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SOLLICH**

**ATLAS - SOLLICH**  
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DEVICE MANUAL

**ATLAS 0931 POTENTIOSTAT - GALVANOSTAT**



**ATLAS INSTRUMENTS**

## ATLAS 0931 POTENTIOSTAT – GALVANOSTAT

### I.1. PURPOSE

ATLAS 0931 POT.-GALV. is a precise four-electrode potentiostat – galvanostat destined to work in lab conditions.

ATLAS 0931 device is cased in ULTRAMAS type case.

The device allows to obtain potential polarisation (potentiostatic) or current polarisation (galvanostatic) of electrochemical systems, by excitation of constant signal which is set by **POTENTIAL/CURRENT SETTINGS** potentiometer.

The device, depending on manufacturing version, may be equipped with digital meters which allow to measure and read present values of working electrode potential and polarising current.

The device has the following setups:

- 1) function: POT - potentiostat  
GALV - galvanostat

2 ) working mode:

- OFF - disconnection of measuring terminals
- CTRL - 10 kOhm internal measuring resistor connected to terminals
- Estat - measurement of stationary potential of system under investigation
- WORK - polarisation of system under investigation

- constant ranges between 10 nA and 200mA

4) switch of bandwidth reduction

- SR min,
- SR max

5) switch of **E<sub>w</sub>** potential measurement ranges,

- 2V
- 20V,

The device is equipped with following inputs - outputs:

1) **INPUTS** terminals for measuring cell connection:

WE, WEsens, RE, CE.

2) Inputs for connecting external programming voltage generator and for external measuring devices

External INPUTS-OUTPUTS.

The device is equipped with acoustic signalling device which informs that bias current has gone beyond range of measurement.

Digital indicators are not included in standard version of the device.

Measurement and reading of potential and bias current is taken by external devices, for instance digital multimeters or other accurate digital voltmeters.

## I.2. ATLAS 0931 POTENTIOSTAT-GALVANOSTAT - TECHNICAL DATA

- function:	POT GALV	- <b>potentiostat</b> - <b>galvanostat</b>		
- operating mode:	OFF  CTR  Estat  WORK	- complete disconnection of device terminals  - switching on of 1 kOhm control resistor, settings control  - stationary potential measurement  - switching on of WE, RE1, RE2, CE external terminals		
- linear operating range of measured electrode				+/- 5 V
- maximum voltage of supporting electrode				+/- 12 V
- maximum current of measured electrode				+/- 200mA
- slew rate of supporting electrode voltage at excitation of step change of voltage	- potentiostat function - at max. transmission range SRmax  - at min. transmission range SRmin			min. 6 V/us  min. 0,1 V/us
- inputs of reference electrodes <b>WEsens</b> and <b>RE</b> input resistance input capacitance input current				> 10 Gohm < 200 pF < 100 pA
- ranges of current measurement				
Range	Inaccuracy of setting and adjustment	Inaccuracy of measurement with usage of external measuring instruments	Resolution of measurement with usage of internal (built-in) measuring instruments	Inaccuracy of measurement with usage of internal (built-in) measuring instruments
100 mA	<0,2 %	<0,2 %	100 uA	< 1% + 10 digit
10 mA	<0,2 %	<0,2 %	10 uA	< 1% + 10 digit
1 mA	<0,2 %	<0,2 %	1 uA	< 1% + 10 digit
100 uA	<0,2 %	<0,2 %	100 nA	< 1% + 10 digit
10 uA	<0,2 %	<0,2 %	10 nA	< 1% + 10 digit
1 uA	<0,5 %	<0,5 %	1 nA	< 2% + 10 digit
100 nA	<1 %	<1 %	100 pA	< 5% + 10 digit
10 nA	<2 %	<2 %	10 pA	< 10% + 10 digit

- ranges of measured electrode potential measurement				
Range	Inaccuracy of setting and adjustment	Inaccuracy of measurement with usage of external measuring instruments	Resolution of measurement with usage of internal (built-in) measuring instruments	Inaccuracy of measurement with usage of internal (built-in) measuring instruments
2 V	<0,2 %	<0,2 %	1 mV	< 1% + 10 digit
20 V	<0,2 %	<0,2 %	10 mV	< 1% + 10 digit

## II. PRINCIPLE OF ATLAS 0931 DEVICE OPERATION.

### II.1. POTENTIOSTAT - GALVANOSTAT

#### II.1.1. Main amplifier

Control voltage of main amplifier of supporting electrode is a sum of voltages:

- set by potentiometer **POTENTIAL/CURRENT SETTINGS**,
- and the voltage from external device which is connected to **External INPUTS-OUTPUTS**.

