LBT Cell

ARBIN INSTRUMENTS

# Laboratory Battery Testing System For Cell Applications

Product Description

Arbin's Laboratory Battery Testing (**LBT**) series offer industry-leading hardware with high-precision measurements and high-frequency data sampling. Software flexibility gives users full control over the system to handle even the most complex research experiments or real-world test applications. Technology engineered for LBT was commercialized from a successful ARPA-E project for which Arbin and its industry partners Sandia Nat'l Lab and Ford won an R&D 100 award. Arbin's LBT provides **true bipolar circuitry** to ensure cross-zero linearity with no switching time between charge and discharge. We invite battery researchers and engineers to compare our I/V control performance and see for themselves why it is trusted around the world more than any other tester.

Product Highlights

- Each channel provides **four** current ranges with industry-leading **24-bit resolution**. (1μV for Voltage)
- Powerful **embedded controllers** provide ultra-fast data logging (up to 2000pts/sec, per system).
- **Fully parallelable** so any number of channels can be connected to increase the current handling capability.
- **Dynamic data acquisition** based on changes in time, voltage, and current to capture more data when it's needed and maintain efficient file sizes.
- Can interface with Arbin's Multi-Zone Temperature Chamber (MZTC) and EIS module.
- **Comprehensive safety features** for lithium-ion battery testing.

Primary Applications

- Battery Life Cycle Testing
- dQ/dV & Coulombic Efficiency (HPC)
- Symmetric-Cell Testing
- PITT/GITT
- Cyclic & Linear Sweep Voltammetry
- Chrono-amperometry/potentiometry
- Multi-Electrode Experiments
- Simulation of Real World Test Profiles
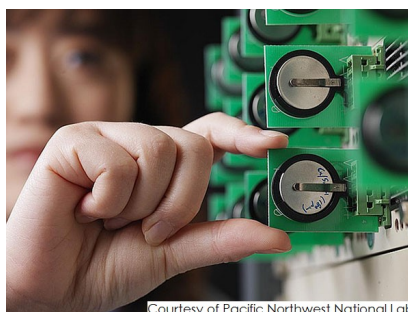
Courtesy of Pacific Northwest National Lab
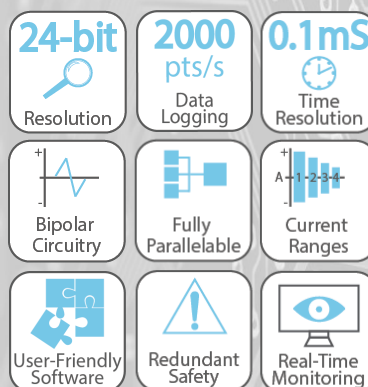
Standard Models

LBT ± 5V - 200mA
LBT ± 5V - 1A
LBT ± 5V - 5A
LBT 0-5V - 5A
LBT ±5V - 10A
LBT 0-5V - 10A
LBT 0-10V - 10A

24-bit Resolution

2000 pts/s Data Logging

0.1mS Time Resolution

Bipolar Circuitry

Fully Parallelable

Current Ranges

User-Friendly Software

Redundant Safety

Real-Time Monitoring

"With Arbin, you can see minute changes in the battery and this gives researchers better predictability of when the end of life will occur in a reduced amount of time."
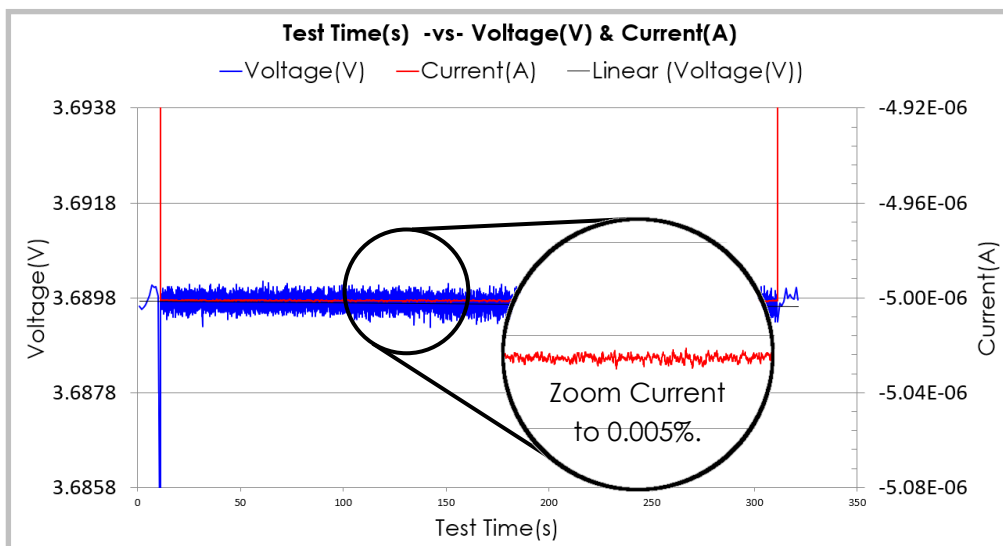
— J. Novak, Sandia

