



Electric Vehicle Testing Solutions

With over 20 years of experience in designing and manufacturing energy storage devices, Arbin offers complete testing solutions for high power battery packs in the Electric Vehicle (EV) and Hybrid Electric Vehicle (HEV) markets.

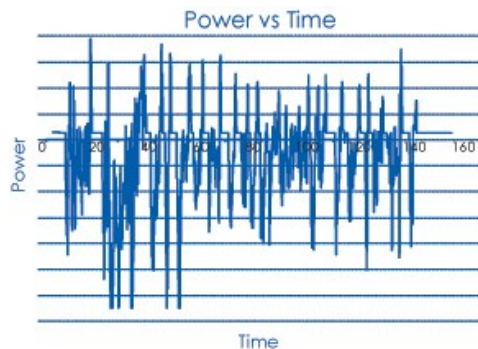
Arbin's EVTS series is designed to meet the needs of R&D and Quality Control testing that requires advanced test schedules and protocols. The EVTS series is a potentiostat/galvanostat test station designed for testing high power EV and HEV batteries, packs, and modules. The regenerative power circuitry within the system allows power to be sent back to the grid, providing a more economical testing solution.

Key Features

- High Speed Drive Cycle Simulation Control for standard or customized testing
- Arbin CAN-Bus Communication is used to test battery packs with integrated BMS systems
- Arbin Controller & MITS Pro Testing Software provides flexible control types and streamlined testing
- Standard & Customizable Solutions ranging in power up to 450kW

Arbin's EVTS Test Station provides high-speed data acquisition, while running user-defined test regimes as well as standard tests, such as FUDS, USABC testing, DST, Life Cycle testing, Sustained Hill-Climb and more.

EVTS is capable of advanced charge and discharge regimes using a library of unique control types. One of the most popular features of EVTS is the simulation control type which allows the system to charge or discharge the pack by mimicking the actual vehicle in the lab. Simulation control allows users to easily program advanced test profiles such as Federal Urban Drive Schedule (FUDS) or Dynamic Stress Tests (DST) without writing complex test protocols/schedules.



Arbin's proprietary MITS Pro Software empowers the user to write extremely flexible test schedules based on current, voltage, power and other software based control types.

EVTS Testing

The EVTS is intended to provide a complete test solution for use in R&D testing that requires advanced test schedules and protocols.



EVTS

Design Options

	60V	150V	300V	400V	500V	600-800V
Number of Channels	2-8	2-4	1-2	1-2	2	1-2
Minimum Voltage	15V, Lower Voltage Options Possible					
Current Range Options	100-480A	100-300A	150-400A	200-300A	200-250A	200A
Number of Ranges	2 to 3 Ranges Available					
Parallel Capability	Up to 8 Channels	Up to 4 Channels	2 Channels			
Current & Voltage Accuracy	0.1%					
Resolution	16 Bit					

Hardware Features

- Arbin's latest circuit regenerative power board design allows for testing of batteries, packs, and modules ranging from 10V to 800V, up to 450kW in a single chassis.
- With a rise time as fast as 10mS, Arbin's EVTS allows the ser to switch from a full charge to discharge in as little as 20mS. This allows for precise testing while simulating real-life drive cycles on your battery pack.
- With a dedicated microcontroller per channel, the test station can handle 100mS per point during simulation control with data logging as fast as 100mS to precisely record how the device is reacting to the test protocol.
- Regenerative Power Efficiency: >=90%
- Multiple Current Ranges and Dual Voltage Ranges can be provided for greater flexibility and accuracy when testing low and high power battery packs with the same test station
- 0.1% Full Scale Accuracy provided with at 16 Bit Resolution for accurate and detailed result analysis
- Uninterruptible Power Supply provided inside test station for a controlled start-up and shut-down sequence during normal operation. This UPS also ensures that no damage will be incurred to the machine in case of power outages.
- Arbin can provide an optional auxiliary chassis that can be used to house separate auxiliary channels to provide additional data collection and safety monitoring:

