Thanks for purchasing product, please read this operation instruction carefully before using, we will have no responsibility for any damage caused by misuse.

The specification data may be different from the real product since MTI keeps upgrading the machine; if any confusion, please visit our website at batteriespace.com for the latest information.
1. Introduction

Owning multi-channel, Battery Testing System is mainly used for testing batteries such as Li-polymer, Li-ion, Ni-MH, Ni-Cd batteries in the field of materials research, battery performance testing, small-scale battery formation, capability grading, battery pack testing and so on. According to the international standard design, each channel of the system has both an independent constant-current source and constant-voltage source. They can be easily programmed and controlled as desired. In addition, independent pulse source is added to each battery channel to meet the requirement of dynamic internal resistance measurement. With plug-and-play design, the user can freely load and remove the module units under a nonstop status, without interrupting other module units’ normal running. This function is convenient for the system’s maintenance.

Principle of Internal Modular Construction
2. Performance

• **Advanced and easy-to-use battery grading function**
  According to the parameters such as battery’s capacity, internal resistance and charge/discharge platform, the Battery Testing System series can well grade the batteries. However, the only thing customer needs to do is to assemble the battery and set the program, then, wait for the grading result which is automatically analyzed by the system.

• **8 independent programmable channels**
  With built-in power supply and complete controllable circuit, each channel can set different working modes as well as each module can work independently.

• **Excellent programming character**
  Once set all the working steps, parameters and working modes, the system will run the whole working cycle step by step, and flexibly, the user can modify everything at any time by using GOTO, restart and resume functions during the cycle if necessary. After that, program can be saved and opened in the form of schedule for convenience.

• **Powerful data and graph processing function**
  The software adopts standard SQL data-base management, and is compatible with Access, Excel. It features large data processing capacity. The user can define the curve coordinate personally such as voltage-time curve, current-time curve, capacity-voltage curve, loop times-charge/discharge capacity curve, loop times-charge/discharge efficiency curve, etc.

• **Dynamic battery internal resistance test (optional)**
  Each channel of Battery Testing System has a built-in pulse source which can calculate battery’s internal resistance value by means of applying HF pulse to the battery and measuring the battery’s sub-voltage. Internal resistance test can be conducted automatically during the process of charge and discharge.

• **Complete test process record (log function)**
  The Battery Testing System series can make a complete record of all the events happened in the test. During the process of test, some accidents such as power failure, system shutting down, erroneous communication, operation misplay and so on will lead to sudden changes of the test data (sudden changes of the voltage or current). By checking the record, user can more easily find these external interferential causes.

• **Intelligent power failure protection**
  If there is a power failure, the testing systems will automatically shutdown present working channels, and when the power recovers, the system will automatically resume those stopped channels and ensure that the test is normally conducted and of course, the data will never lose in any case.

• **4-electrode measuring**
  All the battery fixtures have 4 electrodes, including 2 current measuring ends and 2 voltage measuring ends. Multi-electrode measurement improves measuring accuracy.
• **Channel can be inputted impedance up to 10MΩ**
  Any battery channel of the Battery Testing System has more than 10MΩ input impedance and its current leakage is less than 0.5μA. This feature ensures the reliability of the test result and provides good guarantee for the micro-current measurement.

• **High reliability**
  Standard production follows the procedures of ISO9001; Test on randomly selected samples prior to the delivery of products; Independent protection circuit in every channel to prevent over current and over voltage; Upper and lower dual software protection.

• **Measuring voltage up to 45V**
  Normally, the system provides –5V~+5V voltage measuring range. We also produce equipments with 10V, 20V, 45V voltage.

• **Timely before sale service and after sale service**
  Our purpose is to manufacture the most satisfied products and provide the most considerate service for every customer. We will be glad to provide technical training for free if you are interested in our products. Any time, our engineers are ready for answering all of your questions about our products. If you are planning to buy our products, we may send some sample machines to your company first for your trial use free of charge. We sincerely welcome you to our company for a further understanding of our products. We provide free maintenance during one year after the sales, and only charge for the cost after the guarantee period. We will constantly follow the status of our products by contacting our customers. Please also note that we will timely provide the latest upgraded software of our products to our customers all the time.

