Catalog

Electrochemistry accessories.

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Our comprehensive product portfolio covers cutting-edge scientific products in such diverse applications as electrochemistry, battery testing and fuel cell/material testing.
And supporting these high-precision measurement tools is an extensive line of product accessories ranging from sophisticated quartz crystal microbalances to electrodes.
So whatever your research field, we can provide you with high-quality, hard-wearing equipment.
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Analytical Cells.

SVC-2

SVC-3

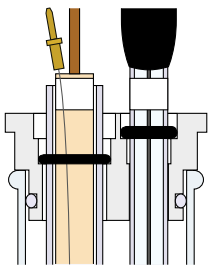
Small Volume Cells

Each voltammetry cell is designed for a specific application (specific working electrode, volume of solution, oxygen-free condition, etc.).
For example, for voltammetry investigations using standard working electrodes with an outer diameter (OD) of 6 mm, the fixed configuration of SVC-3 kit is recommended.
For applications requiring other working electrode shapes, SVC-2 is more suitable.
If only a small amount of the electroactive compound is available, SVC-2 in the microvolume mode is recommended. Here is a list of the available cells:

- SVC-2, modular
- SVC-3, for a volume of 5 to 20 mL, only for working electrode with OD of 6 mm
- VC-4, for a volume of 1 to 3 mL, only for working electrode with OD of 6 mm
- Bulk electrolysis cell, for a volume of 100 mL

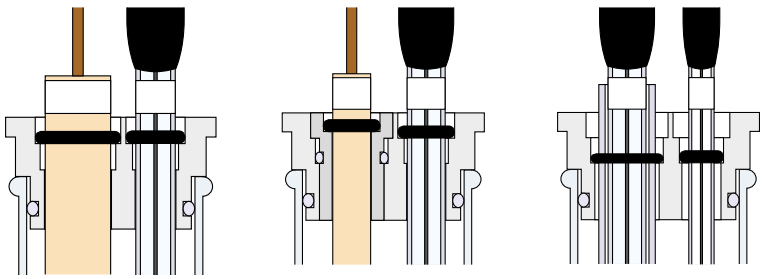
SVC-2 modularity:

microvolume mode



Small amount of solution
(200 µL in the sample holder)

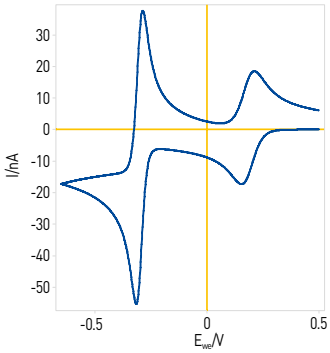
oxygen free mode



For electrode
with OD of 10 mm

For electrode
with OD of 6 mm

For microelectrode
with OD of 4 mm



Please note that a full, purpose-built, analytical kit is also available SK-2 (A-012763) but the reference electrode must be purchased separately.
This kit includes:

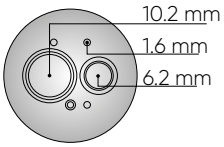
- SVC-3 kit (A-012669)
- PK-3 polishing kit (A-011975) see page 16
- one glassy carbon electrode, OD 6.0 mm, ID 3.0 mm (A-002012) see page 17
- one platinum electrode, OD 6.0 mm, ID 1.6 mm (A-002013) see page 17

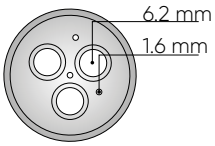
VC-4

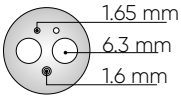
Bulk electrolysis cell

Small Volume Cells		Catalog n°		Catalog n°		Catalog n°		Catalog n°
Products	SVC-2	**A-012668**	SVC-3	**A-012669**	VC-4	**A-011224**	Bulk electrolysis cell	**A-001197**
Content								
Sample vial/mL	20 (7 pieces)	**A-001056**	20 (7 pieces)	**A-001056**	5 (7 pieces)	**A-011504**	100 (1 piece)	**A-012632**
Counter electrode (CE)/mm	57	**A-002222**	50	**A-002222**	57	**A-002222**	230	**A-002234**
PTFE cap		**A-012670**		**A-012671**		**A-011226**		**A-0 12551**
Purge tube (ETFE), 100 mm		**-**		**-**		**-**		**-**
Additional items	Adapter 10 to 6 mm	**-**			Cell holder	**A-011227**	Porous carbon electrode	**A-010530**
							Lid for CE	**A-001198**
							Chamber for CE	**A-001196**
							O-ring	**A-001236**
							Port plug	**A-009131**
							Stirrer bar	**A-000178**
Options								
Sample holder/mm	9.0 (2 pieces)	**A-012177**	6.0 (2 pieces)	**A-012176**				
Cell holder	for 20 mL	**A-001209**	for 20 mL	**A-001209**				
Purge tube (ETFE)/m	1	**A-010537**	1	**A-010537**	1	**A-010537**	1	**A-010537**
Working electrodes	See page 17		See page 17		See page 17			
Reference electrodes	See page 18		See page 18		See page 18		See page 18	

PTFE cap







Cell geometry

The geometry of the cell should be optimized to reduce the ohmic drop. Working and reference electrodes must be positioned close to one another. The counter electrode should not limit the transfer of electrons, so its contact surface should be larger than the contact surface of the working electrode.

Analytical Cells.

Large Volume Cells

An analytical cell available in sizes ranging from 50 to 250 mL that is particularly well-suited to larger volumes of electrolyte.

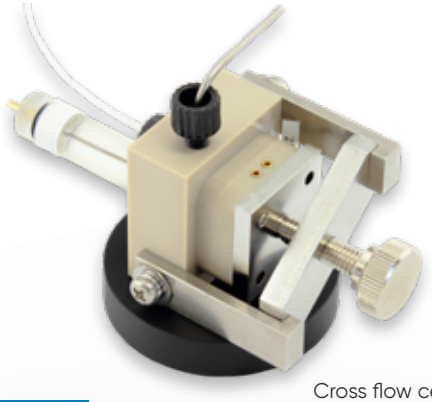
Two types of packages are available:

- A standard analytical cell kit
- A full analytical cell kit (which allows temperature control and gas purging)

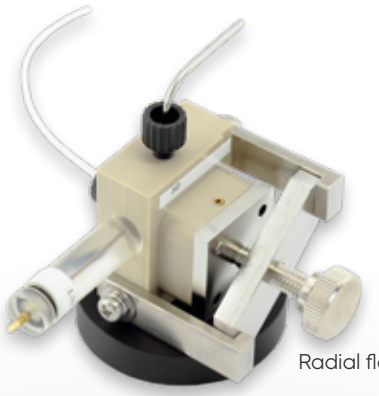
	Standard analytical cell kit (80 mL) EL-ELECTRO-1	Complete analytical cell kit (80 mL) EL-ELECTRO-2	Complete analytical cell kit (150 mL) EL-ELECTRO-3	Catalog n°
Glass cell 80 mL	■			**EL-A-001**
Double jacketed glass cell 80 mL		■		**EL-A-002**
Double jacketed glass cell 150 mL			■	**EL-A-020**
PTFE cap 5 holes	■	■	■	**EL-A-003**
PTFE ring, silicon encapsulated, OD 102 mm	■	■	■	**EL-A-004**
Cell collar with clamp	■	■	■	**EL-A-005**
Double purge tube		■	■	**EL-A-006**
Bridge tube for reference electrode, OD 6 mm	■	■	■	**EL-A-008**
Platinum counter electrode	■	■	■	**EL-A-009**
Purge tube	■			**EL-A-016**
Reference electrode RE-2BP Hg/Hg_2Cl_2 (Cells kits following RoHS recommendations are also provided, see below)	■	■	■	**A-013430**
Double nut 25 mm and 12 mm diameter		■	■	**EL-A-011**
Telescopic cell stand		■	■	**EL-A-012**
Options				
Electrode bridge extension for electroanalytical cell				**EL-A-022**
Bridge tube for reference electrode of OD 8 mm				**EL-A-017**
PT100 probe, indicate connector type				**EL-C-014**
Magnetic stirrer & heater, without PT100 probe — 220 V				**EL-C-015A**
Magnetic stirrer & heater, without PT100 probe — 110 V				**EL-C-015B**
Aluminum base holder for magnetic stirrer				**EL-C-018**
Set of 10 porous 4 mm glass frits (CoralPor™) with PTFE heat shrink (200 mm)				**092-VYC4**
Optional cells kits following RoHS recommendations				
EL-ELECTRO-1 cell with Ag/AgCl reference electrode				**EL-ELECTRO-1A**
EL-ELECTRO-2 cell with Ag/AgCl reference electrode				**EL-ELECTRO-2A**
EL-ELECTRO-3 cell with Ag/AgCl reference electrode				**EL-ELECTRO-3A**
EL-ELECTRO-1A compatible with **BluRev RDE** (comes with **094-A-CAP** an additional PTFE cap compatible with BluRev)				**EL-BLUREV**

EL-A-012

EL-A-002 EL-A-003 EL-A-004 EL-A-005 EL-A-008 EL-A-009 EL-A-022

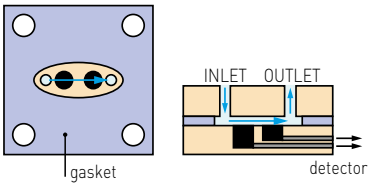
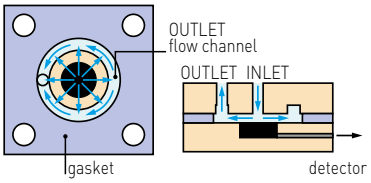


Cross flow cell

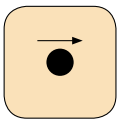


Radial flow cell

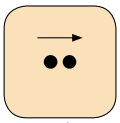
Flow Cells

	Cross Flow Cell	Catalog n°	Radial Flow Cell	Catalog n°
Product	Cross flow cell*	**A-012798**	Radial flow cell*	**A-012799**
Schematic diagram				

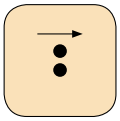
* Gasket, working, reference electrodes and connectors are sold separately



Single/radial flow



Dual, series/cross flow



Dual, parallel/cross flow

Options

Cross flow	Electrode	Glassy carbon	Ø 3 mm x 2 (dual type), size 25 x 25 mm	**A-001000**
		Gold	Ø 3 mm x 2 (dual type), size 25 x 25 mm	**A-001002**
		Platinum	Ø 3 mm x 2 (dual type), size 25 x 25 mm	**A-001012**
		Silver	Ø 3 mm x 2 (dual type), size 25 x 25 mm	**A-001008**
		Carbon paste	Ø 3 mm x 2 (dual type), size 25 x 25 mm	**A-001004**
		Nickel	Ø 3 mm x 2 (dual type), size 25 x 25 mm	**A-001009**
		Glassy carbon/gold	Ø 3 mm x 2 (dual type), size 25 x 25 mm	**A-001006**
		Glassy carbon/platinum	Ø 3 mm x 2 (dual type), size 25 x 25 mm	**A-012583**
	Gasket	TG-2M PTFE (4 pieces)	Film thickness 12 µm	**A-001046**
		TG-5M PTFE (4 pieces)	Film thickness 25 µm	**A-001047**
		TG-6M PTFE (4 pieces)	Film thickness 50 µm	**A-001048**
		TG-8M PTFE (4 pieces)	Film thickness 100 µm	**A-001049**
		TG-11M silicon (4 pieces)	Film thickness 500 µm	**A-001092**
		TG-12M silicon (4 pieces)	Film thickness 1,000 µm	**A-001093**
	Cross flow cell block		Material PEEK	**A-001032**
Radial flow	Electrode	Glassy carbon	Ø 6 mm (single type), size 25 x 25 mm	**A-001016**
		Glassy carbon	Ø 3 mm (single type), size 25 x 25 mm	**A-012124**
		Platinum	Ø 3 mm (single type), size 25 x 25 mm	**A-009908**
		Gold	Ø 3 mm (single type), size 25 x 25 mm	**A-011155**
		PFCE (Plastic Formed Carbon Electrode)	Ø 3 mm (single type), size 25 x 25 mm	**A-000999**
		Carbon paste	Ø 3 mm (single type), size 25 x 25 mm	**A-010251**
	Gasket	TG-2MR PTFE (4 pieces)	Film thickness 12 µm	**A-001146**
		TG-5MR PTFE (4 pieces)	Film thickness 25 µm	**A-001147**
		TG-6MR PTFE (4 pieces)	Film thickness 50 µm	**A-001148**
		TG-8MR PTFE (4 pieces)	Film thickness 100 µm	**A-012802**
		TG-11MR PTFE (4 pieces)	Film thickness 500 µm	**A-001192**
		TG-12MR PTFE (4 pieces)	Film thickness 1,000 µm	**A-001193**
	Radial flow cell block		Material PEEK	**A-001031**
Cross/ radial	RE-3VT Ag/AgCl reference electrode screw type		Size Ø 10 x 48 mm	**A-013488**
	RE-7VT Non-aqueous Ag/Ag^+ reference electrode screw type		Size Ø 10 x 48 mm	**A-013489**
	0.04" Single lead connector (2 pieces)			**A-012912**
	0.04" MM connector (10 pieces)			**A-013273**
	1/16" Peek tube		ID 0.25 mm, length 3.0 m	**A-001531**
	Dynaseal peek fingertight (10 pieces)		Screw for pipe connecting integrated 1/16"	**A-004130**

Corrosion Cells.

Standard Corrosion Cells

For corrosion applications, two packages for large volumes i.e. ~1 L are available:

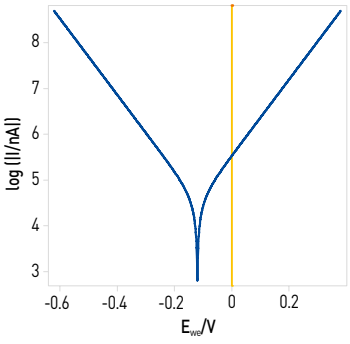
- A basic corrosion cell kit
- A complete corrosion cell kit (allows temperature control and includes sample holder and cell stand)

	Basic corrosion cell kit EL-CORR-1	Complete corrosion cell kit EL-CORR-2	Catalog n°
Glass cell 1 L	■		EL-C-001
Double jacketed glass cell 1 L		■	EL-C-002
PTFE cap	■	■	EL-C-003
PTFE ring, silicon encapsulated, OD 102 mm	■	■	EL-C-004
Cell collar with clamp	■	■	EL-C-005
Double purge tube		■	EL-C-006
Graphite counter electrode rod (2 pieces) ρ = 1.070 µΩ cm	■	■	EL-C-009
Double nut 25 mm and 12 mm diameter		■	EL-C-011
Telescopic cell stand		■	EL-C-012
Sample holder 1 cm^2 (max sample thickness 3.4 mm and max diameter 14.6 mm)		■	092-C-016
Purge tube	■		EL-C-016
Bridge tube for 8 mm diameter reference electrode	■	■	EL-C-017
Calomel reference electrode length 80 mm, OD 8 mm screw cap	■	■	R-XR300
Cable connection for screw cap 100 mm, 2 mm banana plug	■	■	R-A94L111
12 mm OD conical rings for reference electrode of 8 mm (4 pieces)	■	■	R-X31M012

Options

Bridge tube for 6 mm diameter reference electrode		EL-C-008
PT100 probe (indicate connector type)		EL-C-014
Magnetic stirrer & heater, without PT100 probe	220 V	EL-C-015A
	110 V	EL-C-015B
Aluminum base holder for magnetic stirrer and 1 L cell vial		EL-C-018
Set of 10 porous frits (4 mm CoralPor™) with PTFE heat shrink (200 mm)		092-VYC4

500 mL double jacketed glass cell is also available (EL-C-020).



