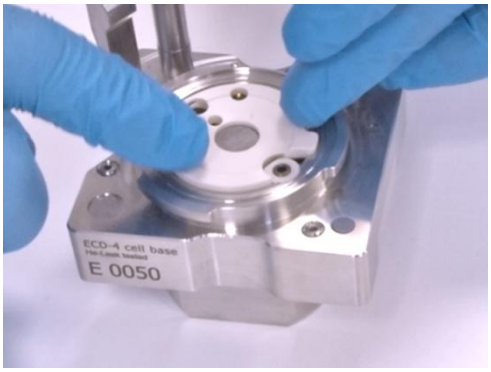


4. Insert the frit sleeve.



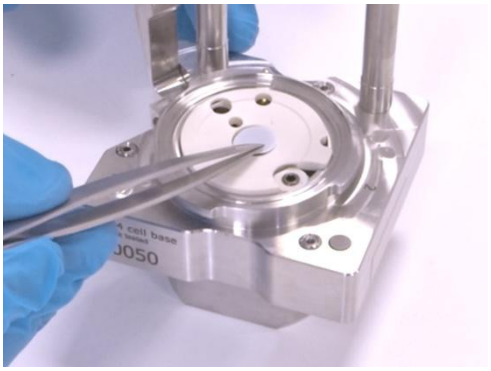
5. If installed, detach the plunger for the half-cell setup from the plunger assembly. Then insert the plunger assembly into the frit sleeve.

6. Now put on the thrust screw and tighten it by hand.



7. Insert the unit into the cell base. When properly aligned, the unit will slide into position easily. As a test, you should now be able to press the unit down with light force, and it should pop back a bit..

8. Place the lower electrode on top of the glass frit. The active layer must point upwards.



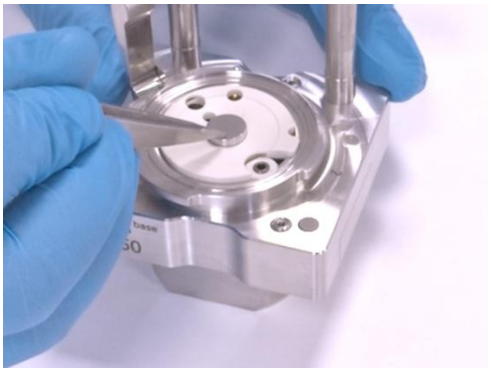
9. Place the 10 mm-diameter separator on the electrode. We recommend a well-wettable polyolefin separator with a thickness of around 20 µm.

10. Place the Adjustment tool on the separator.

11. Place the upper electrode on top of the separator, with the active side pointing downwards.

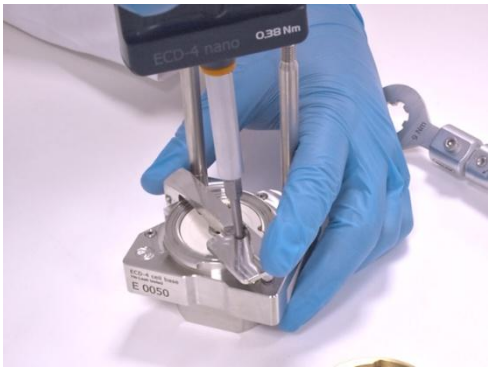
    Please note: At least one electrode should be smaller in diameter than the separator. This prevents a short circuit along the separator's edge.

12. Add approx. 40 µl of electrolyte using a pipette.
    Never use more than 50 µl of electrolyte, as this can lead to spillage and severe contamination of the cell base.



