

Product Catalog

WBRS Series Battery Test System



*For
Battery
Battery material
Supercapacitor*

Rack Type Battery Test System

- Battery cycle life test
- Fuel cell test, Supercapacitor test
- For research and small scale production
- Potentiostat/Galvanostat circuit
- Various safety functions
- Universal graphic function
- Other large-scale channel applications

The **WBRS series** is a system equipped with a battery cyler in a rack, and can be configured with up to 40/88/128/256 channels in one rack. WBRS series is perfect choice for battery cell test.

The maximum number of channels per rack is 256, 128, 88 or 40 depending on the model.

- WBRS10: 128 channels or 256 channels
- WBRS20/20_10V/50: 128 channels
- WBRS100: 88 channels
- WBRS200/200H: 40 channels

The rack height is 1100 mm or 1800 mm, depending on the model.

- WBRS10: 1100 mm (128 channels) or 1800 mm (256 channels or PC rack)
- WBRS20/20_10V: 1100 mm (128 channels) or 1800 mm (128 channels for PC rack)
- WBRS50: 1400 mm (128 channels) or 1800 mm (112 channels for PC rack)
- WBRS100/200/200H: 1800 mm

WBRS can be configured in a mixed system as follows.

- 48 channels system configuration example
- : WBRS10, 32 channels (Two 16 channels frames are stacked)
- + WBRS100, 16 channels (Two 8 channels frames are stacked)

WBRS series provide independent control over each channel, user can test multiple samples simultaneously and independently. The powerful software can give various plots for users to analyze test results easily.

The WBRS series are designed with 4 probe type true potentiostat/galvanostat circuit and various switching conditions and multiple condition parameters can be input. Pre-defined techniques for battery test allow user to test their battery so easily even if he/she is a novice for battery testing. And it also can easily create test conditions using the schedule editor.

The WBRS series are designed to be suitable for battery testing and analysis and provides techniques such as EVS and variable scanning speed CV as well as charging and discharging test.

There are 7 kinds of WBRS model depending on current range specification.

- WBRS10
- WBRS20
- WBRS20_10V
- WBRS50
- WBRS100
- WBRS200
- WBRS200H

● WBRS10

Voltage range: $\pm 5V$
Max. current: $\pm 1A$
Current ranges: 4 ranges
1A, 100mA, 10mA, 1mA

● WBRS20

Voltage range: $\pm 5V$
Max. current: $\pm 2A$
Current ranges: 4 ranges
2A, 200mA, 20mA, 2mA

● WBRS20_10V

Voltage range: $-1V \sim +10V$
Max. current: $\pm 1A$
Current ranges: 4 ranges
1A, 100mA, 10mA, 1mA

● WBRS50

Voltage range: $-1V \sim +5V$
Max. current: $\pm 5A$
Current ranges: 4 ranges
5A, 500mA, 50mA, 5mA

● WBRS100

Voltage range: $-1V \sim +5V$
Max. current: $\pm 10A$
Current ranges: 4 ranges
10A, 1A, 100mA, 10mA

● WBRS200

Voltage range: $-1V \sim +5V$
Max. current: $\pm 20A$
Current ranges: 4 ranges
20A, 2A, 200mA, 20mA

● WBRS200H

Voltage range: $-1V \sim +20V$
Max. current: $\pm 5A$
Current ranges: 4 ranges
5A, 500mA, 50mA, 5mA

Features

● **Potentiostat/Galvanostat Circuit**

- No switching time (charging to discharging, discharging to charging)
- Analog feedback control to keep constant voltage & current
- Energy test system including battery charge/discharge test
- Rack mounted system for large scale channels
- Provides software for charge and discharge testing for large scale channels

● **High Precision**

- 16bit ADC, DAC: High resolution of 0.0015% f.s. (control and data storage)
- Voltage and current accuracy depend the model
 - WBRS10/20/20_10V: 0.02% f.s (voltage), 0.02% f.s (current)
 - WBRS50/100/200: 0.02% f.s (voltage), 0.03% f.s (current)
 - WBRS200H: 0.02% f.s (voltage), 0.05% f.s (current)
- 4 current ranges
- Power control circuit of MOSFET type
- Includes a digital coulometer: Calculates real-time capacity at hardware sampling speed and stores it in memory