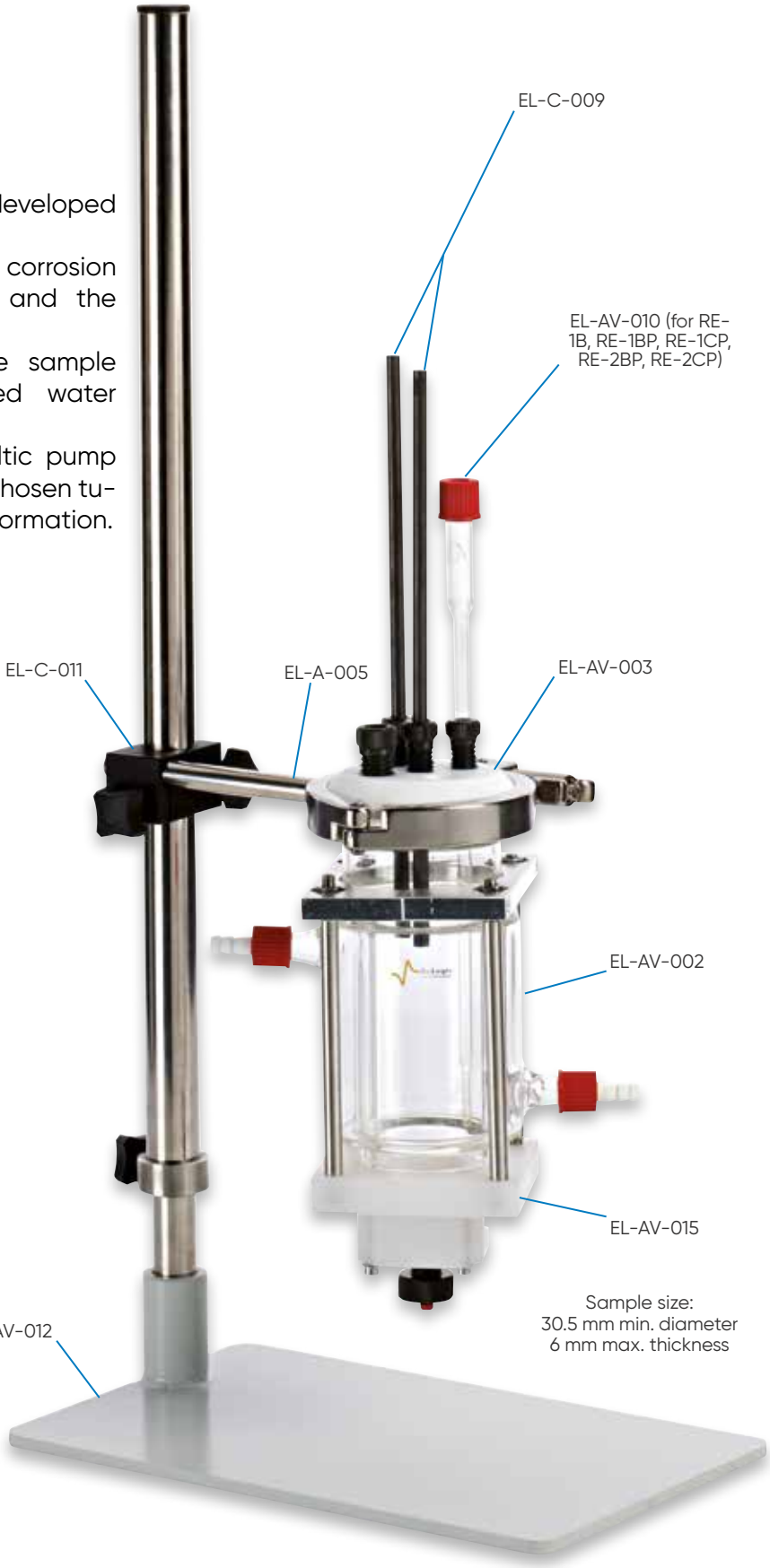
092-C-016

EL-C-002 EL-C-003 EL-C-004 EL-C-005 EL-C-017 EL-C-009

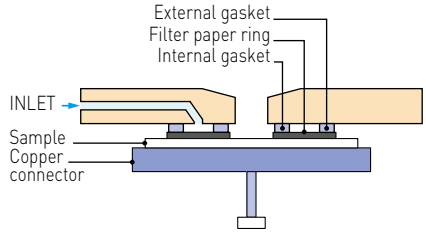
Avesta Cell

The Avesta Cell is an electrochemical cell developed for pitting corrosion testing (ASTM G150).
It is designed to avoid microcrevice corrosion formed between the working electrode and the gasket at the bottom aperture of the cell.
A filter paper ring placed between the sample and the gasket is flooded by distilled water in order to eliminate crevice corrosion.
The water flow is controlled by a peristaltic pump (EL-AV-008). The flow rate depends on the chosen tubings, contact your local retailer for more information.

Avesta Cell	Catalog n°
Avesta cell kit	**EL-AV-001**
Content	
Double jacketed cell glass 250 mL	**EL-AV-002**
PTFE cap 5 holes	**EL-AV-003**
O-ring PTFE silcone encapsulated	**EL-AV-004**
Cell collar with clamp	**EL-A-005**
Double purge tube	**EL-AV-006**
Filter paper ring (100 pieces)	**EL-AV-007**
Graphite counter electrode rods (2 pieces) ρ = 1.070 µΩ cm	**EL-C-009**
Bridge tube for RE 6 mm	**EL-AV-010**
Double nut	**EL-C-011**
Telescopic cell stand	**EL-AV-012**
Skeleton	**EL-AV-015**
Options	
Peristaltic pump for low flow	**EL-AV-008**
Bridge tube for reference electrode with OD of 8 mm	**EL-AV-013**
Single purge tube	**EL-AV-014**
Temperature probe PT100	**EL-C-014**
Set of 10 porous frits (4 mm CoralPor™) with PTFE heat shrink (200 mm)	**092-VYC4**



Principle of Avesta cell



Corrosion Cells.

Flat Cells,
1 to 10 cm² sample area

Sample size:
30.5 mm min. diameter (EL-FLAT)
40.5 mm min. diameter (EL-FLAT-2)
6 mm max. thickness

This cell with a volume of 250 mL is suited to perform experiments on flat specimens of 1 or 10 cm² surface area.
This cell has a double jacket for temperature control and three holes for reference electrodes, purge tubes and temperature probes with an inner diameter of 17.6 mm and the two others of 8.3 mm.

Flat Cell 1 cm²	Catalog n°
Flat cell kit 1 cm²	**EL-FLAT**
Content	
RE-2BP calomel reference electrode (length: 90 mm, OD: 6 mm)	**A-013430**
Platinum mesh counter electrode (54 mm wire/80 mesh), 25 x 35 mm	**A-702439**
Reference electrode bridge tube (6 mm diameter)	**EL-F-004**
Corrosion flat cell 1cm²	**EL-FLAT-3**
EL-FLAT-3 includes: - glass part for flat cell (250 mL) - mechanical part for corrosion flat cell 1 cm²	**EL-F-002** **EL-FLAT-3H**

Flat Cell 10 cm²	Catalog n°
Flat cell kit 10 cm²	**EL-FLAT-2**
Content	
RE-2BP calomel reference electrode (length: 90 mm, OD: 6 mm)	**A-013430**
Platinum mesh counter electrode (54 mm wire/ 80 mesh), 25 x 35 mm	**A-702439**
Reference electrode bridge tube (6 mm diameter)	**EL-F-004**
Corrosion flat cell 10 cm²	**EL-FLAT-4**
EL-FLAT-4 includes: - glass part for flat cell (250 mL) - mechanical part for corrosion flat cell 10 cm²	**EL-F-002** **EL-FLAT-4H**

Investigations in agressive media

If the experiment is performed in more agressive media such as fluorhydric acid, it is possible to obtain the body of the flat cell in PVDF* instead of glass.

	Fluorhydric acid 48%		**Sulfuric acid** 98%		**Phosphoric acid** 85%		**Hydrochloric acid** 35%		**Nitric acid** 70%		**Perchloric acid**		**Sodium hydroxide** 50%		**Potassium hydroxide** concentr.	
Temperature	20° C	50° C	20° C	50° C	20° C	50° C	20° C	50° C	20° C	50° C	20° C	50° C	20° C	50° C	20° C	50° C
PTFE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PVDF*	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Borosilicated glass	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

■ excellent
■ good
■ not recommended
■ not compatible

Options	Catalog n°
PVDF* body (single-jacketed)	**EL-F-PVDF**
EPDM O-rings for 1 cm² with PEEK ferrule for CE**	**EL-SEAL-1B**
EPDM O-rings for 10 cm² with PEEK ferrule for CE**	**EL-SEAL-10B**
PTFE O-rings for 1 cm² with PEEK ferrule for CE**	**EL-SEAL-T1B**
PTFE O-rings for 10 cm² with PEEK ferrule for CE**	**EL-SEAL-T10B**
EPDM O-rings for 1 cm²**	**EL-SEAL-1**
EPDM O-rings for 10 cm²**	**EL-SEAL-10**
PTFE O-rings for 1 cm²**	**EL-SEAL-T1**
PTFE O-rings for 10 cm²**	**EL-SEAL-T10**
Set of 10 porous frits (4 mm CoralPor™) with PTFE heat shrink (200 mm)	**092-VYC4**

* Polyvinylidenefluoride
** The O-ring kits include 4 O-rings for the glassware side and 10 O-rings for the sample side

Sample size:
30.5 mm min. diameter (EL-GAL-1)
40.5 mm min. diameter (EL-GAL-10)
6 mm max. thickness

Galvanic Cells, 1 to 10 cm² sample area

Thanks to the modular design of the flat cell, it is possible to place two different materials at each end of the cell. The surface area may be 1 or 10 cm².

Galvanic Cell 1 cm²	Catalog n°
Galvanic cell kit 1 cm²	**EL-GAL-1**
Content	
Flat cell kit 1 cm²	**EL-FLAT**
Galvanic kit 1 cm²	**092-FLAT/1**

Galvanic Cell 10 cm²	Catalog n°
Galvanic flat cell kit 10 cm²	**EL-GAL-10**
Content	
Flat cell kit 10 cm²	**EL-FLAT-2**
Galvanic kit 10 cm²	**092-FLAT/10**

Plate Material Evaluating Cell, up to 1 cm² sample area

This cell was developed to evaluate a plate material such as metals, semi-conducting plates, etc.
The sample plate is sandwiched between the two cell blocks. The required volume of solution is about 1 mL.

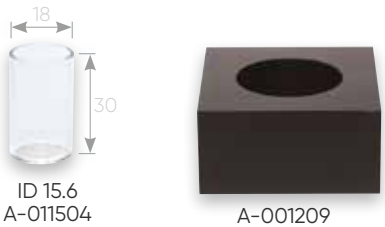
Plate Material Evaluating Cell	Catalog n°
Plate material evaluating cell	**A-011951**
Content	
PTFE cell [body & base] (1 piece)	-
O-ring (1 piece)	-
Screw 20 mm (1 piece)	-
Purging tube, 100 mm	-
Platinum counter electrode (1 piece)	**A-002222**
Options	
O-ring (10 pieces)	**A-012022**

Coating Cell

Coating Cell	Catalog n°
Coating cell kit	**EL-COAT**
Content	
Glass for coating cell	**EL-P-002**
Nylon base with three feet	**EL-P-003**
Rubber cup with two holes	**EL-P-004**
Metallic clamp	**EL-P-005**
O-ring for coating cell	**EL-P-006**
Graphite rod counter electrode (L: 145 mm, OD: 6 mm, ρ = 1.070 µΩ cm)	**EL-P-009**
Options	
RE-1B Ag/AgCl reference electrode (OD: 6 mm)	**A-012167**
Bridge tube for 6 mm reference electrode	**EL-P-008**
Mask for 1 cm² (20 pieces)	**EL-P-011**
Mask for 3 cm² (20 pieces)	**EL-P-012**
Mask for 10 cm² (20 pieces)	**EL-P-013**

Small Volume Cell Vials
up to 200 mL

To complete a kit, the cell vials are also available separately.
Please note that other volumes are available on request.

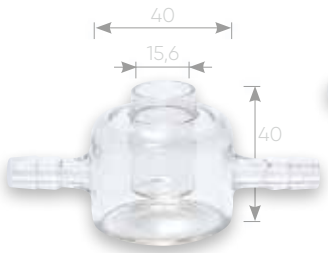


ID 15.6
A-011504

A-001209
cell holder for
A-001056

ID 25.6
A-001056

ID 46.4
A-012632



A-012672

A-001051

A-012652

Small & Large Volume Cell Vials		Volume/mL	OD/mm	ID/mm	Height/mm	Quantity	Purpose	Catalog n°
Small Volume Cell Vials	Simple vial	5	18	15.6	30	10	VC-4	**A-011504**
		20	28	25.6	50	10	SVC-2, SVC-3	**A-001056**
		100	50	46.4	72	1	RRDE-3A, bulk electrolysis	**A-012632**
	Water jacketed-glass vial	5	40	15.6	40	1	VC-4	**A-012672**
		20	55	25.6	50	1	SVC-2, SVC-3	**A-001051**
		100	70	46.4	80	1	RRDE-3A, bulk electrolysis	**A-012652**
	Simple vial for alkaline solution	100	51.5	46.5	72	10	RRDE-3A, bulk electrolysis	**A-013580**
		200	67	62	72	8	RRDE-3A, bulk electrolysis	**A-013581**
	Cell holder for 20 mL vial	-	-	-	-	1	SVC-2, SVC-3	**A-001209**
	PTFE cap for 100 mL cells	-	-	-	-	1	For **A-012632**, **A-012652**, **A-013580**	**A-012631**
	PTFE cap for 200 mL cells	-	-	-	-	1	For **A-013581**	**A-013582**
Large Volume Cell Vials	Simple vial	80	90	62	80	1	EL-ELECTRO-1	**EL-A-001**
		250	-	-	-	1	EL-FLAT, EL-FLAT-2, EL-GAL-1, EL-GAL-10	**EL-F-002**
		1,000	120	90	175	1	EL-CORR-1	**EL-C-001**
	Water jacketed-glass vial	80	90	62	85	1	EL-ELECTRO-2	**EL-A-002**
		150	-	-	-	1	EL-ELECTRO-3	**EL-A-020**
		1,000	120	90	200	1	EL-CORR-2	**EL-C-002**
		2,000	-	-	-	1	EL-CORR-2	**EL-C-021**
	Cell holder for king-size vial (1 L)					1	EL-CORR-1	**EL-C-018**

Large Volume Cell Vials
up to 2,000 mL

EL-A-001

EL-A-002

EL-C-001

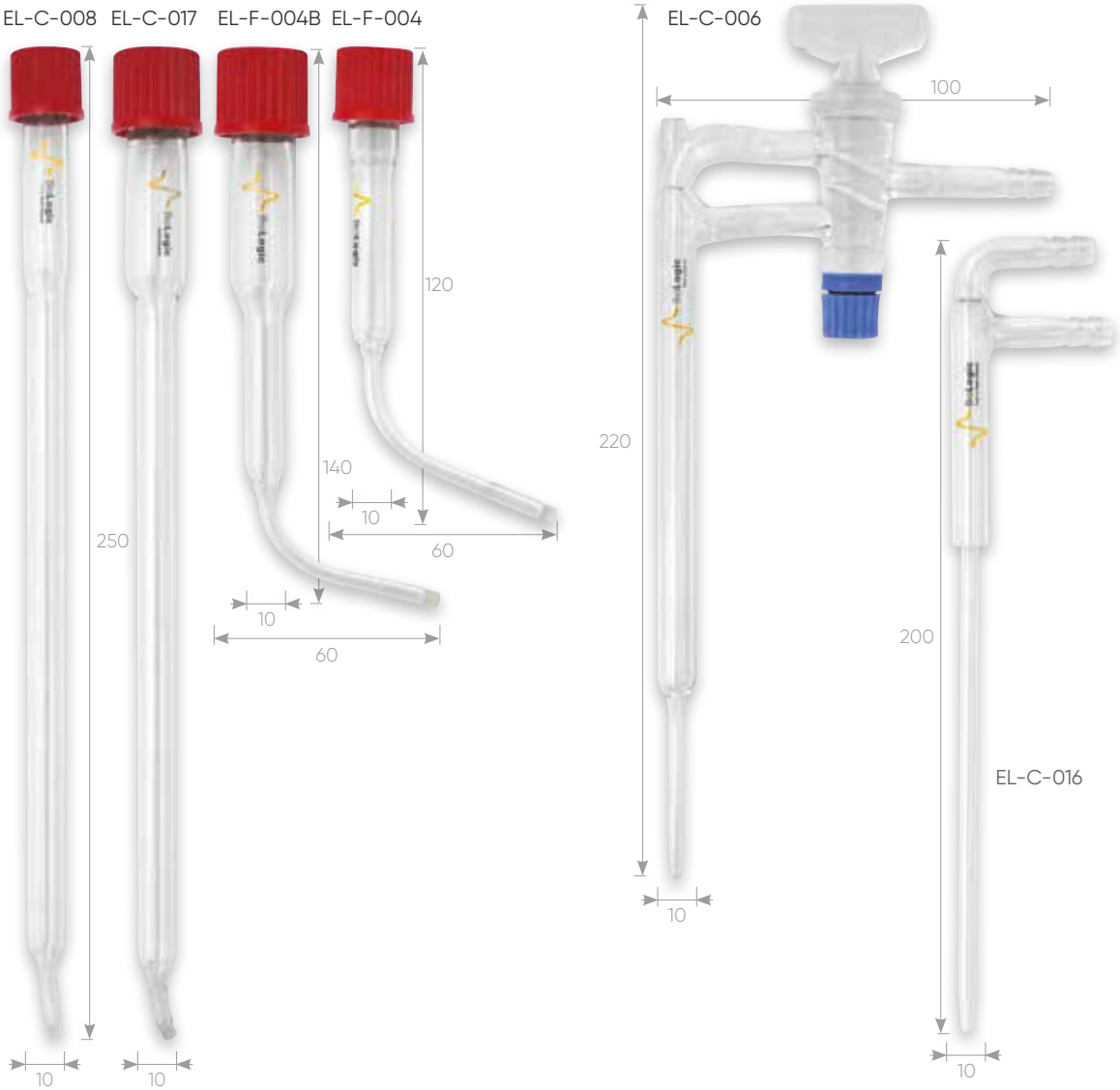
EL-C-018,
cell holder for EL-C-001

EL-C-002

Dimensions in mm

Bridge & Purge Tubes
for corrosion cells

The tolerance of each dimension is approximately ±0.5 mm.



