Battery Simulation / Test Function

PSU Series

USER MANUAL

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

Good Will Instrument Co., Ltd.
No. 7-1, Jhongsing Rd., Tucheng Dist., New Taipei City 236, Taiwan.

Table of Contents

Outline

Background

With the development of the battery industry, battery testing has received more and more attention. The PSU provides two battery functions for this, battery simulation and battery test.

In the battery function, there are five built-in battery models: lithium battery, lead-acid battery, 1.2V NiMH battery, 12V NiMH battery, and NiCd battery for users to use.

The five groups of preset battery models voltage and internal resistance ranges are as follows:

Battery models	Voltage range	Internal resistance ranges
B001 (Li Ion)	3.003~4.199V	0.062~0.083Ω
B002 (lead acid)	10.812~13.588V	0.085~0.607Ω
B003 (NiMH1.2V)	1.008~1.4V	0.073~0.122Ω
B004 (NiMH12V)	10.734~14.377V	0.086~1.607Ω
B005 (Ni Cd)	1.132~1.397V	0.154~0.906Ω

The built-in models available for PSU are listed below. Please select the appropriate machine model when the user needs to use the built-in model.

PSU model type	B001	B002	B003	B004	B005
PSU 6-200	V	X	V	X	V
PSU 8-180	V	X	V	X	V
PSU 12.5-120	V	X	V	X	V
PSU 15-100	V	V	V	V	V
PSU 20-76	V	V	V	V	V
PSU 30-50	V	V	V	V	V
PSU 40-38	V	V	V	V	V
PSU 50-30	V	V	V	V	V
PSU 60-25	V	V	V	V	V
PSU 80-19	V	V	V	V	V
PSU 100-15	V	V	V	V	V
PSU 150-10	V	V	V	V	V
PSU 300-5	V	V	V	V	V
PSU 400-3.8	V	V	V	V	V
PSU 600-2.6	V	V	V	V	V

Note	This function can only be enabled after paid purchase, please contact GW Instek for purchase details.
Note	Please note that this battery function is only available with firmware version 2.18 or later version

Battery simulation

Background

In general testing with real batteries, charging/discharging the batteries to a specified state of charge takes too much time. Our battery simulation feature instantly specifies battery state of charge, avoiding lengthy battery preparation times.

Additionally, continuous cycling of real batteries for testing may result in shorter battery life and inaccurate test results. Using the battery simulation function provides greater test consistency and repeatable test results.

Best of all, the battery emulation function is much safer than a real battery. The PSU provides over-voltage and over-current protection, which interrupts the output in the event of an abnormality in the test.

In the battery simulation function, the PSU will simulate battery discharge according to the battery model.

Battery Model

In terms of battery models, we provide five sets of preset models for lithium batteries, lead-acid batteries, 1.2V NiMH batteries, 12V NiMH batteries and NiCd batteries for use.

Battery models	Voltage range	Internal resistance ranges
B001 (Li Ion)	3.003~4.199V	0.062~0.083Ω
B002 (lead acid)	10.812~13.588V	0.085~0.607Ω
B003 (NiMH1.2V)	1.008~1.4V	0.073~0.122Ω
B004 (NiMH12V)	10.734~14.377V	0.086~1.607Ω
B005 (Ni Cd)	1.132~1.397V	0.154~0.906Ω

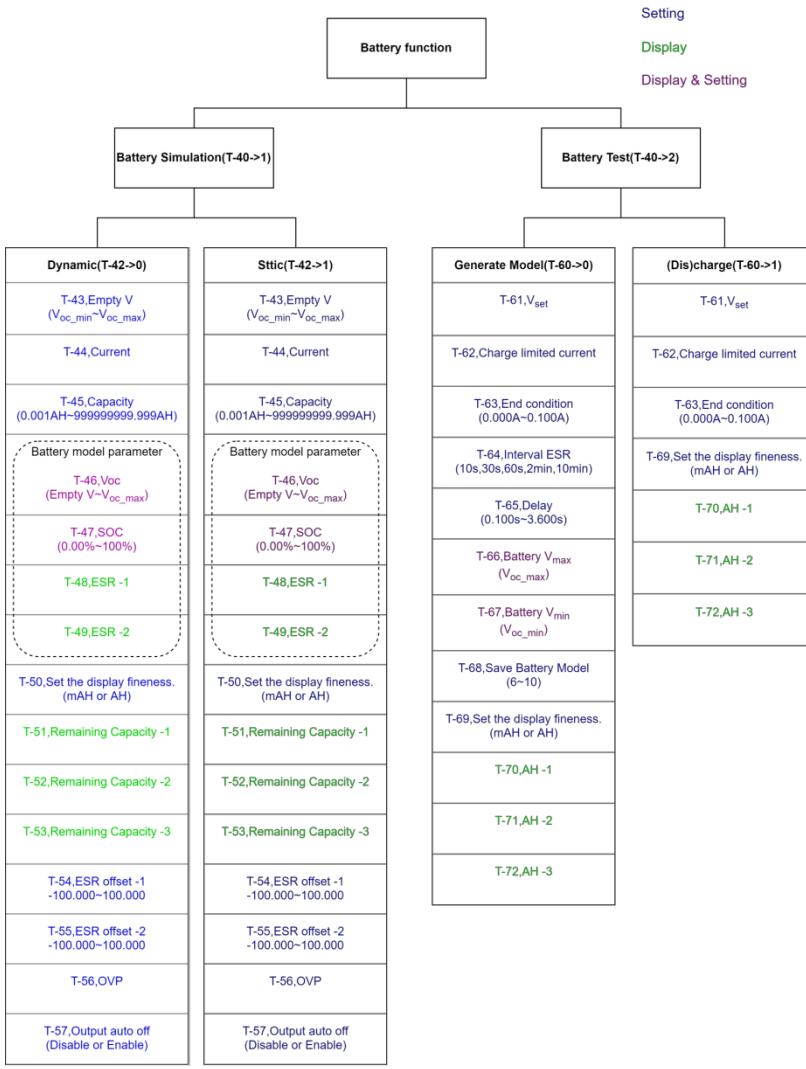
	The five groups of preset battery models voltage and internal resistance ranges are as follows: There are also five sets of battery models available for user customization.
Simulation Method	According to the battery simulation method, it is divided into dynamic and static: • Dynamic As the capacity is consumed, the SOC (State of charge) will decrease over time, and the corresponding ESR will be changed with the current SOC (State of charge), and the corresponding V_{oc} (open circuit voltage) will be output. • Static According to the current set SOC, output the corresponding Voc (open circuit voltage).