● **Safety**

- Unique "Fail check" function
 - : To protect the system and cell itself, the experiment will stop automatically when the measured value is different from control value due to battery failure or wrong cell connection, etc. For example, if the control value is 1 Amp and the measured value is 500 mA, the experiment will automatically stop.
- System safety parameter
 - : If the measured value is over system specification or user defined safety limit condition, the experiment stops automatically.
 - : User defined safety condition setting
 - User can input safety level depending on chemical properties of reactants in test cell.
- Automatic cell connection check
 - : Before experiment, if the cell voltage value is over than standby voltage range, program gives the warning message for the operator to check the cell connection.
- If operator presses stop button by mistake, a confirmation message box will appear.
- To prevent over current, a poly-switch is located in each channel.
- Watchdog function
 - : Experiments stop of the channel connected to the board when error occurs in the CPU operation of the SIF board.
- Even in the event of PC failure or communication issues, the system operates without data loss and stores up to 290,000 data points per control board.
- If the main program goes down due to an unstable operating system, the independent server program ensures the experiment (control and data acquisition) continues without downtime.

● **Maintenance & System Expansion**

- Channel expansion :
The channels of WBRS can be expanded up to 128 or 256 (WBRS10), 128(WBRS20/20_10V/50), 88(WBRS100), 40(WBRS200/200H) channels per system.
- Automatic data backup function
- Hard disk space check function
- While one or more channels are working, calibration for other channels in rest mode is available.
- Software specialized for battery testing (Battery Interface Software)
- Easy calibration software
- TCP/IP communication
- Automatic firmware upgrade

Options

● **Auxiliary voltage & temperature measurement (not available in WBRS10_256 channel system)**

- Auxiliary voltage monitoring
- Temperature measurement monitoring

● **Mixed model configuration available eg) 32-channel WBRS10 + 16-channel WBRS100 in one rack**

● **Various Battery jig**

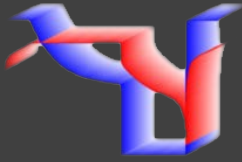
- Coin cell jig
- Universal jig
- Pouch cell jig
- Prismatic cell jig
- Pouch cell clamp
- Coin cell clamp

Specifications

- Rack mounted system
- Potentiostat/galvanostat circuit
- 4 Kelvin probe type connection
- Maximum channels per one rack
 - WBRS10: 128 or 256 channels
 - WBRS20/20_10V/50: 128 channels
 - WBRS100: 88 channels
 - WBRS200/200H: 40 channels
- Voltage range
 - WBRS10/20: $\pm 5V$
 - WBRS20_10V: $-1V \sim +10V$
 - WBRS50/100/200: $-1V \sim +5V$
 - WBRS200H: $-1V \sim +20V$
- 4 current ranges
- Voltage(reading & control) accuracy: 0.02% f.s
- Current(reading & control) accuracy
 - WBRS10/20/20_10V: 0.02% f.s
 - WBRS50/100/200: 0.03% f.s
 - WBRS200H: 0.05% f.s
- Standby voltage checking function
- Safety checking function
- Control value fail checking function
- Sampling time: 50 msec

Battery Test System WBRS Series

Software (Battery Interface)



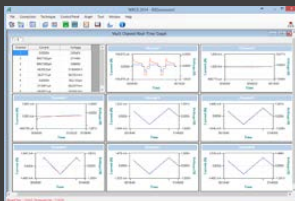
- 32bit/64bit OS
- TCP/IP communication
- Max. 200 step conditions can be made
- Max.10 cut-off conditions can be input for each step
- Max. 290,000 data points can be stored on the communication board
- Single/multichannel control panel
- Various types of real time graphs and axis adjustment functionality
- Data backup function
- WYSIWYG graphics
- User friendly software

Virtual Control Panel

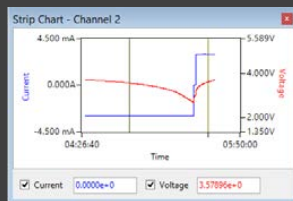
- BCO (Button click operation): The user can perform any task with just a button click, no menu selection required.



- By selecting the combo box, users can easily change the charge/discharge condition file for the channel.
- Experiment condition files for multiple channels can be changed simultaneously.
- Real-time dual-channel (V&I) strip chart display for selected channels or all running channels.



Multichannel real time graph



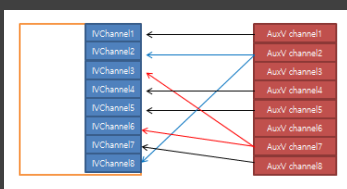
Single channel real time graph

- Display channel status on the status bar
- Various task functions: run, stop, hold, moving step, etc.