Secondary Voltage Measurements

Temperature Measurements

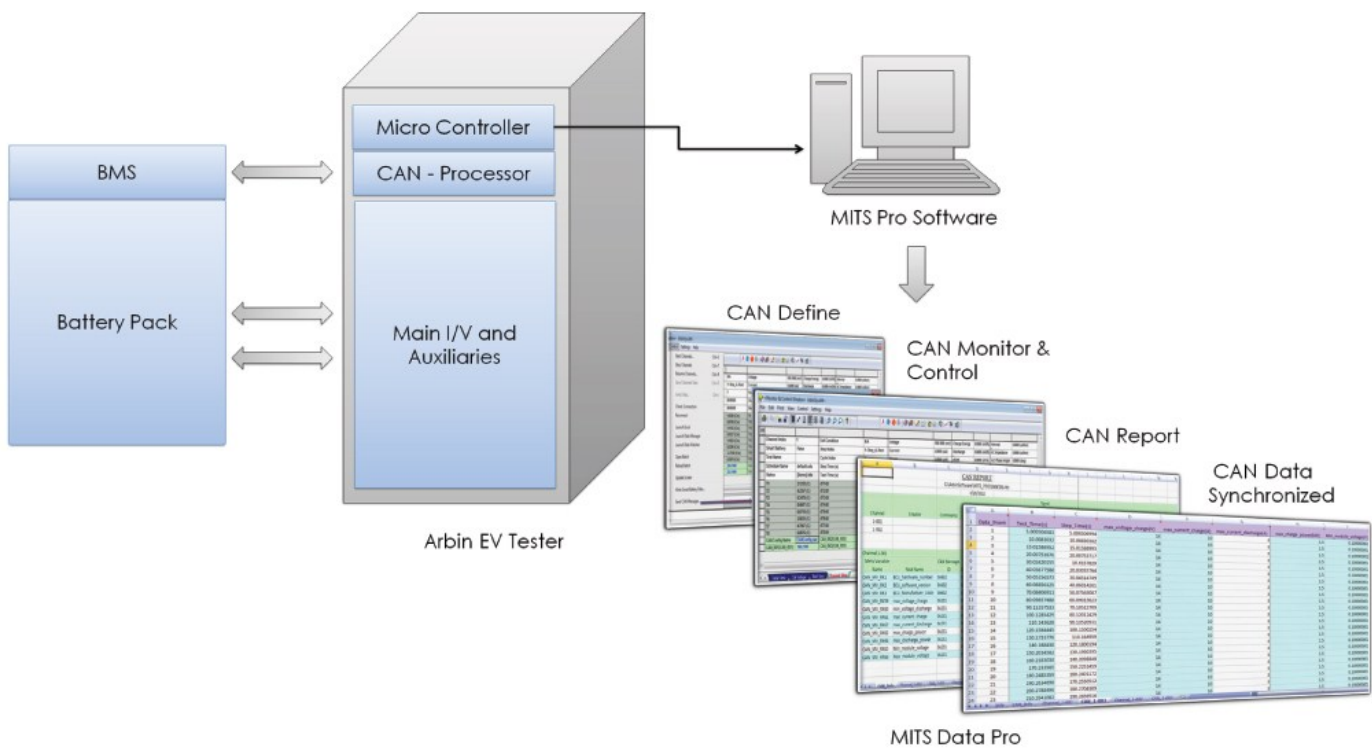
Digital Input/Output



EVTS

CAN-Bus Communication

Arbin provides CAN-Bus Communication for our EVTS systems that can be used to test battery packs with integrated Battery Management System (BMS) systems. The Arbin CAN-Bus device supports reading, writing and sending CAN messages, logging, monitoring, setting, controlling, and protecting the battery pack. For example, if over-voltage occurs the BMS systems protects the battery from operating out of safe operating limits. The CAN-Bus communicates this valuable information to Arbin's MITS Pro Software and the EVTS tester before causing any damage to the battery.