Battery test

Background	In the battery test function, the PSU can charge and discharge the real battery, and the user can also charge the battery to generate a battery model. (This model can also be used in the battery simulation function to simulate discharge.)
Test Mode	Battery Test provides the following features: • Generate battery model According to the battery charging process, measure the battery's open circuit voltage, battery capacity (amp-hour) and current, and calculate the equivalent resistance to generate a battery model. • Charge or Discharge Perform charge and discharge tests on batteries.

Menu configuration

Menu structure



Menu configuration table

Please use the configuration settings listed below when applying the configuration settings.

Battery function setting	Setting	Setting Range
Battery mode	T-40	0 = Disable, 1 = Battery Simulation, 2 = Battery Test
Battery simulation function		
Battery simulation Model	T-41	1~10
Method	T-42	0 = Dynamic, 1 = Static
Empty V	T-43	V_{oc_min} *1 ~ V_{oc_max} *2
I-Limit	T-44	0 ~ 200.0A (PSU6-200) 0 ~ 180.0A (PSU8-200) 0 ~ 120.0A (PSU 12.5-120) 0 ~ 100.0A (PSU 15-100) 0 ~ 76.00A (PSU 20-76) 0 ~ 50.00A (PSU 30-50) 0 ~ 38.00A (PSU 40-38) 0 ~ 30.00A (PSU 50-30) 0 ~ 25.00A (PSU 60-25) 0 ~ 19.00A (PSU 80-19) 0 ~ 15.00A (PSU 100-15) 0 ~ 10.00A (PSU 150-10) 0 ~ 5.000A (PSU 300-5) 0 ~ 3.800A (PSU 400-3.8) 0 ~ 2.600A (PSU 600-2.6)
Battery capacity*3	T-45	0.001AH ~ 999999999.999AH
Open circuit voltage	T-46	Empty V ~ V_{oc_max} *2
SOC (State of charge)	T-47	0.00% ~ 100.0%
ESR*4 (Battery resistance)-1	T-48	Display the current ESR value.
ESR*4 (Battery resistance)-2	T-49	Display the current ESR value.
Sets the display fineness of the remaining battery capacity*5	T-50	0: mAH, 1: AH
Remaining battery capacity -1	T-51	Displays the current remaining battery capacity.
Remaining battery capacity -2	T-52	Displays the current remaining battery capacity.

Remaining battery capacity -3	T-53	Displays the current remaining battery capacity.
ESR offset*6-1	T-54	-100.000 ~ 100.000
ESR offset*6-2	T-55	-100.000 ~ 100.000
OVP	T-56	0.6 ~ 6.300V (PSU6-200) 0.8 ~ 8.400V (PSU8-180) 1.25 ~ 13.12V (PSU 12.5-120) 1.5 ~ 15.75V (PSU 15-100) 2 ~ 21.00V (PSU 20-76) 3 ~ 31.50V (PSU 30-50) 4 ~ 42.00V (PSU 40-38) 5 ~ 52.50V (PSU 50-30) 5 ~ 63.00V (PSU 60-25) 5 ~ 84.00V (PSU 80-19) 5 ~ 105.0V (PSU 100-15) 5 ~ 157.5V (PSU 150-10) 5 ~ 315.0V (PSU 300-5) 5 ~ 420.0V (PSU 400-3.8) 5 ~ 630.0V (PSU 600-2.6)
Automatically turn off the output	T-57	0 = Disable, 1 = Enable
Battery test function		
Test mode	T-60	0: Generate battery model, 1: Charge or Discharge
V_{set} (Target voltage value for (dis)charging)	T-61	0 ~ 6.000V (PSU6-200) 0 ~ 8.000V (PSU8-180) 0 ~ 12.50V (PSU 12.5-120) 0 ~ 15.00V (PSU 15-100) 0 ~ 20.00V (PSU 20-76) 0 ~ 30.00V (PSU 30-50) 0 ~ 40.00V (PSU 40-38) 0 ~ 50.00V (PSU 50-30) 0 ~ 60.00V (PSU 60-25) 0 ~ 80.00V (PSU 80-19) 0 ~ 100.0V (PSU 100-15) 0 ~ 150.0V (PSU 150-10) 0 ~ 300.0V (PSU 300-5) 0 ~ 400.0V (PSU 400-3.8) 0 ~ 600.0V (PSU 600-2.6)
Charge Limit	T-62	0 ~ 200.0A (PSU6-200) 0 ~ 180.0A (PSU8-200)

