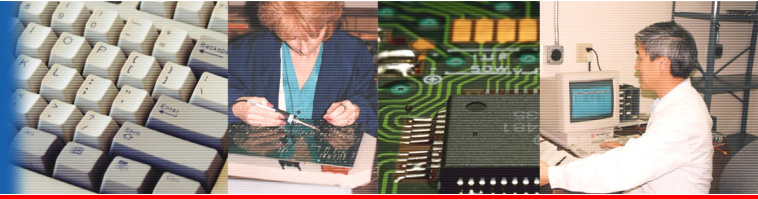


MITs Pro



Multiple Integrated Testing Software



- Flexible Scheduling
- User-friendly Interface
- Distributed System Control & DAQ
- Data Management & Presentation

Arbin **MITs Pro** is the most powerful software available in the battery testing marketplace today. It has been expanded to extend to *fuel cell, super-capacitor* and *other energy storage device* testing. **MITs Pro** has been refined, simplified, and ruggedized for improved stability and ease of use. These innovations greatly enhance the quality and efficiency of testing with existing hardware. In this way, **MITs Pro** sets a new standard for energy storage device testing software and technology.

These are the highlights of the software:

- Independent testing on multiple channels.
- Boolean control of test parameters.
- “On the fly” modification of test parameters in real time without interrupting testing.
- Ability to assign auxiliary inputs to main channels in a variety of configurations.
- Flexible user interface.
- Ability to control and monitor external devices from within the software.
- Software paralleling of channels allowing increased maximum current available to a test while integrating results into one data file.
- Complete data management utility.

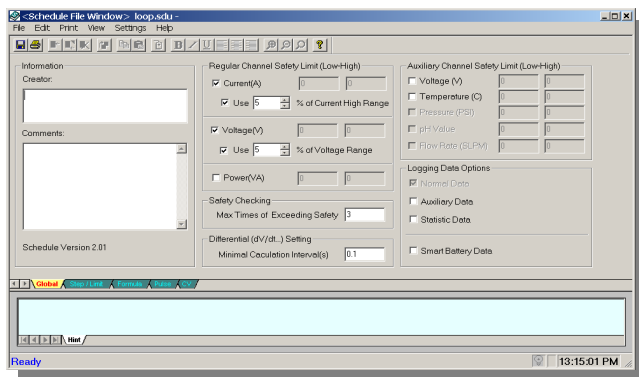


The power of Arbin's **MITS Pro** arises largely from the capability to create and implement tests of varying degrees of complexity within a few clicks and a few minutes procedure. The following information briefly describes the main structure and function of the software.

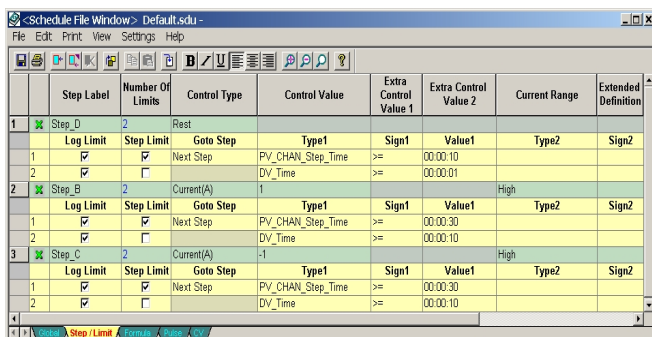
A Schedule

MITS Pro places all of the test parameters, including safety limits, test criteria, and logging instructions into a single file called a Schedule. The Schedule can then be run on an individual channel or group of channels.

A schedule is comprised of several pages. The first of which, the Global page, contains universal safety criteria and logging options specific to this test. This means that dissimilar devices with widely differing parameters can be run on the same machine easily and safely.



The second page, the Step/Limit page, contains the sequential instructions that define the test protocol.