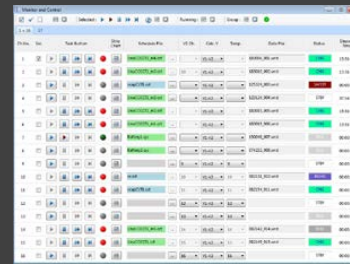


Jump step function

- Assign temperature and Auxiliary voltage channel on virtual control panel.



- Single channel & multichannel control/monitor panel



Multichannel control panel



Single channel control/monitor panel

- VOI(Value of Interest) bar is located in upper side of control/monitor window.

The first value on the far left represents the elapsed time since the experiment started. Other parameter values can be selected or hidden selectable control types: voltage, current, auxiliary voltage, temperature, load, power, capacity and energy.

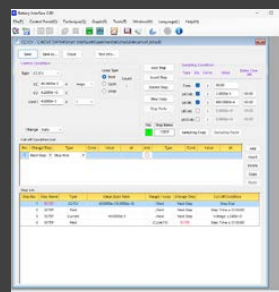
Elapsed Time	Voltage(V)	Current(A)	Power(W)	Auxiliary(V)	Temperature(°C)
00:00:50	1.5m	0.000	0.000	181.3m	0.0

Voltage control

Step Time	Voltage(V)	Current(A)	Power(W)	Auxiliary(V)	Temperature(°C)
00:00:20	3.887	-50.0m	-194.4m	237.4m	0.0

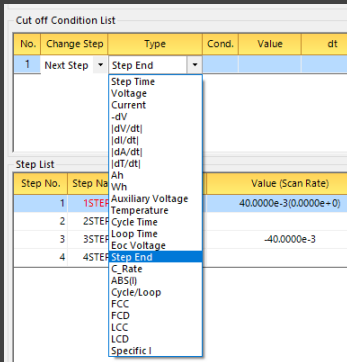
Current control

Schedule Editor



- One stop test condition creation/modification
- Multiple input parameters available
- Create schedules with a max of 200 steps
- Control parameters
 - Constant voltage, LastV
 - Constant current, LastI
 - Constant power
 - Constant load
 - C-rate
 - Voltage scanning, current scanning
 - Conditioning potential
 - Conditioning current
 - Rest
 - LastVscan
 - CstepV(Staircase Voltage Sweep)
 - CstepI(Staircase Current Sweep)
 - CC/CV, CL/CV, CP/CV, C-rate/CV
 - Id, Is control
- Step flow is defined by next step, loop and cycle
- Selection of cut-off conditions and values
 - step time, voltage, current, dV/dt, dI/dt, cycle time, loop time, capacity, -dV, Whr, Ahr, temperature, Aux voltage, dT/dt, Eoc, stepend

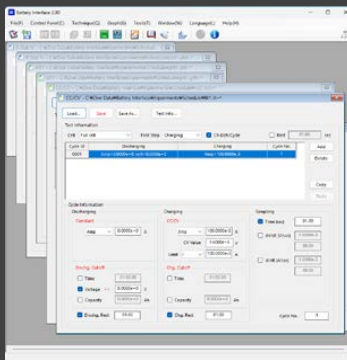
Battery Test System WBRS Series



Cut-off condition

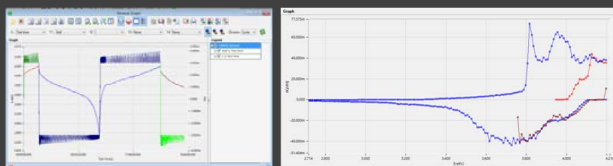
- Data sampling condition by each step
: time, dV/dt , dI/dt , dT/dt , dV_2/dt
- And/Or logic for cut-off condition settings

● Menu Selection (Pre-defined techniques)



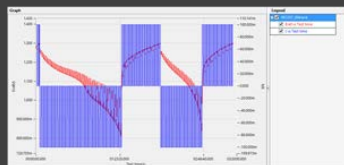
■ Techniques

- CC/CV (Lithium battery) test
- CC/CC (NiCd(NiMH) battery) test
- Steady state CV
- Pstat IV curve
- Gstat IV curve
- EVS (Electrochemical voltage spectroscopy) test
- GITT (Galvanostatic intermittent titration technique) test
- PITT (Potentiostatic intermittent titration technique) test
- Discharge test
- Variable scan rate CV test