Dimensions in mm

Small-Size Bridge Tubes

Bridge & Purge Tubes
for analytical cells

Bridge Tubes
for king-size reference electrodes

Dimensions in mm

Glassware		OD/ mm	Height/ mm	Quan-tity	Purpose	Vycor type compati-bility	Catalog n°
Small-size bridge tube	Ø 6 mm	6	68	2	SVC-2, SVC-3	**092-VYC3**(1)	**A-012176**
	Ø 6 mm	6	68	22	SVC-2, SVC-3		**A-012306**
	Ø 9 mm	9	68	2	SVC-2		**A-012177**
	Ø 9 mm	9	68	22	SVC-2		**A-012307**
Bridge tube for corrosion cells	Ø 6 mm	10	250	1	EL-CORR	**092-VYC4**(2)	**EL-C-008**
	Ø 8 mm	10	250	1	EL-CORR		**EL-C-017**
	Ø 6 mm	10	120	1	EL-FLAT		**EL-F-004**
	Ø 8 mm	10	140	1	EL-FLAT		**EL-F-004B**
Bridge tube for analytical cells	Ø 8 mm	10	165	1	EL-ELECTRO		**EL-A-017**
	Ø 6 mm	10	155	1	EL-ELECTRO		**EL-A-008**
Purge tube for analytical cells	Single	10	165	1	EL-ELECTRO		**EL-A-016**
	Double	10	200	1	EL-ELECTRO		**EL-A-006**
Purge tube for corrosion cells	Single	10	200	1	EL-CORR		**EL-C-016**
	Double	10	220	1	EL-CORR		**EL-C-006**
Bridge tube with ceramic junction	Short	12	70	1			**R-AL100**
	Standard	8	250	1			**R-AL110**
	With reverse sleeve (non aqueous)	8	138	1			**R-AL210**
	Standard	8	138	1			**R-AL120**
Options							
(1) Set of 10 porous 2.8 mm glass frits (CoralPor™) with PTFE heat shrink (200 mm)							**092-VYC3**
(2) Set of 10 porous 4 mm glass frits (CoralPor™) with PTFE heat shrink (200 mm)							**092-VYC4**

Working Electrodes

To address every application, a wide range of working electrodes (WE) is available with diameters ranging from 7 µm up to 6 mm and built with different materials.

Dimensions in mm

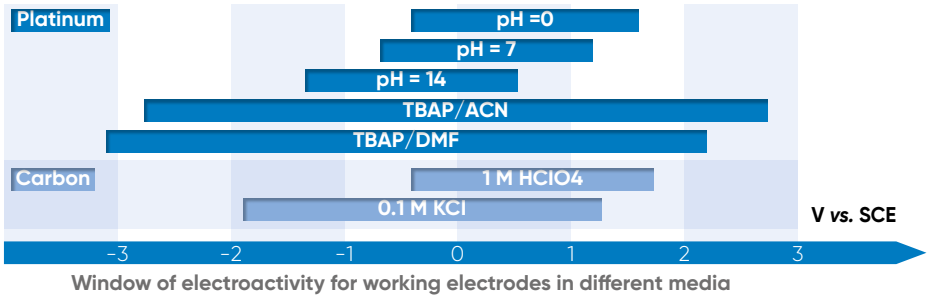
BioLogic exclusive

M-BDD-3: Boron-doped diamond 3 mm diameter disk

Maintenance of working electrodes

To refresh the electrode surface, we recommend polishing it before each measurement.

	Catalog n°
PK-3 electrode polishing kit	**A-011975**
Content	
0.05 µm polishing alumina (20 mL)	**A-001050**
1 µm polishing diamond (10 mL)	**A-002054**
Glass plate (1 piece)	**A-002249**
Alumina polishing pad (10 pieces)	**-**
Diamond polishing pad (10 pieces)	**-**
Spare parts	
Alumina polishing pad (20 pieces)	**A-001040**
Diamond polishing pad (20 pieces)	**A-001041**
Emery paper UF800 (20 pieces)	**A-012611**
Coarse polishing pad (20 pieces)	**A-001042**
6 µm polishing diamond (10 mL)	**A-002053**



Window of electroactivity for working electrodes in different media

Working Electrodes			Isolation	OD/mm	Electrode Ø ±4%	Catalog n°
Carbon	Long glassy carbon electrode		PEEK	6	3 mm	**A-012744**
	Standard glassy carbon electrode		PEEK	10	5 mm	**A-002417**
			PEEK	6	3 mm	**A-002012**
			PEEK	6	1.6 mm	**A-012297**
			PEEK	6	1 mm	**A-002411**
	Small glassy carbon electrode		PEEK	3	1.6 mm	**A-012298**
			PEEK	3	1 mm	**A-002412**
	Micro carbon fiber electrode		glass	4	33 µm	**A-002002**
			glass	4	7 µm	**A-002007**
	Standard pyrolytic graphite electrode	Basal plane	PEEK	6	3 mm	**A-002252**
		Edge plane	PEEK	6	3 mm	**A-002253**
	Standard pfce carbon electrode		PEEK	6	3 mm	**A-002408**
			PEEK	6	1 mm	**A-002409**
	Small pfce carbon electrode		PEEK	3	1 mm	**A-011854**
Platinum (99.95% purity)	Platinum gauze electrode 80 mesh		PEEK	-	25 x 35 mm	**A-002250**
	Long platinum electrode		PEEK	6	3 mm	**A-012745**
	Standard platinum electrode		PEEK	10	5 mm	**A-002420**
			PEEK	6	3 mm	**A-002422**
			PEEK	6	1.6 mm	**A-002013**
	Small platinum electrode		PEEK	3	1.6 mm	**A-002313**
	Micro platinum electrode		glass	4	100 µm	**A-002009**
			glass	4	25 µm	**A-002003**
			glass	4	15 µm	**A-002015**
			glass	4	10 µm	**A-002005**
Gold	Gold gauze electrode 100 mesh		PEEK	-	25 x 35 mm	**A-002251**
	Long gold electrode		PEEK	6	3 mm	**A-012746**
	Standard gold electrode		PEEK	10	5 mm	**A-002418**
			PEEK	6	3 mm	**A-002421**
			PEEK	6	1.6 mm	**A-002014**
	Small gold electrode		PEEK	3	1.6 mm	**A-002314**
	Micro gold electrode		glass	4	100 µm	**A-002010**
			glass	4	25 µm	**A-002004**
			glass	4	10 µm	**A-002006**
Silver	Standard silver electrode		PEEK	10	5 mm	**A-002416**
			PEEK	6	3 mm	**A-002419**
			PEEK	6	1.6 mm	**A-002011**
	Small silver electrode		PEEK	3	1.6 mm	**A-002315**
Palladium	Standard palladium electrode		PEEK	6	1.6 mm	**A-002019**
	Small palladium electrode		PEEK	3	1.6 mm	**A-002319**
Nickel	Standard nickel electrode		PEEK	6	1.5 mm	**A-002016**
	Micro nickel electrode		glass	4	100 µm	**A-002273**
Copper	Standard copper electrode		PEEK	6	1.6 mm	**A-002017**
			PEEK	6	3 mm	**A-012584**
	Micro copper electrode		glass	4	25 µm	**A-002271**
Iron (99.65% purity)	Standard iron electrode		PEEK	6	1.5 mm	**A-002018**
			PEEK	6	3 mm	**A-012585**
Carbon paste	Standard carbon paste electrode hole depth 4 mm		PEEK	6	3 mm	**A-002210**
	Small carbon paste electrode hole depth 4 mm		PEEK	3	1.6 mm	**A-002223**
	Cpo carbon paste oil base 1 g					**A-001010**
Boron-doped diamond	Doping level between 500 and 1000 ppm. The electrode is 500 µm thick disk attached to a conductive rod in brass. It is polished with an Ra<10 nm.		PEEK	7	3 mm	**M-BDD-3**

King-Size Reference Electrodes

King-Size Reference Electrodes	Connection type	Junction	Length	OD/mm	Catalog n°
Red rod reference electrode	Banana cable	Ceramic	103 mm	7.5	**R-REF201**
Ag/AgCl reference electrode Sat KCl for CV	Screw cap(1)	Ceramic	120 mm	8	**R-XR300**
Red rod reference electrode in 1 M KNO_3	Screw cap(1)	Fiber rod	120 mm	8	**R-XR440**
Ag/AgCl reference electrode for EIS	Screw cap(1)	Ceramic	160 mm	8	**R-XR820***
Options					
(1) Cable connection for screw cap electrode. We recommend you use this cable to connect these reference electrodes to BioLogic instruments.	Banana plug of 2 mm		100 mm		**R-A94L111**
	Banana plug of 4 mm		1 m		**R-CL111**
Salt bridges		Ceramic	70 mm	12	**R-AL100**
		Ceramic	138 mm	8	**R-AL120**
		Ceramic	250 mm	8	**R-AL110**
Salt bridge with reverse sleeve, non aqueous			138 mm	8	**R-AL210**
Conical rings for 8 mm OD 12 mm electrodes (4 pieces)					**R-X31M012**

*Ground joint Rin = 14.5/23

How to check your reference electrode

To check your reference electrode, perform an EIS measurement with a two-electrode connection. Choose Galvano Mode EIS (GEIS) to avoid polarization of your reference electrode.

The reference electrode is used as a working electrode and a platinum or gold electrode can be used as counter electrode.

The impedance of the reference electrode should be below 1 kΩ. If it is higher, the junction needs to be replaced.

Counter Electrodes

Dimensions in mm

Metallic Electrodes

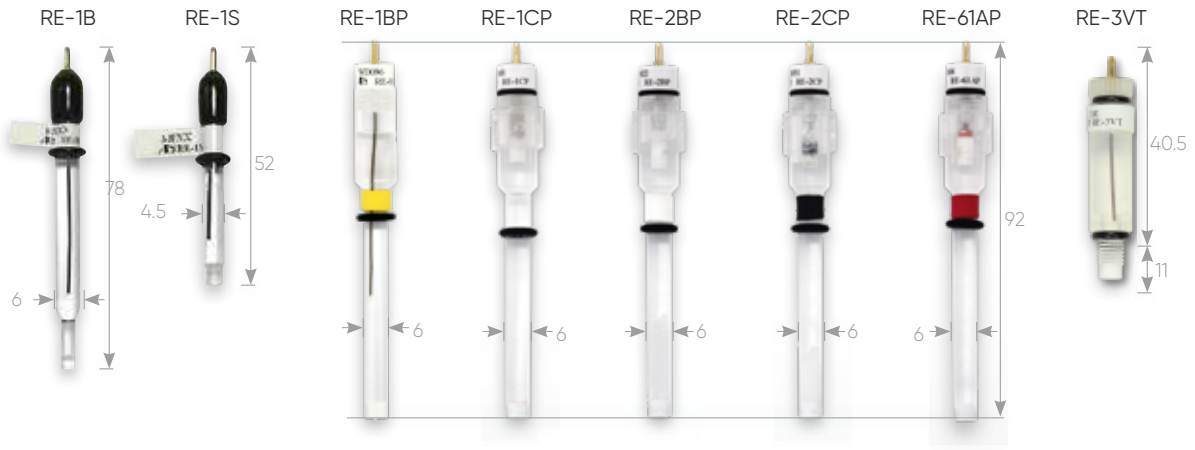
Counter Electrodes	Size/mm	Wire Ø/mm	Surf. area/ cm^2	Purpose	Catalog n°
Platinum*	57	0.5	~ 0.7	SVC-2, VC-4, plate material evaluating cell	**A-002222**
	50	0.5	~ 0.7	SVC-3	**A-002233**
	230	0.5	~ 3.6	RRDE-3A, bulk electrolysis, SVC-3	**A-002234**
Gold	230	0.5	~ 3.6	RRDE-3A, bulk electrolysis, SVC-3	**A-012638**
Nickel	230	0.5	~ 3.6	RRDE-3A, bulk electrolysis, SVC-3	**A-012639**
Stainless steel	50	1.5	~ 2.35	Flow cell	**A-012198**
Platinum* gauze electrode, PEEK body 80 mesh	25x35	0.08	~ 22.9		**A-002250**
Platinum* gauze electrode, 54 mm wire 80 mesh	25x35	0.08	~ 22.9	Flat cell	**A-702439**
Platinum* electrode for bulk electrolysis cell 80 mesh	40x50	0.5	~ 47.4	Bulk electrolysis cell	**A-013612**
Gold gauze electrode, PEEK body 100 mesh	25x35	0.07	~ 29		**A-002251**

*99.95 % purity

Metallic Electrodes	Length/mm	OD/mm	Wire dimension/ mm	Catalog n°
Platinum(1)	80	8	Ø 1	**R-XM110**
	120	8	Plate 5x5	**R-XM120**
	120	8	Plate 8x8	**R-XM140**
	120	12	Disk of 10	**R-XM150**
Options				
(1) Cable connection for screw cap electrode. We recommend you use this cable to connect these references electrodes to BioLogic instruments.	100 mm, banana plug of 2 mm			**R-A94L111**
	1 m, banana plug of 4 mm			**R-CL111**
Conical rings for 8 mm OD 12 mm electrodes (4 pieces)				**R-X31M012**

Small-Size Reference Electrodes
for aqueous media

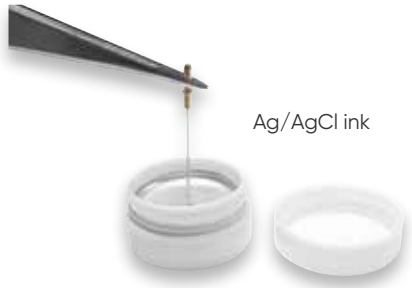
Reference electrodes are divided into two groups according to the media in which the electrode is immersed (aqueous or organic media).