Schedule Editor

3	Step_B	2	Current(A)	1	1	2		
	Log Limit	Step Limit	Goto Step	Type1	Sign1	Value1		
1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Next Step	PV_CHAN_Step_Time	>=	00:00:30		
2	<input checked="" type="checkbox"/>	<input type="checkbox"/>		DV_Time	>=	00:00:10		

Each step includes the definitions of:

- ① **Control Type (what to control)**
- ② **Control Value (what value to control)**
- ③ **Step condition**
- ④ **Data logging criterion**

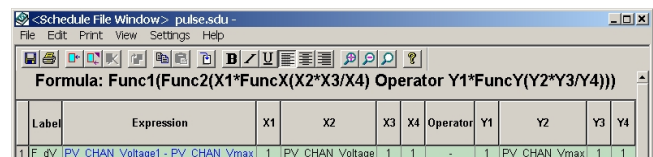
Advanced Options

The flexibility of test schedules is expanded further by the following advanced features. As these options are selected, additional pages appear in the schedule.

Advanced Options	
1	<input checked="" type="checkbox"/> Pulse Control
2	<input checked="" type="checkbox"/> Formula
3	<input checked="" type="checkbox"/> Smart Battery
4	<input checked="" type="checkbox"/> One-To-Many Virtual Mapping
5	<input checked="" type="checkbox"/> Auto Calibration
6	<input checked="" type="checkbox"/> Simulation Control
7	<input checked="" type="checkbox"/> CV Control
8	<input type="checkbox"/> Auto Resume
9	<input checked="" type="checkbox"/> Parallel Channels
10	<input checked="" type="checkbox"/> Fuel Cell
11	<input type="checkbox"/> AddIn

Advanced System Options

Formula allows the user to define control values based upon transcendental functions and mathematical equations.



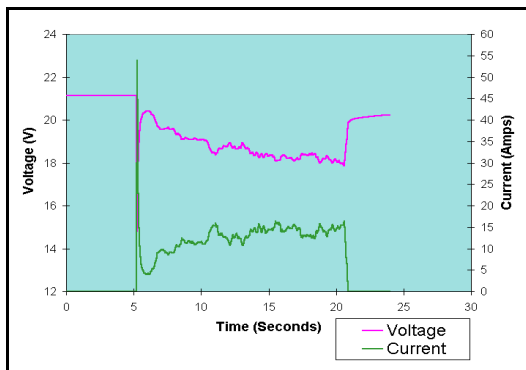
Sample Formula

Pulse control enables test engineers to implement standard mobile telephone cell tests and to create custom pulse regimes in systems with the requisite hardware.

Pulse Index	Pulse Label	Number Of Stages	Log Interval(s)	Pulse Type
1	Pulse_A	2	15	GSM
	Stage Index	Time(ms)	Amplitude	
	Base	4.05	-1.34	
	Stage 2	0.55	-0.108	
2	Pulse_B	2	15	CDMA
	Stage Index	Time(ms)	Amplitude	
	Base	3.75	-1	
	Stage 2	2.5	-1	

Pulse Editor

Simulation Control permits the recreation of environmental current and voltage profiles in the software so that they may be implemented in the laboratory.



Pseudo-random Voltage Simulation

Auto Calibration

MITS Pro provides a capability for autonomous calibration of main channels and auxiliary inputs in system with the requisite hardware.

The Auto Calibration Window includes the following sections:

- Select Station/Channels:** Station: NO.1, From Chan: [], To Chan: []
- Set Points By Type:** []
- Num of Points:** []
- Point Percentage(%)** buttons: Point, Percentage(%)
- Multimeter Sampling:** Value Change Tolerance(%): 0.05, Sampling Value Interval(s): 30, Stability Timeout(s): 120
- Select Calibration Type(s):**
 - Current-High
 - Current-Med
 - Current-Low
 - Voltage
 - Aux Voltage
 - Aux Temperature
 - Aux Pressure
 - Aux pH
 - Aux Flow Rate
- Measure/Control Error Tolerance(%):** 0.10
- Always Append Log Data, Check Calibration Only
- Low Range:** [], **High Range:** []

Auto Calibration Screen

Test Management

MITS Pro offers a well-defined hierarchy for structuring the testing environment. Individual schedules may be grouped together in a batch file and executed independently or in concert. The definition of each test station is accomplished through editing a **Batch file**. In a batch file, there are two screen pages.

The **Test** screen is used to assign pre-defined schedules to each channel and to input information for a specific test such as nominal capacity of the battery being tested.

