Model 700E Series Bipotentiostat

The Model 700E series are computerized general purpose potentiostat / bipotentiostat / galvanostat instruments. A typical application involves a rotating ring-disk electrode (RRDE), but these systems can also be used for other applications where dual channel measurements are essential, such as dual channel electrochemical detection. The system contains a fast digital function generator, a direct digital synthesizer for high frequency AC waveforms, high speed dual-channel data acquisition circuitry, (bi)potentiostat, and a galvanostat (only available in select models). The potential control range is ±10 V and the current range is ±250 mA. The instrument is capable of measuring current down to tens of picoamperes. The steady state current of a 10 µm disk electrode can be readily measured without external adapters. With the CHI200B Picoamp Booster and Faraday Cage (fully automatic and compatible with the 700E series), currents down to 1 pA can be measured (primary current channel only). These instruments are very fast. The function generator can update at a 10 MHz rate. Two high speed and high resolution data acquisition channels allow both current channels or current and potential (or an external voltage signal) to be sampled simultaneously at 1 MHz rate with 16-bit resolution. The instrument provides a very wide dynamic range of experimental time scales. For instance, the scan rate in cyclic voltammetry can be up to 1000 V/s with a 0.1 mV potential increment or 5000 V/s with a 1 mV potential increment. The potentiostat / galvanostat uses a 4-electrode configuration, allowing it to be used for liquid/liquid interface measurements and eliminating the effect of the contact resistance of connectors and relays for high current measurements. The data acquisition systems allow an external input signal (such as spectroscopic) to be recorded simultaneously during an electrochemical measurement. The instrument will also automatically re-zero both potential and current, so that periodic re-calibration of the instrument can be avoided.

The 700E series shares many common features with the 600E series. When used as a single channel potentiostat, the instrument is identical to the model 600E series. The bipotentiostat is realized with an add-on board that includes circuitry for the second channel's potential control, current measurement, two filter stages, three extra gain stages, and channel selection circuitry. When it is used as a bipotentiostat, the second channel can be controlled at an independent constant potential, to scan or step at the same potential as the first channel. In case of CV, it can also scan with a constant potential difference with the first channel. Techniques available for the second channel include CV, LSV, SCV, CA, DPV, NPV, SWV, and i-t.

The 700E series is the upgrade to our very popular 700/700A/700B/700C/700D series. The major improvements of this series are very stable and accurate potential and current control, and dual channel data acquisition at high speed.

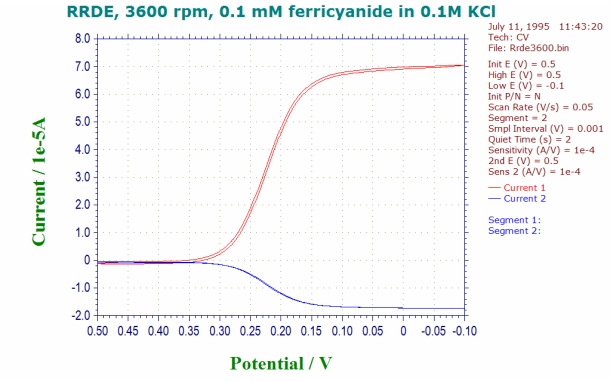
The 700E series has a USB port (default) and a serial port for data communication with the PC. You can select either USB or serial port (but not both) by changing the switch setting on the rear panel of the instrument.

The 700E series also has a true integrator for chronocoulometry.

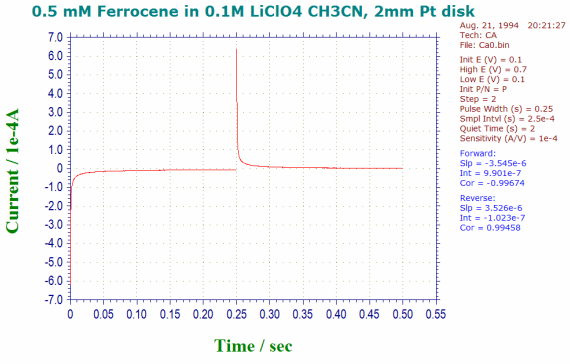
Two 16-bit highly stable bias circuits are used for current and potential bias, allowing wider dynamic range in AC measurements. These can also be used to re-zero the DC current output.

The instrument is capable of a wide variety of electrochemical techniques, and is available with integrated simulation and fitting software functions for both impedance and cyclic voltammetry. These features provide powerful tools for both electrochemical mechanistic studies and trace analysis.

