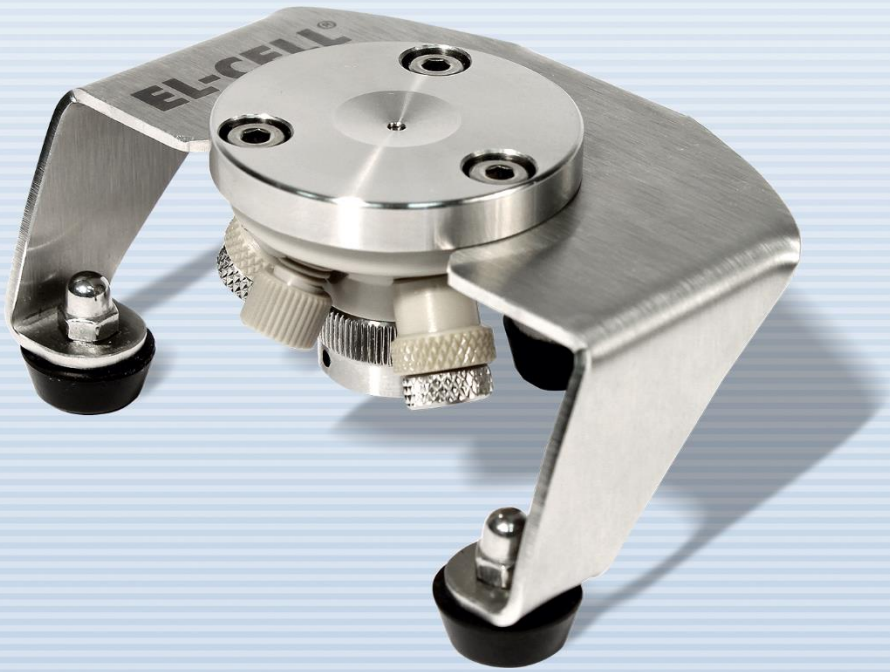
EL-CELL®
electrochemical test equipment

User Manual

Release 1.59

ECC-Opto-Std-Aqu

Electrochemical test cell



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The information provided in this documentation includes general descriptions and/or technical characteristics regarding the performance of the equipment described herein. This documentation cannot serve as a proper evaluation of the suitability or reliability of the equipment for any specific application by any user and 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 with respect to their specific application. EL-Cell GmbH cannot be held responsible or liable for any misuse of the information contained herein.