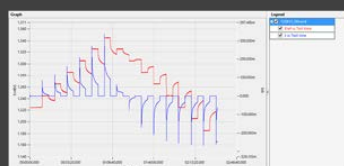


EVS test raw data

EVS graph format (dQ/dV vs. V)



GITT test



PITT test raw data

- Real time data monitor



- Real time display: time, voltage, current, channel status
- Channel status displayed by color: charging, discharging, standby, idle, calibration

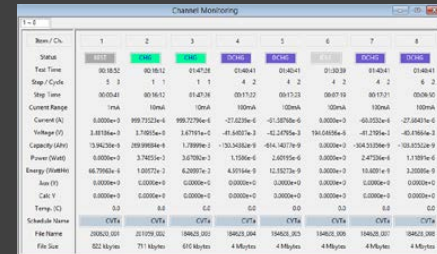
- Grouping

- Classification/grouping channels by user's purpose
- Each group can be named based on user name, chemistries, etc
- Group monitoring available
- Group control



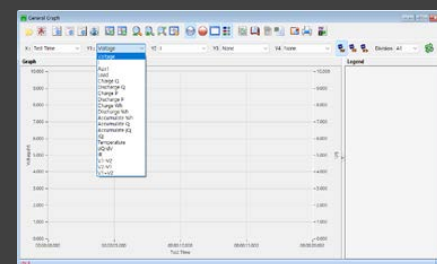
● Detailed Data Monitor

- Display test data: status, running time, step number, cycle number, step time, current range, current, voltage, capacity, power, energy, Aux V, Calc V, temp, cycle file name, data file name, and file size.
- Monitor type selection: All channels, running channels only, and grouped channels.
- Display active status only for running channels

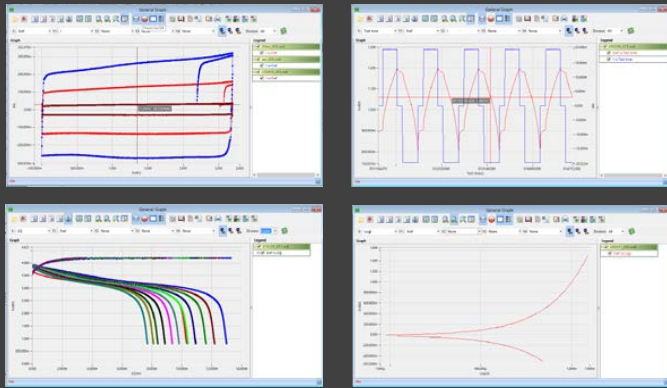


● Graphics

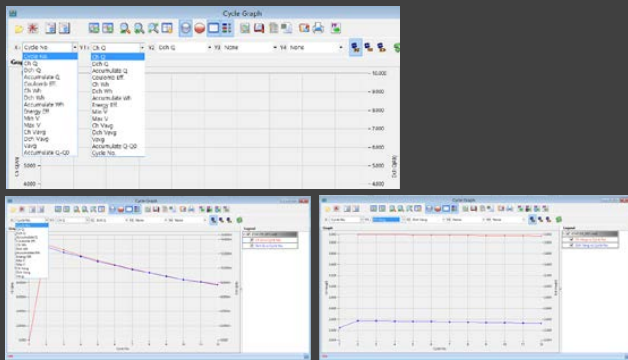
- Multiple graph format
 - General graph
 - Cycle graph
- General graph format



Battery Test System WBRS Series

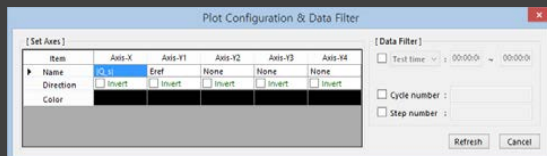


Cycle graph format

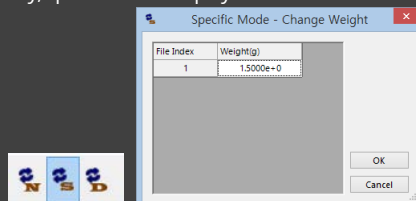


General graph functions

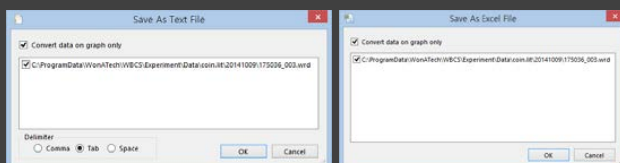
- Various axis variable settings
- Graph overlay : max. 20 data
- Universal graph : Combinations of X, Y1, Y2, Y3, Y4 axis parameters
- Automatically update the plot of running channels by pressing the 'reload' button
- Automatic/manual scale and polarity selection for each axis