		0 ~ 120.0A (PSU 12.5-120) 0 ~ 100.0A (PSU 15-100) 0 ~ 76.00A (PSU 20-76) 0 ~ 50.00A (PSU 30-50) 0 ~ 38.00A (PSU 40-38) 0 ~ 30.00A (PSU 50-30) 0 ~ 25.00A (PSU 60-25) 0 ~ 19.00A (PSU 80-19) 0 ~ 15.00A (PSU 100-15) 0 ~ 10.00A (PSU 150-10) 0 ~ 5.000A (PSU 300-5) 0 ~ 3.800A (PSU 400-3.8) 0 ~ 2.600A (PSU 600-2.6)
End condition*7	T-63	0 ~ 0.1A (The output will be turned off when the charge current is lower than the set value.)
ESR sampling period	T-64	10 seconds. 30 seconds. 60 seconds. 120 seconds. 600 seconds.
Delay time*8	T-65	0.100s ~ 3.600s
Battery V_{oc_max}*2 (SOC = 100%)	T-66	0 ~ 6.000V (PSU6-200) 0 ~ 8.000V (PSU8-180) 0 ~ 12.50V (PSU 12.5-120) 0 ~ 15.00V (PSU 15-100) 0 ~ 20.00V (PSU 20-76) 0 ~ 30.00V (PSU 30-50) 0 ~ 40.00V (PSU 40-38) 0 ~ 50.00V (PSU 50-30) 0 ~ 60.00V (PSU 60-25) 0 ~ 80.00V (PSU 80-19) 0 ~ 100.0V (PSU 100-15) 0 ~ 150.0V (PSU 150-10) 0 ~ 300.0V (PSU 300-5) 0 ~ 400.0V (PSU 400-3.8) 0 ~ 600.0V (PSU 600-2.6)

Battery V_{oc_min}[*1] (SOC = 0%)	T-67	0 ~ 6.000V (PSU6-200) 0 ~ 8.000V (PSU8-180) 0 ~ 12.50V (PSU 12.5-120) 0 ~ 15.00V (PSU 15-100) 0 ~ 20.00V (PSU 20-76) 0 ~ 30.00V (PSU 30-50) 0 ~ 40.00V (PSU 40-38) 0 ~ 50.00V (PSU 50-30) 0 ~ 60.00V (PSU 60-25) 0 ~ 80.00V (PSU 80-19) 0 ~ 100.0V (PSU 100-15) 0 ~ 150.0V (PSU 150-10) 0 ~ 300.0V (PSU 300-5) 0 ~ 400.0V (PSU 400-3.8) 0 ~ 600.0V (PSU 600-2.6)
Save battery model	T-68	6 ~10
Set the AH display fineness[*9]	T-69	0: mAH, 1: AH
AH -1	T-70	Displays the current accumulated ampere-hour
AH -2	T-71	Displays the current accumulated ampere-hour
AH -3	T-72	Displays the current accumulated ampere-hour
Battery state		
Battery state	T-90	0 = Disable, 1 = Battery Simulation/ Test Start
Battery model		
Import battery model	T-91	6~10
Export battery model	T-92	6~10
Remove battery model	T-93	6~10
Battery data log		
Battery data log[*10]	T-99	0 = Disable, 1 = Stored in the USB storage, 2 = Remote control.

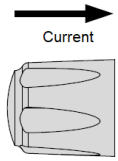
Notes:

[*1] The minimum value of the open circuit voltage in the selected battery model.

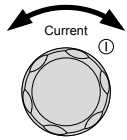
[*2] The maximum value of the open circuit voltage in the selected battery model.

[*3] When switching to menu T-45, 0 - XX will be displayed on the right.

Press the “Current” knob to switch to the leftmost parameter.



Rotate the current knob to change the Battery capacity display. Suppose set to 99.99AH, As shown on the below, 0-00 starts to display from the highest digit.



00	00	00	09	9.9	90
0	1	2	3	4	5

*4 If T-48: _ _12., T-49: 3450
⇨Current ESR : 12.345Ω
*5 If T-50 set (0), T-51: 1234, T-52: 5678, T-53: 9.012
⇨Remaining battery capacity : 123456789.012AH
If T-50 set (1), T-51: 1234, T-52: 5678, T-53: 9012
⇨Remaining battery capacity : 123456789012AH
*6 If T-54:+_12., T-55: 3450
⇨ESR offset: + 12.345Ω

*7 If the cut-off current is set too small, it may cause the charging time to be too long.

*8 This delay time is to ensure that the current rises to the set value and then obtain the correct sampling data to calculate the equivalent series resistance.