Small-Size Reference Electrode for Aqueous Media (Ag/AgCl, Hg)

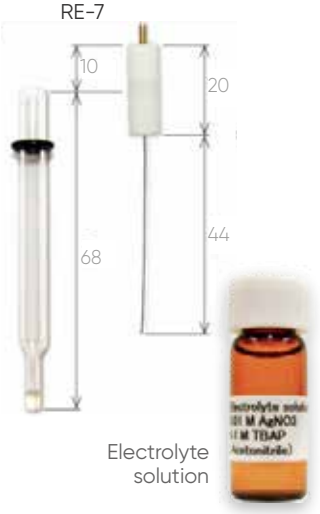
	Junction	Electrolyte	Purpose	Catalog n°
RE-1B Ag/AgCl reference electrode[1]	IPPG*	3 M NaCl	SVC-2, SVC-3, VC-4, bulk electrolysis, RRDE-3A, flat cell	**A-012167**
RE-1S Ag/AgCl reference electrode[1]	IPPG*	3 M NaCl	SECM	**A-012168**
RE-1BP reference electrode (Ag/AgCl)	Ceramic	3 M NaCl	SVC-2, SVC-3, VC-4, bulk electrolysis, RRDE-3A, EQCM, flat cell	**A-013613**
RE-1CP Ag/AgCl reference electrode	Ceramic	Saturated KCl	SVC-2, SVC-3, VC-4, bulk electrolysis, RRDE-3A, flat cell	**A-013429**
RE-3VT Ag/AgCl reference electrode screw type	Ceramic	3 M NaCl	For flow spectroelectrochemical cell SEC-3F	**A-013488**
Ag/AgCl ink, 2 mL	Surface resistance: 0.2 Ω/25.4 µm² Viscosity: 50,000 ±10,000 CP @ 21.1 °C Flash point: 82 °C		For micro CV cell, IDA measurement	**A-011464**
RE-2BP Hg/Hg_2Cl_2 reference electrode	Ceramic	Saturated KCl	SVC-2, SVC-3, VC-4, bulk electrolysis, RRDE-3A, flat cell	**A-013430**
RE-2CP Hg/Hg_2SO_4 reference electrode, free from chloride	Ceramic	Saturated K_2SO_4	SVC-2, SVC-3, VC-4, bulk electrolysis, RRDE-3A, flat cell	**A-013431**
RE-61AP Hg/HgO reference electrode main body in polyacetal resin	Ceramic	1 M NaOH	For alkaline media	**A-013395**
RHE Reversible Hydrogen Electrode kit	IPPG*	HCl or H_2SO_4	For acidic media (pH < 2)	**A-013373**
Spare parts				
Set of 10 porous 2.8 mm glass frits (CoralPor™) with PTFE heat shrink (200 mm)				**092-VYC3**
Options				
RE-PV preservative vial for reference electrode, 10 mL				**A-012108**
Bridge tube Ø 9.0 mm (2 pieces)				**A-012177**
Bridge tube Ø 9.0 mm (22 pieces)				**A-012307**
Double junction chamber kit for RHE				**A-013375**

* Ion Permable Porous Glass

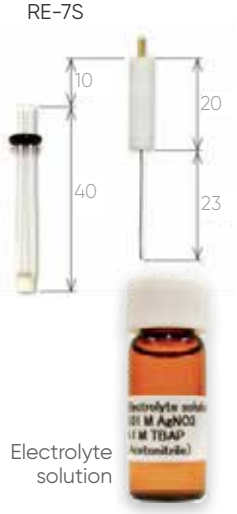


Small-Size Reference Electrodes
for non aqueous media

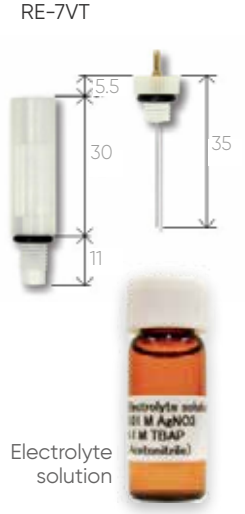
RE-7



RE-7S



RE-7VT



Small-Size Reference Electrodes for Non Aqueous Media (Ag/Ag⁺)

	Junction	Electrolyte	Purpose	Catalog n°
RE-7 non aqueous reference electrode (Ag/Ag⁺)	IPPG*	Ag/Ag⁺/ACN**/ TBAP***	CV	**A-012171**
RE-7S non aqueous reference electrode (Ag/Ag⁺)	IPPG*	Ag/Ag⁺/ACN**/ TBAP***	SECM	**A-012172**
RE-7VT non aqueous reference electrode (Ag/Ag+) with poly-methyl pentene body	Ceramic	Ag/Ag⁺/ACN**/ TBAP***	For flow cell (LC, EQCM, SEC-2F).	**A-013489**

Spare parts	
Electrolyte solution (10 mL)	**A-012549**
PTFE cap with Ag wire (for RE-7)	**A-012057**
PTFE cap with Ag wire (for RE-7S)	**A-012058**
Sample holder 6 mm diameter (for RE-7) (2 pieces)	**A-012176**
Set of 10 porous 2.8 mm glass frits (CoralPor) with PTFE heat shrink (200 mm)	**092-VYC3**

Options	
RE-PV preservative vial for reference electrode, 10 mL	**A-012108**
Bridge tube Ø 9.0 mm (2 pieces)	**A-012177**
Bridge tube Ø 9.0 mm (22 pieces)	**A-012307**

* Ion Permable Porous Glass
** Acetonitrile
*** Tetra Butyl Ammonium Perchlorate

A-012177

A-012108

Maintenance of Reference Electrodes.

Maintenance of reference electrodes

Store your reference electrode immersed in the electrolyte

When not in use, we recommend that you keep reference electrodes in sealed, air-tight vials in order to prolong their life. The storage solution should be identical to the filling solution of the reference electrode. Prefer a cold and dark place.

* Ion Permable Porous Glass

Prevent contamination

To prevent contamination of the reference electrode, a sample holder can be used (see p. 14).

Replace the junction when needed

If you are using IPPG junctions, yellowish discoloration indicates contamination. This is caused by the absorption of organic compounds into the pores. The average pore diameter of IPPG is about 40 - 200 Å.

If you are using CoralPor™ junctions, you might want to use the replacement kit 092-VYC3 (see page 20).

The average pore diameter of CoralPor™ is about 4 - 10 nm.

Storage of reference electrodes

To avoid electrolyte leakage or concentration due to evaporation during storage or transport, the electrolyte is separated from the body. This enables it to be regularly filled up.

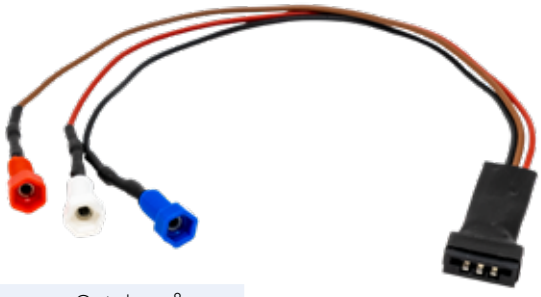
Potentials of common reference electrodes

E/V vs. NHE at 25 °C

0.930	Hg/HgO/ NaOH (0.1 M)
0.650	Hg/Hg_2SO_4 / K_2SO_4 (sat)
0.624	Fc/Fc^+ TBAP (0.1M) ACN
0.542	Ag/Ag^+ TBAP (0.1M) ACN
0.241	Hg/Hg_2Cl_2 KCl (sat)*
0.236	Hg/Hg_2Cl_2 NaCl (sat)*
0.205	Ag/AgCl/ KCl (3.5 M)
0.197	Ag/AgCl/ KCl (sat)
0.194	Ag/AgCl/ NaCl (sat)
0.000	NHE Normal Hydrogen Electrode

* Hg/Hg_2Cl_2 : Calomel

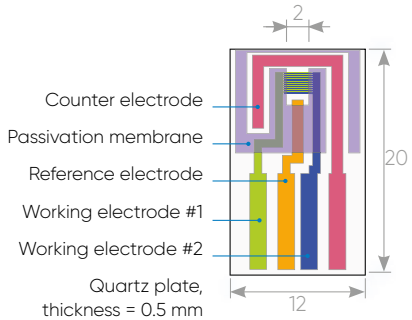
Other Electrodes.



Screen printed electrodes

Description	Catalog n°
3 electrode SPEs: WE and RE: graphite ; CE: silver printed on alumina (48 pcs)	**L-CCAG-AL203**
3 electrode SPEs: WE and RE: graphite ; CE: silver printed on PET (48 pcs)	**L-CCAG-PET**
Connector for L-CCAG-AL203 and L-CCAG-PET with 2 mm receptacles	**L-CONNECTOR**

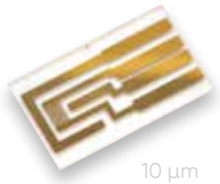
InterDigitated Array (IDA) electrodes



The passivation membrane is a Novolac resin + naphtoquinone-diazido compounds.

IDA Electrode	Width/µm	Interval/µm	Length/mm	N° of feet	Film thickness/nm	Catalog n°
Gold	2	2	2	65 pairs	90	**A-012257**
Platinum	2	2	2	65 pairs	90	**A-012258**
Gold without passivation membrane	2	2	2	65 pairs	90	**A-012261**
Platinum without passivation membrane	2	2	2	65 pairs	90	**A-012264**
Gold	3	3	2	65 pairs	90	**A-012129**
Platinum	3	3	2	65 pairs	90	**A-012130**
Gold without passivation membrane	3	3	2	65 pairs	90	**A-012260**
Platinum without passivation membrane	3	3	2	65 pairs	90	**A-012263**
Gold	10	5	2	65 pairs	90	**A-012125**
Platinum	10	5	2	65 pairs	90	**A-012126**
ITO	10	5	2	65 pairs	100 ±20	**A-012128**
Carbon	10	5	2	65 pairs	1200 ±100	**A-012127**
Gold without passivation membrane	10	5	2	65 pairs	90	**A-012259**
Platinum without passivation membrane	10	5	2	65 pairs	90	**A-012262**
ITO without passivation membrane	10	5	2	65 pairs	100 ±200	**A-012265**
Carbon without passivation membrane	10	5	2	65 pairs	1200 ±100	**A-012266**
Options						
Ag/AgCl ink for reference electrode (2.0 mL)						**A-011464**
Cable kit for IDA electrode						**A-011066**
Content						
Electrode fixer						-
Mini vice						-
Connecting cable						-

3 µm



10 µm

12.5 x 22 x 0.5 mm

Ring-disk type electrodes

Ring-disk type electrodes	Ring OD/mm	Ring ID/mm	Disk/mm	Catalog n°
Gold ring-disk electrode (3 pieces)	6	4	3	**A-002081**
Platinum ring-disk electrode (3 pieces)	6	4	3	**A-002082**
Carbon ring-disk electrode (3 pieces)	6	4	3	**A-002083**

BluRev Rotating Disk Electrode (RDE)

The **BluRev RDE** is a versatile and rugged rotating disk electrode ideal for use with any BioLogic potentiostat/galvanostat. It is available with a wide choice of quick-fit exchangeable tips.

The **BluRev RDE** has been designed to be used with EL-ELECTRO cells series. Please note that if you already have an EL-ELECTRO cell an additional PTFE cap is needed: **094-A-CAP**. Otherwise, **EL-BLUREV** is the cell compatible with **BluRev RDE**.

Furthermore, a special enclosure has been designed for an easy operation and set-up of the **BluRev RDE**: the **BluRev Enclosure**. This makes it easy to hold the RDE body as well as the BioLogic potentiostat cables.

The RC-10k unit controls the RDE rotation speed. It offers an accuracy of ±1 rpm over the whole rotational range for precise and fully reproducible experimental conditions. The measured rotation speed is clearly displayed on a five-digit LCD screen. The speed can be set manually or remotely by using the analog output of a BioLogic instrument. Any other device with an analog output can be used.

Using EC-Lab®, you can easily program and perform a Levich experiment all in one go, and also use the new EIS element W_{inf} that will directly give you the diffusion coefficient.

BluRev RDE	Catalog n°
BluRev RDE kit (tips & cell are not included)	**094-RC/RDE**
Content	
RC-10k Rotation controller	**094-RC**
Rotating disk electrode (motor, shaft, electrode body with contact)	**094-RDE**
DB9 to BNC connector for external control of RC-10k	**092-22/1**
1 m BNC/BNC cable	**COR28100**
1 replacement contact	**094-RDE-BRUSH**
1 transport case	**-**
Tips	
2 mm diameter 99.9% Platinum disk electrode	**094-Pt/2**
2 mm diameter 99.9% Gold disk electrode	**094-Au/2**
3 mm diameter Glassy Carbon disk electrode	**094-GC/3**
3 mm diameter 99.9% Silver disk electrode	**094-Ag/3**
3 mm diameter 99.9% Copper disk electrode	**094-Cu/3**
3 mm diameter 99.9% Nickel disk electrode	**094-Ni/3**
3 mm diameter 99.9% Aluminium disk electrode	**094-Al/3**
3 mm diameter 316L Stainless steel disk electrode	**094-316L/3**
5 mm diameter Glassy Carbon disk electrode	**094-GC/5**
Cells	
EL-ELECTRO-1A cell compatible with BluRev RDE	**EL-BLUREV**
PTFE 5 holes cap compatible with BluRev RDE (needed if you already have an EL-ELECTRO cell)	**094-A-CAP**

Specifications

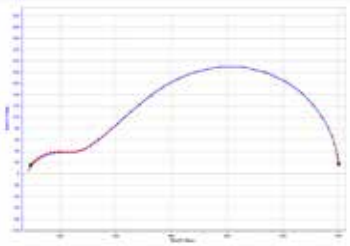
Rotational range/rpm	100 - 10,000
Accuracy/rpm	1 typical over the whole rotational range
Precision/rpm	3 typical over the whole rotational range
Eccentricity/mm	<0.1
Setting resolution/rpm	10 (Manual control) or 25 (Remote control)
Materials of RDE	PEEK, Al alloy
Gas inlet for brush contact purging/mm	Ø 2
Operating temperature/°C	10 - 40
Power	24 Vdc, 1 A max
Max consumption/W	24
Dimensions/mm	RC-10k: 95x227x178 (HxWxD), RDE: 233.6 (length with tip)
Weight/kg	RC-10k: 1.00 RDE: 0.36 (without tip)

BluRev Enclosure	Catalog n°
Protective housing and stand kit for the BluRev	**094-ENCL**
Content	
1 stainless steel plate with M6 threaded holes to fix the support poles	-
2 support poles to hold the BluRev RDE and the cell **(The clamp and the clamping nut are not included)**	-
1 clamping flange for the BluRev	-
3 half-clamps for the potentiostat cables (all BioLogic cables are supported)	-
1 plexiglas protective housing	-
Specifications	
Dimensions with protective housing (HxWxD)/mm	287x318x308
Weight (with protective housing)/kg	5.3

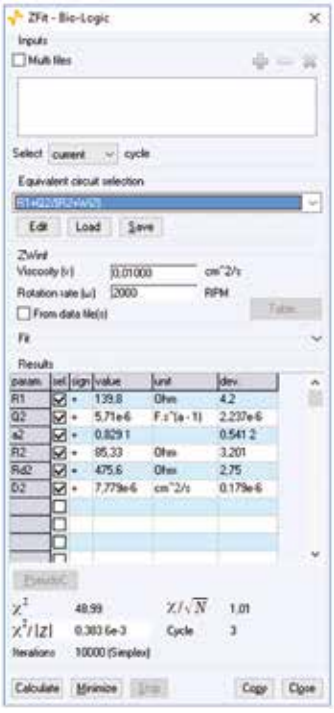
RDE

W_{inf}:direct access to the diffusion coefficient.

Levich and Koutecký-Levich methods[1] are powerful analysis tools used to obtain kinetic electrochemical parameters such as the diffusion coefficient of a redox species in a given medium and the reaction constant. These analyses require potentiodynamic curves at various rotation speeds.
However, fitting impedance measurements made on a redox reaction occurring at a rotating electrode, at only one rotation speed, also enables the direct measurement of the diffusion coefficient.
A PEIS measurement was performed on a 2 mm Pt electrode, using an equimolar solution of $K_3Fe(CN)_6$ and $K_4Fe(CN)_6$ with concentrations of 5 mM in 0.1 M KCl, a BluRev RDE rotating at 2000 rpm.
The considered electrochemical reaction is the following:
$[Fe(CN)_6]^{3-} + e^- \leftrightarrow [Fe(CN)_6]^{4-}$
The obtained impedance graph is shown below:



Using ZFit and the equivalent circuit shown below that contains W_{inf} as a diffusion impedance, we directly obtain the diffusion coefficient of the species of interest, in our case 7.8 x 10^{-6} cm^2/s, which is in agreement with the data found in the literature[2,3]. For more detailed information please see the EC-Lab application note #66[4].



RRDE

For RRDE measurements, a bipotentiostat is needed. A bipotentiostat controls the two working electrodes i.e. one channel to control the disk electrode and the other to control the ring. An SP-300 equipped with two channels would be an appropriate instrument for RRDE applications.

Because of the presence of two working electrodes in the same setup, a specific connection mode (to avoid any ground loop trouble) is needed. This can be achieved in two different ways:

- isolating the two channels (at least one potentiostat in floating mode),
- grounding the counter electrode. The "CE-to-ground" mode of the BioLogic instruments provides this unique capability.

Of these two options, the latter is preferred because there is less leakage of current. All of the BioLogic multichannel potentiostats (except cyclers) offer such types of electrode connection.

At the disk electrode, the electro-active species are oxidized or reduced according to the applied potential. This new species is detected by reduction or oxidation at the ring, respectively.
In a typical experiment, a CV is performed on the disk electrode and a constant voltage is applied on the ring electrode. This is the CV-CA technique that is available in EC-Lab® in the "bipotentiostat" techniques folder.