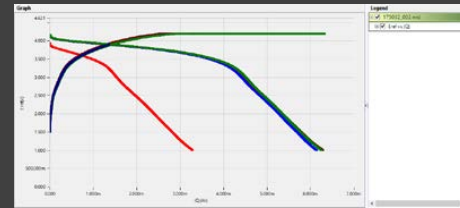
- Cross-hair pointer by mouse click/arrow key displays coordinate values on graph
- Mouse zooming
- Density, specific value display



- Graphic data can be copied to the clipboard for use in other application software
- Grid on/off and dot/line selection
- Only the data on the graph can be converted to an ASCII file or an Excel file



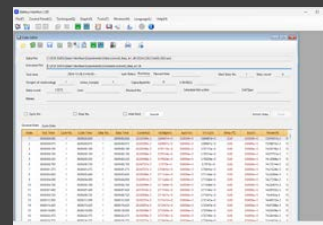
- Parameter change without reloading the data file
- Data On/Off settings: Data can be shown or hidden by selecting or deselecting it.
- Rest step data hidden function
- Advanced graph settings



Voltage vs. |capacity| graph

Tools

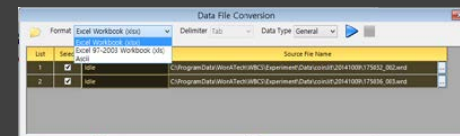
- Data Editor
 - General data report
 - Cycle data report



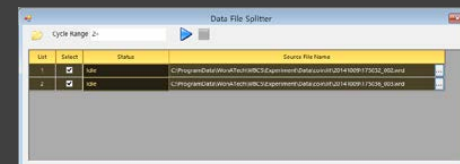
- * Data editing
- * Data filtering

Data Conversion

- Convert data to ASCII or Excel file format

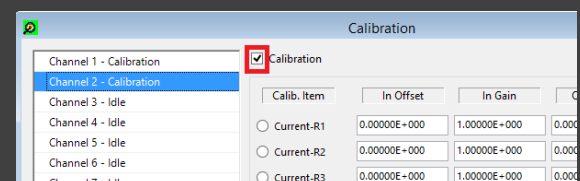


Data file splitter by cycle number

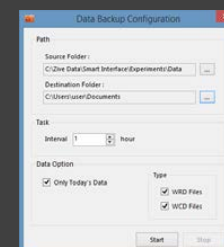


Calibration

- User can calibrate channel(s) while other channels are running.



Data backup



Independent Data Analysis Software



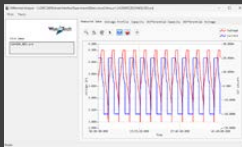
The data format obtained using BI and SI can be analyzed with independent data analysis software, and the following analysis tools are available for free.

- IVMAN differential analysis (battery analysis) software
- IVMAN photovoltaic cell analysis
- IVMAN peak find module

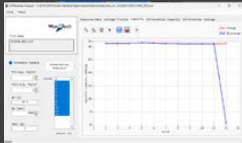


IVMAN DA™ Battery Test Data Analysis Software

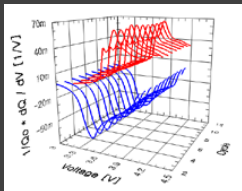
- Battery test data analysis
- Electrochemical voltage spectroscopy (dQ/dV vs. V)
- Voltage vs. capacity analysis (V vs. Q)
- Cycle graph (Q vs. cycle)
- Differential voltage graph (dV/dQ vs. Q)



