



designed for scientists

ElektraSyn 2.0

Declaration of conformity

We declare under our sole responsibility that this product corresponds to the regulations 2014/35/EU, 2006/42/EC, 2014/30/EU and 2011/65/EU and conforms with the standards or standardized documents: EN 61010-1, EN 61010-2-051, EN 61326-1, EN 60529, EN ISO 12100.

A copy of the complete EU Declaration of Conformity or further declarations of conformity can be requested at sales@ika.com.

ENGLISH

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Device setup

/// ElectraSyn 2.0



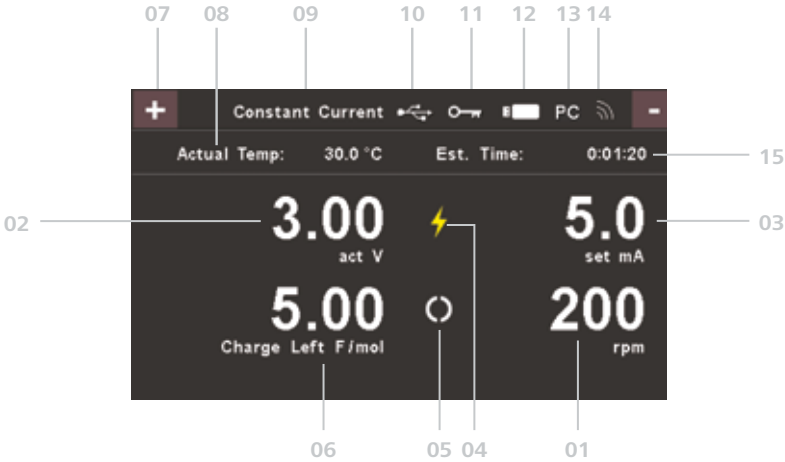
Explication of symbols

A	ON/OFF switch (standby)
B	Rotating knob (chose values / start-stop)
C	"Menu" button
D	"Cyclic Voltammetry" button
E	"Back" button
F	"Graph" button
G	"Lock" button



H	Display
I	Power socket
J	Contact thermometer jack
K	Micro USB interface
L	Threaded hole for vertical rod
M	Single vial holder

/// Display



Display

01	Set speed	09	Operation mode (constant voltage / constant current)
02	Actual / set voltage (depending on selected operating mode)	10	USB connection with PC
03	Actual / set current (depending on selected operating mode)	11	All operation elements locked
04	Charge activated	12	USB-stick plugged into USB interface
05	Motor activated	13	Connection with PC established
06	Timer / remaining charge	14	Wireless connection established
07	Polarity indicator	15	Estimated duration of experiment / charge counter
08	Actual temperature (in connection with an external PT1000 sensor)		

Safety instructions

/// Explication of warning symbols



Indicates an (extremely) hazardous situation, which, if not avoided, **will result in death, serious injury.**



Indicates a potentially hazardous situation, which, if not avoided, **can result in death, serious injury.**



Indicates a potentially hazardous situation, which, if not avoided, **can result in injury.**



Indicates practices which, if not avoided, **can result in equipment damage.**



Attention!
- risk of damage due to magnetism.



DANGER!
- note on hazards arising from a hot surface.

Safety instructions

/// General information

- › **Read the operating manual in its entirety before using the device and follow the safety instructions.**
- › Keep the operating manual in a place where it can be accessed by everyone.
- › Ensure that only trained staff work with the device.
- › Follow the safety instructions, guidelines, occupational health and safety and accident prevention regulations.

/// Device design

Danger! (X)

- › Do not use the device in explosive atmospheres, it is not EX-protected.
- › With substances capable of forming an explosive mixture, appropriate safety measures must be applied, e.g. working under a fume hood.
- › To avoid body injury and property damage, observe the relevant safety and accident prevention measures when processing hazardous materials.
- › Set up the device in a spacious area on an even, stable, clean, non-slip, dry and fireproof surface.
- › The feet of the device must be clean and undamaged.
- › Check the device and accessories for damage before each use.
Do not use damaged components.

Caution! (B)

Device surface is partially made of glass!