12. Insert the spacer disc. The spacer disc should completely cover the upper electrode.

13. Fold the lever down to the stop and hold it in this position.

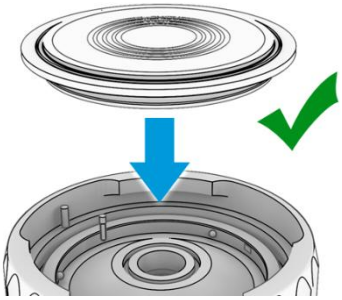


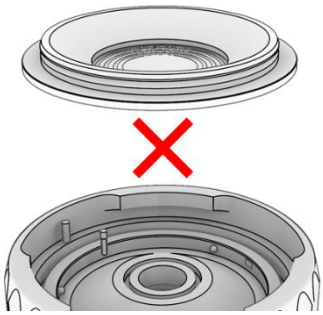
14. Continue to hold the lever in this position and gently tighten the clamping screw using the torque wrench supplied. Pay attention to the low tightening torque.

15. Flip the lever back up and insert a new PE sealing ring.

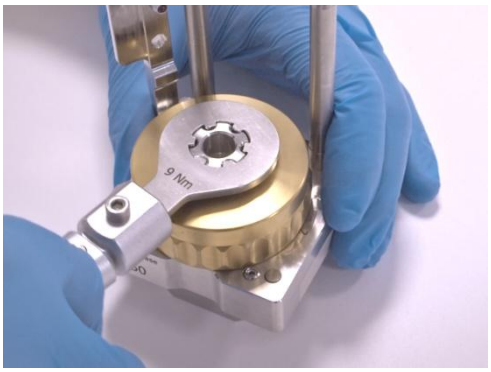
16. Insert the membrane into the screw cap. Be careful to touch the membrane only at the edge, not the center area.

    Pay attention to the membrane's correct orientation. (see images below)





17. Press the membrane down gently at the edge until it clicks into place. It should not fall out when you turn the lid upside down.
    Never press on the center of the membrane!



18. Put the screw cap on and tighten the centering thrust screw with the torque wrench until the tool releases.

    We recommend fixing the dilatometer in the assembly block to achieve the necessary torque.

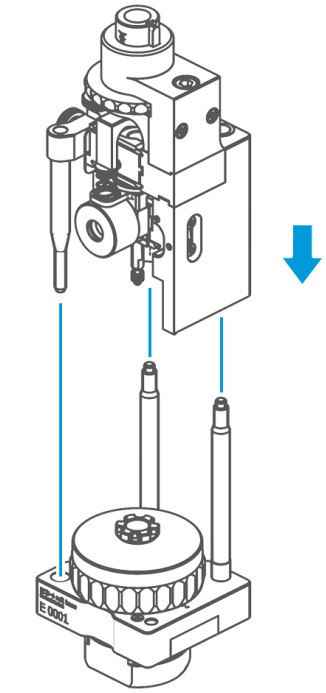
    Remove the assembly from the glove box.

    Proceed with chapter 12.4

NOTICE

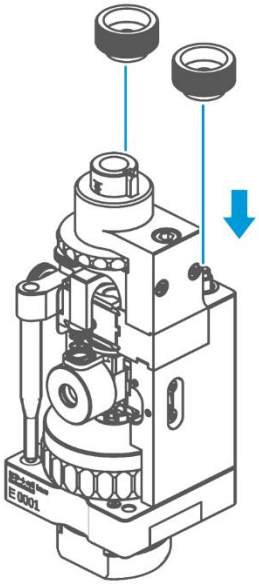
Normal use may cause the membrane to appear indented. This does not represent a technical defect.

12.4 Final Assembly Steps Outside the Glovebox



1. Attach the sensor unit to the cell base unit.

   Caution:
   The sensor head may only be attached when the spacer disc is inserted. Otherwise, the membrane will be damaged.



2. Fix the sensor unit with the two knurled nuts.

   The ECD-4-nano is now fully assembled.

13 Disassembly and Cleaning

When working with aprotic, moisture-sensitive electrolytes such as $LiPF_6$, it is best to avoid opening the cell base outside the glove box and only expose those components to room air that need to be cleaned or disposed of.

After opening the cell lid inside the glovebox, the clamping screw is slightly loosened using the specified torque wrench (M4, 0.38 Nm) to release the frit flange unit mechanically. Complete removal of the clamping screw is not required. Once released, the frit flange unit can be extracted from the cell base.