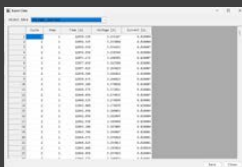
Measured data



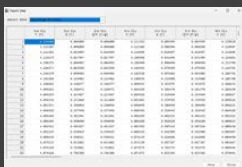
Cycle graph



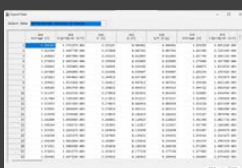
3D graph



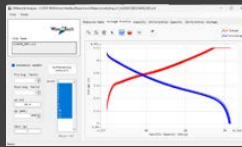
V/I vs. T



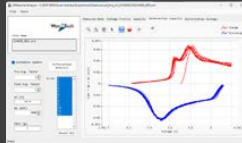
Discharging profile



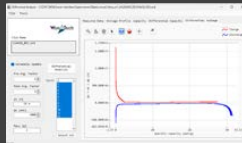
Charging EVS



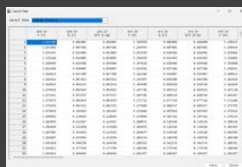
V vs. Q



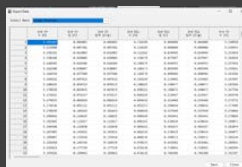
dQ/dV vs. V



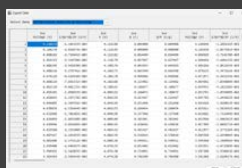
dV/dQ vs. Q



Charging profile



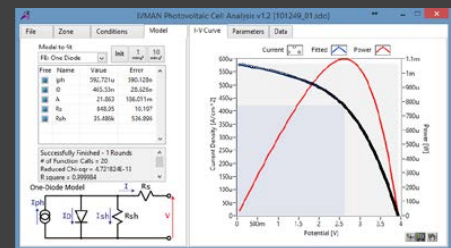
Cycle profile



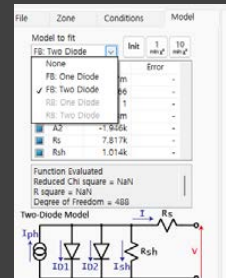
Discharging EVS



IVMAN™ photovoltaic cell analysis



• V vs. I graph



• Model selection and fitting

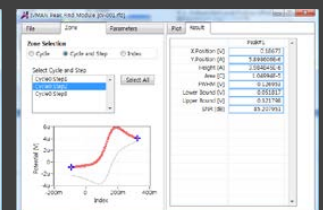
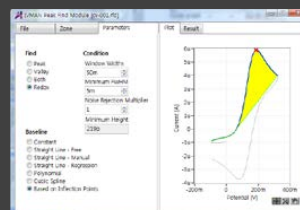
Parameter	Value	Unit
Open-circuit voltage (V)	1.722049	V
Short-circuit current (A/cm²)	-0.00118	A/cm²
Current @ max power (A/cm²)	0.000697	A/cm²
Max power (mW/cm²)	0.000944	mW/cm²
Efficiency (%)	2.74687	%
Photo-induced current (A/cm²)	0.00118	A/cm²
Diode quality factor	1.0	
Series resistance (ohm)	0.00118	ohm
Shunt resistance (ohm)	0.00118	ohm

- Automatic analysis of parameters
 - open circuit voltage, open circuit current, max. power, efficiency
 - photo induced current, diode quality factor, series resistance, etc.



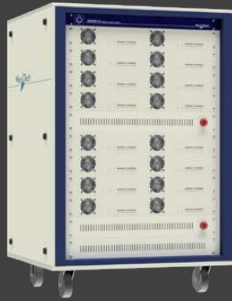
Peak Find Module

- Independent peak finding software

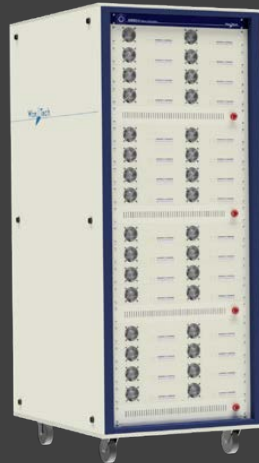


Battery Cell Test System WBRS Series

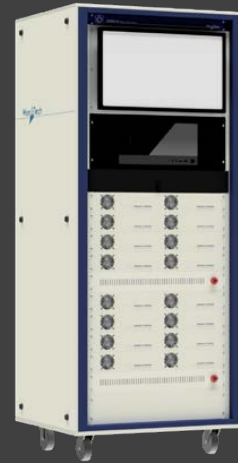
WBRS10



128 channels



256 channels



128 channels with a mounted PC

Application

- Energy devices of under 1 Amp
- Coin cell battery

Options

- Temperature monitoring *
 - Auxiliary voltage monitoring *
 - Rack with a mounted PC
 - Coin cell jig
 - Battery jig
- (* Temperature measurement monitoring and auxiliary voltage monitoring is not available on the 256 channel system.)