- › Glass surface can be damaged by impact.
- › If glass surface is damaged it could cause injury, do not use the device anymore.

/// Permissible medium / contaminants / side reactions

Warning! (!)

Beware of hazards due to:

- › flammable materials
- › glass breakage
- › incorrect container size
- › overfilling of media
- › unsafe condition of container

Danger! (X)

Only process media that will not react dangerously to the extra energy produced through processing. This also applies to any extra energy produced in other ways, e.g. through light irradiation.

- › The stir plate can heat up due to the action of the magnets at high motor speeds.
- › Please consider any possible contaminations and unwanted chemical reactions.
- › It may be possible for wear debris from rotating accessory parts to reach the material being processed.

/// Experimental procedures

Warning! (!)

Wear your personal protective equipment in accordance with the hazard category of the media to be processed.

There may be a risk from

- › splashing and evaporation of liquids
- › ejection of parts
- › release of toxic or combustible gases

Reduce the stirring speed, if

- › the medium splashes out of the vessel because the speed is too high.
- › the device is not running smoothly.
- › the container moves on the stirring plate.
- › an error occurs.

/// Accessories

- › Safe operation is only guaranteed with the accessories described in the "Accessories" chapter.
- › Always disconnect the plug before attaching or removing accessories.
- › Observe the operating instructions of the accessories.
- › Ensure that the external temperature sensor is inserted into the medium to a depth of at least 20 mm when connected.
- › Accessories must be securely attached to the device and must not come off by themselves. The center of gravity of the assembly must lie within the surface on which it is set up.
- › External temperature probes can react with the medium and cause a short-circuit.
 1. It is important to use a sensor that is isolated against electricity. Our recommendation is to use temperature probe PT 1000.90. Please ensure that the coating is resistant to the solvent being used and in an undamaged condition.
 2. A non-insulated or not fully coated temperature sensor can seriously damage or destroy ElectraSyn 2.0. Measuring outside of the vial, e.g. inside a dry block, a metal probe can be used.

/// Power supply / Switching off

- › The voltage stated on the type plate must correspond to the mains voltage.
- › The socket for the power cord must be easily accessible.
- › The device can only be disconnected from the power supply by pulling out the power plug or the connector plug.

/// Protecting your device

- › This device should only be disassembled by qualified IKA personnel.
- › Protect the device and accessories from bumps and impacts.
- › Keep base plate clean.

Proper usage

/// Basics

Usage

- › The potentiostat IKA ElectraSyn 2.0 has been designed for electrochemical reactions and mixing.
- › Unpack the device carefully. **Any damage to the exterior packaging should immediately be reported to the carrier (mail, rail or freight forwarding company).**

Area of use

- › Indoor environments similar to that a laboratory of research, teaching, trade or industry.

The safety of the user cannot be ensured, if

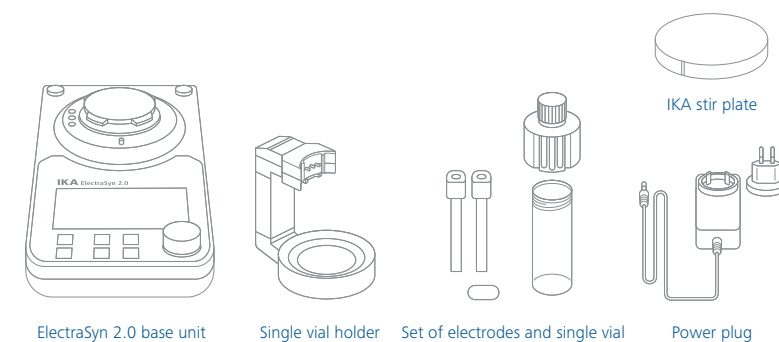
- › the device is used in conjunction with accessories not made or recommended by the manufacturer!
- › modifications to the device or parts of the device are made by third parties!
- › the device is operated in violation of the safety instructions!