Channel Index	Schedule	Voltage Clamp Low	Voltage Clamp High	Mass (g)	Specific Capacity (Ah/g)	Capacity (Ah)	Item ID	Smart Battery Channel Index
1	test.sdu					1.1		
2								
3	test.sdu					1.2		
4	formula_limit.sdu			0.023	0.316			
5	test.sdu					1.9		
6	simulation.sdu					5.6		
7	test.sdu					1.9		
8	test.sdu					1.8		

The **Map** screen permits the association of each auxiliary channel with one or more main channels. This feature allows the user to multiplex the finite number of secondary inputs in a wide array of possible configurations.

Channel Index	Auxiliary Type	Auxiliary Channel Index	Physical Channel Index
1	Aux Voltage	1	1
	Aux Temperature	1	1
2	Aux Voltage	1	2
	Aux Temperature	1	2
3	Aux Voltage	1	3
	Aux Temperature	1	3
4	Aux Voltage	1	4
	Aux Temperature	1	4
5	Aux Voltage	1	5
	Aux Temperature	1	5
6	Aux Voltage	1	6
	Aux Temperature	1	6
7	Aux Voltage	1	7
	Aux Temperature	1	7
8	Aux Voltage	1	8
	Aux Temperature	1	8



MITS Pro uses the information stored in the batch file, such as test schedule assignments, to control the testing environment. There are four view screens in the Monitor and Control Window that present the real-time status of experiments being conducted and managed by **MITS Pro**.

Detail view screen provides detailed information for all stations in one page.

ID	Test Name	Schedule Index	Status	Step Index	Cycle Index	Step Time (s)	Test Time (s)	Value	Current	Charge Capacity	Discharge Capacity	Charge Energy	Discharge Energy
001	testdata	1	Idle	1	0	00:00.00	00:00.00	0.0000 (V)	0.0000 (mA)	0.0000 (mAh)	0.0000 (mAh)	0.0000 (mWh)	0.0000 (mWh)
002	testdata	1	Idle	1	0	00:00.00	00:00.00	0.0000 (V)	0.0000 (mA)	0.0000 (mAh)	0.0000 (mAh)	0.0000 (mWh)	0.0000 (mWh)
003	testdata	1	Idle	1	0	00:00.00	00:00.00	0.0000 (V)	0.0000 (mA)	0.0000 (mAh)	0.0000 (mAh)	0.0000 (mWh)	0.0000 (mWh)
004	testdata	1	Idle	1	0	00:00.00	00:00.00	0.0000 (V)	0.0000 (mA)	0.0000 (mAh)	0.0000 (mAh)	0.0000 (mWh)	0.0000 (mWh)
005	testdata	1	Idle	1	0	00:00.00	00:00.00	0.0000 (V)	0.0000 (mA)	0.0000 (mAh)	0.0000 (mAh)	0.0000 (mWh)	0.0000 (mWh)
006	testdata	1	Idle	1	0	00:00.00	00:00.00	0.0000 (V)	0.0000 (mA)	0.0000 (mAh)	0.0000 (mAh)	0.0000 (mWh)	0.0000 (mWh)
007	testdata	1	Idle	1	0	00:00.00	00:00.00	0.0000 (V)	0.0000 (mA)	0.0000 (mAh)	0.0000 (mAh)	0.0000 (mWh)	0.0000 (mWh)
008	testdata	1	Idle	1	0	00:00.00	00:00.00	0.0000 (V)	0.0000 (mA)	0.0000 (mAh)	0.0000 (mAh)	0.0000 (mWh)	0.0000 (mWh)

Detail View Screen

Brief View permits the user to survey the status of every channel through color-coding and updated current and Voltage data.

ID	Test Name	Status	Value	Current	Charge Capacity	Discharge Capacity	Charge Energy	Discharge Energy
1.8	1 REST 6	2 REST 6	3 CHARGE 14	4 REST 6	5 CHARGE 4	6 CHARGE 4	7 DISCHG 8	8 DISCHG 8
9.16	9 CHARGE 4	10 CHARGE 7	11 CHARGE 14	12 CHARGE 4	13 DISCHG 8	14 DISCHG 8	15 CHARGE 4	16 CHARGE 4
17.24	17 DISCHG 14	18 DISCHG 14	19 REST 3	20 DISCHG 16	21 DISCHG 5	22 CHARGE 1	23 CHARGE 14	24 CHARGE 15
25.32	25 DISCHG 2	26 CHARGE 14	27 CHARGE 15	28 DISCHG 3	29 CHARGE 15	30 DISCHG 3	31 REST 4	32 FUSE 10