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

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

Manufacturer and customer service

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Email: support@el-cell.com

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

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

Shipping address for repairs

EL-Cell GmbH

Tempowerkring 8

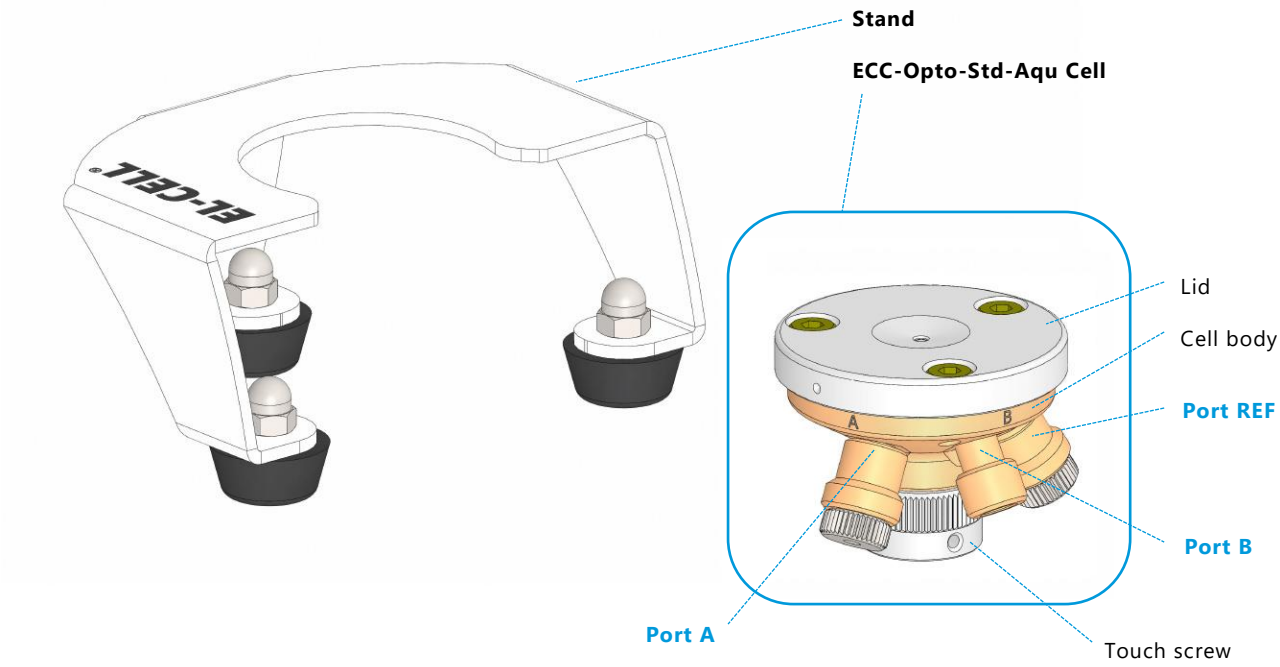
21079 Hamburg - Germany

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 Product Description

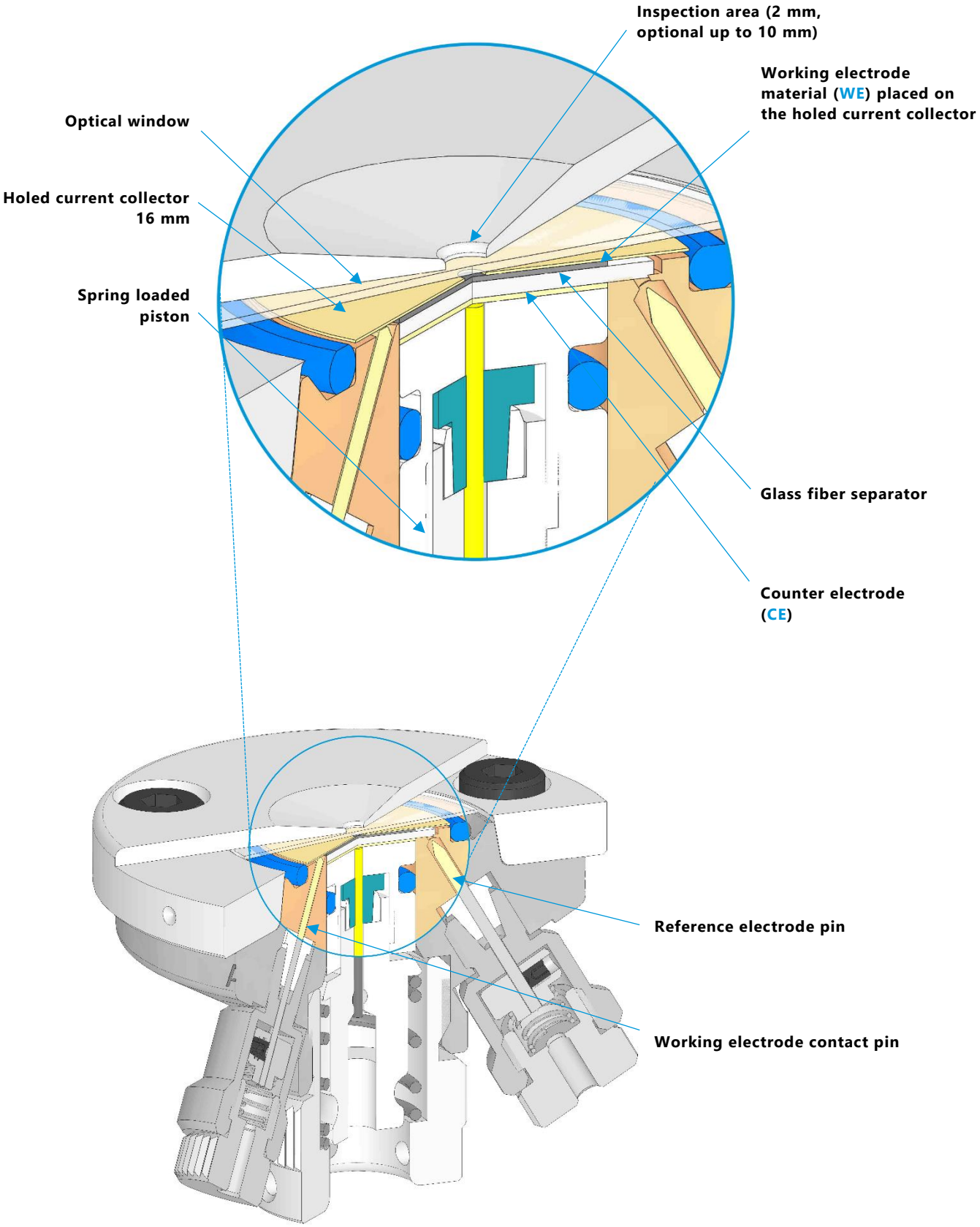
The ECC-Opto-Std-Aqu test cell is a version of the ECC-Opto-Std test cell specialized to highly corrosive aqueous and non-lithium aprotic electrolytes. For this purpose, current collectors are made of gold (optional nickel or platinum), replacing stainless steel. One restriction must be noted: Gold current collectors are not fully compatible with aprotic lithium-based electrolytes, as lithium may alloy with gold at very low potentials. With this in mind, the ECC-Opto-Std-Aqu may be operated almost the same way as the ECC-Opto-Std. The present manual only covers the standard sandwich operation mode. For the alternative side-by-side arrangement of electrodes, please refer to the manual of the ECC-Opto-Std.



2 Features

- 2- and 3-electrode cell with optical window for highly corrosive aqueous and non-lithium aprotic electrochemistry.
- Materials in media contact are gold, PEEK, and EPDM
- In the standard sandwich set-up, the backside of the disc-shaped working electrode material supported on a holed or meshed current collector can be observed through the optical window on top. The inspection area diameter is 2 mm by default (up to 10 mm optionally).
- Alternative side-by-side set-ups allow using electrode strips supported on continuous current collectors (metal foils) as both working and counter electrodes. The strips can easily be cut off from single-sided electrode films.
- Typically used with optical or Raman microscopy in the reflection mode. X-ray option with Beryllium window available.
- The provided optical window is made of borosilicate glass. Other window materials are available upon request.
- Easy and clean electrolyte filling via the vacuum (syringe) method.
  All necessary equipment is included.
- Cell assembly and filling may be carried out inside a glove box. Once sealed, the cell may be operated outside the box in an ambient atmosphere.
- Small and defined electrolyte volume down to 0.1 cm^3 due to minimized dead volume
- Connection to potentiostat/battery tester via 2 mm banana sockets. Adapters for 4 mm banana sockets are included
- Temperature operation range -20 to +70 °C

Working principle of the ECC-Opto-Std-Aqu (shown for the sandwich set-up):



3 Safety Precautions

Use proper safety precautions when using hazardous electrode materials and electrolytes. Wear protective glasses and gloves to protect you against electrolyte that may accidentally spill out during filling and disassembly. Upon cell disassembly, dispose all materials properly.