Start-up

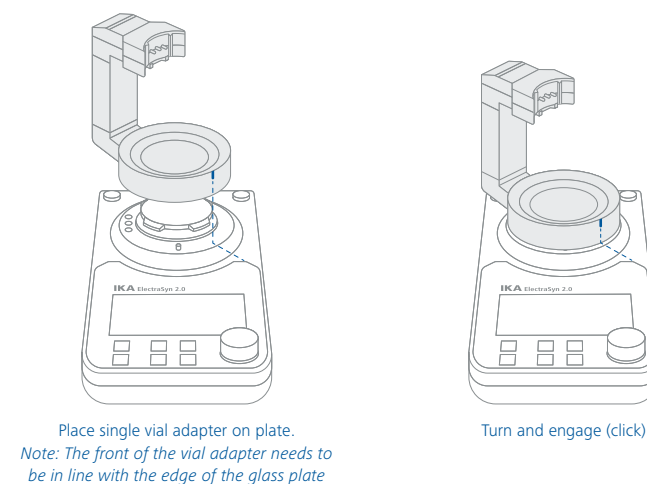
/// Your ElectraSyn package

Unpack the device carefully. **Any damage should immediately be reported to the carrier (mail, rail or freight forwarding company).**

SCOPE OF DELIVERY



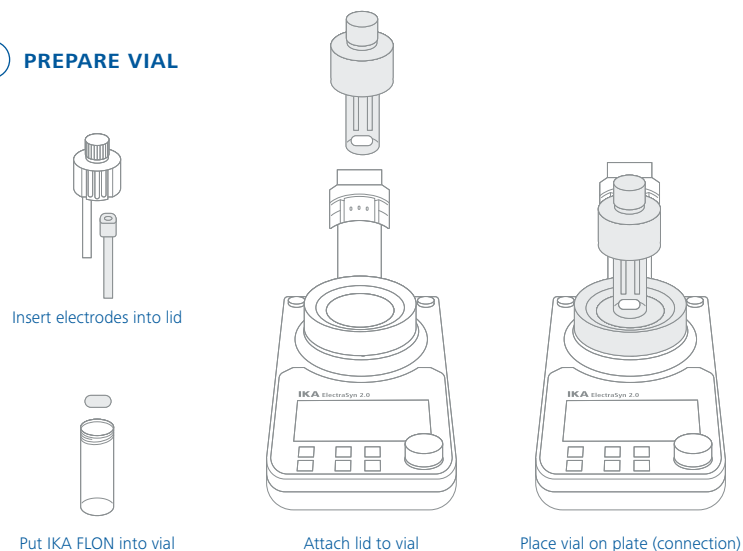
1 PREPARE STATION



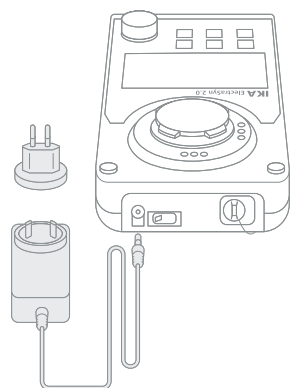
Setting up a reaction

/// Basic guide

2 PREPARE VIAL



3 PLUG



1. Turn on ElectraSyn 2.0.
2. Select "new experiment".
3. Choose experiment type (constant voltage or constant current; rapid alternating polarity; pulsed alternating polarity).
4. Set the voltage/current desired (**note:** if unsure of the voltage/current assist mode can be used to approximate reaction conditions).
5. Indicate if a reference electrode will be used (**note:** if no reference electrode will be used, the voltage displayed will be the potential difference between the working and counter electrode).
6. Set duration of experiment
 - › Total charge duration will run the reaction until the set charge has passed, based on mmol of substrate and equivalents of electrons (F/mol)
 - › Timer will run the reaction for set amount of time
 - › Run continuous will run the reaction until the user manually stops the reaction
7. Experiment type specific settings
 - 7.1 Constant voltage- / Constant current-experiment
 - Indicate if you would like to alternate the polarity of the electrodes during the reaction (**note:** this feature is used for reactions where electrode fouling can occur and can help certain reactions avoid some of these issues. This feature should only be used when the anode & cathode are the same electrode material)
 - 7.2 Rapid alternating polarity-experiment
 - Choose how often to switch polarity (**note:** this feature should only be used when the anode & cathode are the same electrode material)
 - 7.3 Pulsed alternating polarity-experiment
 - Choose upper- and lower- polarity hold time.
8. Save the experiment parameters if desired.
9. The experiment parameters are now displayed in the edit screen. Select "start" to begin experiment, or select "edit" to edit any of the parameters.