The **External INPUTS-OUTPUTS** enables to controll the device from external voltage generators or signal generators.

#### II.1.2. The POT / GALV switch

Selection of **POT** position - the device works as **POTENTIOSTAT**

Selection of **GALV** position - the device works as **GALVANOSTAT**

##### Potentiostat facility

The main amplifier forces flow of electrical current between working electrode WE and supporting electrode CE.

The value of bias current of these electrodes is such, that obtained potential difference between reference electrodes WE<sub>sens</sub> i RE will be equal to given control voltage.

Potential difference between reference electrodes can be read on **Potential** measuring instrument.

Transducer **I/U** converts value of bias current to proportionate value of voltage, which can be read on **Current** measuring instrument.

##### Galvanostat facility

The main amplifier forces polarisation of working electrode **WE** and of supporting electrode **CE** in such way, that intensity of current flowing between these electrodes will be equal to programmed value.

### II.1.3. The OPERATING MODE switches

- trybu pracy -
  - OFF - Disconnection of instrument terminals
  - CTRL - 10 kOhm internal measuring resistor connected to terminals
  - Estat - measurement of stationary potential of system under investigation
  - WORK - polarisation of system under investigation

#### **OFF - Disconnection of instrument terminals**

Terminals of main amplifier are disconnected from external measuring terminals and internal circuits.

Measuring cell which is joined to the device, is disconnected from measuring circuits.

#### **CTRL - Checking of the device.**

An internal resistor 10kOhm is connected to terminals of the main amplifier. It allows to set of initial values of potentials, or polarising currents, and to verify proper operation of the device.

#### **Estat - Measurement of stationary potential.**

External terminals **WE**, **WEsens** and **RE** are connected to measuring circuits of the device. Potential difference, which occurs between points of connecting **WEsens** and **RE** electrodes, will be measured for system which is joined to these terminals.

#### **WORK - Polarisation of measured system.**

Measured system which is joined to external terminals is polarised according to device function and to set values.

### II.1.4. The 2V / 20V switch

The switch changes range of voltage measured by internal voltmeter.

In **2V** position: range of measured potential is +/- 1.999 [ V ]

In **20V** position: range of measured potential is +/- 19.99 [ V ]

### II.1.5. Acoustic signalisation

The main amplifier has circuit of working stability supervision.

The main amplifier of potentiostat has ability to reduce bandwidth in case of unstable working of the device with joined measuring cell.

Acoustic signal informs that excitation of the system has occurred and it is necessary to reduce bandwidth, or that current exceeded value of set current measuring range.

In situation of excitation of the device it is necessary to reduce bandwidth of the amplifier from **Srmin** to **Srmax**, or to enhance current measuring range.

### III. CONNECTING OF MEASURING CELL.

POTENTIOSTAT - GALVANOSTAT ATLAS 0931 can work with two-electrode, three-electrode or four-electrode measuring cell.

Measuring cord for cell connecting has four wires, which each one corresponds with one measuring electrode.

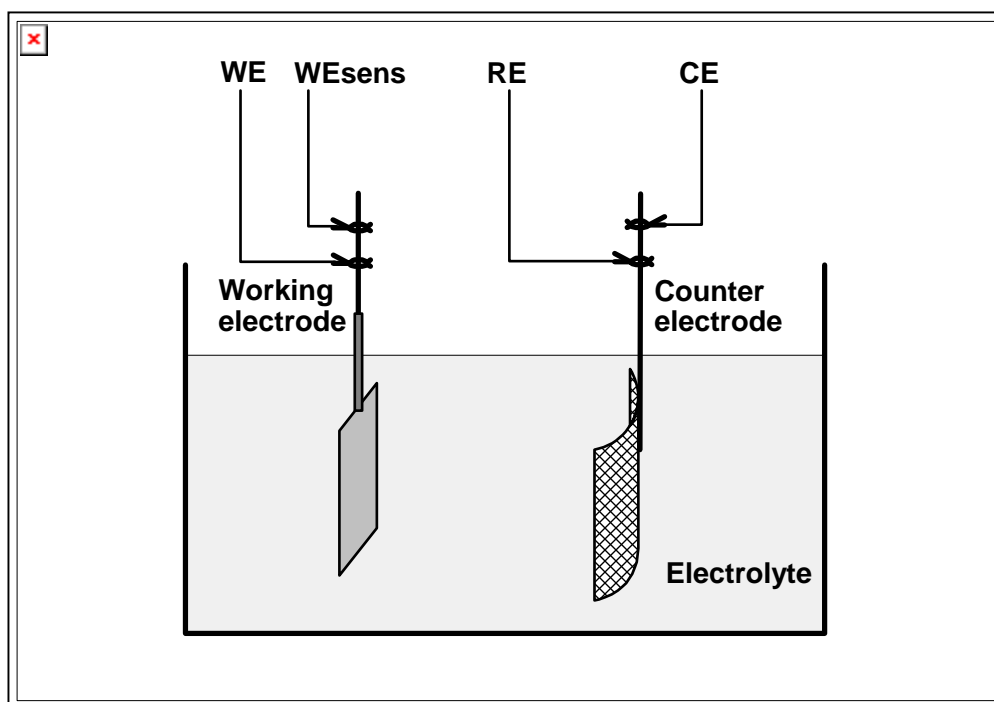
BLACK wire	-WE	- working electrode
BLUE wire	-WEsens	- working sense electrode
YELLOW wire	-RE	- reference electrode
RED	-CE	- counter electrode