Tip: For removal of the frit flange unit, insert the tips of a pair of tweezers into the outermost holes of the frit flange unit and apply controlled upward leverage to lift the assembly out of the cell base without inducing tilt or mechanical stress.

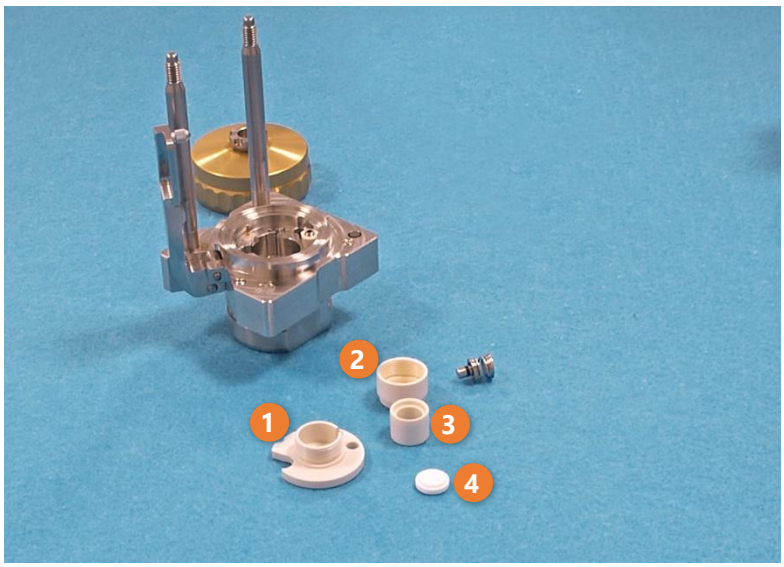
If the cell base is contaminated with electrolyte, clean it in the glove box using tissue paper or a cotton swab with a battery-compatible solvent such as DMC.

Never immerse the cell base in liquid. In particular, avoid contact with the electronic components on the bottom of the cell with any liquid.

For cleaning, the frit flange unit must first be disassembled inside the glovebox. We recommend cleaning the spacer disc, the plunger, and the spring-loaded lower piston inside the glovebox using a tissue paper and a few drops of a battery-compatible solvent such as DMC. In cases of heavier contamination, these parts may also be cleaned outside the glovebox using appropriate solvents. The frit flange, thrust screw, frit sleeve, and glass frit should be cleaned outside the glovebox using a sufficient amount of a suitable solvent, such as deionized water.

After cleaning and drying, all parts except for the lid seal can be reused. The Cell base must be dried in a vacuum oven at 80 °C for at least 12 hours before first use and always after contact with ambient air.

The other parts have to be dried at the specified temperatures in a vacuum for at least 12 hours before each use.



1. Frit flange: 120°C
2. Thrust screw: 120°C
3. Frit sleeve: 120°C
4. Glass frit: 180°C

NOTICE

- Protect yourself against chemical hazards. Electrolytes may spill during cleaning, and electrode materials and electrolytes may react with the ambient atmosphere or the cleaning solvents. Wear appropriate protective equipment, goggles, and gloves.
- Clean all cell parts right after disassembly. Leaving cell parts in contact with the ambient atmosphere while still being wetted with electrolytes may result in severe corrosion.

14 Available Accessories

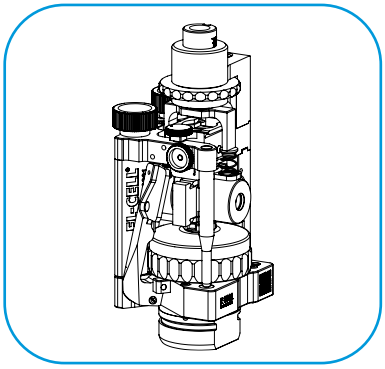
The listed items represent only a portion of the available accessories. Please contact us for further information or a specific connection cable for a third-party battery tester.