4 Assembly and Connection

The test cell can be used in several different configurations, which mainly differ in the type and size of the working electrode used, the charging geometry (the position of working and counter electrode relative to each other), and the connection to the potentiostat (2- or 3-electrode connection). In the following, the cell assembly is described for the standard sandwich geometry using PTFE bound activated carbon as the electrodes and aqueous sulfuric acid as the electrolyte.

Assembly:

1. Load a small amount of PTFE-bound activated carbon into the REF opening of the cell body. The reference pin mounted into port REF will later contact this reference material.

2. Push the counter electrode piston into the cell body to the uppermost position.

3. Pull the piston slightly back, and insert the gold current collector disc and the activated carbon counter electrode (max. 10 mm in diameter, max. 1 mm thick)

4. Put the provided glass fiber separator on top.

5. Place a self-standing PTFE-bound activated carbon electrode on the separator. The electrode must be larger than the 1 mm hole in the current collector, and should not exceed the 10 mm diameter of the counter electrode.

6. Cover the working electrode with the provided holed current collector. Note that the ductile working electrode will be pressed against the window on top in the fully assembled state. This way, the incident beam shines directly on the backside of the WE and does not have to pass an electrolyte layer.

7. Insert the upper O-Ring seal (16 x 1.8 mm) into the cell body and place the glass window on top. Make sure that the window is in the center position.

8. Attach the lid and fasten the three socket screws.

9. Attach the **WE** contact pin to **port A**.

10. Attach the reference pin to the reference port. If working without a reference electrode, plug the reference port.

11. Attach the touch screw from below and raise it to the uppermost position; then turn the touch screw back (counterclockwise) by about 30°.

12. Fill the cell with electrolyte (e.g. 3M sulfuric acid) according to the following procedure:

    - Connect the provided transfer line to **port B**.
    - Charge a 5 ml syringe with ca. 0.2 ml of electrolyte.

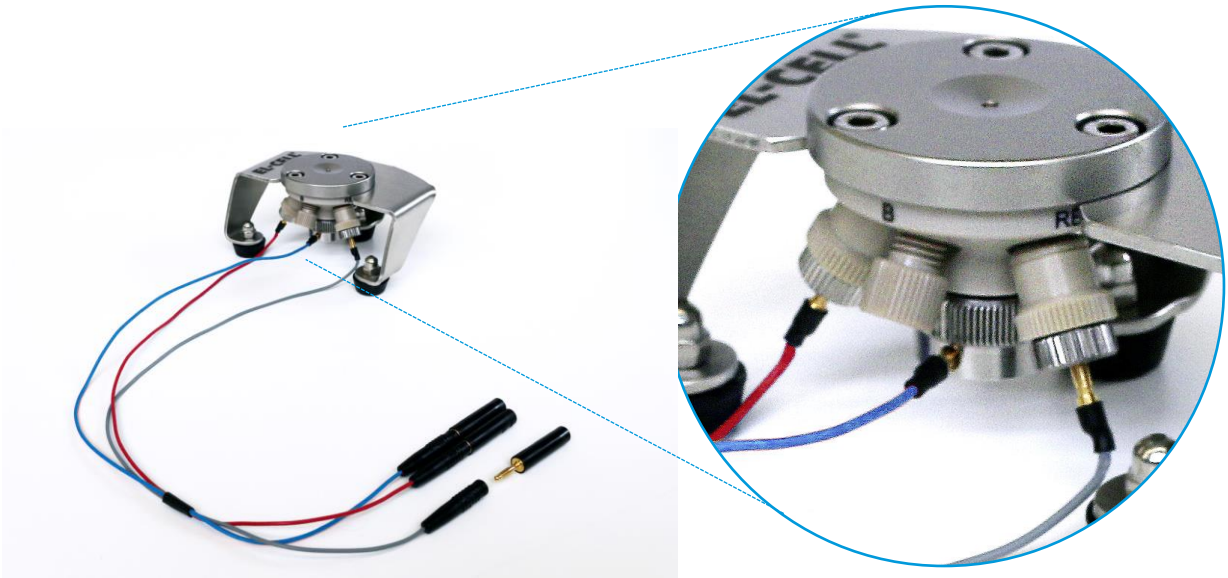
    NOTE: We recommend single-use PP plastic syringes with low friction silicone pistons.

    - Connect the syringe to the Luer adapter of the transfer line.
    - Pull the syringe piston back to evacuate the cell. Hold the piston a few seconds in the strained position.
        - Make sure that the tip of the syringe points downwards. Then release the piston, so that the electrolyte is sucked into the cell by the previously applied vacuum.
          NOTE: Never pressurize the cell during the filling procedure.
        - Remove the transfer line and close port B with the second contact pin.

13. Insert the cell into the stand.

14. Connect the cell cable as shown in the picture below.

15. Connect your potentiostat to the 2 mm sockets (1) of the cell cable (**grey: REF**; **red: WE**; **blue: CE**). Adapters (2) are provided for connection to 4 mm banana plugs.