We provide several different models in the 700E series. The following table compares the different models. Other than what is listed, the specifications and features of these models are identical. Models 700E and 710E are basic units for mechanistic study and electrochemical analysis, respectively. Models 720E and 730E are comprehensive electrochemical analyzers. Model 750E and 760E are advanced electrochemical workstations.



Voltammogram at rotating ring-disk electrode.



Chronoamperometric data.

Specifications

Potentiostat / Biptentiostat:

- Zero resistance ammeter
- 2- or 3- or 4-electrode configuration
- Floating (isolated from earth) or earth ground
- Maximum potential: ±10 V for both channels
- Maximum current: ± 250 mA continuous (sum of two current channels), ±350 mA peak
- Compliance Voltage: ±13 V
- Potentiostat rise time: < 1 µs, 0.8 µs typical
- Potentiostat bandwidth (-3 dB): 1 MHz
- Applied potential ranges: ±10 mV, ±50 mV, ±100 mV, ±650 mV, ±3.276 V, ±6.553 V, ±10 V
- Applied potential resolution: 0.0015% of potential range
- Applied potential accuracy: ±1 mV, ±0.01% of scale
- Applied potential noise: < 10 µV rms
- Measured current range: ±10 pA to ±0.25 A in 12 ranges
- Measured current resolution: 0.0015% of current range, minimum 0.3 fA
- Current measurement accuracy: 0.2% if current range >= 1e-6 A/V, 1% otherwise
- Input bias current: < 20 pA

Galvanostat:

- Galvanostat applied current range: 3nA – 250mA
- Applied current accuracy: 20 pA ± 0.2% if > 3e-7 A, ±1% otherwise
- Applied current resolution: 0.03% of applied current range
- Measured potential range: ±0.025 V, ±0.1 V, ±0.25 V, ±1 V, ±2.5 V, ±10 V
- Measured potential resolution: 0.0015% of measured range

Electrometer:

- Reference electrode input impedance: 1e12 ohm
- Reference electrode input bandwidth: 10 MHz
- Reference electrode input bias current: <= 10 pA @ 25°C

Waveform Generation and Data Acquisition:

- Fast waveform update: 10 MHz @ 16-bit
- Fast data acquisition: dual channel 16-bit ADC, 1,000,000 samples/sec simultaneously
- External signal recording channel at maximum 1 MHz sampling rate

Experimental Parameters:

- CV and LSV scan rate: 0.000001 to 10,000 V/s, two channels simultaneously
- Potential increment during scan: 0.1 mV @ 1,000 V/s
- CA and CC pulse width: 0.0001 to 1000 sec
- CA minimum sample interval: 1 µs, both channels
- CC minimum sample interval: 1 µs
- True integrator for CC
- DPV and NPV pulse width: 0.001 to 10 sec
- SWV frequency: 1 to 100 kHz
- i-t sample interval: minimum 1 µs, both channels
- ACV frequency: 0.1 to 10 kHz
- SHACV frequency: 0.1 to 5 kHz
- FTACV frequency: 0.1 to 50 Hz, simultaneously acquire 1st, 2nd, 3rd, 4th, 5th, and 6th harmonics ACV data
- IMP frequency: 0.00001 to 1 MHz
- IMP amplitude: 0.00001 V to 0.7 V rms

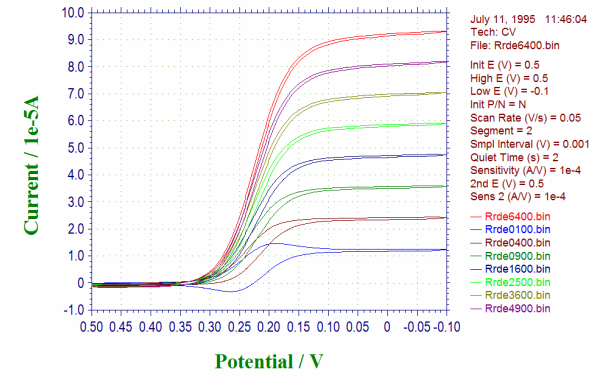
Other Features:

- Automatic and manual iR compensation
- Current measurement bias: full range with 16-bit resolution, 0.003% accuracy
- Potential measurement bias: ±10V with 16-bit resolution, 0.003% accuracy
- External potential input
- Potential and current analog output
- Programmable potential filter cutoff: 1.5 MHz, 150 KHz, 15 KHz, 1.5 KHz, 150 Hz, 15 Hz, 1.5 Hz, 0.15 Hz
- Programmable signal filter cutoff: 1.5 MHz, 150 KHz, 15 KHz, 1.5 KHz, 150 Hz, 15 Hz, 1.5 Hz, 0.15 Hz
- RDE control output (Model 730E and up): 0-10V (corresponding to 0-10000 rpm), 16-bit, 0.003% accuracy
- Digital input/output lines programmable through macro command
- Flash memory for quick software update
- Serial port or USB port selectable for data communication
- Cell control: purge, stir, knock
- Maximum data length: 256K-16384K selectable
- CV simulation and fitting program, user defined mechanisms
- Impedance simulation and fitting program
- Dimension: 14.25”(W) × 9.25”(D) × 4.75”(H)
- Weight: 12 lb.

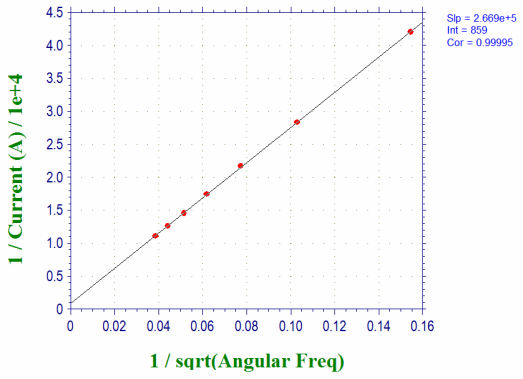
Differences of 700E Series Models

Functions	*700E*	*710E*	*720E*	*730E*	*750E*	*760E*
Cyclic Voltammetry (CV)*	●	●	●	●	●	●
Linear Sweep Voltammetry (LSV) [&,*]	●	●	●	●	●	●
Staircase Voltammetry (SCV) [#,&,*]				●	●	●
Tafel Plot (TAFEL)				●	●	●
Chronoamperometry (CA)*	●		●	●	●	●
Chronocoulometry (CC)	●		●	●	●	●
Differential Pulse Voltammetry (DPV) [#,&,*]		●	●	●	●	●
Normal Pulse Voltammetry (NPV) [#,&,*]		●	●	●	●	●
Differential Normal Pulse Voltammetry (DNPV) [#,&]						●
Square Wave Voltammetry (SWV) [&,*]			●	●	●	●
AC Voltammetry (ACV) [#,&,$]				●	●	●
2nd Harmonic AC Voltammetry (SHACV) [#,&,$]				●	●	●
Fourier Transform AC Voltammetry (FTACV)						●
Amperometric i-t Curve (i-t)*				●	●	●
Differential Pulse Amperometry (DPA)					●	●
Double Differential Pulse Amperometry (DDPA)					●	●
Triple Pulse Amperometry (TPA)					●	●
Integrated Pulse Amperometric Detection (IPAD)						●
Bulk Electrolysis with Coulometry (BE)	●		●	●	●	●
Hydrodynamic Modulation Voltammetry (HMV)					●	●
Sweep-Step Functions (SSF)					●	●
Multi-Potential Steps (STEP)					●	●
AC Impedance (IMP)					●	●
Impedance - Time (IMPT)					●	●
Impedance - Potential (IMPE)					●	●
Chronopotentiometry (CP)						●
Chronopotentiometry with Current Ramp (CPCR)						●
Multi-Current Steps (ISTEP)						●
Potentiometric Stripping Analysis (PSA)					●	●
Electrochemical Noise Measurement (ECN)						●
Open Circuit Potential - Time (OCPT)	●	●	●	●	●	●
Galvanostat						●
RDE control (0-10V output)				●	●	●
Full version of CV simulation and fitting program				●	●	●
Limited version of CV simulation and fitting program	●	●	●			
Impedance simulation and fitting program					●	●
iR Compensation	●	●	●	●	●	●
External Potential Input	●	●	●	●	●	●
Auxiliary Signal Measurement Channel	●	●	●	●	●	●

#: Corresponding polarographic mode can be performed.
&: Corresponding stripping mode can be performed.
$: Phase selective data are available.
*: Second channel (bipotentiostat mode) can be performed.



RDE Voltammograms at different rotation rates



Koutecky-Levich plot