(1) Application Note #56 "Electrochemical reaction kinetics measurement: the Levich and Koutecký-Levich analysis tools"
(2) A. J. Bard, W. Faulkner, in: Electrochemical Methods, Fundamentals and Applications, 2nd Ed., Wiley, New York (2001) 381.
(3) D. R. Lide, H. V. Kehiaian, in: CRC handbook of thermophysical and thermochemical data, CRC Press, Inc., Boca Raton, (1994)
(4) Application Note 66 "EIS measurements on a Rotating Disk Electrode (RDE) Part I: Determination of a diffusion coefficient using the new element W_{inf}"

Rotating Ring-Disk Electrode (RRDE)

RRDE-3A is a system that can be used to perform hydrodynamic (RDE or RRDE) measurement. Its design (short stainless steel shaft) allows users to accurately control electrode rotation and modulation.

RRDE-3A is electronically controlled by a closed loop circuit driving a DC servo-motor. Electrodes are small and rapidly interchangeable.

The unit also provides an adjustable valve system for inert gas purging inside the cell vial. Additionally, access to the glass cell facilitates rinsing, cleaning, and replacing the electrodes. It is also easy to remove and replace the cell vial.

RRDE-3A can be operated as a stand-alone unit or directly controlled by a BioLogic electrochemical workstation.

Features

- Remote and manual-controlled rotation
- Small sample volume (up to 10 - 15 mL), gas line connector is available, remote and manual controlled purge lines
- Open architecture for an easy access to the cell

Specifications

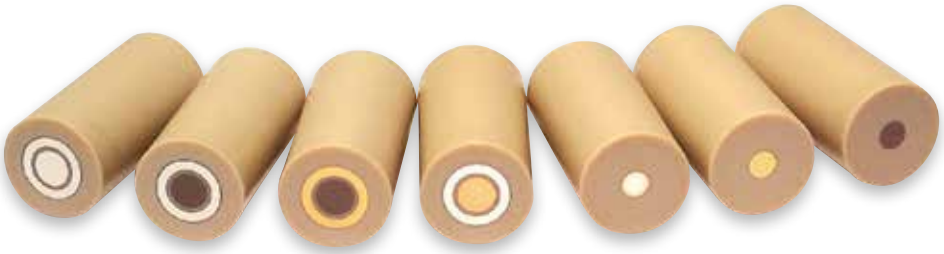
Rotational range/rpm	100 - 8,000
Setting resolution/rpm	1
Accuracy	< 0.1%
Rotation control type	PWM (Pulse Width Modulation)
Bandwidth	60 Hz at 3,500 rpm Base and 1,000 rpm Peak-to-peak modulation
Inlet gas pressure	5 PSI
Temperature/°C	10-50
Power	100-240 VAC, 50/60 Hz
Dimensions (HxWxD)/mm	400x185x(base: 230, body: 120)
Weight/kg	6

Rotating Ring-Disk Electrode	Catalog n°
RRDE-3A apparatus V 2.0	**A-012180**

Working electrodes (page 27), reference electrodes (page 20) and counter electrodes (page 19) must be purchased separately.

Content	
RRDE-3A glass cell vial 100 mL	**A-013580**
Spin coating adapter	**A-012064**
Nipple for purge valve	**A-012065**
Tygon tubing, OD 6.4 mm x ID 3.2 mm (1.3 m)	**A-010058**
PTFE cap for RRDE-3A	**A-012631**
Instruction manual	**-**
Power cable	**-**

Options	
Sample vials for alkaline solution (100mL) (10 pcs)	**A-013580**
Sample vials for alkaline solution (200mL) (8 pcs)	**A-013581**
Water-jacketed glass cell (100 mL, OD 70 mm, ID 46.4 mm, H 80 mm)	**A-012652**
DB9 cable to control RRDE-3A	**092-22/11**
Bipotentiostat cable for two standard channels	**092-22/12**
Corrosion resistant bearing assembly	**A-013605**



A-011172 A-011162 A-011163 A-011164 A-011170 A-011171 A-011169

Working Electrode

Standard tips		Tips length/mm	Tips OD/mm	Ring ID/mm	Ring OD/mm	Disk Ø/mm	Catalog n°
RRDE Disk electrode Ø 4 mm Ring electrode Ø 7 mm RRDE Ø 12 mm	Platinum ring/platinum disk	25	12	5.0	7.0	4.0	**A-011172**
	Platinum ring/glassy carbon disk	25	12	5.0	7.0	4.0	**A-011162**
	Gold ring/glassy carbon disk	25	12	5.0	7.0	4.0	**A-011163**
	Platinum ring/gold disk	25	12	5.0	7.0	4.0	**A-011164**
	Gold ring/platinum disk	25	12	5.0	7.0	4.0	**A-012617**
	Glassy carbon ring/glassy carbon disk	25	12	5.0	7.0	4.0	**A-012618**
RDE Disk electrode Ø 3 mm RDE Ø 12 mm	Glassy carbon disk	25	12	-	-	3.0	**A-011169**
	Glassy carbon disk	25	12	-	-	5.0	**A-013482**
	Glassy carbon disk with PTFE spacer	25	12	-	-	3.0	**A-013490**
	Glassy carbon disk with PTFE spacer	25	12	-	-	5.0	**A-013491**
	Platinum disk	25	12	-	-	3.0	**A-011170**
	Gold disk	25	12	-	-	3.0	**A-011171**
	Aluminum disk	25	12	-	-	3.0	**A-011966**
	Silver disk	25	12	-	-	3.0	**A-011967**
	Copper disk	25	12	-	-	3.0	**A-011968**
	Nickel disk	25	12	-	-	3.0	**A-011969**
	Tantalum disk	25	12	-	-	3.0	**A-011970**
	Titanium disk	25	12	-	-	3.0	**A-011971**
	Tungsten disk	25	12	-	-	3.0	**A-011972**
	Carbon paste disk, hole depth 4 mm	25	12	-	-	3.0	**A-011973**
Option							
PK-3 polishing kit							**A-011975**

Disk Replaceable Electrode tips		Catalog n°
RRDE	Platinum ring/GC disk replaceable electrode kit	**A-013336**
	Content Platinum ring assembly	**A-013337**
	Glassy carbon disk	**A-013338**
	PTFE spacer (3 pieces)	**A-013339**
RDE	Glassy carbon disk replaceable electrode kit	**A-013362**
	Content Glassy carbon disk	**A-013338**
	PTFE spacer (3 pieces)	**A-013339**
	Disk assembly	**A-013361**
	Gold disk replaceable electrode kit	**A-013364**
	Content Gold disk	**A-013366**
	PTFE spacer (3 pieces)	**A-013339**
	Disk assembly	**A-013361**
	Platinum disk replaceable electrode kit	**A-013365**
	Content Platinum disk	**A-013367**
	PTFE spacer (3 pieces)	**A-013339**
	Disk assembly	**A-013361**
Tool kit		
Disk electrode polishing/exchange kit		**A-013340**

RRDE platinum ring/GC disk replaceable electrode kit

Disk electrode polishing/exchange kit

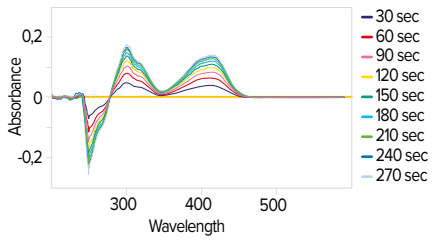
Spectroelectrochemistry.

Spectrometer System

Spectroelectrochemistry (SEC) can be useful to elucidate electrochemical reaction mechanisms.
The spectroelectrochemical kit is made up of three parts (spectrometer, light source and cuvette holder).
The spectrometer is equipped with a trigger to synchronize electrochemical and spectroscopic measurements.

SEC2020 Spectrometer system	Catalog n°
SEC2020 spectrometer kit	**A-013609**
Content	
SEC2021 Spectrometer (x 1)	-
SEC2022 Deuterium halogen light source (x 1)	-
SEC2023 Cuvette holder (x 1)	-
SEC2024 Platform (x 1)	-
AC adaptor (x 1)	-
Power cable (x 1)	-
USB cable (x 1)	-
Collimator (x 2)	-
Fiber collimator (x 1)	-
Platform screw (x 7)	-
External device connection trigger cable (x 1)	-
Light source control trigger cable (x 1)	-
Plastic cuvette (x 1)	-
SMA905 adaptor for light source (x 3)	-
SMA905 adaptor for light shielding (x 2)	-
Hexagon wrench 0.89 mm (x 1)	-
Hexagon wrench 1.50 mm (x 1)	-
Software (USB memory) (x 1)	-
Waterproof box (x 1)	-
Quick manual, wavelength calibration data sheet, linearity test data sheet and warranty certificate are also included.	
Option	
Connecting cable to synchronize the SEC2020 with BioLogic instrument.	**092-22/11**

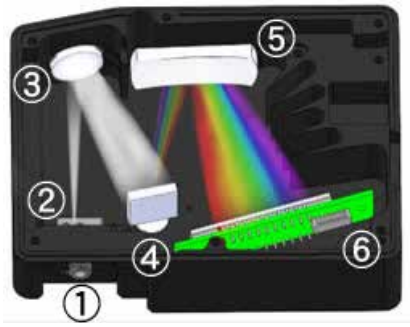
Spectrometer specifications	
Detector	2048 element linear silicon CCD array
Full description	SEC2021-025-DUVN
Detector range/nm	200 - 1025
Grating	Blaze wavelength (300 nm)
Slit/µm	25
Wavelength resolution/nm	1.3
Fiber connector	SMA905 Core diameter: 600 µm NA=0.22
Interface	USB2.0
Operating system	WindowsTM 7 / 8.1 / 10 (32bit / 64bit)
Dimensions (HxWxD)/mm	32x86x110



Light source specifications	
Light type	Deuterium halogen light source
Wavelength range/nm	200 - 1700
Stability	<0.1%
Drift/h	0.25%
Bulb life/h	>1000 (D2 lamp) >2000 (halogen lamp)
Fiber connector	SMA905
Size (HxW×D)/mm	46x100×165

The SEC2020 spectrometer system uses the Czerny-Turner optical mount. This system is an M-shaped structure symmetrical to the grating (4) and is an optical system with extremely small aberration.

Light source structure



1. SMA905 Connector
2. Slit
3. Collimating mirror
4. Grating
5. Focus mirror
6. 2048 element CCD array

Utilization modes

Transmittance

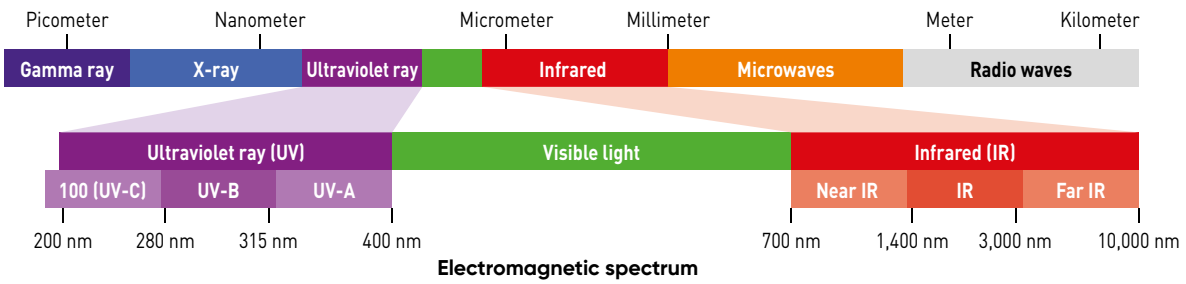
Absorbance/ transmittance	- Concentration of chemicals (solution) - Polymer extrusion processes - DNA quantification
Reflectance	- Freshness testing - Film thickness/composition (quality control) - Activation energy of photocatalytic species - Textile quality control

Fluorescence

Fluorescence	- Marine organisms - Biology (DNA, protein, cell proliferation assay, histamine-analysis, alga monitoring) - Environmental fields (waste water analysis, ground water trace studies, hydrocarbon detection, dissolved oxygen) - Plant efficiency (plant physiology, plant breeding, horticulture, agronomy, agrochemicals, pollution studies, forestry, ecology) - Tissue diagnosis
Scattering	- Oil concentrations of oil/water system - Raman spectroscopy - Physical transition phenomena (e.g, melting point, glass transition crystallize temperature)

Irradiance

Emission	- Astronomy (e.g, spectra of Hale-Bopp, plasma monitoring) - In situ metal monitoring - Luminescence (PL,EL), LED & laser wavelength



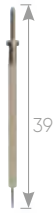
Electromagnetic spectrum

Static Cell

A-012813

A-012815

A-012606

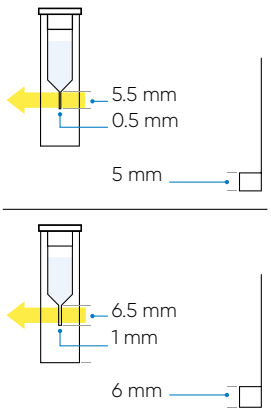


A-012609

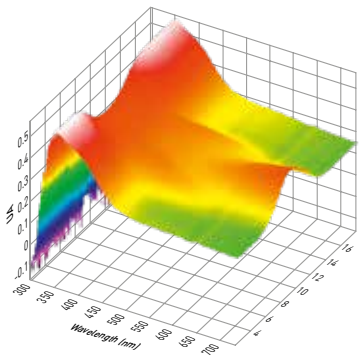
A-011501

Purging tube

Quartz glass spectroelectrochemical cell kit		Platinum	Catalog n°	Gold	Catalog n°
0.5 mm			**A-012813**		**A-012814**
	Content				
	Platinum counter electrode		**A-012609**		**A-012609**
	Thin layer quartz glass cell		**A-012815**		**A-012815**
	PTFE cap		**A-011501**		**A-011501**
	Purging tube (ETFE, 100 mm)		**-**		**-**
	Gauze working electrode	80 mesh, height 5 mm	**A-012606**	100 mesh, height 5 mm	**A-012607**
1 mm			**A-013510**		**A-013511**
	Content				
	Platinum counter electrode		**A-012906**		**A-012906**
	Thin layer quartz glass cell		**A-012907**		**A-012907**
	PTFE cap		**A-011501**		**A-011501**
	Purging tube (ETFE, 100 mm)		**-**		**-**
	Gauze working electrode	80 mesh, height 6 mm	**A-011498**	100 mesh, height 6 mm	**A-012017**

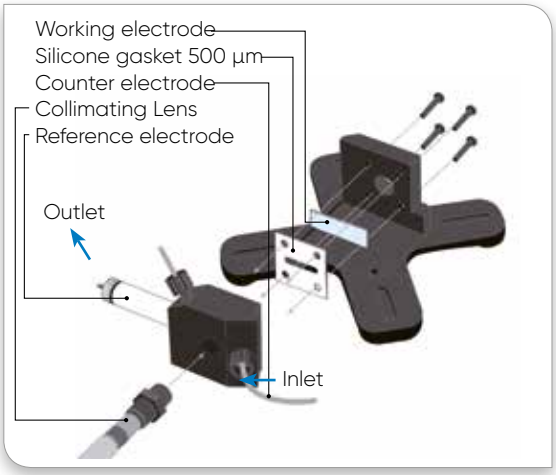


Options	
RE-1BP Ag/AgCl reference electrode	**A-013613**
RE-7 non aqueous reference electrode	**A-012171**
Purging tube (ETFE), 1 m	**A-010537**



Flow Cell

Flow Cell			Quantity	Catalog n°
SEC-2F spectroelectrochemical flow cell				**A-012660**
Content				
SEC-2F flow cell		Base	1	-
		Cover	1	-
		Block a	1	-
		Block b	1	-
SEC-2F S500 silicone gasket			2	**A-012661**
Stainless tube OD 1.59 mm (length of 50 mm)			1	**A-012198**
Needle adaptor			1	-
Dynaseal PEEK fingertight			2	-
Silicon tube (300 mm)			1	-
PTFE tube (1 m)			1	-
Options				
Reference electrode screw type	Ø 10x55 mm	RE-3V aqueous		**A-012169**
		RE-3VP aqueous (PEEK)		**A-012170**
		RE-7VT non aqueous		**A-013489**
Working grid electrode for flow cell	8x27x1 mm	Platinum (1 piece)		**A-012655**
		Gold (1 piece)		**A-012656**
		Carbon grid electrode (1 piece)		**A-012657**
		ITO electrode (4 pieces)		**A-012658**
	8x27x0.5 mm	ITO electrode (12 pieces)		**A-011465**
	10x20x0.5 mm	ITO electrode (10 pieces)		**A-010887**
	10x10x0.5 mm	ITO electrode (30 pieces)		**A-011233**
	Ø 4 inchx0.5 mm	ITO electrode (1 piece)		**A-011827**
Gasket	Silicone	S500, 500 µm thick (4 pieces)		**A-012661**
	PTFE	T500, 500 µm thick (4 pieces)		**A-012664**
		T250, 250 µm thick (4 pieces)		**A-012665**
		T100, 100 µm thick (4 pieces)		**A-012666**
Fibre and lens		400 µm optical fibre SR, 250 mm		**A-012667**
		400 µm optical fibre SR, 2 m		**A-011522**
		UV/VIS collimating lens, 200-2,000 nm		**A-012234**



Gold grid electrode **A-012656**

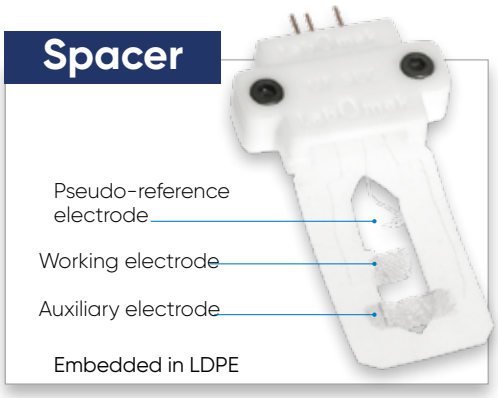
Solution volumes

		Volume
Gasket of	100 µm	4.6 µl
	250 µm	11.5 µl
	500 µm	230 µl

Thin Layer Cells

The UFS set has been designed to perform thin-layer (optical path ~ 0.2 mm) spectroelectrochemistry experiments.