5 Disassembly and Cleaning

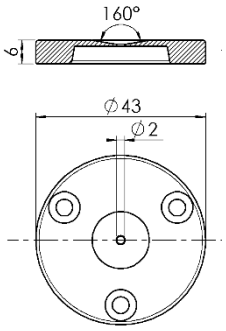
After use, disassemble the test cell in the reverse order of assembly. Dispose of electrodes and electrolytes properly. Clean wetted cell parts with deionized water and/or other appropriate detergent wash and solvent. The cell base and CE piston may be additionally cleaned in an ultrasonic bath. After cleaning with water, dry parts with compressed air. If working with aprotic electrolytes, and before building a new cell, dry parts overnight at 80°C under vacuum. This treatment is essential for PEEK parts and EPDM O-ring seals, as these parts may absorb water.

NOTES:

- Protect yourself against chemical hazards. Electrolytes may spill out during cleaning, and electrode materials and electrolytes may react with the ambient atmosphere or solvents used for cleaning. Wear appropriate protection equipment, such as 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.

6 Window Kits

ECC-Opto Borosilicate Glass Window (Standard)



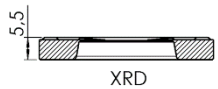
ECC1-00-0127-A

List of Components:

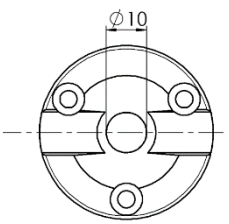
1. Glass window (1 pc, 22 x 0.3 mm) LAB0018
2. Lid (1 pc) ECC1-00-0127-A

ECC-Opto Beryllium window kit

ECC1-00-0156-B



XRD



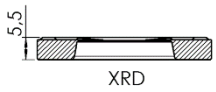
ECC1-00-0127-C

List of Components:

1. Beryllium window (1 pc, 22 x 0.2 mm) ECC1-00-0222-A
2. Lid (1 pc) ECC1-00-0127-C

ECC-Opto Beryllium Window Kit II

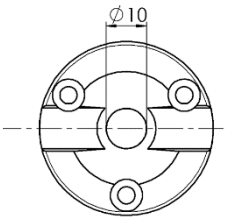
ECC1-00-0156-F



XRD

List of Components:

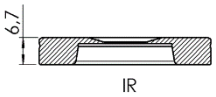
1. Beryllium window (1 pc, 22 x 0.2 mm) ECC1-00-0222-A
2. Lid (1 pc) ECC1-00-0127-M



ECC1-00-0127-C

ECC-Opto Polyimide Window Kit:

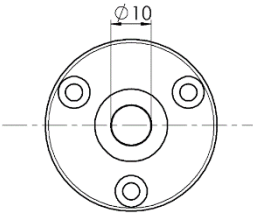
ECC1-00-0156-F



IR

List of Components:

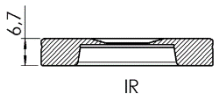
1. Polyimide (Cirlex) window (3 pcs, 22 x 0.23 mm) ECC1-00-0250-A
2. Lid (1 pc) ECC1-00-0127-C



ECC1-00-0127-E

ECC-Opto Zinc Selenide Window Kit:

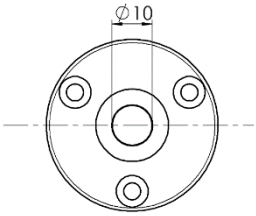
ECC1-00-0156-D



IR

List of Components:

1. Zinc Selenide window (1 pc, 22 x 1.0 mm) ECC1-00-0250-B
2. Lid (1 pc) ECC1-00-0127-E



ECC1-00-0127-E

ECC-Opto Calcium Fluoride Window Kit:

ECC1-00-0156-E

List of Components:

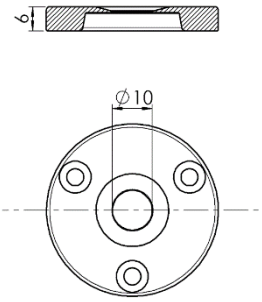
1. Calcium fluoride window (1 pc, 22 x 1.0 mm) ECC1-00-0250-C
2. Lid (1 pc) ECC1-00-0127-E

ECC-Opto Sapphire Window Kit:

ECC1-00-0156-C

List of Components:

1. Sapphire window (1 pc, 22 x 0.3 mm) ECC1-00-0149-A
2. Lid (1 pc) ECC1-00-0127-B



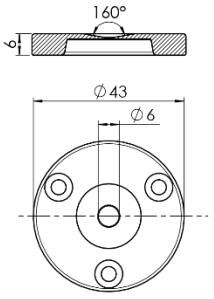
ECC1-00-0127-B

ECC-Opto Sapphire Window Kit II:

ECC1-00-0156-J

List of Components:

1. Sapphire window (1 pc, 22 x 0.3 mm) ECC1-00-0149-A
2. Lid (1 pc) ECC1-00-0127-H



ECC1-00-0127-H

7 Cell Holders

Cell Holder I for ECC-Opto-Std

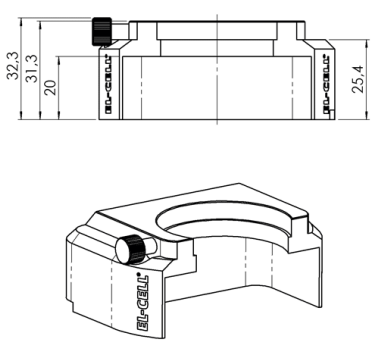
ECC1-00-0414-A

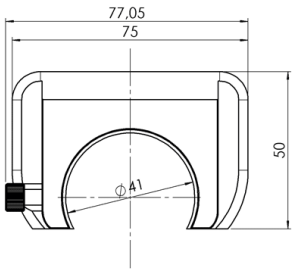
Measurements:

Height: 32 mm

Width: 75 mm

Depth: 50 mm





Cell holder I (ECC-Opto-Std)

ECC1-00-0414-A

Cell Holder II for ECC-Opto-Std

ECC1-00-0335-A

Measurements:

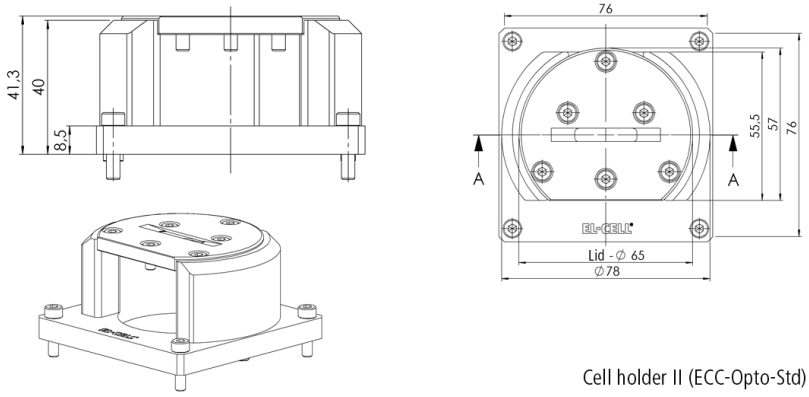
Height: 41.8 mm

Width: 78 mm

Depth: 76 mm

Designed for Bruker D8

Note: Only in combination with Lid ECC1-00-0127-M



Cell holder II (ECC-Opto-Std)
ECC1-00-0335-A

Cell Holder III for ECC-Opto-Std

ECC1-00-0419-A

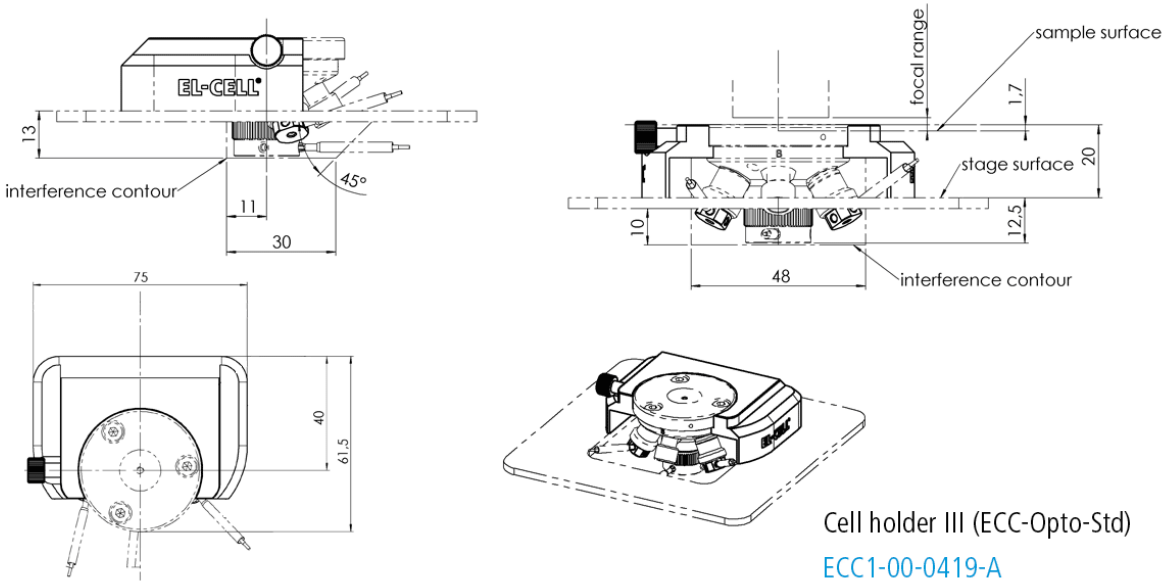
Measurements:

Height: 20 mm

Width: 75 mm

Depth: 61.5 mm

Designed for Bruker FTIR Hyperion 2000.



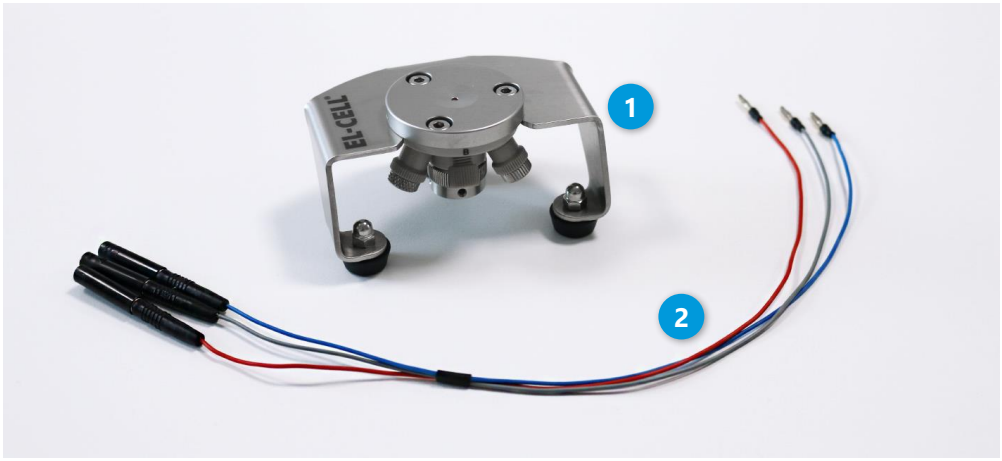
Cell holder III (ECC-Opto-Std)
ECC1-00-0419-A