*9 If T-69 set (0), T-70: 1234, T-71: 5678, T-72: 9.012
⇨Current accumulated ampere-hour : 123456789.012AH
If T-69 set (1), T-70: 1234, T-71: 5678, T-72: 9012
⇨Current accumulated ampere-hour : 123456789012AH

*10 The sampling time is in accordance with the menu F- 83. Save to USB folder name according to menu F-84.

Function introduction

Battery simulation

Overview

In this application, the PSU will discharge according to the battery model.

In terms of battery models, we provides five sets of preset models for lithium batteries, lead-acid batteries, 1.2V Ni-MH batteries, 12V Ni-MH batteries, and Ni-Cd batteries for use. There are also five sets of battery models available for user customization.

The five groups of preset battery module voltage and internal resistance ranges are as follows:

Battery models	Voltage range	Internal resistance ranges
B001 (Li Ion)	3.003~4.199V	0.062~0.083Ω
B002 (lead acid)	10.812~13.588V	0.085~0.607Ω
B003 (NiMH1.2V)	1.008~1.4V	0.073~0.122Ω
B004 (NiMH12V)	10.734~14.377V	0.086~1.607Ω
B005 (Ni Cd)	1.132~1.397V	0.154~0.906Ω

The form of the battery model is as shown in the figure below:

	A	B	C	D
1	PSU50-30			
2	Capacity=3.100AH			
3	SOC(%)	Open Volta	ESR(ohm)	
4	0	3.003	0.083	
5	1	3.493	0.074	
6	2	3.494	0.073	
7	3	3.572	0.068	
8	4	3.634	0.068	
9	5	3.683	0.067	
10	6	3.722	0.067	
	.			
	.			
	.			
96	92	4.162	0.062	
97	93	4.169	0.062	
98	94	4.175	0.063	
99	95	4.18	0.063	
100	96	4.184	0.063	
101	97	4.189	0.063	
102	98	4.193	0.064	
103	99	4.196	0.064	
104	100	4.199	0.066	

The battery model contains the following parameters:

- Capacity
- SOC: State of charge
- Open circuit voltage
- ESR: battery resistance

There are two methods to simulate battery discharge, dynamic or static.

- Dynamic: As the capacity is consumed, the SOC (State of charge) will decrease with time, and the corresponding ESR will be changed with the current SOC, and the corresponding V_{oc} (open circuit voltage) will be output.
- Static: According to the current set SOC, output the corresponding V_{oc} (open circuit voltage).

Example

The following example demonstrates the procedure of simulating a battery with PSU in the battery simulation function.

Equipment required:

- PSU Series
- Load
- Wires

The operation steps and the corresponding SCPI commands are as follows:

1. Set the T-40 Battery mode setting to 1(Battery simulation).
   :BATTery:MODE 1
2. Select the first (Li Ion) set of battery models (T-41).
   :BATTery:SIMulator:MODel:RECall 1
3. The Empty V (T-43) will display 3.003V, open circuit voltage (T-46) will display 4.199V, SOC (T-47) will display 100%, and ESR (T-48,T-49) will display 0.066 ohms.
   :BATTery:SIMulator:VOC:EMPTy?
   >3.003
   :BATTery:SIMulator:VOC?
   >4.199
   :BATTery:SIMulator:SOC?
   >100
   :BATTery:SIMulator:RESistance?
   >0.066
4. Set Method to Dynamic (T-42).
   V_{oc} and SOC will change with state of discharge, just like a battery.
   :BATTery:SIMulator:METHod 1
5. Set the Empty V (T-43) to 3.683V.
   Discharge to the open circuit voltage to 3.683V, the end of discharge.

:BATTery:SIMulator:VOC:EMPTy 3.683

6. Set the current (T-44) to 1A.
   :BATTery:SIMulator:CURRent:LIMit 1
7. Set Capacity (T-45) to 0.1AH. This menu allows you to change the default battery capacity.
   :BATTery:SIMulator:CAPacity:LIMit 0.1
8. Set SOC (T-47) to 80% and V_{oc} (T-46) to 4.199V. The value of SOC will change with the value of Voc and vice versa.
   :BATTery:SIMulator:SOC 80
   :BATTery:SIMulator:VOC?
   >4.097
   :BATTery:SIMulator:VOC 4.199
   :BATTery:SIMulator:SOC?
   >100
9. Enable auto-off output function (T-57). When the discharge reaches V_{oc} = Empty V, the output will automatically turn off to end the discharge.
   :BATTery:SIMulator:OUTPut:OFF:AUTO 1
10. Set the data log (T-99) in battery form to 1 (Stored in the USB storage).
    :BATTery:DLOG:STATe 1
11. Mass storage plugged into front USB port.
12. After setting the T-90 to 1 (Battery start), “batt wait" is displayed on the panel.
    :BATTery:PROGram:STATe RUN
13. After pressing output, start simulating battery discharge.
    :BATTery:SIMulator:PROGram:STATe RUN
14. During the discharge process, the menu will display the current open circuit voltage, SOC, internal resistance and remaining capacity.
    :BATTery:SIMulator: MEASure ALL?
    >+3.7830,+1.0000,+0.066,10.00,0.01
    The returned values are as follows

Voc	+3.783V
Current	+1.0000A
ESR	+0.066Ω
SOC	10.00%
Capacity	0.01AH

15. When the discharge reaches V_{oc} = Empty V, the output will automatically turn off to end the discharge.

16. After the battery simulation discharge is completed, you can open the .csv file stored in the mass storage to view the simulation status.

