

Battery Analyzers  
BA6010 Series



The BA6010 Series battery analyzers measure voltage and resistance of modern battery technologies with high accuracy, resolution, and speed. Additionally, these instruments provide auxiliary measurement parameters inductance, capacitance, dissipation factor, impedance, quality factor, reactance, and phase angle in degrees and radians.

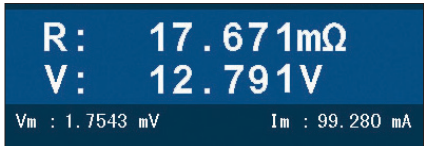
The BA6010 Series is suitable for characterizing battery chemistries that are responsive to a 1 kHz AC stimulus signal, including lead acid, lithium and alkaline type batteries used in consumer products, electric vehicles, power backup, security, and fire alarm systems. Model BA601I supports voltage measurements of battery packs up to 300 V whereas the BA6010 features a 6 V measurement range ideal for battery cell testing. The handler and remote interfaces expand the analyzer's application to R&D and automated manufacturing environments.

Features & Benefits

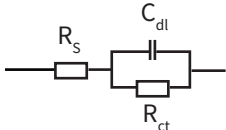
- 4.3 inch color LCD display
- Trace function for graphical display of voltage and resistance with on-screen cursor measurements
- 4-wire kelvin test leads with monitoring of Hi / Low / High and Low drive open faults
- Compare and sort using 9 bins with statistical evaluations
- Δ% mode for quickly determining the percent difference between batteries
- Pass/Fail indicator with audible tone
- Fast test speed up to 50 measurements per second to increase manufacturing throughput
- Trigger modes internal, manual, bus and external
- 100 internal and external storage locations for setup and screen save
- Handler interface for easy integration with a component handler or integration with PLC
- Standard RS232, USB (USBTMC and virtual COM) interfaces

Wide range of measurements

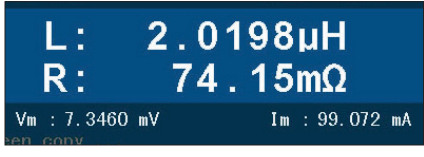
Two user-selected measurements can be displayed simultaneously, along with stimulus signals Vm and Im. Unlike comparable battery testers that only support voltage and resistance measurements, users can also characterize additional parameters such as battery capacitance thus providing additional insight into a battery's condition.