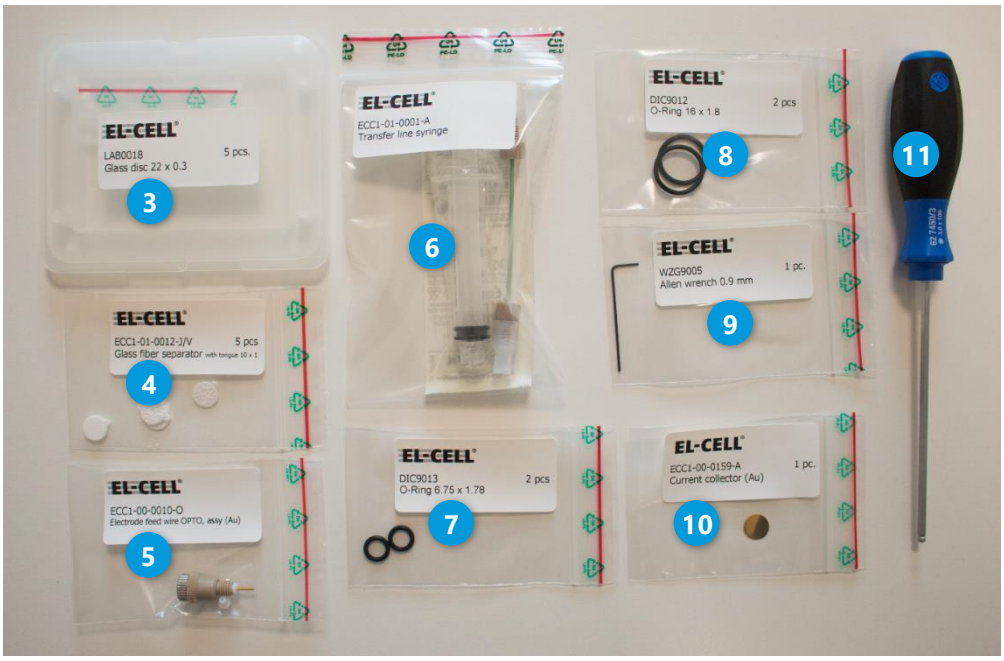
Note: The cell holders for our optical test cells can be customized on request.

8 Unpacking

Check the contents of the packages against the list given below to verify that you have received all of the required components. Contact EL-CELL, if anything is missing or damaged. **NOTE**: Damaged shipments must remain within the original packaging for freight company inspection.

List of components:





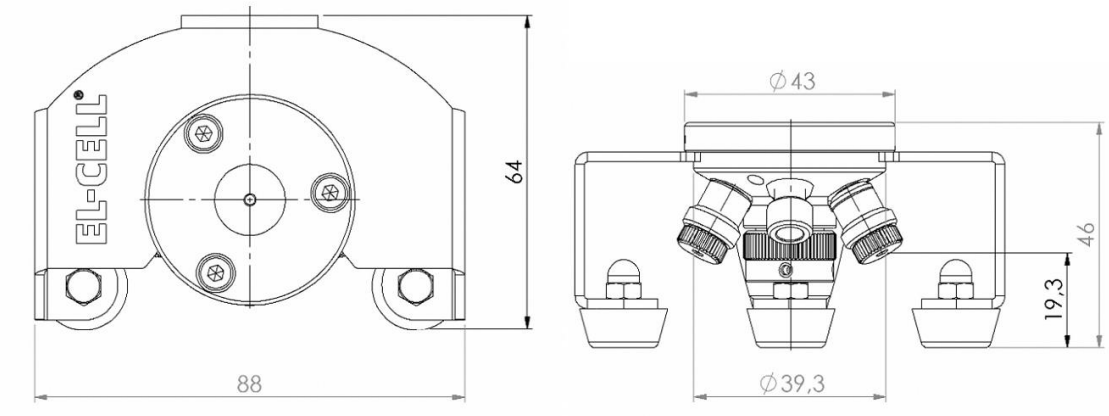
1 **ECC-Opto-Std-Aqu test cell with stand**, fully equipped for use in both 2-electrode and 3-electrode (reference) configuration in aqueous electrolytes

2 ECC-Opto cell cable ECE1-00-0075-A

3. Glass windows (5 pieces) LAB0018/V
4. Glass fiber separators (5 pieces) ECC1-01-0012-J/V
5. Feed wire (Au), assy ECC1-00-0010-O
6. Transfer line syringe (5 ml) for vacuum filling ECC1-01-0001-A
7. O-Ring 6.75 mm x 1.78 mm DIC9013
8. O-Ring 16 mm x 1.8 mm DIC9012
9. Hex wrench 0.9 mm WZG9005
10. Current Collector 10mm, Au ECC1-00-0159-A
11. Spherical hex screw driver 3 mm WZG9002