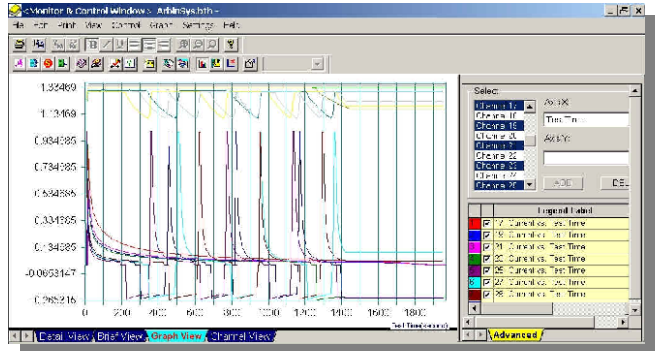
Brief View Screen

Channel view screen provides more detailed information, including smart battery data, for one station per screen.

Parameter	Value	Parameter	Value
DAO Chan Index	1	Step Index	16: Step 3, Current
Smart Battery	True	Cycle Index	0
Test Name	test_w_max	Charge Capacity	130.2761 (mAh)
Schedule Name	FullRate	Discharge Capacity	0.8677 (mAh)
Status	Running	Charge Energy	0.8992 (mWh)
ManufacturerData	2000 05 15	Internal Resistance	0.0000 (mΩ)
ManufacturerAccess	04259	AC Impedance	0.0000 (mΩ)
SpecificRate	0.0010	BatteryMode	128@0000
FullChargeCapacity	3000(mAh)	RemainingCapacity	2841(mAh)
ChargingCurrent	2000(mA)	Run Time To Empty	(N/A)
ChargingVoltage	12.6000(V)	Primary Battery Support	0
DesignCapacity	3750(mAh)	Condition Flap	1
DesignVoltage	10.8000(V)	Charger Controller Enable	0
SerialNumber	86	Charger Mode	0
ManufacturerName	ECOCCEL	Capacity Mode	m:small
DeviceName	S1001S	Max Error	100%
DeviceChemistry	LiION	RelativeStateOfCharge	75%
ManufacturerData	8-050504	AbsoluteStateOfCharge	75%
Aux Voltage 1	1.3500 (V)	Aux Voltage/dt 1	0.0000 (mV/s)
Aux Temperature 1	24.7462 (C)	Aux Temperature/dt 1	0.0000 (C/s)

Channel View Screen

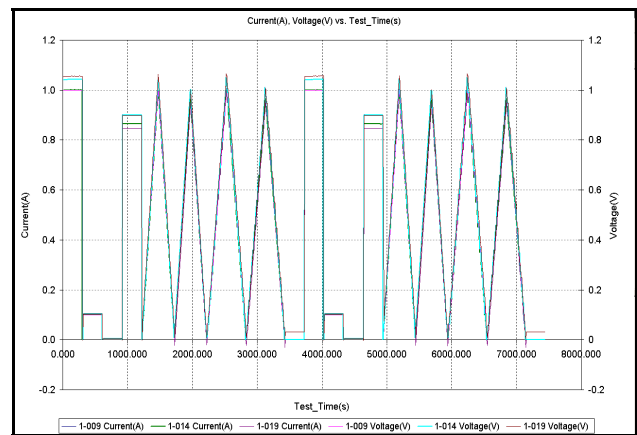
Graph view shows test data graphically in approximately real time. It can show the graph of several parameters of several tests simultaneously.



Graph View Screen

Data Presentation

MITS Pro provides a seamless interface between the scientific information contained in results files and the limitless rendering capabilities of Microsoft® Excel. Moreover, with the Arbin Data Pro macro installed, any computer becomes a powerful data station, able to generate presentation-grade plots of fundamental and derived data. Data files generated in Microsoft Access tables are viewable using any spreadsheet software. There are no time consuming exporting or other steps involved to view the data.



Results Data Plotted in Microsoft Excel

Remote Monitoring

Arbin's **MITS Pro** testing software employs Windows® 2000™ and is network-ready. Operators can monitor remotely from other computers throughout the network. Data can also be treated and transferred remotely.