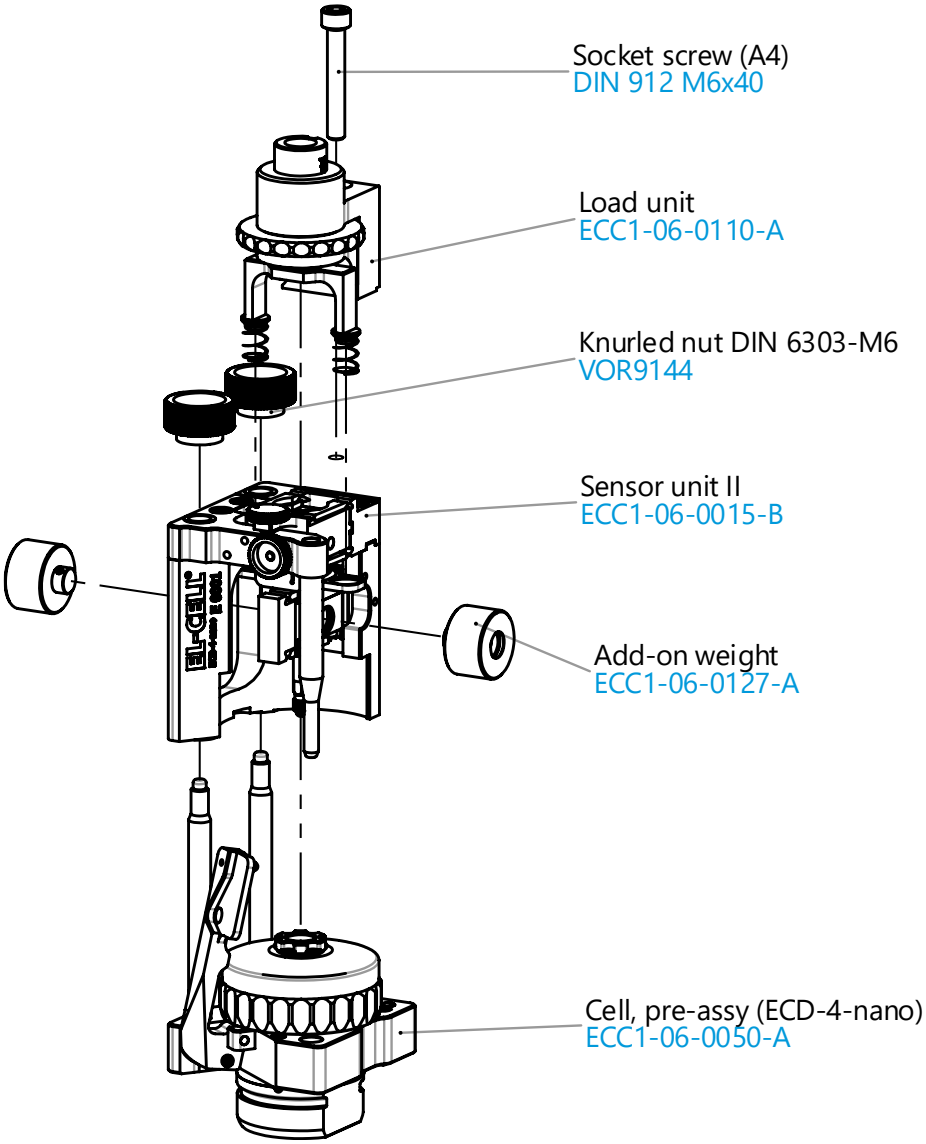
- Cable, PAT-Channel to ECD-4-nano Sensor Box, ECE1-00-0368-A
- Cable, PAT-Channel-1 to PAT-Stand/Clamp-1, ECE1-00-0297-A A
- ECD-4-nano to Biologic Auxiliary cable, ECE1-00-0371-A
- ECD-4-nano to open-ended, cable, ECE1-00-0374-A
- ECD-4 full cell kit, ECC1-00-0379-A
- Torque wrench ECD-4, ECC1-02-0039-B
- Cell assembly block III, ECC1-02-0045-A
- ECD-4 Centering Device, ECE1-00-0400-A