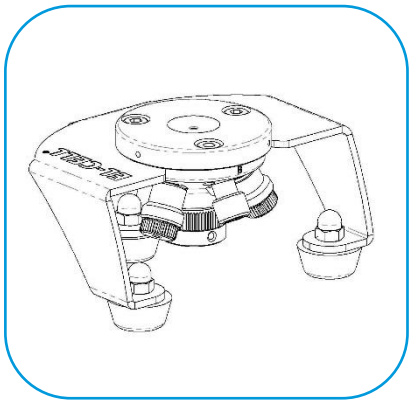
9 Technical data

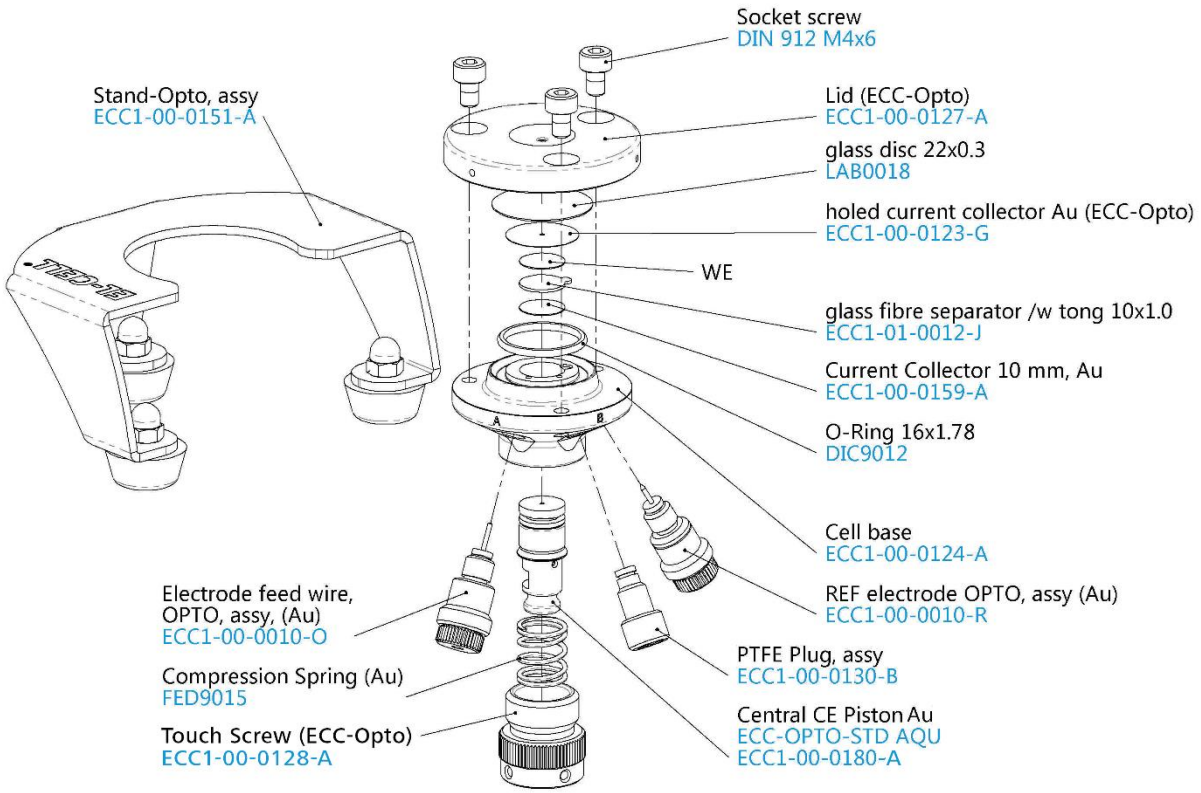
- Height / Width / Depth: : 46 / 88 / 64 mm
- Weight: approx. 0.2 kg
- Electrode diameter: 10 mm
- Electrolyte volume: min. 0.1 ml
- Temperature operation range -20 to +70 °C