Main measurement parameters



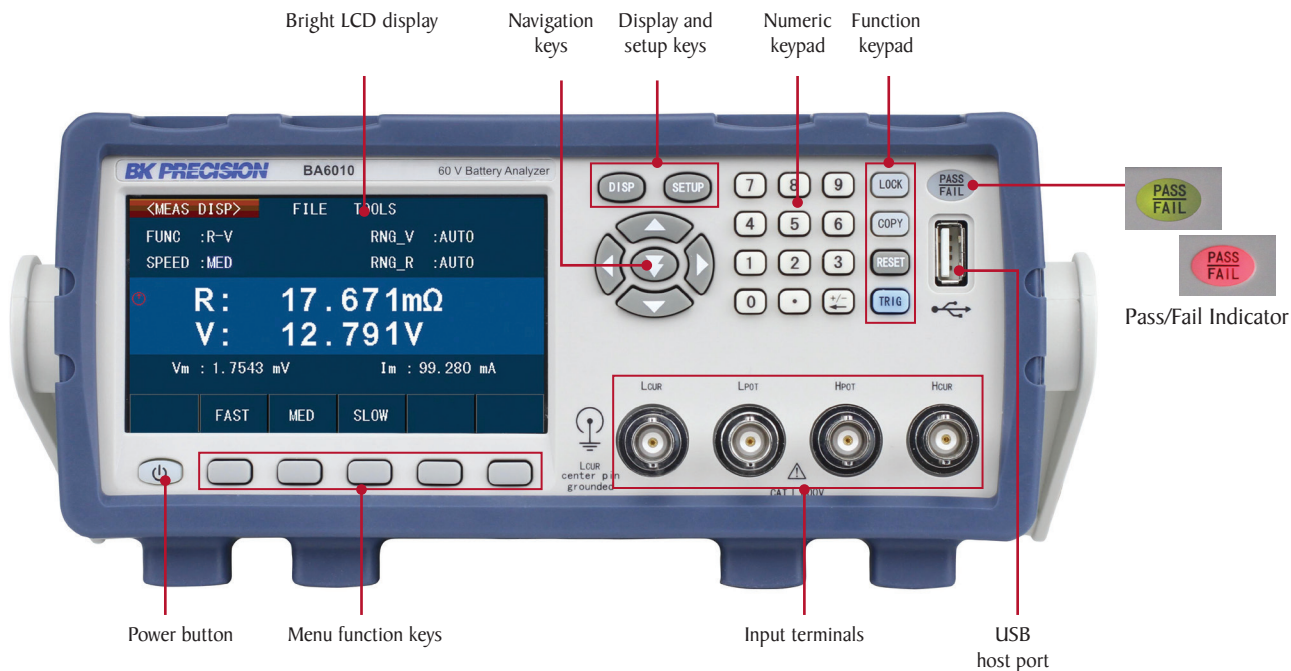
Simplified Randles cell



Auxiliary measurement parameters

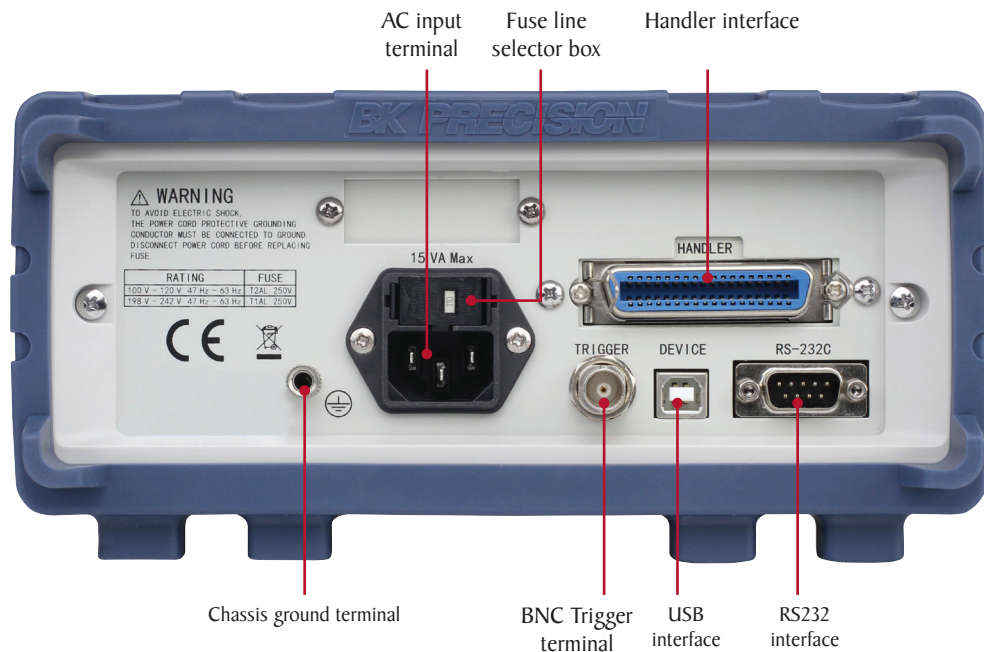
| Model  | Input voltage range | Basic voltage accuracy | Voltage resolution |
|--------|---------------------|------------------------|--------------------|
| BA6010 | 6 V / 60 V          | 0.05 %                 | 100 μV             |
| BA601I | 30 V / 300 V        | 0.05 %                 | 1 mV               |

## Front panel



Large 4.3 inch color LCD screen for easy viewing of configuration and measurements. 4-terminal front panel connection and quick connect test fixture for high accuracy measurements.

## Rear panel



Standard RS232, USB (USBTMC and virtual COM) interfaces, handler interface and external BNC trigger input are useful for production automation.

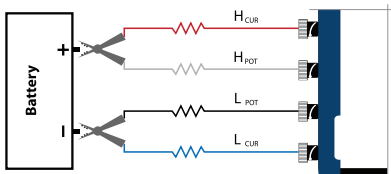
Flexible operation

Improved measurement accuracy

The 4-terminals on the front of the BA6010 Series are used together with the Kelvin clip test fixture. This system minimizes the influence of the test lead resistance and improves measurement accuracy.

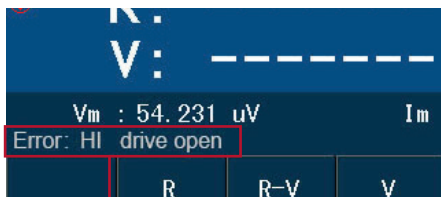


Kelvin clip test fixture



4-wire kelvin connection

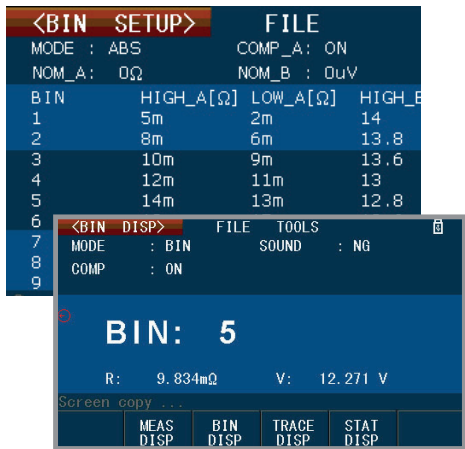
On screen monitoring system detects test probe contact failure and damaged leads for reliable measurements.