15 Consumables

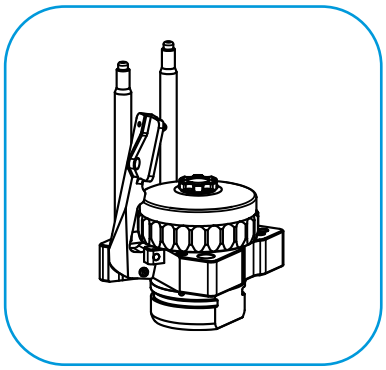
- PE Sealing, 10 pcs, ECC1-06-0043-A/X
- T-Frit 10 mm/12.5 mm/3.5 mm, 10 pcs, ECC1-06-0041-A/X
- Ref-ring II, Li coated, ECD-4-nano, 10 pcs, ECC1-01-0078-B/X

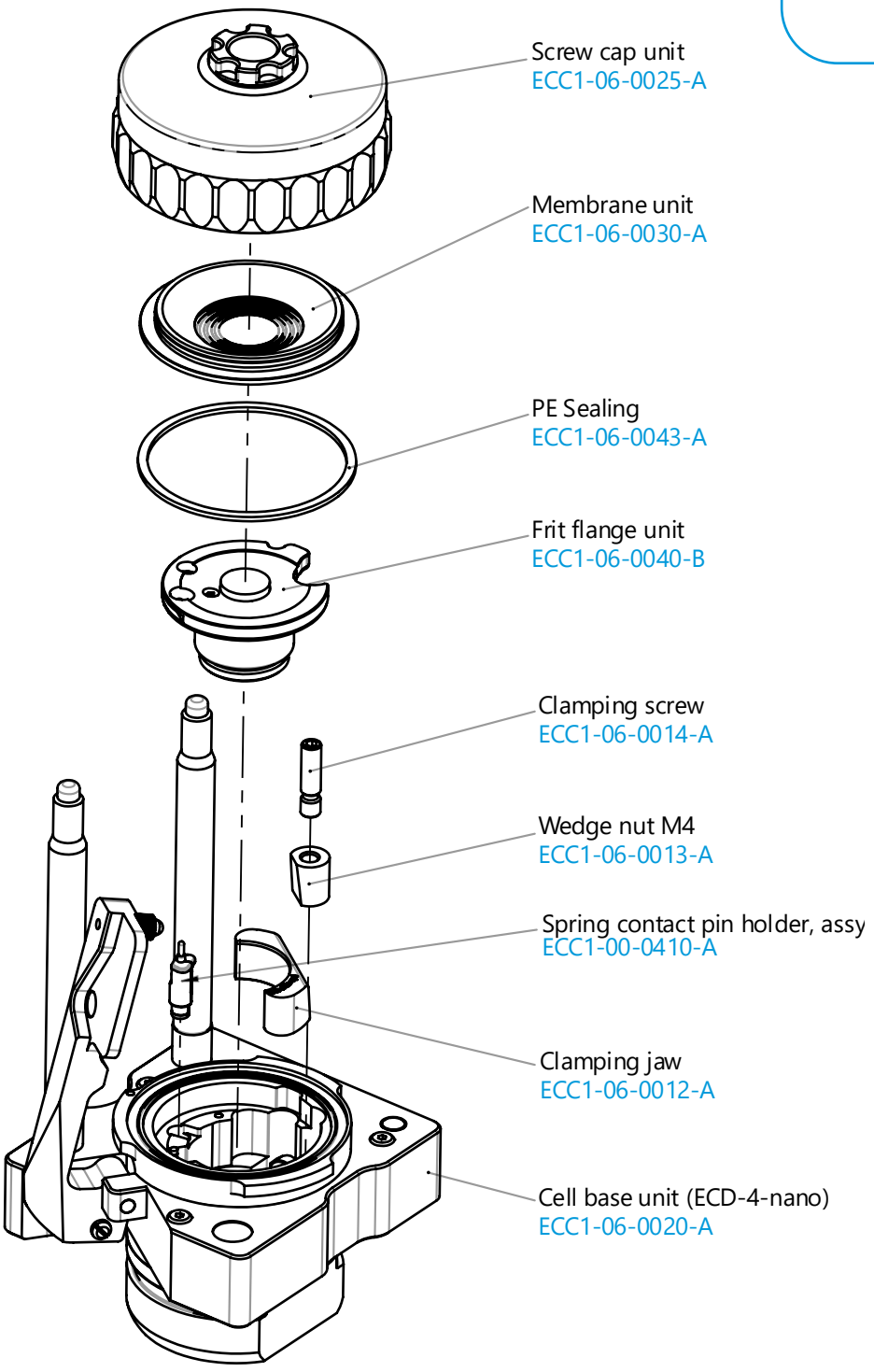
16 Spare Parts ECD-4-nano



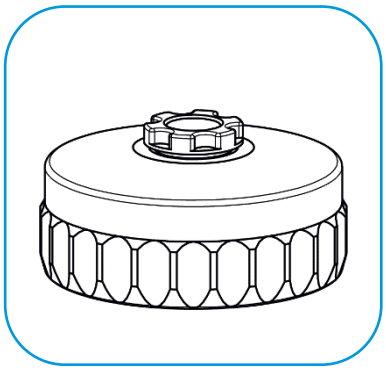


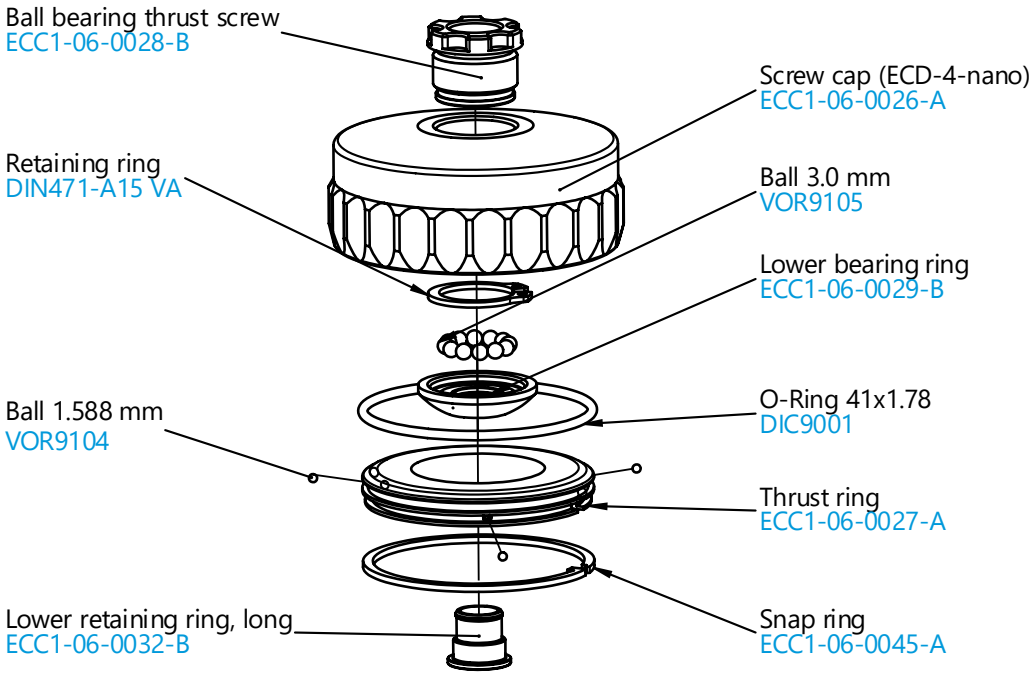
16.1 Cell pre-assy (ECD-4), ECC1-06-0050-A