• **System specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td>110v or 220v 50/60Hz Optional</td>
</tr>
<tr>
<td>Current Range</td>
<td>±3000 mA or ±10mA</td>
</tr>
<tr>
<td>Voltage Range</td>
<td>5V</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>≥10MΩ</td>
</tr>
<tr>
<td>Power</td>
<td>120W</td>
</tr>
<tr>
<td>Current Measurement Accuracy</td>
<td>±(0.2% of reading + 0.1% of range)</td>
</tr>
<tr>
<td>Voltage Measurement Accuracy</td>
<td>±(0.2% of reading + 0.05% of range)</td>
</tr>
<tr>
<td>Time Measurement Resolution</td>
<td>Second</td>
</tr>
<tr>
<td>Cycle Measurement Range</td>
<td>1~9999 times</td>
</tr>
<tr>
<td>Data register conditions</td>
<td>Time interval: (5-900S)</td>
</tr>
<tr>
<td>Port</td>
<td>RS232</td>
</tr>
<tr>
<td>Size</td>
<td>245mmW x 197mmD x 60mmH</td>
</tr>
<tr>
<td>Weight</td>
<td>35lbs</td>
</tr>
</tbody>
</table>
3. Hardware Structure

1. The Front Panel
   ① Power On/Off
   ② Power and mode LED
   ③ Channel working LED

2. Picture of Rear Panel
   ① Communication port socket

   ② Power socket

3. Description on Battery Fixture

a. General-purpose battery fixture
   As picture shown below, this fixture is mainly used for cylinder battery and the setscrew can be adjusted upward or downward to match the different size.

b. Alligator clip
   Every set of fixture is composed of two alligator clips, one is red and the other is black.
The large red alligator is power output positive electrode and the small one is voltage test positive electrode. They should be connected with the positive electrodes of the batteries. The large black alligator is power output negative electrode and the small one is voltage test negative electrode. They should be connected with the negative electrodes of the batteries.

4. Connection to Computer

a. One machine to one computer
Generally, the computer provides at least one RS232 serial communication port. Plug one end of the communication cable (provided with the test system) to the communication port socket at the back of the machine and the other end into the RS232 serial communication port of the computer.

b. Multi-machines to one computer
As the picture showing above, customer can apply the multi-ports cable of RS232, to connect up to ten battery analyzers to work simultaneously but using only one computer. Thus, lots of time and hardware resources are saved.

4. Instructions on Installing Software
a. Insert the installation disc labeled "MTI Corporation" into your computer.

a-1. If your computer automatically pops up a window and asks you "what do you want Windows to do?" Click the folder icon called "Open folder to view files using Windows Explorer", then go to step b.

a-2. If your computer does not automatically pops up the window referred to in step a-1, please click "Start", then click "My Computer", and then double click the disk drive called “MTI-TC", then go to step b.

b. When you see the folder named "MTI-TC5.0", copy it to your local hard disc drive where you can easily find it (For instance, you can copy it to C:\Program Files or desktop).

c. Have all the connections done, firstly power on the machine and then double click the icon named "TestCtrl.exe" in the folder, let this smart software help you do testing job.

5. Software Operation

1. Start
When start the software, the system will automatically check whether the testing modules have already been connected, if yes, it pops up the result like "COM1 finds * unit", and then, the channel modules will appear (the * is the number depending on how many cases you connect in parallel).

![Software Interface](image)

Figure 1

Note: If the system can not find the extra box you have already connected by multiple-ports, please go to tool bar area 1 (discussed below), and click "option" then “Quick Search Slave” to select right box and port range, and then, restart the software to continue your work.
2. Software Function

1) Tool Bar Area 1

<table>
<thead>
<tr>
<th>Channels</th>
<th>View</th>
<th>Option</th>
<th>Help</th>
</tr>
</thead>
<tbody>
<tr>
<td>Startup</td>
<td>Dynamic</td>
<td>Quick Search Slave</td>
<td>About</td>
</tr>
<tr>
<td>Stop</td>
<td>List</td>
<td>Alarm Parameter</td>
<td></td>
</tr>
<tr>
<td>Resume</td>
<td>Curve Line</td>
<td>Status Bar</td>
<td></td>
</tr>
<tr>
<td>Force Jump</td>
<td>Capacity Static Table</td>
<td>Language</td>
<td></td>
</tr>
<tr>
<td>Modify Step</td>
<td>Option Look-over</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity Grading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connect Slave</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Tool Bar Area 2

The function of this tool bar is almost the same to the “right click” function on each module, please refer to it later.