Spacer



Thin layer spectroelectrochemical cell kit		Platinum	Catalog n°	Gold	Catalog n°
Full kit			**UF-Full-PT**		**UF-Full-AU**
	Content				
	1 PTFE windows aligner + 1 spacer (platinum auxiliary electrode/ Ag pseudo-reference electrode)	Platinum working electrode	**UF-SEC-PT**	Gold working electrode	**UF-SEC-AU**
	Stainless steel body cell		**-**		**-**
	XY holder (with magnets) to universally fit the cell in a spectrophotometer		**UF-XY**		**UF-XY**
	Plug		**UF-P**		**UF-P**
	PTFE mask		**UF-M**		**UF-M**

Options	
PTFE adapter for optical fibres with UV/VIS/NIR collimating lenses (200-2500 nm), adjustable focus, SMA-905 connection	**UF-OFA**
Base stand for optical fibre measurements	**UF-BS**
PTFE cuvette holder to be used with UF-OFA and UF-BS	**UF-C**
1 spacer (platinum working electrode/platinum auxiliary electrode/Ag pseudo-reference electrode)	**UF-SPP**
1 spacer (gold working electrode/platinum auxiliary electrode/Ag pseudo-reference electrode)	**UF-SPA**
Optical fibre: SMA-SMA connector length 1 m	**092-101**

Full kit +
PTFE adapter for optical fibres + optical fibres

Finite Diffusion Conditions

In such finite diffusion conditions, a thin solution layer (≤ 0.2 mm) adjacent to the electrode is confined by the cell walls, so that the cell thickness is smaller than the diffusion layer and the mass transfer can be ignored. The most significant virtue of thin-layer cells is the absence of the effect of the diffusion process and the rapidity with which the electro-active species can be completely electrolyzed. The dropping to near zero of the current flow following the peak in the current potential plot is a characteristic behavior of thin-layer cells, indicating exhaustive electrolysis of the cell reactant and minimal diffusion effects in thin-layer electrochemical cells[1] [2].

Small potential sweep rates (2-10 mV/s) are necessary both to ensure homogeneity of the reactant/product concentrations in the cell and to control resistive effects.

Cyclic voltammetry should be used in your SEC cell to better identify the redox process of interest: in fact, the UF spacer has a silver pseudo-reference electrode, which is sensitive to the solution medium (but is expected to remain constant in time in each given experimental condition). Potential drifts can be observed in the presence of irreversible redox reactions, which may alter the solution/analyte composition.

To keep the ohmic drop as low as possible, the current should also be kept low which means low scan rates and low sample concentrations may be preferred. However, in some cases, due to the narrowness of the optical path, the use of a relatively high concentration of the sample may be required to study the changes of bands with a low molar extinction coefficient.

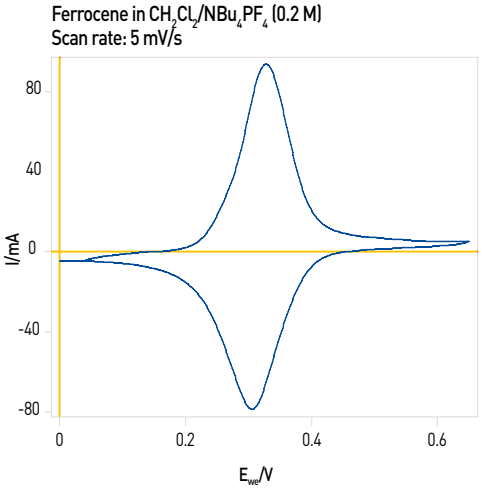
A milli-molar concentration appears to be the most optimized concentration, but in some cases, the concentration can be adapted.

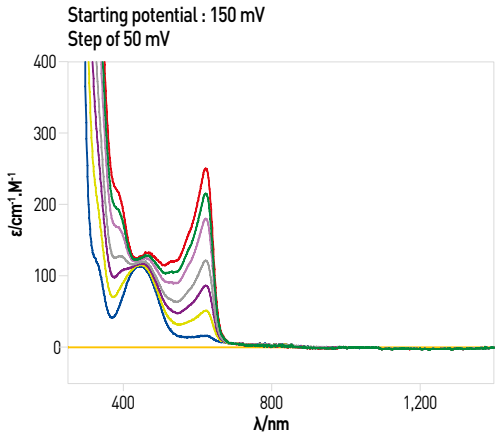
Due to the high Infra-Red absorbance of more common solvents and electrolytes, a very carefully measured background should be obtained before each Infra-Red spectroelectrochemical experiment.

For the same reason, it is also important to avoid changing the tightness of the cell screws during the experiment itself to avoid changes of the optical path.

(1): M. Krejčik, M. Daněk and F. Hartl, J. Electroanal. Chem., 1991, 317, 179.

(2): P. Leoni, F. Marchetti, C. Bonaccorsi, F. Fabrizi de Biani, L. Marchetti, P. Zanello, Chem. Eur. J.,2008, 14, 847





BluQCM QSD

Acoustic sensing principle

The acoustic sensing principle is based on the precise detection of changes on the properties of an acoustic (mechanical) wave traveling through the bulk (QCM-AWS, HFF-AWS) or the surface (LOVE-AWS) of the acoustic wave sensor.

QCM-AWS sensors consist of a thin piece of quartz confined between a pair of metal-based electrodes. An alternating current applied to the quartz crystal induces mechanical oscillations on the quartz due to the piezoelectric effect. A wave is generated and propagated through the sensor and the films attached to it.

The resonance frequency of this wave depends on the oscillating mass of the sensor and its adhering layers. When a thin film is attached to the sensor, the properties of the wave change as well, modifiying the resonance frequency and amplitude. If the film is thin and rigid, the decrease in frequency is proportional to the mass of the film.

In this way, the QCM works in the gravimetric regime and the mass of the film can be calculated using the well-known Sauerbrey equation. If the film is not rigid, the measurement of the damped resonance enables the measurement of the viscoelastic changes of the film, allowing the characterization of the QCM working in the non-gravimetric regime.

A mass increase results in a frequency decrease. Sauerbrey was the first to provided a description and experimental verification of the mass/frequency relationship between foreign layers firmly attached to the quartz crystal resonator[1][2].

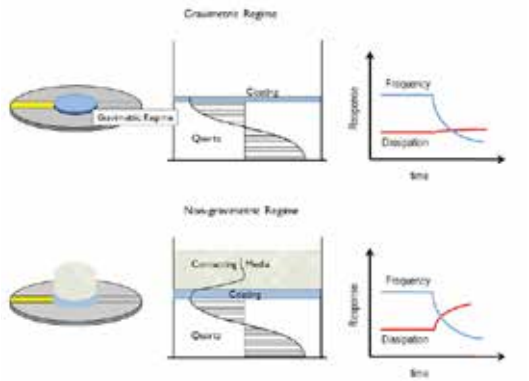
The Sauerbrey equation is defined as:

$$\Delta f = \frac{2f_0^2}{A\sqrt{\rho_q \mu_q}} \Delta m$$

f_0: resonant frequency (Hz)
Δf: frequency change (Hz)
Δm: mass change (g)
A: piezoelectrically active crystal area (area between electrodes, cm^2)
ρ_q: density of quartz (ρ_q = 2.648 g/cm^2)
μ_q: shear modulus of quartz for AT-cut crystal (μ_q = 2.947x1011 $g/(cm.s^2)$)

Special features

- High accuracy temperature control
- Dissipation measurement
- Measurement in air
- Measurement at overtones



(1): G. Sauerbrey, Phys. Verh., 1957, 8, 113-114.
(2): G. Sauerbrey, Z. Phys., 1959, 155, 206-222.

Cell \ Sensor	14 mm wrapped	1'' wrapped	HFF
In-batch eQCM 	**AW-BEQ01Q**	**AW-BEQ02Q**	**AW-BEQ01HQ**
Flow eQCM 	**AW-FEQ01Q**	-	**AW-FEQ01HQ**
Flow QCM 	**AW-FQ01Q**	-	**AW-FQ01HQ**
In-batch QCM 	**AW-BQ01Q**	**AW-BQ02Q**	**AW-BQ01HQ**
Hermetic Li research in batch eQCM 	**AW-BEQLIQ**	-	-
In batch probe eQCM 	**AW-PEQ11Q**	-	-

All these cells feature the patented Quick-Lock design that facilitates operation and ensures an excellent reproducibility.

Most of these cells are available with SMA connectors to be used with standard impedance and network analyzers. Please contact your local reseller for further details.

Sensor type	14 mm	1''	HFF
Resonant frequency/MHz	5, 10	5, 9	50, 100, 150
Available finish	Rough (Au/Ti only), polished		N/A
Available material	Au/Cr Au/Ti C, Pt (5 MHz only)		Au/Cr

To obtain the catalog n° and if a different material is needed, please ask your local distributor.

Reference and counter electrodes have to be purchased separately (except for eQCM flow cells where the Pt plate counter electrode is integrated in the lid of the cell). Compatible counter and reference electrodes are shown in the following table:

	Reference electrode		**Counter electrode**
	Aqueous	Non-aqueous	
In-batch eQCM cells	RE-1B **A-012167**	RE-7 **A-012171**	Pt wire 23 cm coiled **A-002234**
Flow eQCM cells	RE-1S **A-012168**	RE-7S **A-012172**	Pt disk integrated in the cell lid

QSD-300

General function	
Operation modes	Tracking* and high resolution** at single and multiple overtones
Sensors technologies	QCM, HFF-QCM, LOVE-SAW
Cells available	See p.3
Liquid volume above sensor/µL	3 – 45 (depending on sensor and cell type)
Temperature control	Optional (QSD-TCU)
Measurement in air	Yes
Simultaneous overtones measurements	Up to 7 (up to 13th)
Dimensions (HxWxD)/mm	90x220x260
Weight/ kg	3
Sensor	
Frequency range/MHz	4 – 160
Best frequency resolution/Hz	0.1
Best frequency accuracy/Hz	± 0.5
Max. acquisition rate***/points/s	250
Best mass sensitivity in liquid****/pg/cm^2	50
Best dissipation sensitivity	10^{-7}
Catalog n°	
BluQCM QSD-300	**AW-QSD-300**

* Tracking mode provides the full impedance spectrum of the sensor around resonance frequency
** Patented fast and high-resolution single frequency point measurement
*** High-resolution mode at single frequency
**** For HFF-QCM

QSD-TCU

General function	
Temperature control range/°C	15 - 45
Temperature stability/°C	±0.05
Dimensions (H x W x D)/mm	60x220x260
Weight/kg	4.5
Catalog n°	
BluQCM QSD-TCU	**AW-QSD-TCU**

QSD-FCU

General function	
Syringe volume/µL	250 (default)*
Flow rate range for a 250 µL syringe/µL/min**	12.5-14500 (Standard) 0.625 - 1062.5 (Smooth)
Dimensions (H x W x D)/mm	195x70x250
Weight/kg	0.75
Catalog n°	
Standard flow control unit	**AW-QSD-FCU**
Smooth flow control unit	**AW-QSD-FCUS**

*Other syringe volumes are available upon request, from 12.5 µL to 5000 µL
** Flow rates depend on the syringe volume. For the standard flow unit, the flow rate change is 0.6250 - 290000 µL/min. For the smooth flow unit, it is 0.0313-21250 µL/min. For more information, please contact your local reseller.

Quartz Crystal Microbalance.

QCA922A

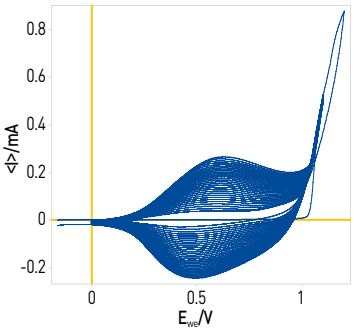
This instrument monitors both the resonant frequency and the resonant resistance which are also reflected on the two analog outputs.

It is possible to connect the QCM device to a BioLogic potentiostat using a DB9-8BNC cable (catalog n°: 092-22/1).

092-QCA-FC

SE-CL3

eQCM			Catalog n°
Quartz crystal microbalance 27 MHz kit			**SE-QCA922A**
Content			
EQCM 27 MHz main unit and cable			**SE-QCA922A-00**
Male BNC/BNC cable (2 pieces, length 1 m)			**COR28100**
Options			
Connector from QCA to potentiostat			**092-22/1**
Low flow peristaltic pump			**EL-AV-008**
Cells			
Holder is needed to get a full QCM or EQCM set-up		Static and flow QCA cell	**092-QCA-FC**
		Dip cell	**SE-CL3**
		Well cell (PTFE)	**SE-CL4**
		Well cell (PEEK)	**SE-CL4PK**
		Transparent well cell	**SE-CL5**
		Flow cell (90 µl) (PTFE)	**SE-CL6**
		Flow cell (90 µl) transparent (PTFE)	**SE-CL7**
		Flow cell (90 µl) (PEEK)	**SE-CL6PK**
Resonators			
5 MHz		Gold electrode (25 pieces)	**SE-5AU**
	Standard finish, Resonator and lead wire	Aluminum electrode (25 pieces)	**SE-9AL**
		Gold electrode (25 pieces)	**SE-9AU**
		Copper electrode (25 pieces)	**SE-9CU**
		Molybdenum electrode (25 pieces)	**SE-9MO**
		Nickel electrode (25 pieces)	**SE-9NI**
		Platinum electrode (25 pieces)	**SE-9PT**
		Stainless steel (SS304) electrode (25 pieces)	**SE-9SS**
	Standard finish, Separated lead wire	Gold electrode (25 pieces)	**SE-9AU-S**
		Platinum electrode (25 pieces)	**SE-9PT-S**
	Mirror finish, Resonator and lead wire	Aluminum electrode (25 pieces)	**SE-9AL-M**
		Gold electrode (25 pieces)	**SE-9AU-M**
		Gold electrode (500 pieces)	**SE-9AU-M2**
		Copper electrode (25 pieces)	**SE-9CU-M**
		ITO electrode (25 pieces)	**SE-9IT-M**
		Nickel electrode (25 pieces)	**SE-9NI-M**
		Platinum electrode (25 pieces)	**SE-9PT-M**
		Silicon electrode (25 pieces)	**SE-9SI-M**
		Stainless steel (SS304) electrode (25 pieces)	**SE-9SS-M**
		Titanium electrode (25 pieces)	**SE-9TI-M**
	Mirror finish, Separated lead wire	Gold electrode (25 pieces)	**SE-9AU-MS**
		ITO electrode (25 pieces)	**SE-9IT-MS**
		Platinum electrode (25 pieces)	**SE-9PT-MS**
Others			
Resonators lead wire no sputter (50 pieces)			**SE-LEAD/2**
Resonators 9 MHz, no sputter		No lead wire (50 pieces)	**SE-9Q/2**
		Mirror finish no lead wire (50 pieces)	**SE-9Q-M/2**
Control software for QCM922, QCM922A (no potentiostat control)			**SE-WQCM**



Gold electrode

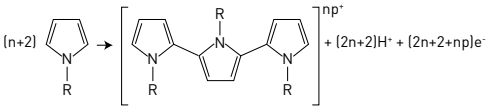
Platinum electrode

Stainless steel electrode

Measurement examples

Electropolymerization of pyrrol

The polypyrrol film was deposited on an Au-coated quartz using cyclic voltammetry (twenty cycles).