10 Spare Parts

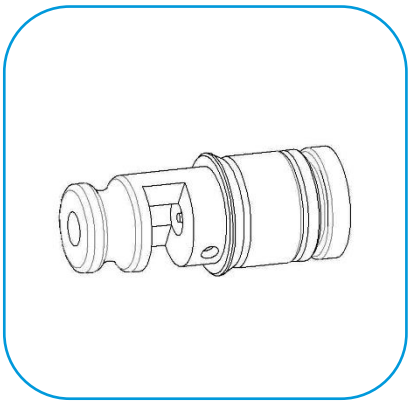
ECC-Opto-Std-Aqu Test Cell

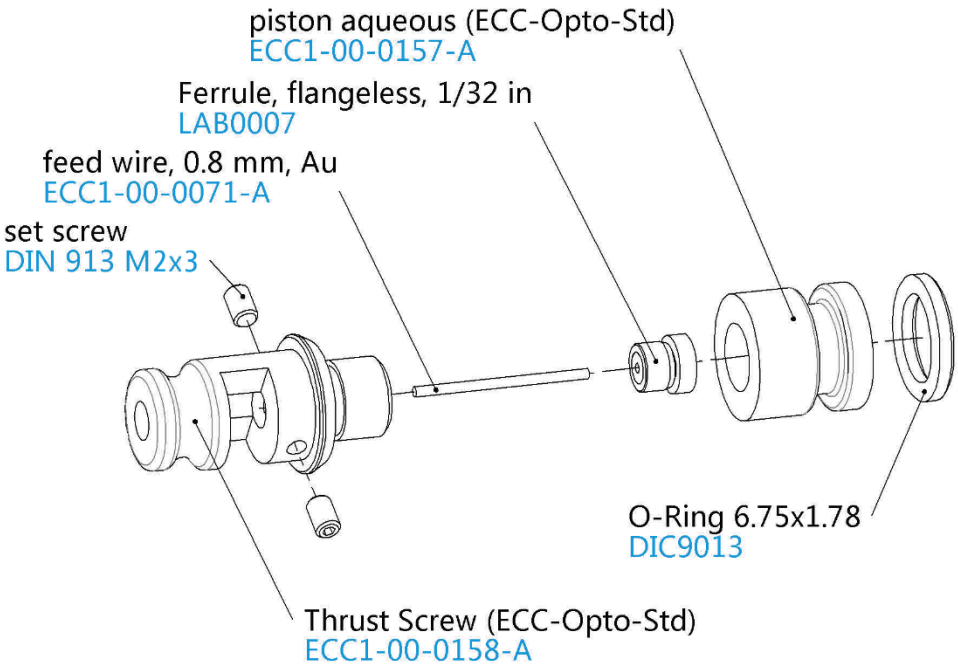




Central CE Piston Au

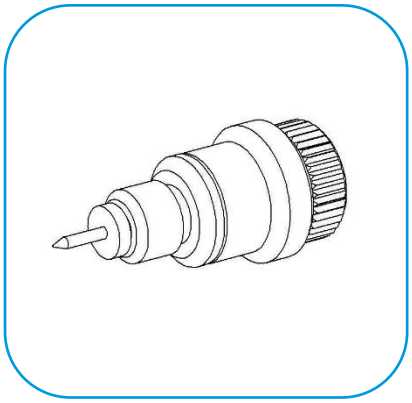
ECC-OPTO-STD AQU
ECC1-00-0180-A

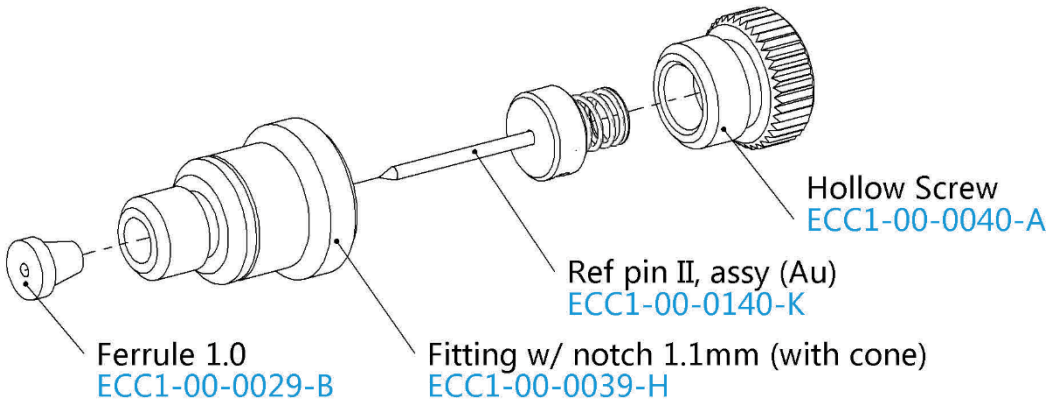




REF Electrode OPTO, assy (Au)

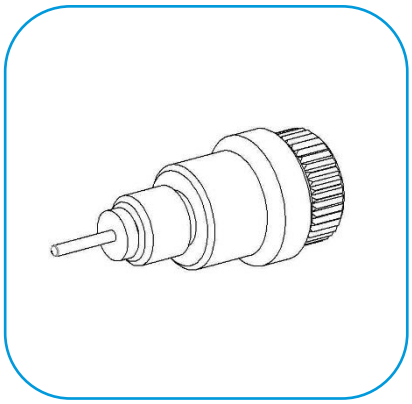
ECC1-00-0010-R

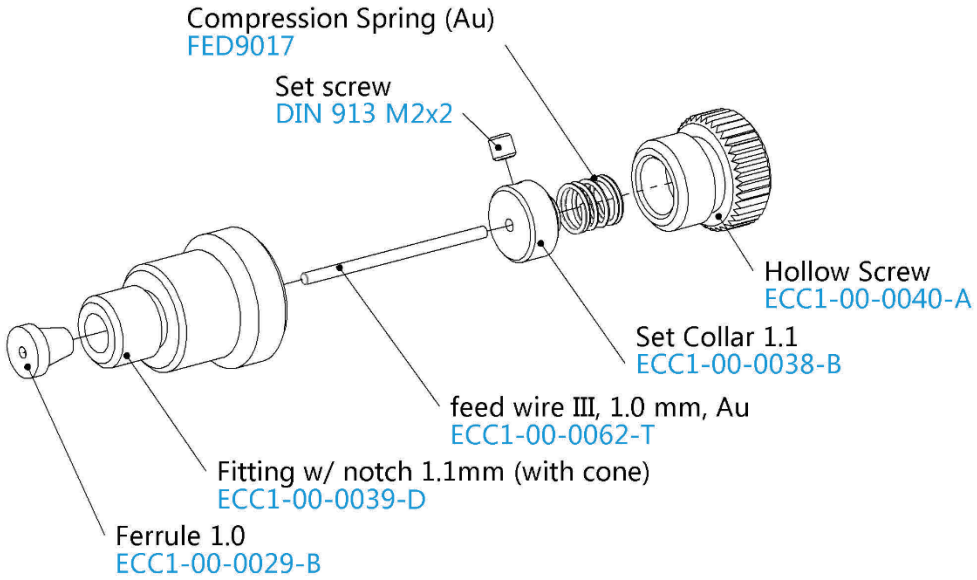




Electrode Feed Wire, OPTO, assy (Au)

ECC1-00-0010-O





11 Warranty

For a period of one year from the date of shipment, EL-Cell GmbH (hereinafter Seller) warrants the goods to be free from defect 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. Buyer's exclusive remedy is repair or replacement of defective and nonconforming goods, or, at Seller's option, the repayment of the price.

Seller excludes and disclaims any liability for lost profits, personal injury, interruption of service, or for 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 a non-authorized person or service center performs repairs. At 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, 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 in accordance with 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.