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Experts in Test Instrumentation

We learned a lot about measurement precision during our **3-year ARPA-E project** with **Ford Motors** and **Sandia National Laboratories**. We use premium reference meters and shunts representing the global standard for metrology. Arbin has all the tools necessary to develop testing circuits beyond the old industry standards, and under a wide range of environmental conditions. This allows us to have a proper understanding of instrument performance and deliver the best possible product to our customers around the world.

"The measurement precision of Arbin testers allow them to generate high confidence data you can rely on."

Test Time(s) -vs- Voltage(V) & Current(A)

—Voltage(V) —Current(A) —Linear (Voltage(V))

Zoom Current to 0.005%.

ABOVE: constant current discharge at -5µA with 100ms data logging performed with Arbin LBT ±5V 200mA standard model.
Plot axis shows *0.02%* range of voltage measurement and current control.

BELOW: test profile built in Arbin MITS Pro software for -5µA discharge for five minutes, logging at 100ms.

3		CC_Dischrg	2	Current(A)	-5e-006			Range4	
		Log Limit	Step Limit	Goto Step	Variable1	Operator1	Value1	Variable2	
	1	✓	✓	Next Step	PV_CHAN_Step_Time	>=	00:05:00		
	2	✓			DV_Time	>=	00:00:00.100		

3-year ARPA-E project to Develop a true high precision testing system for currents up to 200A! We scaled down technology for low current applications.

Arbin + leading industry partners: Ford Motors, Sandia National Laboratories, and Montana Tech completed ARPA-E, high-precision tester project.

2016 R&D 100 WINNER

Technology learned during this project has revolutionized Arbin's products, which has resulted in the **highest precision testers** commercially available on the market.

"High precision measurements are not the only answer to understanding battery life, but it is a key component. Sandia National Lab brings their expertise in metrology and precision measurements and has helped Arbin as they've designed the new series of testers."

— S. Ferreira, Sandia

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Hardware Specifications

Model Name	Channel Voltage Range	Channel Current Ranges (±)	Max Continuous Channel Power
LBT ±5V - 200mA	-5V to 5V	200mA / 10mA / 1mA / 100µA	1W
LBT ±5V - 1A	-5V to 5V	1A / 50mA / 2mA / 100µA	5W
LBT 5V - 5A**	0V to 5V**	5A / 500mA / 20mA / 1mA	25W
LBT 5V - 10A**	0V to 5V**	10A / 500mA / 20mA / 1mA	50W
LBT 10V - 10A	0V to 10V	10A / 500mA / 20mA / 1mA	100W
** (-5) to 5V range also available for LBT 5V-5A and LBT 5V-10A			

Specification		LBT ±5V - 200mA	LBT ±5V - 1A	LBT 5V - 5A
Voltage	Measurement Resolution	<1µV (24-bit)	<1µV (24-bit)	<1µV (24-bit)
	Precision	< 100ppm (0.01%)	< 100ppm (0.01%)	< 100ppm (0.01%)
	Control Accuracy	< 0.02%	< 0.02%	< 0.02%
	Input Impedance	10G Ohm	10G Ohm	10G Ohm
Current	Noise Free Resolution	0.0003% (18-bit)	0.0003% (18-bit)	0.0003% (18-bit)
	Precision	< 100ppm	< 100ppm	< 100ppm
	Control Accuracy (0.02% FSR)	200mA Range < 80µA 10mA Range < 4µA 1mA Range < 0.4µA 100µA Range < 0.04µA	1A Range < 400µA 50mA Range < 20µA 2mA Range < 0.8µA 100µA Range < 0.04µA	5A Range < 2mA 500mA Range < 0.2mA 20mA Range < 8µA 1mA Range < 0.4µA
	Rise Time	<100µs Time required for current output to get from 10-90% of setpoint value	<100µs Time required for current output to get from 10-90% of setpoint value	<100µs Time required for current output to get from 10-90% of setpoint value
Time	Minimum Step Time	5mS		
	Data Logging Rate	2000 points per second, per system		
	Measurement Precision	100µS		
Bipolar Linear Circuit Type		Allows cross-zero linearity and no switching time between charge & discharge		
Connection for PC		TCP/IP (Ethernet)		
Ventilation Method		Air cooled, *variable speed fans*		