Smart Assist

/// Take the guesswork out of Electrochemistry

The Smart Assist feature on the ElectraSyn 2.0 is designed to guide a new user through the steps of setting up an electrochemical reaction. In addition, more experienced users may find this feature useful to determine appropriate current levels when running a reaction for the first time.

Smart Assist works by determining the current needed to achieve a cell potential the corresponding power level selected by the user. Power level "low", "medium" and "high" correspond to cell potentials of 2, 4 and 6 volts respectively (without reference electrode). For example, selecting power level "medium" will allow the ElectraSyn 2.0 to determine the current needed for a starting potential of 4 V. The current determined will then be used to run a constant current electrolysis reaction. The experiment duration for Smart Assist is determined by calculating the charge needed based on the user's input of # mmol of substrate, and the desired equivalents of electrons (F/mol).

When using Smart Assist, it is recommended to start with power level "medium". If no reaction is observed, power level "high" can be used, while if over-oxidation/reduction is observed, power level "low" should be used. Further optimization of reaction conditions can be carried out by beginning a new experiment or by editing the reaction parameters using the "edit" function in Smart Assist.



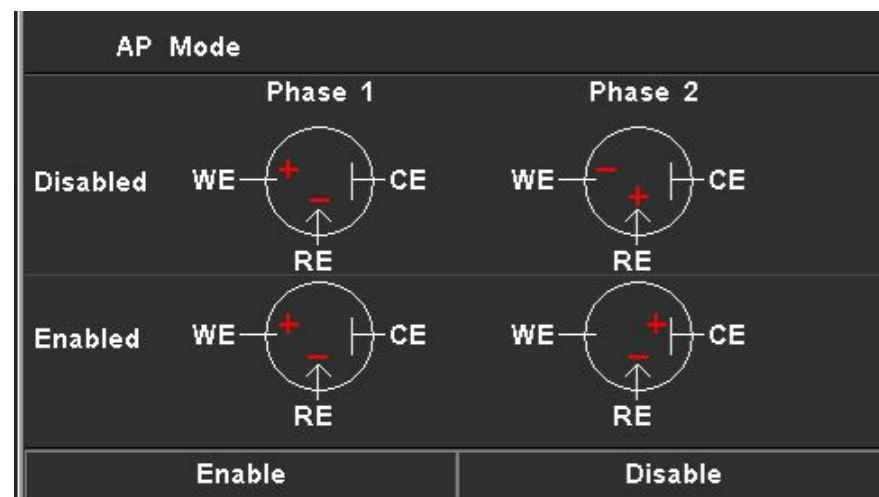
Constant Voltage using alternating polarity

/// Choose your AP Mode wisely

When choosing constant voltage, the intended reaction takes place on the surface of working electrode (WE), because reaction voltage is controlled between WE and reference electrode (RE).

When alternating polarity (AP) is chosen, there are two phases: in phase 1, the intended reaction takes place on the surface of WE, and reaction voltage is controlled between WE and RE; in phase 2, the intended reaction takes place on the surface of counter electrode (CE). In order to keep the constant voltage reaction consistent, reaction voltage should be controlled between CE and RE in phase 2.

By enabling AP mode, reaction voltage is consistently controlled in both phases. If AP Mode is disabled, ElectraSyn 2.0 will only control the voltage between WE and RE during the whole reaction, meaning reaction voltage is not controlled during phase 2. The user is responsible for choosing the appropriate AP mode for his reaction when prompted.



Pulsed alternating polarity

/// An extended version of AP

Pulsed Alternating polarity allows the user to set two different voltage/current levels for different durations. This helps the user to run an experiment at $V1/I1$ for $t1$ amount of time and then switch to $V2/I2$ for $t2$ amount of time.