In respect to previous three-electrode potentiostat, the four-electrode device yields more accurate measurement of working electrode potential.

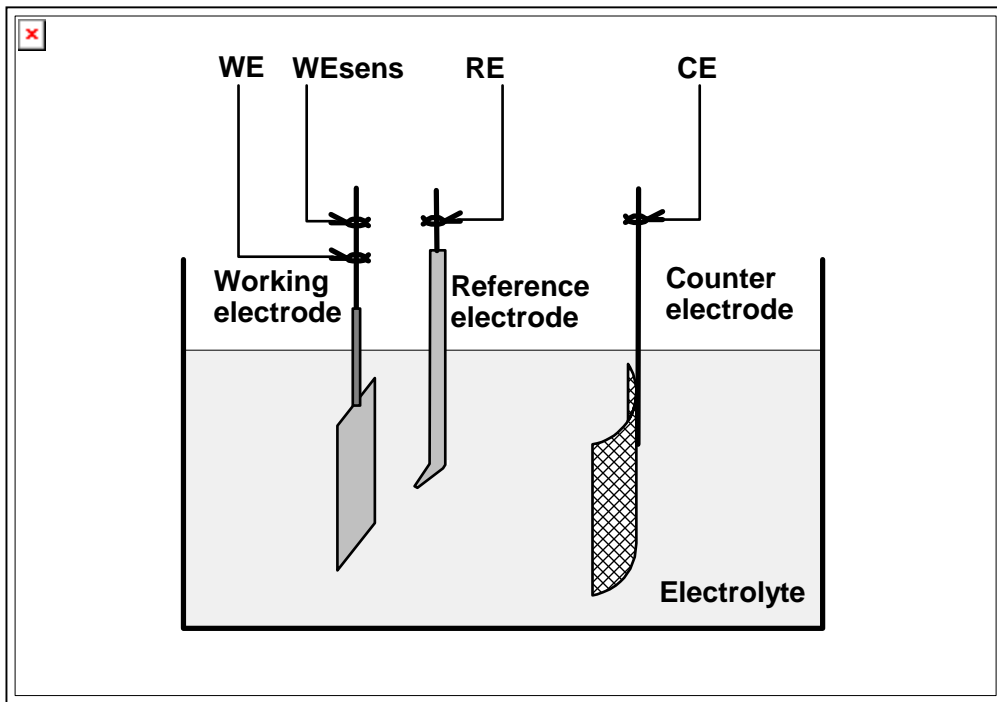
Altering from four-electrode to three-electrode device can be obtained by connecting **WEsens** wire to **WE** wire on the lead of measured electrode ( look fig. 2.4 - three-electrode cell)

The **RE** electrode fulfill a purpose of reference electrode.