The illustration above graphical represents the CAN-Bus communication for Arbin's EVTS Systems.

Arbin's MITS Pro Software allows the test equipment to be programmed to both receive CAN Messages from and transmit CAN messages to customers' CAN devices. Arbin follows the standard CAN-Bus specification such as SAE J1939 protocol, CANopen or even user-defined protocols, With Arbin's CAN-Bus, there is no third party equipment, 3rd party DLL package or 3rd party licenses' needed to operate.



EVTS

Software Features

Arbin's MITS Pro Software is the most comprehensive battery testing software solution available in the marketplace today. Over the past decade, MITS Pro has been the front end of the Arbin test stations of the BT-2000, MSTAT, SCTS, and the EVTS systems. This has allowed Arbin to refine and simplify the software and user interface for improved stability and ease of use.

The power of MITS Pro comes from its capacity to create and implement tests from very simple to very complex all with a simple interface. Using the same software, you can write new test schedules, implement test regimes, as well as monitor and view real-time data.

		Step Label	Number Of Limits	Control Type	Control Value	Extra Control Value 1	Extra Control Value 2	Current Range
1	<input checked="" type="checkbox"/>	Step_A	1	Rest				
		Log Limit	Step Li	Goto Step	Type1	Sign1	Value1	Type2
	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Next Step	PV_CHAN_Step_Time	>=	00:00:00	
2	<input checked="" type="checkbox"/>	Step_B	2	Current(A)	0.1			Medium
		Log Limit	Step Li	Goto Step	Type1	Sign1	Value1	Type2
	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Next Step	PV_CHAN_Voltage	<=	2.2	
	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Next Step	DV_Time	>=	00:00:10	
3	<input checked="" type="checkbox"/>	Step_C	1	Set Variable(s)	Reset	Increment	Decrement	
		Log Limit	Step Li	Goto Step	Type1	Sign1	Value1	Type2
	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Next Step	PV_CHAN_Step_Time	>=	00:00:00	

Menu Driven Test Scheduling

Available Control Types

MITS Pro allows for extremely flexible test scheduling due to its broad availability of control types. A simple pull-down menu allows for easy selection of the available control types which include:

- Current
- Voltage
- Power
- Load
- Ramp
- Internal Resistance
- Simulation
- C-Rate
- Formula Control

On-the-Fly Test Modification

Arbin's hardware and software design allows for real-time changes to be made on test schedules running on the test station. With the ability for the user to modify running test schedules, the requirement to stop and restart tests is not necessary, providing for longer uninterrupted testing.

Life Cycle Testing

MITS Pro software allows the user to quickly write customizable test schedules allowing for easy life cycling of the devices. Using as little as two steps, the user can implement a test schedule and cycle it an unlimited number of times. Capacity limits can be set in the software to allow the user to run a test with end conditions based on capacity, instead of time.

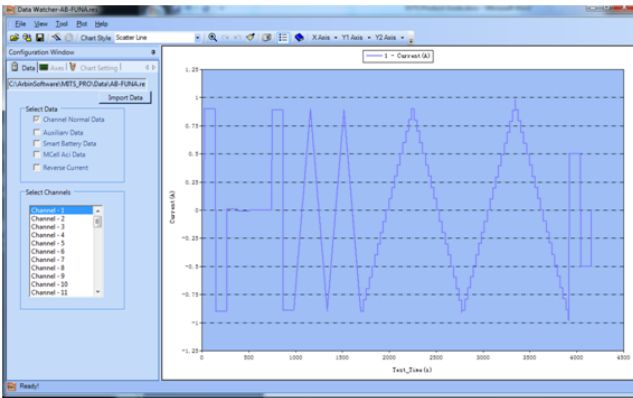
EVTS

Data Analysis

Once a test schedule has been assigned and started, a Microsoft Access file will be created with the results. This Access Database file can be opened using a third-party software, or using the Arbin software provided at no additional costs. Arbin provides two options for data analysis: Data Watcher and Microsoft Excel.