Note: When defining the duration for each level, user must consider the rise time for the voltage/current to reach the set value. It is recommended to set the duration long enough for the voltage or current to settle.

Reaction protection

/// Voltage limit

1. Select the gear icon on the top right corner of the main menu
2. Select "Voltage Limit"
3. Click and rotate the knob to view the voltage limit.
4. Click the knob to confirm the voltage limit.
5. Touch Menu button to return to the main screen

Note: A warning message will appear if actual voltage reaches the device limit.

Cyclic Voltammetry

/// Scope of delivery



/// Reference Electrode (RE)

The reference electrode is delivered in "dry" form. One of the most common types of electrolyte for this electrode is aqueous 3 M KCl. However, different solutions of interest could be used as electrolyte as well. For example, a solution of perchloric acid (HClO_4) should use 3 M NaCl as reference electrolyte, since potassium perchlorate (KClO_4) is a sparingly soluble salt and it may deposit on the frit. For measuring non-aqueous solutions, aqueous 3 M KCl is compatible in most cases. However it is not advisable to use the reference electrode continuously for an extended period of time, as there might be crystallization on KCl on the frit. If needed, non-aqueous electrolyte such as acetonitrile solution of AgNO_3 could also be applied.

After the electrode has been filled, it should be left inside a solution containing the same electrolyte to allow the frit to soak. After using the electrode, rinse thoroughly with water or acetone (depending on the electrolyte used) and immerse it in the previously mentioned solution. Another alternative would be to fit it inside the rubber cap with a small volume of the electrolyte inside.

To use the electrode, rinse it and insert it in the center hole of the cap (as depicted in the picture), then twist it clockwise until secured.

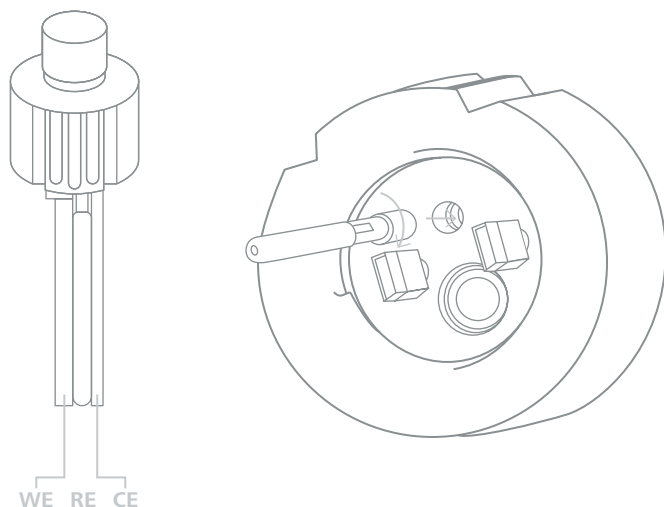
Over time, the electrolyte solution will lose ions. In this case, empty the solution and refill by following the steps above.

/// Working Electrode (WE)

The working electrode contains a glassy carbon disc which is 3 mm in diameter. This surface will accumulate debris from its use in different reactions. To ensure efficacy, it is recommended to re-polish it with high grit sand paper (above 1200 grit). This electrode should be placed in the WE section of the cap (There is also an indication of W and C at the top of a cap).

/// Counter Electrode (CE)

The counter electrode consists of a platinum coated copper substrate. It is not recommended to sand this electrode as exposing the substrate might hinder its functionality. This electrode should be placed in the CE section of the cap.



WE = Working Electrode
CE = Counter Electrode
RE = Reference Electrode

/// CV setup

1 ASSEMBLE REFERENCE ELECTRODE AND CV CELL

1. Remove Ag wire and electrode head from glass tube.
2. Fill tube to halfway point with electrolyte solution*
3. Insert Ag wire and electrode head into glass tube, the rubber seal should fit snugly
4. Place assembled reference electrode in a tube containing the electrolyte solution and let stand until glass frit is saturated
5. Attach reference electrode into ElectroSyn vial lid
6. Attach working electrode and counter electrode to ElectroSyn vial lid (note, "W" and "C" on top of vial lid correspond to position working electrode and counter electrode orientation)
7. Attach lid onto vial
8. Add CV sample to vial via top cap (note: solution level should be high enough in the vial to submerge the working electrode and reference electrode tips by ~5 mm)