	A	B	C	D	E	F	G
1	Sample Period : 1.0 sec						
2	Number	Voltage(V)	Current(A)	ESR(ohm)	SOC(%)	State(Hex)	
3	0	4.199	-0.0053	0.066	100	0x00000000	
4	1	4.199	-0.0053	0.066	100	0x00000000	
5	2	4.199	-0.0053	0.066	100	0x00000000	
6	3	4.199	-0.0066	0.066	100	0x00000108	
7	4	4.199	-0.0045	0.066	100	0x00000108	
8	5	4.1989	0.9937	0.066	99.97	0x00000108	
9	6	4.1987	0.9942	0.066	99.91	0x00000108	
10	7	4.1985	0.9947	0.066	99.86	0x00000108	
11	8	4.1984	0.9947	0.066	99.8	0x00000108	
12	9	4.1982	0.9942	0.066	99.75	0x00000108	
13	10	4.198	0.9947	0.065	99.69	0x00000108	
14	11	4.1979	0.9934	0.065	99.64	0x00000108	
15	12	4.1977	0.9934	0.065	99.58	0x00000108	
16	13	4.1975	0.9942	0.065	99.53	0x00000108	
17	14	4.1974	0.9929	0.065	99.47	0x00000108	

Note The sampling time is in accordance with the menu F-83. Save to USB folder name according to menu F-84.

Note If you want to perform the next round of simulated discharge, you need to close the menu T-90, and then re-select how many SOC to simulate the discharge again.

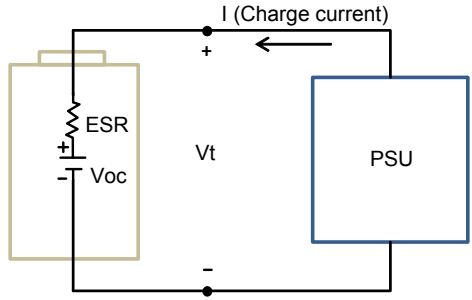
Battery test

The battery test function allows you to generate battery models, perform charge and discharge tests and A-H measurements.

Generate a battery model

Overview

The diagram below shows a simplified circuit when the PSU is charging the battery.



- I: Charge current.
- V_{oc}: Open circuit voltage.
- V_t: V_{oc} plus the voltage change during charging.

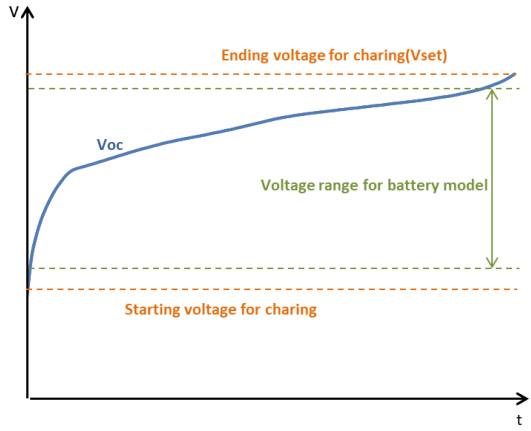
$$V_t = V_{oc} + I \cdot ESR$$

- ESR: battery resistance

$$ESR = \frac{V_t - V_{oc}}{I}$$

According to the battery charging process, measure the battery's open circuit voltage, battery capacity (amp-hour) and current, and calculate the equivalent resistance to generate a battery model.

When charging is finished, you can select to generate a battery model after setting the voltage range for the battery model. As you can see from the following figure, the range should be within the starting voltage and V_{set} values.



Note	Only the data from charging can be used for generating a battery model because the discharging current cannot be set.

Example

The following example demonstrates the process of generating a battery model for an 18650 Li-Ion battery using the PSU in the battery test function.

Equipment required:

- PSU Series
- 18650 Li-Ion battery
- Wires

The operation steps and the corresponding SCPI commands are as follows:

1. Set the T-40 Battery mode setting to 2 (Battery test).
   :BATTery:MODE 2
2. Set the Test mode (T-60) to 0 (Generate model).
   :BATTery:TEST:MODE 0
3. Set the charging target voltage (V_{set}) to 4.3V (T-61). For example, for Li-Ion batteries that use a range of 3.0 V to 4.2 V, set this value slightly above 4.2 V to ensure the battery is fully