The quartz electrode was immersed in an acetonitrile solution (Bu_4NPF_6 0.2 mol/L) containing a solution of 1 methylpyrrol monomer (0.01 mol/L).

Polypyrrol film growth on the quartz working electrode

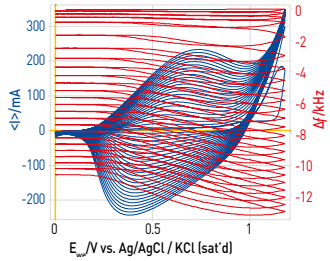
Fig. 1 represents polypyrrol film growth on the quartz electrode during successive cycles of cyclic voltammetry. The reversibility of the charge transfer in such a polymer film is often dependent on the deposition mode (quasi-reversible in this example). This growth is very regular but tends to slow down during the last cycles. This can be due to an interfacial depletion of the solution in methyl pyrrol species in the layer close to the electrode surface and to a saturation of the working electrode surface area.

(1): G. Sauerbrey, Phys. Verh., 1957, 8, 113-114.
(2): G. Sauerbrey, Z. Phys., 1959, 155, 206-222.
(3): Application note #13. Section "Apps & literature of EC-Lab division".

QCM measurements during the film growth

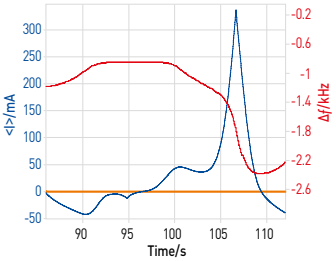
Fig. 1 shows the resonant frequency decrease and the resonant resistance increase while the polymer film is growing. Moreover, the variation is dependent on the potential sweep resulting in a pseudo oscillation of frequency and resistance related to successive cycles. This plot can also be made versus potential (see fig. 1).

Fig. 1: overlaid frequency and current *vs.* E_{we} of the polymer film growth. Scanning at 100 mV/s between 0 and 1.018 V.

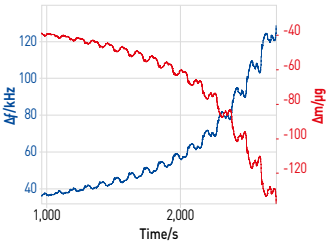


Here, it is interesting to note the frequency evolution versus potential on one cycle. The figure below shows the time evolution on one cycle.

Fig. 2: graphic zoom on one cycle showing the resonant frequency and the current density versus elapsed time[3].



The mass calculation is carried automatically by the EC-Lab® process data tool. More details can be found in the application note[3].



QCA922A specifications

Frequency range	5 MHz-30 MHz, resolution 0.01 Hz
Resonant resistance range	10-16 Ω, resolution 0.1 Ω
ΔF output	Full scale: ±10 V (14 bit) ±100 Hz / ±500 kHz
Mass range	0.1 ng / Hz // 3.5 ng / Hz
Resistance output	Full scale: 0-10 V (14 bit) 10 Ω to 10 kΩ
Gate time	Variable (10 ms / 20 ms / 100 ms / 1 s / 10 s)
Interface	USB

Surface finishing

	Roughness	Electrode materials deposition
Standard finish	0.6 µm	Sputtered
Mirror finish	0.06 µm	Sputtered

A high roughness means a large surface area. A low roughness means an exact surface area.

Battery Accessories.

CCH

CCH-8

Coin Cell Holders

	CCH	CCH-120	CCH-124	CCH-8	CCH-8
Cell max diameter/mm	24	20	24	24	
Cell height/mm	3	3.2	3.2	1.6 - 3.2	
Number of channels	4	1	1	8	
Measurement type	2 point	2 point	2 point	4 point	
To be used with	MPG2 VMP3	BCS-805 BCS-810	BCS-805 BCS-810	VSP VMP3 VSP-300 VMP-300 MPG2	BCS-805 BCS-810
Climatic chamber compatibility	No	No	No	Yes (-30 to 80°C)	
Catalog n°	**092-22/14**	**096-120**	**096-124**	**092-22/24**	**096-128**

CCH-120

CCH-124

Pouch Cell Holders

	PBH-125	PBH-150	PBH-4	PBH-8
Min leads separation distance/mm	0		12	
Max leads separation distance/mm	110*		44	
Number of channels	1		4	8
Max current/A	25	50	32	
Measurement type	4 point			
Receptacles diameter/mm	4 (power) 2 (voltage)	6 (power)** 4 (voltage)	4	
To be used with	All instruments			
Max operating T°/°C	80	100	80	
Size : HxWxD/mm	40x50x210***		135x325x180	135x650x180
Weight/kg	0.2***		1.9	3.8
Catalog n°	**092-P25/1**	**092-P50/1**	**092-P32/4**	**092-P32/8**

*Measured using the guide rail and the middle of the clamp.

Eyelet ring (The connection kit **094-110/CNT can be used for an easier connection to 6 mm diameter cables).

***Measured with the two clamps mounted on the guide rail.

PBH-125

BH-1i

2 and 4 mm receptacles are available for the current (power) cables. For voltage (sense) cables, only 2 mm receptacles are available.

Cylindrical Cell Holders

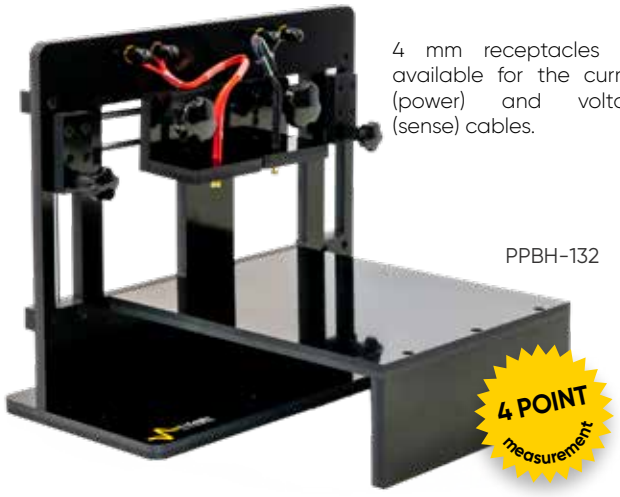
	BH-1i	CBH-4	CBH-8
Cell max diameter/mm	26	60	
Cell min height/mm	0	30	
Cell max height/mm	76	100	
Number of channels	4	4	8
Max current/A	15	32	
Measurement type	4 point	4 point	
Receptacles diameter/mm	2 and 4	4	
To be used with		All instruments	
Max operating T°/°C	60	80	
Size : HxWxD/mm	205x150x95	335x260x150	335x520x150
Weight/kg	0.6	1.9	3.8
Catalog n°	**092-22/15**	**092-C32/4**	**092-C32/8**

CBH-8

4 mm receptacles are available for the current (power) and voltage (sense) cables.

PBH-4

4 mm receptacles are available for the current (power) and voltage (sense) cables.



PPBH-132

4 mm receptacles are available for the current (power) and voltage (sense) cables.

Prismatic and Pouch Cell Holders

	PPBH-132	PPBH-1100
Cell min height/mm	0	
Cell max height/mm	139	
Min leads separation distance/mm	66	
Max leads separation distance/mm	155	
Number of channel	1	
Max current/A	32	100
Measurement type	4 point	
Receptacles diameter/mm	4 (power and sense)	4 (power and sense) and 6 (power)
To be used with	All instruments	
Max operating T°/°C	80	
Size : HxWxD/mm	265x320x300	320x320x360
Weight/kg	3	5.1
Catalog n°	**092-PC32/1**	**092-PC100/1**

PPBH-1100

4 mm receptacles can be used for currents up to 32 A. For higher currents, the 6 mm flush mounting plugs should be used. These are compatible with FlexP 0160, HCV-3048, CC4-60A and CC8 cables (See page 40).

Battery Accessories.

CC4-200A

CC8

Current Collectors

BioLogic's current collectors offer the possibility to connect in parallel several channels and increase the maximum current that can be passed through the cell, in order to simplify and reduce the footprint of your setup.

CC4-60A

	CC4-60A	CC8	CC4-200A
Connection details			
Input			
Power cables/receptacles diameter/mm	4		6 (IP2x)
Voltage sense receptacles diameter/mm	2		4
Number of input channels	4	8	4
Max current/channel/A	15		50
Output			
Power receptacles diameter/mm	6 (IP2x)		8 (Amphenol, IP2x)
Voltage sense receptacles diameter/mm	2 (IP2x)		4 (IP2x)
Max output current/A	60	120	200
Cables details			
Output power cables	1 pair of 2 m power cables with 6 mm receptacles		1 pair of 2.5 m power cables with 8 mm receptacles and M8 threads
Output voltage cables	1 pair of 2 m sense cables with 2 mm banana plugs		1 pair of 2.5 m sense cables with 4 mm banana plugs
Instrument compatibility	BCS-815 VSP-300 VMP-300	BCS-815*	FlexP0160 FlexP0060 HCV-3048
Measurement type	4 point		
Max operating T°/°C	80		
Size (with feet) : HxWxD/mm	70x170x88	70x300x88	120x248x169
Weight/kg	3.8		
Catalog n°	**096-022**	**096-015**	**093-100/CC4**

*The CC8 comes with BCS tablets and cables. It is also compatible with the VSP-300 and VMP-300 and can be provided without cables and tablets using the following part number: 096-015/1.

SAM-50

Sense Adapter Module (SAM-50)

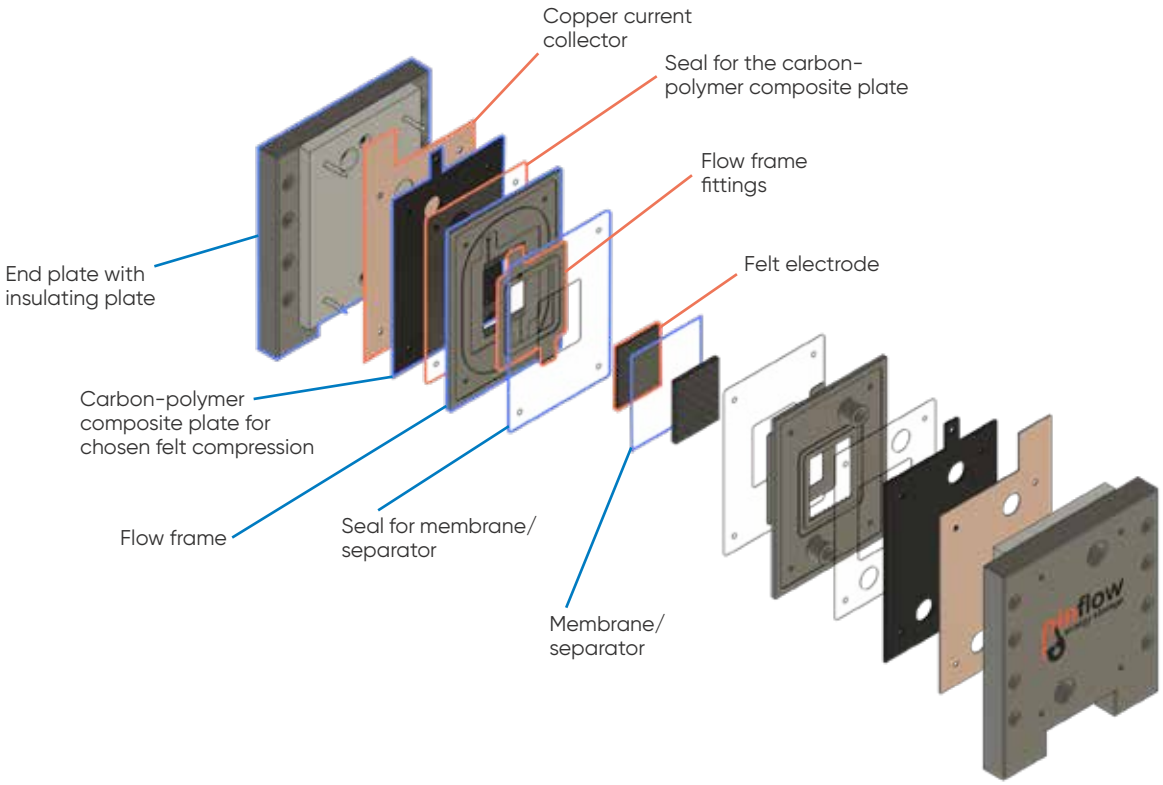
This can be added to a multichannel system to perform stack measurements up to 60 V for 5 channel boards and a 10-element measurement. 3 SAM-50s can be linked to follow-up 30 elements.

Sense Adapter Module	Catalog n°
SAM-50	**092-26**

Redox Flow Battery Cells.

This range of redox flow battery cells are manufactured by **Pinflow energy storage**.
The lab cells are specially designed to control the pressure applied on the carbon felts that are used as electrodes. Using rigid components and non-flat bipolar plates, you can not only perform reproducible experiments but you can also use various electrode thicknesses.

Cells stacks, complete turnkey set-ups with climatic chambers and flow control are also available.
Please ask your local reseller for more information.



Description	Catalog n°
Lab cells	
Redox Flow Lab Cell 20 cm^2 and 3.75 mm spacer thickness	**P-LABCELL/20**
Redox Flow Lab Cell 50 cm^2 and 3.75 mm spacer thickness	**P-LABCELL/50**
Spares	
Set of sealings for <25 cm^2	**P-SSEAL/20**
Pack of sealings for <25 cm^2 cell, contains 10 sets	**P-PSEAL/20**
Set of bipolar plates for different compression for <25 cm^2 cell	**P-SBIPOL/20**
Set of sealings for 50 cm^2	**P-SSEAL/50**
Pack of sealings for 50 cm^2 cell, contains 10 sets	**P-PSEAL/50**
Set of bipolar plates for different compression for 50 cm^2 cell	**P-SBIPOL/50**
Accessories	
Mounting stand	**P-STAND**
Felt cutter	**P-CUTTER**
Torque wrench	**P-WRENCH**
Set of fittings with new FPM O-rings	**P-FPM**

Pinflow cells were used and characterized in the following papers:
https://doi.org/10.1016/j.memsci.2018.02.011
https://doi.org/10.1016/j.jpowsour.2018.01.079

Connection Accessories.

DC3

Dummy cell for booster

Dummy cell for BCS

External Device Connection

External device connection	Catalog n°
DB9-8 BNC connector for auxiliary I/O	**092-22/1**
IS1 isolation module for auxiliary I/O for VMP-300 based instruments	**094-081/5**

Dummy Cells

A specific dummy cell is available for boosters. This cell and DC3s have been designed to clamp onto one another, for ease of use, and to help you better manage your experiments.

Dummy Cell		Catalog n°
DC3	1 R+R/C+R/C circuit.	**094-111/3**
Dummy cell for booster	1 power resistor, 5 mΩ. Precision: 1% Temperature coefficient: ±50 ppm/°C	**092-32/1**
Dummy cell for BCS series	Three test resistors with 1% precision.	**096-016/1**

IS1

DB9-8 BNC

Pt Probe	Catalog n°
PT100 temperature probe, to be connected to the auxiliary I/O, temperature range: -50 °C to 250 °C, Dimensions: 3 x 20 mm, Length of cable: 2.5 m, Accuracy: ±1 °C	**092-22/13**

Test Boxes

Test Boxes		Catalog n°
Test Box 2	Several circuits with high precision resistors, for calibration and validation	**092-22/6**
Test Box 3	Three circuits: linear, two non-linear systems (Tafel & passivating) for teaching and demonstration	**092-22/7**

Test Box 2

Test Box 3

Transport Cases

Transport Cases	Catalog n°
SP-200	**094-082**
SP-240/SP-300	**094-091**

Specific Cables

By default, the potentiostat and the booster are provided with a 1.5 m long cell cable.

The cable connected from the booster to the potentiostat is 0.8 m long for VMP3 based instruments.

For some applications, the user may need different length cables. For this reason, longer cables are available.