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Hardware Specifications

Model Name	Channel Voltage Range	Channel Current Ranges (±)	Max Continuous Channel Power
LBT21084 ±5V - 200mA	-5V to 5V	200mA / 10mA / 1mA / 100µA	1W
LBT21084 ±5V - 1A	-5V to 5V	1A / 50mA / 2mA / 100µA	5W
LBT21084 5V - 5A**	0V to 5V**	5A / 500mA / 20mA / 1mA	25W
LBT21084 5V - 10A**	0V to 5V**	10A / 500mA / 20mA / 1mA	50W
LBT21084 10V - 10A	0V to 10V	10A / 500mA / 20mA / 1mA	100W
** (-5) to 5V range also available for LBT 5V-5A and LBT 5V-10A			

Specification		LBT 5V - 10A	LBT 10V - 10A
Voltage	Measurement Resolution	<1µV (24-bit)	<1µV (24-bit)
	Precision	< 100ppm (0.01%)	< 100ppm (0.01%)
	Control Accuracy	< 0.02%	< 0.02%
	Input Impedance	10G Ohm	10G Ohm
Current	Noise Free Resolution	0.0003% (18-bit)	0.0003% (18-bit)
	Precision	< 100ppm	< 100ppm
	Control Accuracy (0.02% FSR)	10A Range < 4mA 500mA Range < 0.2mA 20mA Range < 8µA 1mA Range < 0.4µA	10A Range < 4mA 500mA Range < 0.2mA 20mA Range < 8µA 1mA Range < 0.4µA
	Rise Time	<100µs Time required for current output to get from 10-90% of setpoint value	<100µs Time required for current output to get from 10-90% of setpoint value
Time	Minimum Step Time	5mS	
	Data Logging Rate	2000 points per second, per system	
	Measurement Precision	100µS	
Bipolar Linear Circuit Type		Allows cross-zero linearity and no switching time between charge & discharge	
Connection for PC		TCP/IP (Ethernet)	
Ventilation Method		Air cooled, *variable speed fans*	

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Available Auxiliary Options

Select from the options below to expand the capability of your LBT system.

		An EIS module can be shared across 4 to 32 channels.		
EIS Module	EIS	**G-1010E** 1A max 10µHz to 2MHz	**G-5000P** 5A max 10µHz to 20kHz	**G-5000E** 5A max 10µHz to 1MHz
Additional Reference Electrodes	Aux Voltage	The standard channel connection is a 4-point Kelvin connection (I+, I-, V+, V-). This option adds additional reference electrodes for multi-electrode experiments.		
Temperature Measurement	Aux Temperature	Thermocouple or Thermistor inputs used to record temperature as well as be used control the test schedule.		
Arbin Multi-Zone Temperature Chamber	MZTC Arbin Multi-Chamber	Arbin's multi-chamber provide 8 independent zones that each provide unique and stable temperature setpoint from 10 to 60 degree Celsius. The 8 zones also allow cell isolation resulting in a safer testing environment than if cells are in a shared space.		
3rd Party Chamber Interface	Chamber Interface	Interface with a 3rd party temperature chamber so Arbin software can turn chamber on/off and adjust temperature.		
Auto-Calibration	AutoCal	Channels may be calibrated automatically when connected to a digital multimeter (sold separately).		
UPS	UPS 1500Wh PC Backup	Uninterrupted power supply for PC so tests can resume automatically after brief power outages.		
Digital & Analog Input/Output	Analog I/O Digital I/O	Digital: Send and receive a simple on/off signal to interact with external devices. Analog: Send and receive a 0-10V signal to operate 3rd party devices.		