charged.
:BATTery:TEST:VOLTage 4.3

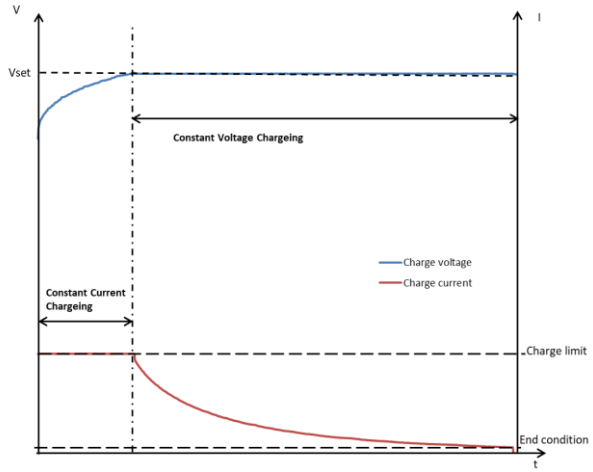
4. Set the Charge limit to 1A (T-62). This value is set according to the battery specification. Charge current greater than the upper battery current limit may cause damage.
BATTery:TEST:SENSe:AH:ILIMit 1
5. Set the termination current for end condition to 0.05A (T-63). When the charging current falls below this value, charging will stop and the output will be turned off.
:BATTery:TEST:CURRent:END 0.05
6. Set the sampling period (Interval ESR) of modeling to 10sec (T-64), and the PSU will measure the open circuit voltage every ten seconds.
:BATTery:TEST:SENSe:AH:ESRinterval S10
7. Set the delay time (T-65) to 0.1sec, this delay time is to ensure that the current rises to the set value and then obtain the correct sampling data to calculate the equivalent series resistance.
:BATTery:TEST:SENSe:ESR:DELay 0.1
8. After setting the T-90 to 1 (Battery start), "batt wait" is displayed on the panel.
:BATTery:PROGram:STATe RUN
9. After pressing output, start battery charge
:BATTery:TEST:PROGram:STATe RUN
10. When charging is complete, enter the V_{oc} range (T-66, T-67) in which to generate the battery model.
:BATTery:TEST:SENSe:AH:GMODel:RANGe 3.0,4.2
11. Select T-68 to 6, and save the created battery model to Model 6. User-customizable models 6 to 10.
:BATTery:TEST:SENSe:AH:GMODel:SAVE 6

Note	Before charging to generate a battery model, make sure the battery is fully discharged.
Note	An incomplete charging may not be able to provide the basis covering battery performance in all situations for generating a battery model.

Battery charge test

Overview

In this application, the PSU performs a charging test on the battery, and the charging is divided into two parts, as shown in the figure below.



Constant current stage: In the initial stage, the PSU charges the battery with the Charge limit, and the output voltage continues to increase to nearly equal to V_{set}.

Constant voltage stage: When the charging voltage reaches the V_{set} value, the PSU charges the battery with constant voltage, and the charging current gradually decreases.

When the charging current drops to the end condition, charging is complete. At this time, the battery open circuit voltage is approximately equal

to V_{set}.

Example

The following example demonstrates the process of testing the charging of an 18650 Li-Ion battery using the PSU in the battery test function.

Equipment required:

- PSU Series
- 18650 Li-Ion battery
- Wires

The operation steps and the corresponding SCPI commands are as follows:

1. Set the T-40 Battery mode setting to 2 (Battery test).
   :BATTery:MODE 2
2. Set the Test mode (T-60) to 1 (Charge or Discharge).
   :BATTery:TEST:MODE 1
3. Set the charging target voltage (V_{set}) to 4.2V (T-61). For example, for Li-Ion batteries that use a range of 3.0 V to 4.2 V, set this value slightly above 4.2 V to ensure the battery is fully charged.
   :BATTery:TEST:VOLTage 4.2
4. Set the Charge limit to 1A (T-62). This value is set according to the battery specification. Charge current greater than the upper battery current limit may cause damage.
   BATTery:TEST:SENSe:AH:ILIMit 1
5. Set the termination current for end condition to 0.05A (T-63). When the charging current falls below this value, charging will stop and the output will be turned off.
   :BATTery:TEST:CURRent:END 0.05
6. After setting the T-90 to 1 (Battery start), "batt wait" is displayed on the panel.

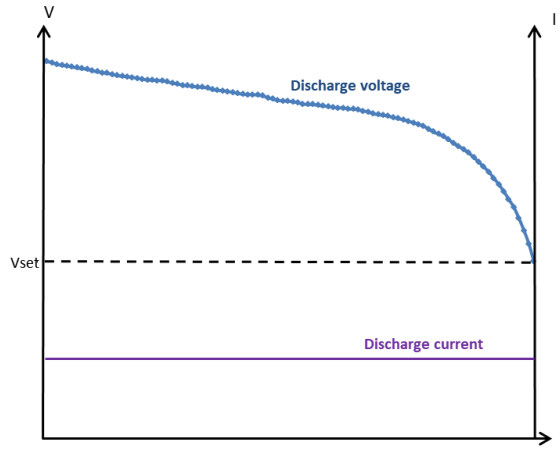
:BATTery:PROGram:STATe RUN

7. After pressing output, start battery charge
   :BATTery:TEST:PROGram:STATe RUN

Battery discharge test

Overview

In this application, the PSU performs a discharging test on the battery, and the discharging is shown in the figure below.



The PSU uses the constant current mode to discharge the battery, and the sink current cannot be set in the discharge mode. During the discharge process, the output voltage will continue to drop to around V_{set}.

When the voltage drops to the set discharge target voltage, PSU will turn off the output and end the discharge. At this time, the battery open circuit voltage is approximately equal to V_{set}.

Example

The following example demonstrates the process of testing the discharging of an 18650 Li-Ion battery using the PSU in the battery test function.