For applications carried out in glove boxes, cell cables are also available.

Hermetic cell cable for glove box

Hermetic cell cable for glove box

	VMP3	VMP-300
Catalog n°	**092-23/5**	**094-101/6**
Content:		
Feedthrough type	12 pins	25 pins*
Inside glovebox (length: 1 m)	Cable with 2 mm connectors on one side and 12-pin Jaeger connector on the other side	Cable with electrometer on one side and 25-pin connector on the other side
Outside glovebox (length: 1.5 m)	Cable with SubD25 connector on one side and 12 -pin Jaeger connector on the other side (length 1.5 m)	Cable with SubD25 connector on one side and 12 -pin Jaeger connector on the other side (length 1.5 m)
Requirement:		
Hole to make in the glove box/mm	27	45

*Two feedthrough seals one installed in the glove box wall the other dedicated to the channel board calibration outside the box

Set-up connection

Bad connections can affect measurements (stability of potentiostat, artifacts etc).

In order to optimise your set-up, we recommend you use the accessories described in this section.

Connection cable from booster to potentiostat	Available length/m	Catalog n°
All boosters	3	**092-33/5**
	5	**092-33/6**

Longer cable	Available length/m	Catalog n°
SP-50, SP-150, VSP, VMP3	2.5	**092-23/2**
	3	**092-23/7**
	5	**092-23/3**
	10	**092-23/4**
Booster 2 A, 5 A for essential range (VMP3)	2.5	**092-33/11**
	3	**092-33/12**
	5	**092-33/13**
Booster 10 A, 20 A for essential range (VMP3)	2.5	**092-33/21**
	3	**092-33/22**
	5	**092-33/23**
BCS-815	0.25	**096-011/1**
	2.5	**096-011/2**
	5	**096-011/3**
	10	**096-011/4**

Connectors

	Catalog n°			
	Black colour	Red colour	Blue colour	White colour
2 mm alligator clip (pack of 10)	**092-1001/1**	**092-1001/2**	**092-1001/26**	**092-1001/22**
4 mm alligator clip (pack of 5)	**092-1001/13**	**092-1001/14**	**092-1001/23**	
2 mm receptacle (pack of 10)	**092-1001/5**	**092-1001/6**	**092-1001/7**	**092-1001/8**
4 mm receptacle (pack of 10)	**092-1001/25**	**092-1001/4**	**092-1001/3**	
2 mm banana plug (pack of 10)	**092-1001/9**	**092-1001/10**	**092-1001/11**	**092-1001/12**
4 mm banana plug (pack of 5)		**092-1001/16**	**092-1001/15**	**092-1001/24**
2 mm receptacle to 4 mm plug adapter (pack of 5)	**092-1001/18**	**092-1001/19**	**092-1001/20**	**092-1001/21**
2 mm receptacle to 4 mm plug adapter for banana plug (pack of 5)	**092-1001/27**			
4 mm receptacle to 2 mm plug adapter for banana plug (pack of 5)	**092-1001/28**			

Connection kits		
For standard board	- 4 alligator clips of 2 mm: blue, white, red, black - 3 receptacles of 2 mm: blue, white, red	**092-1001/30**
For booster board	- 3 alligator clips of 2 mm: blue, white, red - 2 alligator clips of 4 mm: red, black - 3 receptacles of 2 mm: blue, white, red - 2 receptacles of 4 mm: blue, white	**092-1001/31**

Connection Accessories.

Nstat box (8 channels)

Bipot cable: dedicated to RRDE applications

Multi-Electrode Investigation Cables

Multi-electrode investigation cables	Channel	Nb of channels	Length/m	Catalog n°
Nstat box (for VSP, VMP3)	standard	4	1.5	**092-16**
		8	1.5	**092-22/3**
	Low current	8	1.5	**092-22/4**
Bipot cable (for VSP, BiStat, VMP3)	Standard	2	1.5	**092-22/12**
		2	3	**092-22/12A**
		2	4	**092-22/12B**
Option				
External power supply for the Nstat box (this option is needed if more than one Nstat box is connected to a VMP3 or if the user uses VSP)				**092-16/1**

Faraday Cages

Advanced Faraday cage

To avoid any external perturbations, especially for low current applications, we recommend using a Faraday cage.

Please note that in order to ensure that the cage is fully functional, it must be earthed by connecting it to the ground (this is done via a green plug on the instrument's rear panel).

FC-45 Faraday cage

Advanced Faraday cage specifications

Temperature/°C	0 - 50
Power supply	100 VAC-240 VAC, 50/60 Hz
Fuse/A	1
Gas pressure	< 34 kPa max.
Interface	IEEE-488, RS-232C
Weight/kg	3.8

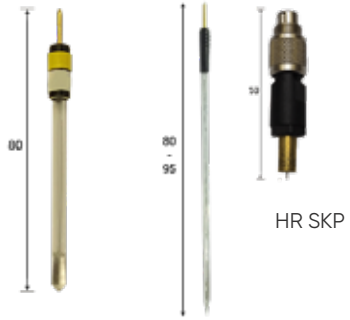
Faraday cages	Catalog n°
FC-45 Faraday cage, 450x450x450 mm	**094-084/1**
Stand for FC-45	**094-084/2**
Standard Faraday cage, 400x200x600 mm	**NS-FAR600**
Advanced Faraday cage, 286x230x320 mm	**A-012033**

Scanning Product Accessories.

Probes

A range of probes dedicated for use with our SECM, SVP, SKP and LEIS scanning probe applications are available for the M370 and M470 systems. SECM probes can also be used with SECM150

Probes	Catalog n°
Fused silica-based SECM 10 µm diameter Platinum disk	**U-23/10**
Fused silica-based SECM 15 µm diameter Platinum disk	**U-23/15**
Fused silica-based SECM 25 µm diameter Platinum disk	**U-23/25**
Capillary based SECM 1 µm diameter Platinum disk	**U-P5/1**
Capillary based SECM 2 µm diameter Platinum disk	**U-P5/2**
Capillary based SECM 5 µm diameter Platinum disk	**U-P5/5**
Capillary based SECM 10 µm diameter Platinum disk	**U-P5/10**
Capillary based SECM 15 µm diameter Platinum disk	**U-P5/15**
Capillary based SECM 25 µm diameter Platinum disk	**U-P5/25**
SKP 500 µm diameter	**U-SKP370/1**
HR SKP 150 µm diameter	**U-SKP-150**
LEIS	**U-LEIS370/1**
SVP	**U-SVP370/1**



Fused silica-based SECM

Capillary based SECM

HR SKP

SKP

LEIS

SVP

VCAM3
Video Microscope System

The VCAM3 is a long working distance video microscope which allows users to view the positioning between probe tip and sample surface in many scanning probe electrochemistry techniques.

VCAM3 specifications

Working Distance	108 mm
Min illumination/lux	0.0003
Field of view/mm	1.4 (x4.5) to 8.6 (x0.7)
Operation temperature/°C	-30 to +70
Catalog n°	**U-VCAM3**

Scanning Product Accessories.

Cells

Three cells are available :
The TriCell™ is a large volume, wide scan range cell, dedicated to LEIS, SVP, SKP, SDS techniques.
The µTriCell™ and its Shallow version are dedicated to SECM techniques (dc, ac and ic mode). The Shallow µTriCell™ contains a slightly smaller volume of electrolyte than the µTriCell™ is more accessible and ideal for ic-SECM.

The Foil Cell has been designed for use with flat, foil type samples, such as those used for battery electrodes. It has been designed to mount directly on the baseplate of the µTriCellTM and Shallow µTriCellTM.

All TriCells accomodate samples mounted in a 32 mm diameter resin cylinder.

Cells	Volume (mL)	Catalog n°
TriCell™	700	**U-TRICELL**
µTriCell™	7	**U-uTRICELL**
Shallow µTriCell™	6	**U-SuTRICELL**
Foil Cell	1	**U-uFoilCell**

TriCell™

µTriCell™

Shallow µTriCell™

Foil Cell™

M470 Glovebox Cables

The M470 Scanning Electrochemical Workstation is supplied with a full set of standard cables for use with all techniques.

For applications requiring use of the M470 in a glove box, additional cell cables are available.

These are supplied as a set of internal, feedthrough and external cables to replace a single cable.

Hermetic scan stage cable for glove box

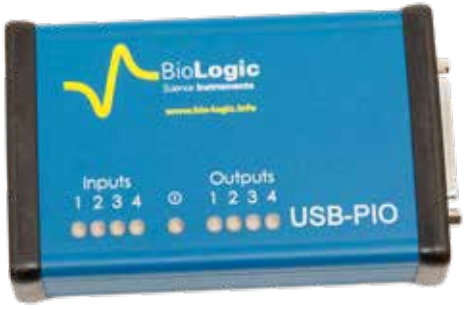
	Electrometer	Piezo Strain Gauge	Piezo Drive	Scan Stage	3300
Content :					
Feedthrough Type/pins	12	6	3	8	25
Inside glove box	Cable with connector to electrometer on one side and 12-pin Jaeger connector on the other side (length 1.5 m)	Cable with connector to piezo strain gauge on one side and 6-pin Jaeger connector on the other side (length 1.5 m)	Cable with connector to piezo drive on one side and 3-pin Jaeger connector on the other side (length 1.5 m)	Cable with connector to scan stage on one side and 8-pin Jaeger connector on the other side (length 1.1 m)	Cable with 4 mm connectors on one side and 25-pin Jaeger connector on the other side (length 1 m)
Outside glove box	Cable with connector to SCV470 on one side and 12-pin Jaeger connector on the other side (length 1 m)	Cable with connector to SCV470 on one side and 6-pin Jaeger connector on the other side (length 1 m)	Cable with connector to SCV470 on one side and 3-pin Jaeger connector on the other side (length 1 m)	Cable with connector to SCV470 on one side and 8-pin Jaeger connector on the other side (length 1.1 m)	Cable with connector to SCV470 on one side and 25-pin Jaeger connector on the other side (length 1 m)
Requirement:					
Hole to make in the glove box/mm	27	21	21	27	45
Max. Required	1	1	1	3	2
Catalog n°	**U-HC470ELE**	**U-HC470PSG**	**U-HC470PD**	**U-HC470STG**	**U-HC3300CL**

USB-PIO

The USB-PIO, designed for use with the M470, allows external devices to be switched on and read. It can be used to control up to four different channels individually or collectively using the M470 software.
The USB-PIO can interface directly to user supplied cables, or to the supplied breakout PCB using the DB25 pin female connector.

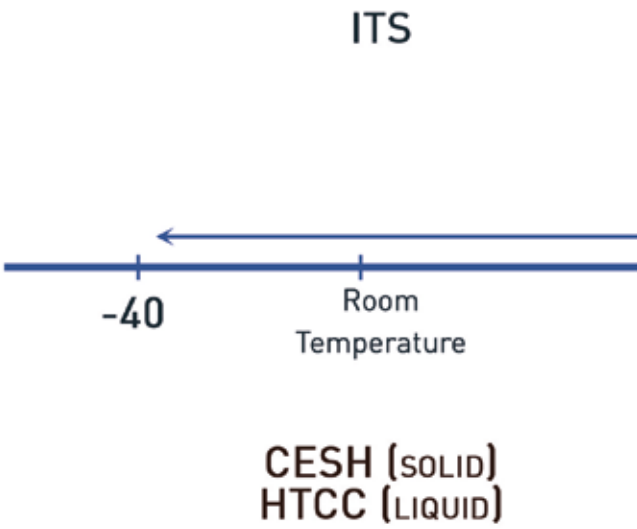
USB-PIO Specifications

Temperature/°C	0 - 50
Power supply	100 VAC-240 VAC, 50/60 Hz
Fuse/A	1
Gas pressure	< 34 kPa max.
Interface	IEEE-488, RS-232C
Weight/kg	3.8



How to identify the correct solution

As the electrical properties of materials depend on temperature, a Temperature Control Unit and a Sample Holder are needed to control the temperature and hold the sample (solid, pasty and liquid sample) between the parallel plates.



Temperature Control Units

High Temperature Furnace (HTF-1100)
HTF-1100 is an horizontal laboratory tube furnace dedicated to the electrical characterization of materials and to heat treatment in the temperature range between the ambient and 1100 °C.


HTF-1100 &
HTSH-1100


ITS

Intermediate Temperature System (ITS)
ITS is a compact temperature chamber dedicated to spectroscopy characterization of electrical properties of material by Impedance spectroscopy under controlled atmospheres in the temperature range between -35 °C and 150 °C.

Temperature Control Unit	Operating Temp.	Features	Catalog n°
HTF-1100	RT to 1100 °C	Heating rate adjustable K-type thermocouple	**097-110**
In-plane ITS	-35 to 150 °C	Temperature accuracy: 0.3 °C PT1000 probes	**097-140/11**
Through-plane ITS	-35 to 150 °C		**097-140/12**

HTF-1100

Temperature Control Units

HTSH-1100

Parallel Plate Sample Holders

HTSH-1100

Sample Holders

High Temperature Sample Holder (HTSH-1100)
HTSH-1100 is a test fixture dedicated to the characterization of electrical properties of materials at high temperatures (up to 1100°C).

CESH on its base

Controlled Environment Sample Holder (CESH)
CESH is a sample holder designed to electrical characterization of flat material samples in parallel plate configuration in the temperature range between -40 °C and 150 °C.

HTCC

High Temperature Conductivity Cell (HTCC)
HTCC is a parallel plate conductivity cell dedicated to laboratory measurements in a wide conductivity range (200 mS/cm to 2 µS/cm).

Sample Holders		Operating Temp.	Features	Compatibility	Catalog n°
HTSH-1100	Φ=25 mm	RT to 1100°C	Quartz tube for controlled atmosphere Leak-tight up to 2 bar relative K-type thermocouple	HTF-1100 Tubular furnaces	**097-133/S**
	Φ=12 mm				**097-132/S**
	Φ=06 mm				**097-131/S**
	Φ=03 mm				**097-130/S**
CESH	In-plane	-40 to 150 °C	Leak-tight up to 2 bar relative	ITS Other temperature units	**097-150/1**
	Through-plane				**097-150/2**
HTCC	Platinized (x10)	-50 to 180 °C	Cell factor: K = 1 +/- 5% cm^{-1} volume: 0.5 - 1.0 mL	MCS 10	**098-10/10**
	Non-platinized (x10)				**098-10/11**

Other accessories	Catalog n°
PT1000 probe long sleeve	**097-140/3**
BNC/SMB RJ175 cell cable for CESH (x4)	**097-140/CC**
K-type Thermocouple for HTSH-1100	**097-13/KT**
Quartz tube for standard HTSH-1100	**097-13/QT**
Quartz tube for leak-tight HTSH-1100	**097-13/QTS**
SMB-Banana cables set (x4) for CESH	**097-13/AD**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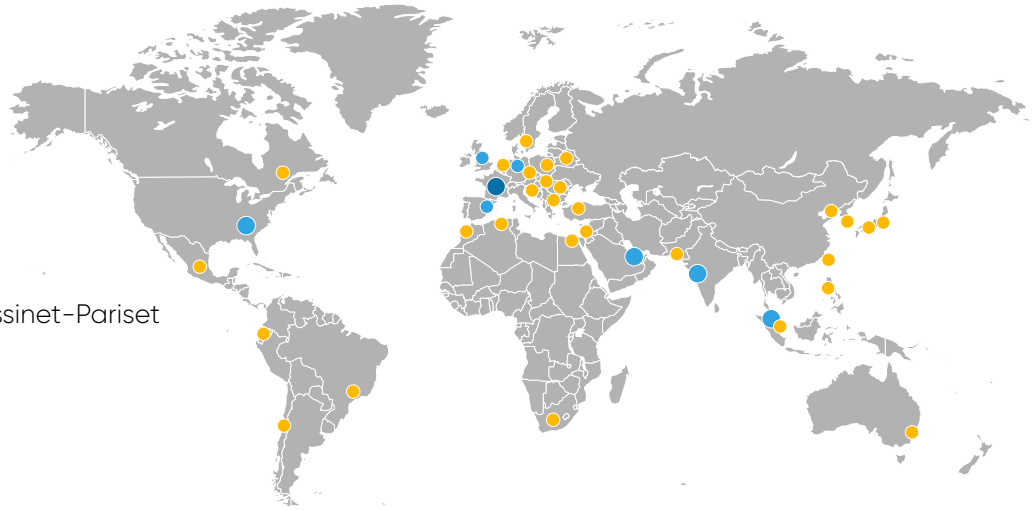

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Together.