- Error: HI drive open
- Error: LO drive open
- Error: HI sense open
- Error: LO sense open
- Error: Measure line open

Binning function

Quickly sort components using up to 9 bins. The bin results are displayed on-screen with each cycle. The handler interface includes dedicated signal pins for each bin, Pass/Fail and end of measurement. The handler interface is suitable for integration with device handler systems or programmable logic controllers (PLC) used in production automation.



Bins for sorting devices

Statistical function

The analyzers can perform statistical calculations on the measurements and display the results on-screen.



Statistical tools menu

Comparator function

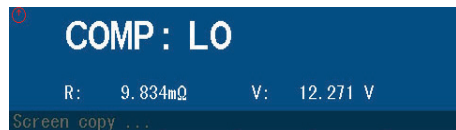
The comparator function evaluates measurements against a user specified upper and lower limit for pass/fail (Go/No Go) style testing. Comparative evaluations can be made using primary, secondary or both measurements. The front panel PASS / FAIL indicator will illuminate and a sounder can be enabled for audible confirmation.



Bin comparator display



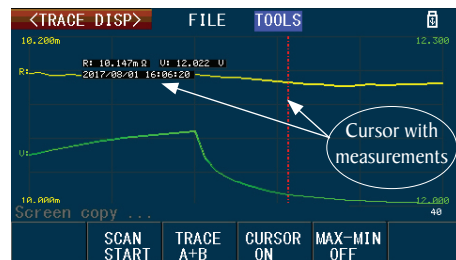
Compare test - below limits



Compare test - above limits

Trace function

The trace function samples and plots two user-selected measurement readings over a specified time. Enable cursors for viewing plotted values and time stamp information.



Trace display

## Specifications

All specifications apply to the unit after a temperature stabilization time of 15 minutes over an ambient temperature range of  $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ . Specifications are subject to change without notice.

| Model                    |                  | BA6010, BA6011                                                                                                                                                                           |
|--------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measurement Parameters   | Main             | V, R                                                                                                                                                                                     |
|                          | Auxiliary        | L, C, D, Z, X, Q, $\theta_d$ , and $\theta_r$                                                                                                                                            |
| Test Frequency           |                  | 1 kHz $\pm$ 0.2 Hz                                                                                                                                                                       |
| Display Resolution       |                  | 5 digits (SLOW & MED), 4 digits (FAST)                                                                                                                                                   |
| Measurement Speed        |                  | SLOW, approx. 6.25 measurements/sec<br>MED, approx. 10 measurements/sec<br>FAST, approx. 50 measurements/sec                                                                             |
| Temperature Coefficient  | Voltage Meas.    | 0.005 % / $^{\circ}\text{C}$                                                                                                                                                             |
|                          | Resistance Meas. | 0.05 % / $^{\circ}\text{C}$                                                                                                                                                              |
| Triggering               |                  | Internal, External, Manual, Bus                                                                                                                                                          |
| Delay Time               |                  | On / Off, 0 ms to 60 s                                                                                                                                                                   |
| Averaging                |                  | 1 to 255 samples                                                                                                                                                                         |
| Statistical Calculations |                  | Valid data count, Invalid data count, Mean, Maximum, Minimum, Standard Deviation, Sample Standard Deviation, Process Capability Index (Dispersion), Process Capability Index (Deviation) |

| Voltage Measurement (BA6010) |                       |                   |                          |
|------------------------------|-----------------------|-------------------|--------------------------|
| <b>SLOW, MED</b>             |                       |                   |                          |
| Range                        | Maximum Display Value | Resolution        | Accuracy                 |
| 6 V                          | 6.5000 V              | 100 $\mu\text{V}$ | $\pm(0.05\text{ \% FS})$ |
| 60 V                         | 65.000 V              | 1 mV              |                          |

| <b>FAST</b> |                       |            |                         |
|-------------|-----------------------|------------|-------------------------|
| Range       | Maximum Display Value | Resolution | Accuracy                |
| 6 V         | 6.500 V               | 1 mV       | $\pm(0.1\text{ \% FS})$ |
| 60 V        | 65.00 V               | 10 mV      |                         |

| Voltage Measurement (BA6011) |                       |            |                          |
|------------------------------|-----------------------|------------|--------------------------|
| <b>SLOW, MED</b>             |                       |            |                          |
| Range                        | Maximum Display Value | Resolution | Accuracy                 |
| 30 V                         | 35.000 V              | 1 mV       | $\pm(0.05\text{ \% FS})$ |
| 300V                         | 310.00 V              | 10 mV      |                          |

| <b>FAST</b> |                       |            |                         |
|-------------|-----------------------|------------|-------------------------|
| Range       | Maximum Display Value | Resolution | Accuracy                |
| 30 V        | 35.00 V               | 10 mV      | $\pm(0.1\text{ \% FS})$ |
| 300 V       | 310.0 V               | 100 mV     |                         |