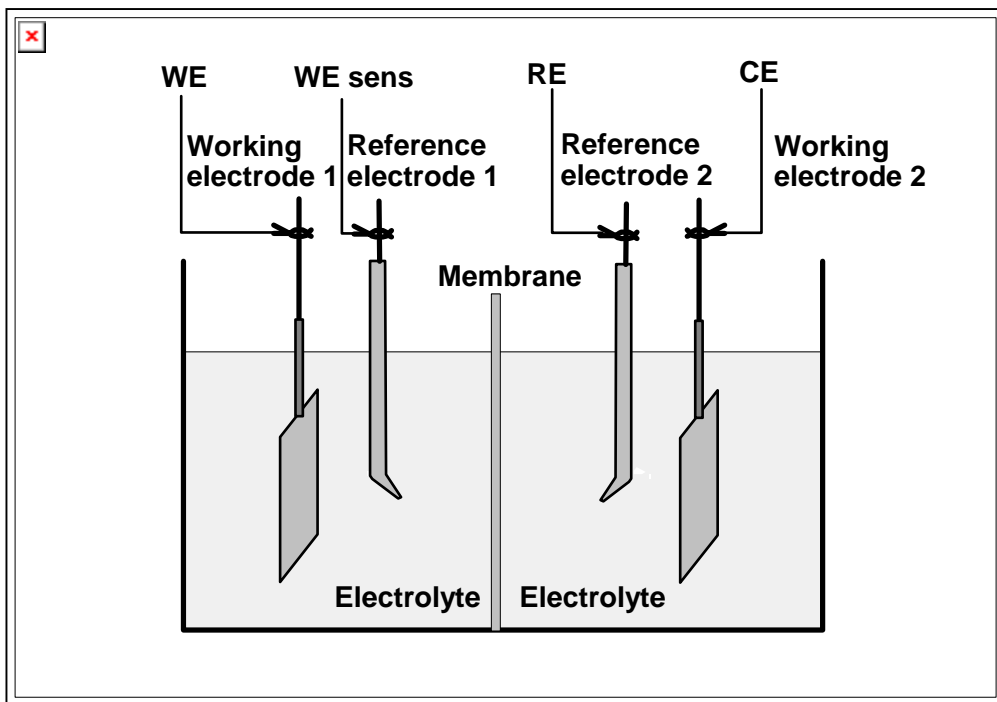
The way of connecting electrochemical cell to measuring terminals is presented on fig.2.4a,b and c.



Rys 2.4a. The way of connecting two-electrode electrochemical cell.



Rys 2.4b. The way of connecting three-electrode electrochemical cell



Rys 2.4c. The way of connecting four-electrode electrochemical cell

#### IV. CONNECTING THE DEVICE TO THE MAINS.

##### ATTENTION !

The device has to be powered from power outlet with zeroing pin or earth pin, from the same power strip as all devices that cooperate with it.

#### IV.1. STARTING THE DEVICE.

To start measurements the following operations have to be done:

- disconnect measured systems from terminals **WE**, **WEsens**, **RE** and **CE** in the device
- set **OFF** position
- set **200mA** position
- set **SRmin** position
- set **POT / GALV** position
- turn on **2V** button
- set **POTENTIAL/CURRENT SETTINGS** in position min. ( turned to the left )
- turn on **ON** key for switching on the mains in the device .

#### IV.2. STARTING THE MEASUREMENT.

- set **CTRL** position
    - set the value of polarising potential by **POTENTIAL/CURRENT SETTINGS** potentiometer.
- Read that value from internal voltmeter set in position :
- **2V**

**Attention: voltmeter reading is WORKING electrode potential value!**

- set **Estat** position, in order to measure stationary potential value.
- set **WORK** position, in order to bias measured system.
- selecting consecutively smaller and smaller range of current measurement, the most accurate range of its measurement should be selected.

#### IV.3. MEASUREMENT COMPLETION.

- set **OFF** position,
- set **200mA** position,
- disconnect measuring cell from device terminals **WE**, **WEsens**, **RE** and **CE**.

#### V. POLARISING TECHNIQUES.

The device allows to conduct all classical measuring techniques which are employed in electrochemistry by using external generator of polarising signal.

##### V.1. Research of non-polarised systems.

1.1. Recording of stationary potential versus time;  $E_{stat} = f(t)$ .

##### V.2. Potentiostatic and Potentiodynamic polarisation.

2.1. Polarisation by constant potential.

Measurement and recording of potential and polarising current versus time;  
 $E_w, I_{pol} = f(t)$ .

2.2. Potentiodynamic polarisation.

Measurement and recording of time and current versus change of potential;

$t, I_{pol} = f(E_w)$ ,  
where changes of potential are controlled by voltage applied to  
**External INPUTS-OUTPUTS** terminal.

### **V.3. Galvanostatic and galvanodynamic polarisation.**

#### 3.1. Polarisation by constant current.

Measurement and recording of current and potential versus time;  $I_{pol}, E_w = f(t)$

#### 3.2. Galvanodynamic polarisation.

Measurement and recording of time and potential versus changes of bias current  
 $E_w, t = f(I_{pol})$ , where changes of current are controlled by voltage applied to  
**External INPUTS-OUTPUTS** terminal.

4. The device enables to set polarisation by potential or constant current and remain polarisation conditions for as long as required.

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*NOTES:*