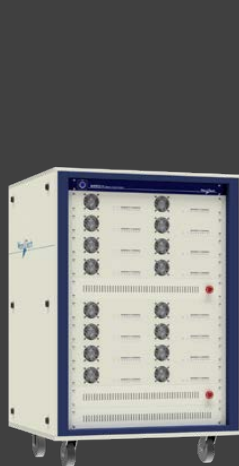
Specifications

Control voltage range	±5V		
Control current range	4 ranges (1A, 100mA, 10mA, 1mA)		
Input impedance	1 TΩ		
Cell connection	4 probe type, alligator clip cables		
Max. channel No.	128 (1100mm height rack)	256 (1800mm height rack)	128 (1800mm height rack)
Min. channel No.	16		
Voltage accuracy	±0.02% f.s.		
Current accuracy	±0.02% f.s.		
Voltage Control/Measurement			
Full scale ranges	±5V		
Resolution (16 bits)	0.15mV		
Current Control/Measurement			
Full scale ranges	Max. 1A@±5V		
Resolution	16 bit (0.0015% f.s)		
Communication	TCP/IP		
Sampling time	50msec		
Safety	Emergency button integrated		
Size	W724xD690xH1100mm (standard 128-channel rack)	W724xD900xH1800mm (256-channel rack)	W724xD690xH1800mm (PC rack)

All specifications are subject to change without notice.

Battery Cell Test System WBR Series

WBR20/WBR20_10V



128 channels



128 channels
with a mounted PC

Application

- Batteries
- Supercapacitors

Options

- Temperature monitoring
- Auxiliary voltage monitoring

- Batteries material

- Auxiliary voltage monitoring
- Battery jig&Holder

Specifications

Control voltage range	±5V (WBR20) -1V ~ +10V (WBR20_10V)
Control current range	4 ranges 2A, 200mA, 20mA, 2mA (WBR20) 1A, 100mA, 10mA, 1mA (WBR20_10V)
Input impedance	1 TΩ
Cell connection	4 probe type, alligator clip cables
Max. channel No.	128
Min. channel No.	16
Voltage accuracy	±0.02% f.s.
Current accuracy	±0.02% f.s.

Voltage Control/Measurement

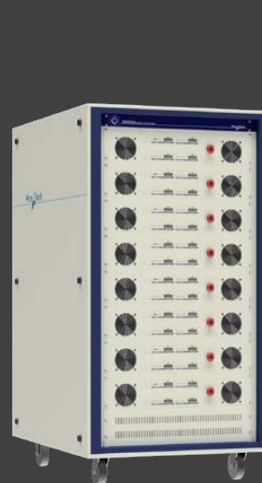
Full scale ranges	±5V (WBR20) -1V ~ +10V (WBR20_10V)
Resolution (16 bits)	0.15mV (WBR20) 0.3mV (WBR20_10V)

Current Control/Measurement

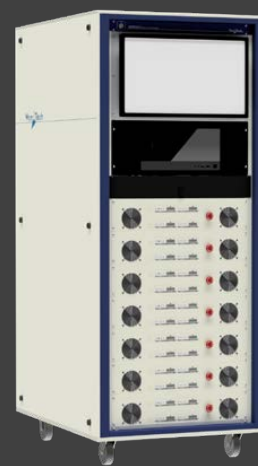
Full scale ranges	Max. 2A@5V (WBR20) Max. 1A@-1V to +10V (WBR20_10V)
Resolution	16 bit (0.0015% f.s)
Communication	TCP/IP
Sampling time	50msec
Safety	Emergency button integrated
Size	W724xD690xH1100mm (standard 128-channel rack) W724xD690xH1800mm (PC rack)

All specifications are subject to change without notice.

WBR50



128 channels



112 channels
with a mounted PC

Application

- Battery lifetime
- Fuel cell

- Supercapacitor
- Solar cell

Options

- Temperature monitoring
- Auxiliary voltage monitoring

- Clamp cable
- Battery jig&Holder

Specifications

Control voltage range	-1V ~ +5V
Control current range	4 ranges 5A, 500mA, 50mA, 5mA
Input impedance	1 TΩ
Cell connection	4 probe type, alligator clip cables
Max. channel No.	128 (112 channels in the PC rack)
Min. channel No.	16
Voltage accuracy	±0.02% f.s.
Current accuracy	±0.03% f.s.