## Specifications

| Resistance Measurement |                       |            |                     |                     |
|------------------------|-----------------------|------------|---------------------|---------------------|
| SLOW, MED              |                       |            |                     |                     |
| Range                  | Maximum Display Value | Resolution | Measurement Current | Accuracy            |
| 30 mΩ                  | 33.000 mΩ             | 1 μΩ       | 100 mA (± 10 %)     | ±(0.3 % + 0.1 % FS) |
| 300 mΩ                 | 330.00 mΩ             | 10 μΩ      | 100 mA (±10 %)      |                     |
| 3 Ω                    | 3.3000 Ω              | 100 μΩ     | 10 mA (± 10 %)      |                     |
| 30 Ω                   | 33.000 Ω              | 1 mΩ       | 1 mA (± 10 %)       |                     |
| 300 Ω                  | 330.00 Ω              | 10 mΩ      | 100 μA (± 10 %)     |                     |
| 3 kΩ                   | 3.5000 kΩ             | 100 mΩ     | 10 μA (± 10 %)      |                     |
| FAST                   |                       |            |                     |                     |
| Range                  | Maximum Display value | Resolution | Measurement Current | Accuracy            |
| 30 mΩ                  | 33.00 mΩ              | 10 μΩ      | 100 mA (± 10 %)     | ±(0.5 % + 0.3 % FS) |
| 300 mΩ                 | 330.0 mΩ              | 100 μΩ     | 100 mA (± 10 %)     |                     |
| 3 Ω                    | 3.300 Ω               | 1 mΩ       | 10 mA (± 10 %)      |                     |
| 30 Ω                   | 33.00 Ω               | 10 mΩ      | 1 μA (± 10 %)       |                     |
| 300 Ω                  | 330.0 Ω               | 100 mΩ     | 100 μA (± 10 %)     |                     |
| 3 kΩ                   | 3.500 kΩ              | 1 Ω        | 10 μA (± 10 %)      |                     |

| Accuracy of Auxiliary Measurement Parameters |               |
|----------------------------------------------|---------------|
| L, C, D, Z, X, Q, θd, and θr                 | 5 % typical** |

\*\* see user manual for more details

| Bin Comparator Function |                                                                                                                           |                                            |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Limit Setting Mode      | Tolerance (TOL) or Absolute (ABS) value                                                                                   |                                            |
| Number of Bins          | 9 sorting bins BIN1-BIN9                                                                                                  |                                            |
| Beep Warning            | OFF, PASS, FAIL                                                                                                           |                                            |
| Trace Function          |                                                                                                                           |                                            |
| Total Time              | 1 s - 99999 s                                                                                                             |                                            |
| Sampling Interval       | 1 s - 86400 s                                                                                                             |                                            |
| General                 |                                                                                                                           |                                            |
| Save/<br>Recall         | Instrument Settings                                                                                                       |                                            |
|                         | Save / Recall                                                                                                             | Internal or External Memory: Up to 100     |
|                         | Measurements, Bin Comparator Results, Screenshots                                                                         |                                            |
|                         | Save                                                                                                                      | External Memory: Up to 100                 |
| Remote Interface        |                                                                                                                           | USBTMC / USB (Virtual COM), RS232, GPIB    |
| Display                 |                                                                                                                           | 4.3", 480 × 272 LCD display                |
| AC Input                |                                                                                                                           | 110 V ±10 % or 220 V ± 10 %, 47 to 63 Hz   |
| Power Consumption       |                                                                                                                           | 15 VA Max.                                 |
| Operating Temperature   |                                                                                                                           | 0 °C to 40 °C                              |
| Storage Temperature     |                                                                                                                           | -10 °C to 70 °C                            |
| Relative Humidity       |                                                                                                                           | up to 80 %                                 |
| Dimension (W×H×D)       |                                                                                                                           | 9.25" x 4.1" x 14.17" (235 x 104 x 360 mm) |
| Weight                  |                                                                                                                           | 7.9 lbs (3.6 kg)                           |
| Three-Year Warranty     |                                                                                                                           |                                            |
| Included Accessories    | User manual (downloadable), power cord, 4-wire kelvin clip test fixture (TLKBI), certificate of calibration & test report |                                            |