More Software Features

The power of MITS Pro comes from its capacity to create and implement tests from very simple to very complex all with a simple interface.



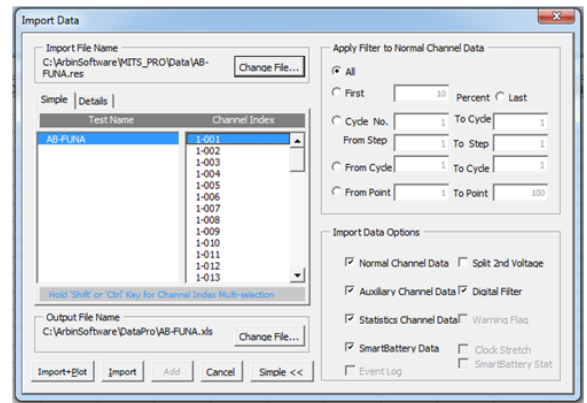
Data Watcher

Data Watcher allows quick and simple plotting of your test results file. Using data watcher, the user can do simple or complex plotting to determine whether or not the battery is reacting gas expected. If a data point falls outside of expectations, the user can double click on the graph and the list of data points will appear as well as the cycle count and step number the test is in. If modifications are required to the test schedule, the user can open the specified test schedule in MITS Pro, make the modification and continue testing with no interruption.

Microsoft Excel

For a more in-depth analysis report, Arbin has created an Excel Macro that will allow for simple importation of the test result file. The results file will contain all information gathered to allow for easy manipulation of the data.

Arbin's macro allows the user to plot all of the data or specific cycles or time, based on any criteria that you may require. The Macro and Data Watcher can be installed on any PC which allows for flexible data analysis outside of the laboratory.



	A	B	C	D	E	F	G	H	I
1	Data_Point	Test_Time(s)	Step_Time(s)	Step_Index	Cycle_Index	Current(A)	Voltage(V)	Charge_Capacity(Ah)	Discharge_Capacity(Ah)
2	1	10.030	10.030	1	1	0.00000	-0.00030	0.0000	0.0000
3	2	20.014	20.014	1	1	0.00000	0.00001	0.0000	0.0000
4	3	30.023	10.009	2	1	0.89996	0.90966	0.0025	0.0000
5	4	40.023	20.009	2	1	0.89996	0.90935	0.0050	0.0000
6	5	50.028	20.014	2	1	0.89996	0.90935	0.0075	0.0000
7	6	60.038	40.024	2	1	0.89996	0.90966	0.0100	0.0000
8	7	70.051	50.037	2	1	0.89996	0.90997	0.0125	0.0000
9	8	80.061	60.047	2	1	0.89996	0.90966	0.0150	0.0000
10	9	90.091	70.077	2	1	0.89996	0.90997	0.0175	0.0000
11	10	100.098	80.084	2	1	0.89996	0.90997	0.0200	0.0000
12	11	110.108	90.094	2	1	0.89999	0.90997	0.0225	0.0000
13	12	120.121	100.107	2	1	0.89996	0.90997	0.0250	0.0000
14	13	130.136	110.122	2	1	0.89996	0.90966	0.0275	0.0000
15	14	140.025	120.011	2	1	0.89999	0.90997	0.0300	0.0000
16	15	150.031	10.006	3	1	-0.90001	-0.91025	0.0300	0.0025
17	16	160.035	20.009	3	1	-0.90001	-0.91025	0.0300	0.0050
18	17	170.045	30.019	3	1	-0.90001	-0.91025	0.0300	0.0075
19	18	180.056	40.031	3	1	-0.90001	-0.91025	0.0300	0.0100
20	19	190.060	50.034	3	1	-0.89997	-0.90994	0.0300	0.0125
21	20	200.075	60.050	3	1	-0.89997	-0.91025	0.0300	0.0150
22	21	210.096	70.071	3	1	-0.90001	-0.91025	0.0300	0.0175
23	22	220.137	80.111	3	1	-0.89997	-0.91025	0.0300	0.0200
24	23	230.152	90.127	3	1	-0.90001	-0.91025	0.0300	0.0225
25	24	240.184	100.158	3	1	-0.90001	-0.91025	0.0300	0.0250
26	25	250.214	110.189	3	1	-0.90001	-0.91025	0.0300	0.0275