Equipment required

- PSU Series
- 18650 Li-Ion battery
- Wires

The operation steps and the corresponding SCPI commands are as follows:

1. Set the T-40 Battery mode setting to 2 (Battery test).
   :BATTery:MODE 2
2. Set the Test mode (T-60) to 1 (Charge or Discharge).
   :BATTery:TEST:MODE 1
3. Set the charging target voltage (V_{set}) to 3.0V (T-61). This value is set according to the battery specification. Discharge voltage lower than the minimum voltage lower limit may cause battery damage.
   BATTery:TEST:VOLTage 3.0
4. After setting the T-90 to 1 (Battery start), "batt wait" is displayed on the panel.
   :BATTery:PROGram:STATe RUN
5. After pressing output, start battery discharge.
   :BATTery:TEST:PROGram:STATe RUN

Note

The discharge current cannot be adjusted, and it may take a long time to discharge.

SCPI command

Note: For detailed PSU SCPI commands, please refer to PSU_Programming_Manual.PDF

Command List

Battery simulation commands

Battery test commands

Battery model commands

Battery simulation commands

:BATTery:SIMulator:PROGram:STATe

Set → / → Query

Description	Change the execution status of the battery simulation program.	
Syntax	:BATTery:SIMulator:PROGram:STATe <NR1>|STOP|RUN	
Query Syntax	:BATTery:SIMulator:PROGram:STATe?	
Parameter	0 | STOP	Stop battery simulation.
	1 | RUN	Run battery simulation.
Return parameter	<NR1>	Returns the execution status of the battery simulation program.
Example	BATT:SIM:PROG:STAT?	
	>1	
	Return the battery simulation execution status.	

:BATTery:SIMulator:OUTPut:OFF:AUTO

Set → / → Query

Description	Set or queries whether the output is automatically turned off when the SOC is equal to 0%.	
Syntax	:BATTery:SIMulator:OUTPut:OFF:AUTO <bool>|DISable|ENABle	
Query Syntax	:BATTery:SIMulator:OUTPut:OFF:AUTO?	
Parameter	0 | DISable	The output is automatically turned off.
	1 | ENABle	The output does not turn off automatically.
Return parameter	<NR1>	Returns the setting in <bool> format.
Example	BATT:SIM:OUTP:OFF:AUTO ENAB Sets the output is automatically turned off when the SOC is equal to 0%.	

:BATTery:SIMulator:METHod

Set → / → Query

Description	This command sets or queries the simulation method in the battery simulation function.	
Syntax	:BATTery:SIMulator:METHod<NR1>	
Query Syntax	:BATTery:SIMulator:METHod?	
Parameter/ Return parameter	0	Dynamic
	1	Static
Example	BATT:SIM:METH 0 Sets the simulation mode to dynamic mode.	

:BATTery:SIMulator:MODel:RECall

Set → / → Query

Description	This command sets or queries the simulation model recall in the battery simulation function.

Syntax	:BATTery:SIMulator:MODel:RECall <NR1>
Query Syntax	:BATTery:SIMulator:MODel:RECall?
Parameter/ Return parameter	<NR1> 1~10
Example	BATT:SIM:MOD:REC 1 Recall model 1 in the battery simulation function.

:BATTery:SIMulator:VOC

Set → Query

Description	This command sets or queries the open circuit voltage value for the battery simulator function.	
Syntax Query Syntax	:BATTery:SIMulator:VOC <NRf>|MINimum|MAXimum :BATTery:SIMulator:VOC? [MINimum|MAXimum]	
Parameter	<NRf>	Empty V ~ V_{oc_max}
	MINimum	Minimum the open circuit voltage level.
	MAXimum	Maximum the open circuit voltage level.
Return parameter	<NRf>	Returns the open circuit voltage value in volts.
Example	BATT:SIM:VOC MAX Sets the open circuit voltage to the maximum.	

:BATTery:SIMulator:SOC

Set → Query

Description	This command sets or queries the state of charge value for the battery simulator function.	
Syntax Query Syntax	:BATTery:SIMulator:SOC <NRf>|MINimum|MAXimum :BATTery:SIMulator:SOC? [MINimum|MAXimum]	
Parameter	<NRf>	0.0% ~ 100.0%

	MINimum	Minimum the state of charge.
	MAXimum	Maximum the state of charge.
Return parameter	<NRf>	Returns the state of charge value in percentage.
Example	BATT:SIM:SOC? MAX >100 Returns the maximum SOC is 100%.	

:BATTery:SIMulator:VOC:EMPTy

Set → / → Query

Description	This command sets or queries the threshold the open circuit voltage value for the discharging to stop in the battery simulator function.	
Syntax	:BATTery:SIMulator:VOC:EMPTy <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:SIMulator:VOC:EMPTy? [MINimum|MAXimum]	
Parameter	<NRf>	V_{oc_min} ~ V_{oc_max}
	MINimum	Minimum the open circuit voltage level.
	MAXimum	Maximum the open circuit voltage level
Return parameter	<NRf>	Returns the value in volts.
Example	BATT:SIM:VOC:EMPT 0.5 Set the empty open circuit voltage value to 0.5V.	