Voltage Control/Measurement

Full scale ranges	-1V ~ +5V
Resolution (16 bits)	0.15mV

Current Control/Measurement

Full scale ranges	Max. 5A@-1V to +5V
Resolution	16 bit (0.0015% f.s)
Communication	TCP/IP
Sampling time	50msec
Safety	Emergency button integrated
Size	W724xD1015xH1400mm (standard 128-channel rack) W724xD1015xH1800mm (PC rack)

All specifications are subject to change without notice.

Battery Test System WBR Series

WBR100



88 channels

56 channels
with a mounted PC

Application

- Battery lifetime
- Fuel cell
- Supercapacitor
- Solar cell

Options

- Temperature monitoring
- Auxiliary voltage monitoring
- Clamp cable
- Battery jig&Holder

Specifications

Control voltage range	-1V ~ +5V
Control current range	4 ranges 10A, 1A, 100mA, 10mA
Input impedance	1 TΩ
Cell connection	4 probe type, alligator clip cables
Max. channel No.	88 (56 channels in the PC rack)
Min. channel No.	8
Voltage accuracy	±0.02% f.s.
Current accuracy	±0.03% f.s.

Voltage Control/Measurement

Full scale ranges	-1V ~ +5V
Resolution (16 bits)	0.15mV

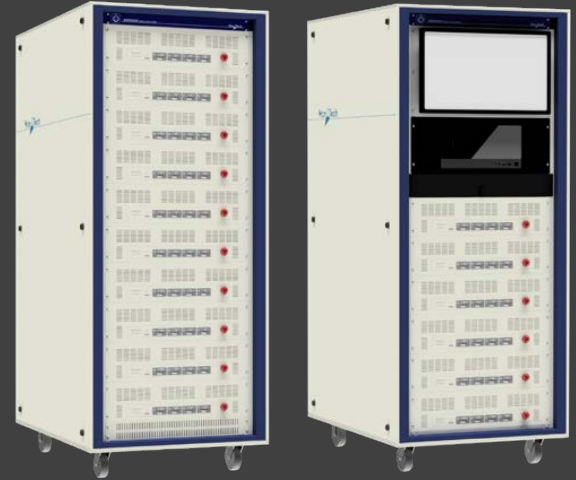
Current Control/Measurement

Full scale ranges	Max. 10A@-1V to +5V
Resolution	16 bit (0.0015% f.s.)

Communication	TCP/IP
Sampling time	50msec
Safety	Emergency button integrated
Size	W724xD1015xH1800mm

All specifications are subject to change without notice.

WBR200/200H



40 channels

24 channels
with a mounted PC

Application

- Battery lifetime
- Fuel cell
- Supercapacitor
- Solar cell

Options

- Temperature monitoring
- Auxiliary voltage monitoring
- Clamp cable
- Battery jig&Holder

Specifications

Control voltage range	-1V ~ +5V (WBR200) -1V ~ +20V (WBR200H)
Control current range	4 ranges 20A, 2A, 200mA, 20mA (WBR200) 5A, 500mA, 50mA, 5mA (WBR200H)
Input impedance	1 TΩ
Cell connection	4 probe type, alligator clip cables
Max. channel No.	40 (24 channels in the PC rack)
Min. channel No.	4
Voltage accuracy	±0.02% f.s.
Current accuracy	±0.03% f.s. (WBR200) ±0.05% f.s. (WBR200H)

Voltage Control/Measurement

Full scale ranges	-1V ~ +5V (WBR200) -1V ~ +20V (WBR200H)
Resolution (16 bits)	0.15mV (WBR200) 0.61mV (WBR200H)

Current Control/Measurement

Full scale ranges	Max. 20A@-1V to +5V (WBR200) Max. 5A@-1V to +20V (WBR200H)
Resolution	16 bit (0.0015% f.s.)
Communication	TCP/IP
Sampling time	50msec
Safety	Emergency button integrated
Size	W724xD1015xH1800mm

All specifications are subject to change without notice.

Battery Test System WBR Series

Jigs

● Battery Jig & Holder

- 4 pin lever type



- Cylindrical cell, coin cell, prismatic cell (standard)



● Clamp Cable

- Two 2-contact clip type (4 contact)



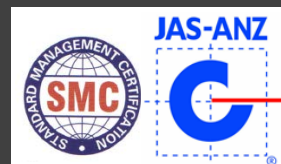
- Pouch cell





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