The imported results file will list all of the relevant information for proper data analysis including:

- Test Time & Date
- Step & Cycle Index
- Current
- Voltage
- Charge/Discharge Capacity (Ah)
- Charge/Discharge Energy (Wh)
- All Auxiliary Data



EVTS

Safety Features

Arbin's Electric Vehicle Test Stations are designed to provide an extremely safe testing environment to ensure the safety of the users as well as the test equipment itself. Arbin has implemented a number of new hardware and software safety features to prevent damage on the device being testes, and the test station.

Temperature Monitors at the Board Level

Temperature sensors on the circuit boards ensure the boards will not operate above a preset temperature to ensure no thermal damage during testing.

Over Current Protection

Temperature sensors on the circuit boards ensure the boards will not operate above a preset temperature to ensure no thermal damage during testing.

Universal Power Supply (UPS)

Protects the test station in event of power failure by providing a controlled shut-down sequence of the three phase power and single powered components.

Voltage Clamp

A unique hardware features that prevents an over or under voltage being applied to the device under test. The voltage clamp reacts at the hardware level.

Schedule Safety Limits

Each Test Schedule in MITS Pro has its own safety limit settings on the Global page. This allows the user to implement different safety limits on each test schedule, and each test channel.

Step Limits

While writing test schedules, the software allows for individual step limits. The step limits can be used as a transition from step to step, or as a safety limit by ending a certain test if main channel voltage, auxiliary channel voltage, temperature, or any other set point exceeds safety limits.

Regular Channel Safety Limit (Low-High)		Auxiliary Channel Safety Limit (Low-High)	
<input checked="" type="checkbox"/> Current(A)	0.0105 0.0105	<input checked="" type="checkbox"/> Voltage (V)	2.1 4.3
<input type="checkbox"/> Use [105] % of Current High Range		<input checked="" type="checkbox"/> Temperature (C)	10 65
<input checked="" type="checkbox"/> Voltage(V)	2.1 4.3	<input type="checkbox"/> Pressure (PSI)	0 0
<input type="checkbox"/> Use [105] % of Voltage Range		<input type="checkbox"/> pH Value	0 0
<input type="checkbox"/> Power(WA)	0 0	<input type="checkbox"/> Flow Rate (slm)	0 0
		<input type="checkbox"/> Concentration (ppm)	0 0
Safety Checking		Logging Data Options	
Max Times of Exceeding Safety [3]		<input checked="" type="checkbox"/> Normal Data	
Differential (dV/dt, dT/dt...) Setting		<input type="checkbox"/> Auxiliary Data	
Minimal Calculation Interval (s) For dT/dt, 15s recommended		<input checked="" type="checkbox"/> Statistic Data	
		<input type="checkbox"/> Smart Battery Data	





About Arbin

Arbin Instruments is one of the fastest growing manufacturers of energy-related testing equipment. Combining the global talents of electrochemists, electronic and software engineers, customer support staff, Arbin Instruments has revolutionized the automated testing instrumentation market. We offer standard and customized testing solutions for a wide variety of energy-storage devices such as batteries, supercapacitors, and fuel cells.

Arbin's focus is exceptional quality, performance and reliability. Our instruments provide scientists and engineers a tool for performing R&D, quality control, production, and characterization in various markets including Hybrid Electric Vehicles, medical, telecommunications, military, alternative energy, space, and consumer products.



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