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Safety Features

- Multiple levels of internal fusing and over-temperature control measures
- Each system has a fully redundant microcontroller dedicated to monitoring internal communication, voltage and current safety limits
- Testing schedules can have layers of global and step-driven safety limits for voltage, current and power
- Logic-driven scheduling interface allows for additional safety layers based on inputs such temperature, current, or voltage measurements

Software Suite

- Cycle a battery until discharge capacity is 80% of nominal
- Parallel any number of channels together
- Over 90+ meta variables to select from in addition to numeric values
- User-defined variables using data from active test - New Feature
- Results stored in SQL database for robust storage solution
- Automatically export data into Excel or CSV format for easy reporting
- Plot data in real-time to see what is happening
- Perform [optional] EIS every [custom] number of cycles
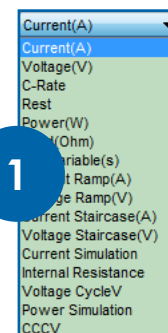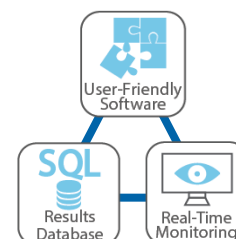
"Arbin software gives the user complete control over the voltage / current functionality of the tester."

1. Add steps and choose the control type from a drop-down list

2. Enter the control value or one of over 90+ meta variable

3. Add one or more termination conditions with the option to use logical AND & OR functions.

4. Set one or more data logging intervals to automatically capture extra data during important events

User-Friendly Software

SQL — Results Database

Real-Time Monitoring

Current(A)			
Current(A)			
Voltage(V)			
C-Rate			
Rest			
Power(W)			
(Ohm)			
riable(s)			
t Ramp(A)			
ge Ramp(V)			
rrent Staircase(A)			
Voltage Staircase(V)			
Current Simulation			
Internal Resistance			
Voltage CycleV			
Power Simulation			
CCCV			

1

Rest	
Goto Step	Variable1
Step	PV_CHAN_Step_Tim
rrent(A)	0.1
Goto Step	

2

Rest			
Goto Step	Variable1	Operator1	Value1
t Step	PV_CHAN_Step_Tim	>=	00:00:10
ent(A)	0.1		
Goto Step	Variable1	Operator1	Value1
Next Step	PV_CHAN_Voltage	>=	4.2

3

Rest			
Goto Step	Variable1	Operator1	Value1
t Step	PV_CHAN_Step_Tim	>=	00:00:10
nt(A)	0.1		
Goto Step	Variable1	Operator1	Value1
t Step	PV_CHAN_Voltage	>=	4.2
	DV_Time	>=	00:00:10
	DV_Voltage	>=	0.01

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2 Year Standard Warranty

Chassis Sizes

Multiple chassis sizes are available ranging from small benchtop units up to large racks with hundreds of test channels.

Dimensions (W x D x H)
16" x 16" x 06"
16" x 17" x 13"
21" x 40" x 35"
21" x 40" x 61"
35" x 40" x 51"
35" x 40" x 72"

Arbin Headquarters
- College Station, Texas USA

Worldwide Locations
- Canada
- China
- Germany
- Hong Kong
- Korea
- Taiwan

Representatives
- Australia
- Brazil
- France
- India
- Israel
- Italy
- Japan
- Singapore
- Spain
- Thailand
- Turkey
- UAE
- United Kingdom
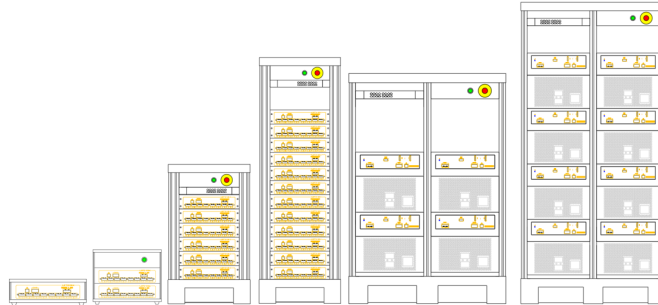
Training & Support

Arbin's knowledgeable customer service team is well-known throughout the industry for their responsiveness and dedication. Application engineers are always available by phone or email, and with equipment running in over 50 countries, Arbin has experienced support technicians nearby to help install equipment, answer questions, and provide any maintenance that may be necessary over the life of your system. Additionally, our expansive library of video tutorials make it easy for novice users to learn or experienced users to refresh their knowledge at any time.

"We did side-by-side comparisons of Arbin and other tester technology. Armed with this data, we moved forward with confidence using Arbin for what is critical to our electrification future [EV]."

— T. Miller, Ford Motors

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Arbin Beijing
Arbin Korea
Arbin Hong Kong
Arbin Taiwan
Arbin Texas (HQ)
Arbin India

- Arbin Headquarters
- Arbin Branch Office
- Representative Office

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