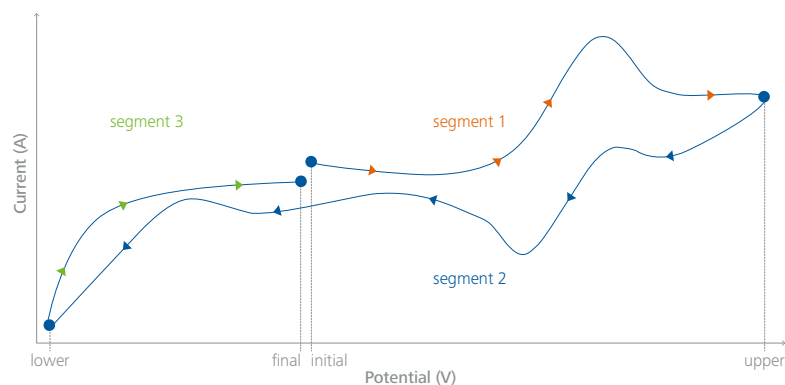
**A standard electrolyte solution is 3 M KCl_(aq); however, other electrolytes and electrolytes in organic solutions can also be used in the ElectroSyn reference electrode.*

Technical data

/// ElectraSyn 2.0 in detail

2 RUNNING A CV EXPERIMENT

1. Turn on ElectraSyn 2.0
2. Select "new experiment"
3. Select "Cyclic Volatametry" (Note: the CV experiment can alternatively be accessed by pressing the "CV" button)
4. Select "start" to begin CV experiment using default settings. The CV graph screen will be displayed and a blue line will move across the top of the screen indicating the ElectraSyn 2.0 is collenting data. When finished the CV curve will be displayed
5. When CV is complete the data can be saved to USB drive
6. To edit CV parameters, select "edit"
7. CV parameters can be modified by selecting "edit" and editing as desired (starting, upper, lower and end voltage, sweep rate etc.)



Example of CV parameters

Segment: 3 | Initial V: 0.0 | Direction: Rising | Upper V: 1.5 | Lower V: -1.0 | Final V: -0.1 | Sweep (mV/sec): 400

Tips

- › Surface of working electrode is clean and flat.
- › Working and counter electrodes are placed correctly.
- › Enough amount of electrolyte (0.05 M – 0.5 M) is included in a sample solution.
- › Concentration of a sample is appropriate (1 mM – 10 mM)
- › Solvent is unreactive within scan range.

Technical data ElectraSyn 2.0

Potentiostat	
Nominal voltage	48 VDC
Max. power input	36 W
Power input standby	5 W
Voltage output (electrode)	30 / 10 V
Current output (electrode)	100 mA
Motor rating output	9 W
Speed range	50 - 1500 rpm
Setting accuracy speed	10 rpm
Stirring quantity max. per stirring position (H2O):	100 ml
Length of stirring bar	20 mm
Display	TFT
USB port	yes
RS-232 interface	no
Analogue output	no
Protection class to DIN EN 60529	IP 40
Permissible ambient temperature	+ 5 ... + 40 °C
Permissible relative humidity	80%
Dimensions incl. glass vessel adapter (W x H x D)	130 x 150 x 250 mm
Weight	1.5 kg

AC adapter x D)

Input	100 – 240 VAC
	0.75 A
	50 – 60 Hz
	5 W
	48 VDC
Output	48 39.84 W LPS (Limited Power Source)
Protection class	II (double insulated)

Warranty

/// Regulations

In accordance with IKA warranty conditions, the warranty period is 24 months.

For claims under the warranty please contact your local dealer. You may also send the machine direct to our factory, enclosing the delivery invoice and giving reasons for the claim. You will be liable for freight costs.

The warranty does not cover worn out parts, nor does it apply to faults resulting from improper use, insufficient care or maintenance not carried out in accordance with the instructions in this operating manual.



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