3) Right Click

Right click the module in the software interface, you will find useful function:

a) Startup:
   a-1. Step Setting: This setting allows the customer to set charge/discharge procedure step by step according to the sample, the step includes constant-current charge, constant-voltage charge, constant-current discharge, Ideal, cycle and stop. Please set the parameters in every step by strictly following the battery research rule.

Tip1: When done the setting, you can synchronically select the channels which will be set the same testing parameters by using “select channel” function.
Tip 2: The same function serving the system is that, when in the main interface prior to setting any channels, press "crtl" and left-click the channels you want to set, after that, right click to set the testing parameters, then “OK”, all the channels you selected will start to testing according to the setting parameters. By using these two tips, lot of time and energy will be saved.

Note 1: Usually, we set the value for “voltage upper” is a little lower than the voltage set in Constant-Voltage Charge, reversely, for “voltage lower” is a little greater than the one in Constant-Current Charge. For instance, Lithium battery’s discharge voltage for 2.75 and charge for 4.2, so, the protection voltage should be 2.5~4.25V (even 4.3-4.5V in some cases).

Note 2: Here the “+/-”for current is not the current warp but for charging or discharging. The protect current range should be greater than the charge/discharge current but not over the specification of the machine.
Figure 5  General Dialog

3) Customer can also modify the name of data file or leave it default, and also, note for the testing.

b) Stop:
After completing all the preset work, the working channel will stop automatically. As well, the user can stop it compulsorily by using this function.

c) Jump:
While the current procedure of a channel is being executed, the user can force it to stop and make it jump to the designated working step. Meanwhile, the battery status and test data of the corresponding channel will go on as usual.

d) Modify Step:
User could change the working parameters under dynamic working status.

e) Resume:
Recover the working status of the channel which is already stopped either by system or customer and resume the data.

f) Copy Template:
User can apply it to move a working status of one channel to any other channels while the original channel will keep running.

g) Dynamic Curve
Customer could use this function to monitor the testing voltage and current on dynamic.

![Figure 7](image)

h) Open Data File:
This function directly provides the Displays user-defined coordinate curve, such as voltage-time curve, current-time curve, capacity-time curve, capacity-voltage curve, ratio capacity-voltage curve, cycle charge/discharge capacity curve and cycle-charge/discharge efficiency curve so that user could easily inspect all the testing process. The above data and curves are adaptive to printing.

Note: Please consult to “Data manager” discussed later for details of this function.

Other functions:
a) Backup data file:
Backup function is used to save the presetting data in a folder in order to quickly open and use it when users enter the “startup” function windows rather than setting the data manually again, thus, lot of time and energy will be saved.

b) Channel Status:
View the information of one channel.

c) Clear finish flag
Clear the finish flag on the module block when done the job.

d) Independent
Name the testing on one module.

3. Software Interface (dynamic/list)
Click the button on the left bottom to change the software interface between dynamic and list to get your preference:

![Software Interface](image)

**Figure 8**

6. Testing

1. Connect the machine and computer by the RS232 cable. Some users may use the RS232 to USB adapter cable because of no RS232 port, just be sure install the related driver if before connecting.

2. Assemble the battery with one of the 8 inputs as figure 7below:

   Note: Please make sure the battery is well touched on the two ends of the channel. Otherwise, the current value will be quite small or the state may be “Protect”. (Also, you can use the four alligators to clamp battery like polymer battery to do the test, red to positive node and black to negative node)

![Battery Assembly](image)

**Figure 9**

After all the hardware assembling is done, plug the power cable, turn the power on and then execute the program, you will see the testing interface.
3. When the system automatically find the right COM terminal, click the COM in the interface, then please follow the steps like the instance below:

3-a. If we connect the battery to the input 5, then find the block 5 in the interface and click it with right button of your mouse, then click “Startup” (shown in figure 2)

3-b. When enter the startup dialog (shown in figure 3), set up the working step such as constant-current charge/discharge, constant-voltage charge, constant-power discharge, constant-resistance discharge, reset, cycle, and stop:

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>The minutes you want this working step to remain, usually used for Idle.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage (mV)</td>
<td>The voltage when doing the working step</td>
</tr>
<tr>
<td>Current (mA)</td>
<td>The current when doing the working step</td>
</tr>
<tr>
<td>Capacity (mAh)</td>
<td>The Capacity of the battery tested</td>
</tr>
<tr>
<td>-dv (mV)</td>
<td>Related parameters when testing the NiCd or NiMH battery</td>
</tr>
<tr>
<td>Cycle</td>
<td>The times when running the working step “cycle”</td>
</tr>
<tr>
<td>Cycle Head</td>
<td>The first step when running cycle</td>
</tr>
</tbody>
</table>

3-c. When have the entire set done, click “OK” to run the program to test the battery.

3-d. When running the program, user can freely apply the function introduced in “Function of Software”.

7. Data Manager

1. Introduction
Data Manager is a perfect data analyzing tool for the battery testing, it features:

a. Text display: Display timing, current, voltage, battery resistance, capacity and etc.

b. Curve display: Display the customized curve, such as Voltage-Time, Current-Time, Capacity-Time, Capacity-Voltage, Loop times-Capacity, Loop times-efficiency and curve compare.

c. Data manage: System can directly import the data into Excel, Word as well as graphic into relative software.

d. Set viewing area: Customer can set the viewing area according to his/her own demand.

e. Others: Curve cursors tracking, data-curve association, and view working information, print information.

Note: For data-curve association, you can double left-click the curve to get the corresponding data and vice versa.

2. Operation
Select menu “File” → “Open file” to enter “Open file” window. Select and open data file (the data file
expanded name is .bts) and the following interface will pop up. In the interface, the left is the curve and right the text data. In the text data, the data is arranged in line with every process.

**Figure 11**

**Notes** Right-click the mouse in the text to operate data display and data print. As shown in the graph, right-click the mouse in the data text to pop out a floating menu. Below is a description on how to select the options of the floating menu.

**Figure 12**

**a. Data fold:**
Select Data fold function to display the first and the last data for all the data included in the process, which facilitates an overall view of the whole process. If the Data fold function is not selected (data extension instead), all the content included in the process will be displayed, which facilitates the view of details.

**b. Time unit:**
Select Process independence and the timing starts from zero for every single process in the data displayed. Otherwise, the timing is accumulated and continuous between various processes.

**c. Working information:**
Working information is used to view the information such as the working processes of starting time and
process.

**Figure 13**

d. View test procedure:

**Figure 14**

The test process record records the type of events, system time and data number when the event took place.

e. Generate text file:
To save disk space and ensure the completeness of the data, the data file (*.res) is in binary format. However, the software provides the function to convert the binary data into text data format (*.txt). In the default mode, the data file format in the generative text file is the same as the display format of the text data.

[Notes]: Cancel the optional setting to generate a “clean” text file used as input file of table or graph software like Microsoft Excel.

f. Generate excel file:
System can also generate excel file suffixed with .xls.
(Especially, when applying the machine which has current range 0.002mA-1mA, please use this function and then display the curve by Excel since the data manager provides a minimum curve measuring scale of 1mA)

g. Print and print preview:
The software supports the printing of the designated page.

3. Curve display:

a. Function
The functional button is shown below for analyzing the curve:

```
1 2 3 4 5 6 7 8 9 10 11 12
```

b. Curve Setting
Right-click the mouse in the curve area to conduct such operations as graph display and print:

Figure 15

Figure 16
Left-click “Graphics Setting” to pop up the dialog, then the customer can freely define the two axes of the curve as well as “graphics style”.

![Figure 17]

Click “Compare” and add the files to compare the different curves for analyzing. Note: “Curve” for selecting curve color and “Back” for the background.

![Figure 18]

c. **Print and print preview:**
Print is automatically adaptive to paper range. In addition, print can also define and memo literal information.

d. **Memo information:**
Left-click Memo information in the floating menu with the mouse to display “Memo information” dialog box
and memo information will be printed below the graph.

![Image of Print Memo Set dialog box]

**Figure 18**

Note: The function discussed below may vary a little in different versions.

If any questions, please contact us at tel: 1-510-525-3070 or email: info@mtixtl.com, MTI’s engineer will help you out within 24 hours.