Battery Charge / Discharge Testing Software

1. Purpose:
   Software enables user to control the process of charge and discharge as per battery specifications and permits programming of the DC Source and DC Load for automatic testing. Software also controls DMM for varied temperature measurement and monitoring during the charge and discharge process.

2. Applications:
   a. Capacity Test
   b. Discharge performance; user can get C-V curve under different discharge rates.
   c. Endurance in Cycles

3. Equipment:
   Connectivity: Software/hardware connection via GPIB/RS232/USB to control DC Source/DC Load/DMM.
   Programmable DC Load: Chroma 63200, 6310 series (support one channel only)
   DMM: Chroma 12061 (for temperature measurement)

4. Software Installation:
   To install the Chroma Battery Charge Discharge Testing Software, unzip file to preferred folder, locate and click install.exe file.

5. Connection:
   It is suggested to connect a Diode at the DC Source output terminal in order to prevent current feedback while DC Source has no output. Also connecting a fuse at “+” terminal of DC Load in will prevent high current feedback from battery once, if any, abnormal short occurs at
internal DC Load.

Choose Diode and Fuse in accordance with the specification of the battery. If the specification is 68V and 100A, user must select a Diode that can allow 68V and 100A, and a fuse that can accept 100A. Chroma recommends increasing 20%. Because there is a diode in the DC Source terminal and diode has a forward bias, user needs to consider the part when setting charging voltage.
6. Software Operation:

6.1 Instrument Selection Screen

A. **Select Operational Mode:** Charge+Discharge, Charge Only, or Discharge Only.

B. **Select DC Source:** DC Source model and interface. 62000P; 62000B; 6260/62120 series.

C. **Select DC Load:** DC Load model and interface. 63200, 6310 series.

D. **Select DMM Select:** DMM model and interface. 12061 series. For temperature measurement, select 12061 2W for two-wire measurement or 12061 4W for four-wire measurement.

E. **Initial:** After clicking the Set OK button, indicates OK for successful initialization or Fail if not correct.

F. Indicates software version.

G. **Continuing function:** Click Set OK button to continue and enter the main test page or Exit to close software.

NOTE: If controlled via RS-232, please confirm whether Baud Rate is 9600 from instrument.

6.2 Configure Screen
A. **1C**: Defines the numbers of amperes. If enabled, the software will calculate current unit as C; if disabled, the software will use A.

B. **Sample Time**: Sets the sample time in the report.

C. **Start Capacity**: Capacity of battery before testing.

D. **Max Capacity**: Capacity of battery in the specification.

E. **Protection ON/OFF**: Function to prevent setting a too high value.

F. **MAX Voltage/Current**: If Protection is enabled, user can set the maximum value of voltage and current.

G. **Back**: Closes configuration window and brings user to the main screen.

6.3 **Main Screen**
The main screen offers 100 sequences and 50 steps; includes the Sequence setting, Step setting, Reading and Chart, and software functions.

**Sequence Setting**

A. **Sequence**: The function of sequence is setting the charge, discharge or no action, and also the value of charge or discharge. Use up/down arrows or the left/right button of slider bar to adjust or enter Number of 0-99.

B. **Action**: Selects Charge, Discharge, and No Action for each sequence.

C. **Voltage**: Sets the voltage value of charge.
D. **Current:** Sets the current limit value of charge or the current value of discharge.
E. **HH:MM:SS:** Sets the execution time in each sequence.
F. **Stop Condition:** Each Sequence has three or four stop conditions. Fourth condition if DMM is enabled. Software will stop the sequence if entered parameters are reached.
G. **Cont/Stop All:** Users can select Continue or Stop All. When the sequence reaches the stop condition within the execution time, it will either continue to the next sequence or stop. Selecting Continue will go to the next sequence. Stop All will stop the sequence.

### Step Setting

H. **Step:** Edits the process of charge and discharge by sequence. Use up/down arrows or left/right button of slider bar to adjust or enter Number 1-50.
   - **Sequence Start:** Sets the initial Sequence Number of each step. Users can select which Sequence to start; however the latter number has to be higher than the previous one.
   - **Sequence End:** Sets the end sequence number of each step. Users can select the sequence to end; however the latter number has to be higher than the previous one. For example, in one step, the Sequence Start Number has to be smaller than the Sequence End Number. The next sequence Start Number has to be larger than previous Sequence End Number.
   - **Loop:** Sets how many times it will loop from Sequence Start to Sequence End in the step.
I. **Count:** Sets the repeat time after all valid steps are executed.
J. **Step Start:** Selects the step to begin. If Step start set at “2”, it will be executed from the 2nd Step.

### Reading and Chart

K. **This part is Reading.**
   - **Time Elapsed:** The current execution time.
   - **Total Time:** Indicates total time.
   - **V (V):** Reading of voltage.
   - **I (I):** Reading of current.
   - **T (°C):** Reading of temperature if DMM is enabled.
   - **Now Count:** Shows how many times it has been counted.
   - **Now Step:** Shows the present Step.
   - **Now Step Loop:** Indicates how many loops have been executed in Step.
**Now Sequence**: Shows the current Sequence.

**L.** Charts voltage, current and temperature if DMM is enabled.

**M.** When clicked this button will clear the curve.

**Software Function**

**N. Software function**

- **Communication**: Goes back to Instrument Selection screen.
- **Report Path & File Name**: Reports Path and File Name.
- **Browse**: Choose path and file name.
- **Report ON**: Enables or disables the report function.
- **Configure**: Goes to the Configure screen.
- **Save As**: Saves a setting parameter file.
- **Open**: Opens a setting parameter file.
- **Exit**: Exits the software.
Example:
The following screenshot shows eight sequences to execute the action of a Charge, Discharge, or No Action. In this example, sequence zero and sequence four are Charge; sequence two and sequence six are Discharge; sequence one, three, five, and seven are No Action. (1C = 2.3A)

Step one is from sequence zero to sequence three and step two is from sequence four to Sequence seven. Since the step two is the final step and the count number is set at “2”, the process of Step’s One and Two will execute and repeat twice. The loop of the second Step is set at “2”, so when the software executes the second step, it will be executed twice. As a result, the software will execute the process of Step 1 >> Step 2 >> Step 2 and repeat two times.
The example chart below indicates a red curve as current and a white curve as voltage. When the current value is positive, it means the software in Charge mode. When the current value is negative, it means the software in Discharge mode. If the current value is zero, the software in No Action mode. The pink line represents step one, yellow line represents loop one of the second step and green line represents loop two of the second step.

The report below was generated from the example above. Reports can be generated with test readings, including voltage, current, capacity, remaining capacity, test time, and related parameters.