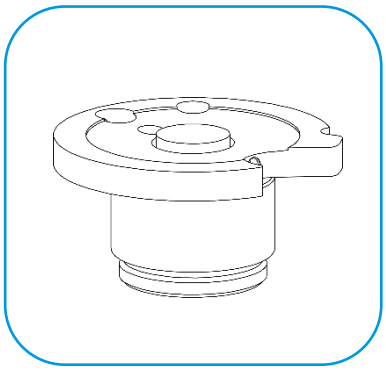


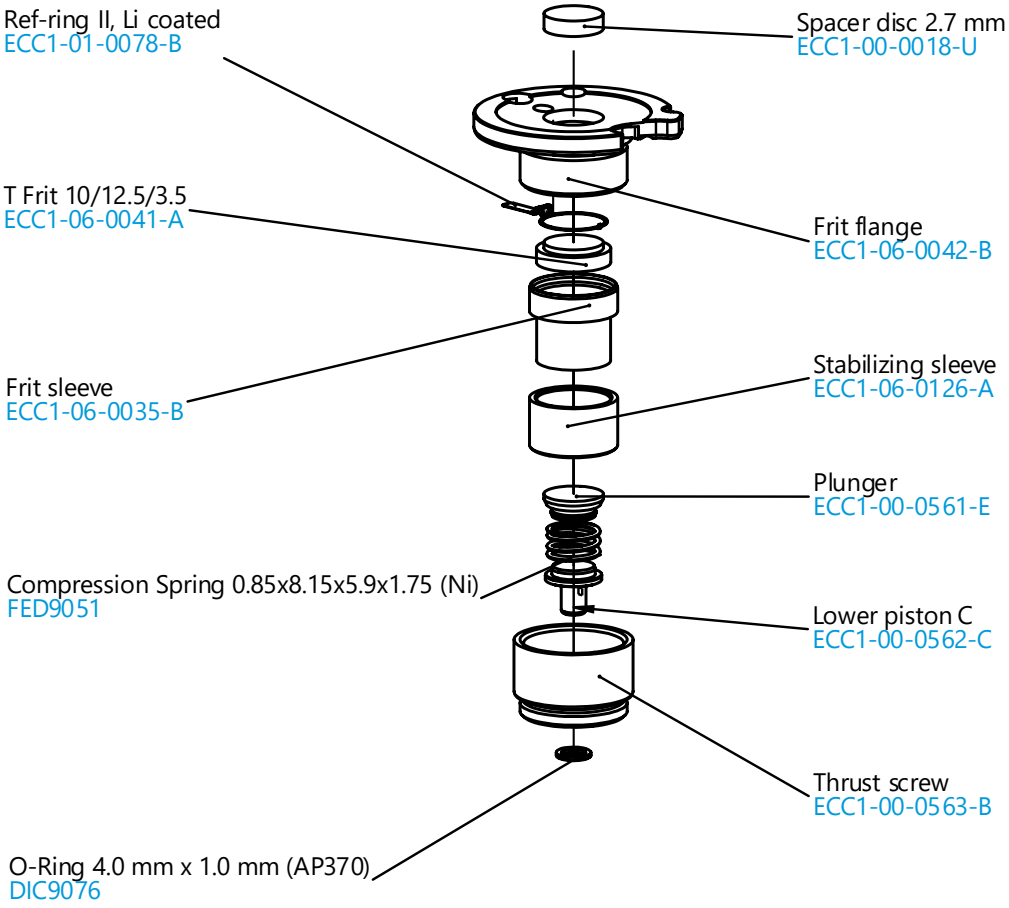
16.2 Screw Cap Unit, ECC1-06-0025-A



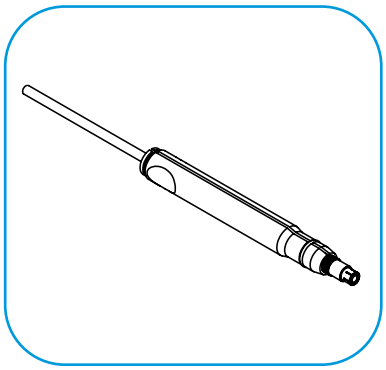


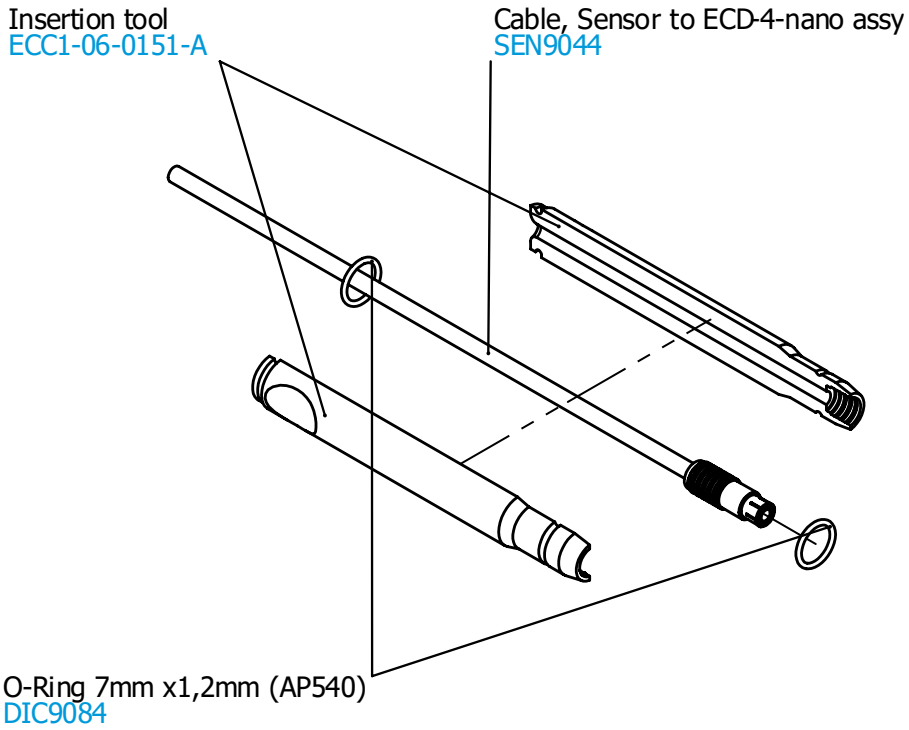
16.3 Frit Flange Unit, ECC1-06-0040-A





16.4 Cable, Sensor to ECD-4-nano, ECC1-06-0155-A





17 Warranty

For a period of one year from the date of shipment, EL-Cell GmbH (hereinafter Seller) warrants the goods to be free from defects in material and workmanship to the original purchaser. During the warranty period, Seller agrees to repair or replace defective and/or nonconforming goods or parts without charge for material or labor, or, at the Seller's option, demand return of the goods and tender repayment of the price. The buyer's exclusive remedy is repair or replacement of defective and nonconforming goods, or, at the Seller's option, the repayment of the price.

Seller excludes and disclaims any liability for lost profits, personal injury, interruption of service, or consequential incidental or special damages arising out of, resulting from, or relating in any manner to these goods.

This Limited Warranty does not cover defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, modification, or the attachment of improper devices to the goods. This Limited Warranty does not cover expendable items. This warranty is void when repairs are performed by a non-authorized person or service center. At the Seller's option, repairs or replacements will be made on-site or at the factory. If repairs or replacements are to be made at the factory, the Buyer shall return the goods prepaid and bear all the risks of loss until delivered to the factory. If Seller returns the goods, they will be delivered prepaid and Seller will bear all risks of loss until delivery to Buyer. Buyer and Seller agree that this Limited Warranty shall be governed by and construed by the laws of Germany.

The warranties contained in this agreement are in lieu of all other warranties expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

This Limited Warranty supersedes all prior proposals or representations oral or written and constitutes the entire understanding regarding the warranties made by Seller to Buyer. This Limited Warranty may not be expanded or modified except in writing signed by the parties hereto.