:BATTery:SIMulator:RESistance

→ Query

Description	This command queries the real-time internal resistance of the battery simulator.	
Query Syntax	:BATTery:SIMulator:RESistance?	
Return parameter	<NRf>	Returns the internal resistance value in Ω.

Example	BATT:SIM:RES? >+0.670 The real-time internal resistance is +0.670Ω.

:BATTery:SIMulator:RESistance:OFFSet

Set → Query

Description	This command sets and queries the resistance offset value in the battery simulation function.	
Syntax	:BATTery:SIMulator:RESistance:OFFSet <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:SIMulator:RESistance:OFFSet? [MINimum|MAXimum]	
Parameter	<NRf>	-100.000 ~ 100.000
	MINimum	Minimum the resistance offset.
	MAXimum	Maximum the resistance offset.
Return parameter	<NRf>	Returns the resistance offset value in Ω.
Example	BATT:SIM:RES:OFFS 1 Sets the resistance offset value to 1Ω.	

:BATTery:SIMulator:CAPacity:LIMit

Set → Query

Description	This command sets and queries the maximum capacity value of the battery in the battery simulation function.	
Syntax	:BATTery:SIMulator:CAPacity:LIMit <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:SIMulator:CAPacity:LIMit? [MINimum|MAXimum]	
Parameter	<NRf>	0.001 ~ 99999999.999AH
	MINimum	The minimum value of the maximum battery capacity.

	MAXimum	The maximum value of the maximum battery capacity.
Return parameter	<NRf>	Returns the capacity value in AH.
Example	BATT:SIM:CAP:LIM 2.5 Sets the maximum capacity value of the battery to 2.5AH.	

:BATTery:SIMulator:CAPacity → Query

Description	This command queries the real-time battery capacity of the battery simulator.
Query Sytax	:BATTery:SIMulator:CAPacity?
Return parameter	<NRf> Returns the capacity value in AH.
Example	BATT:SIM:CAP? >2.000 The real-time battery capacity is 2.0AH.

:BATTery:SIMulator:MEASure:ALL → Query

Description	This command queries the values of V_{oc}, Current, ESR, SOC and Capacity.
Query Syntax	:BATTery:SIMulator:MEASure:ALL?
Return parameter	<NRf> Returns the values of V_{oc}, Current, ESR, SOC and Capacity.
Example	BATT:SIM:MEAS:ALL? >+3.7750,+1.0000,+0.075,10.00,0.50 The returned values are as follows: V_{oc} +3.7750V Current +1.0000A ESR +0.075Ω SOC 10.00% Capacity 0.50AH

:BATTery:SIMulator:CURRent:LIMit

Set → / → Query

Description	This command sets and queries the value of the current limit for stopping the discharging in the battery simulation function.	
Syntax	:BATTery:SIMulator:CURRent:LIMit <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:SIMulator:CURRent:LIMit? [MINimum|MAXimum]	
Parameter	<NRf>	0%~105% of the rated current output level.
	MINimum	Minimum current limit value.
	MAXimum	Maximum current limit value.
Return parameter	<NRf>	Returns the current limit value.
Example	BATT:SIM:CURR:LIM 1 Set the current limit to 1A.	

:BATTery:SIMulator:VOC:PROTection[:LEVel]

Set → / → Query

Description	This command sets the open circuit voltage protection value in the battery simulator function.	
Syntax	:BATTery:SIMulator:VOC:PROTection[:LEVel] <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:SIMulator:VOC:PROTection[:LEVel]? [MINimum|MAXimum]	
Parameter	<NRf>	Minimum: Depends on the unit type: if Vrated * 0.1 > 5V, then Minimum = 5V, else Minimum = Vrated * 0.1 Maximum: Vrated * 1.05
	MINimum	Minimum current limit value.
	MAXimum	Maximum current limit value.

Return parameter	<NRf>	Returns the open circuit voltage protection value in volts.

Example

BATT:SIM:VOLT:PROT 50

Set the open circuit voltage protection value to 50V.

Battery test commands

:BATTery:TEST:MODE

Set → Query

Description	This command sets and queries the test mode in the battery test function.	
Syntax	:BATTery:TEST:MODE <NR1>	
Query Syntax	:BATTery:TEST:MODE?	
Parameter/ Return parameter	<NR1>	0 ~ 1
	0	Generate model
	1	Discharge or charge
Example	BATT:TEST:MODE 0 Set the test mode to Generate Model.	

:BATTery:TEST[:SOURce]:VOLTage[:LEVel]

Set → Query

Description	This command sets and queries the V-set value for charging in the battery test function.

Syntax	:BATTery:TEST[:SOURce]:VOLTage[:LEVel] <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:TEST[:SOURce]:VOLTage[:LEVel]? [MINimum|MAXimum]	
Parameter	<NRf>	0%~105% of the rated output voltage in volts.
	MINimum	Minimum V-set value.
	MAXimum	Maximum V-set value.
Return parameter	<NRf>	Returns the V-set value in volts.
Example	BATT:TEST:VOLT 5 Set the V-set value to 5V.	

:BATTery:TEST:SENSe:AH:ILIMit

Set → / → Query

Description	This command sets and queries the maximum charging current in the battery test function.	
Syntax	:BATTery:TEST:SENSe:AH:ILIMit <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:TEST:SENSe:AH:ILIMit? [MINimum|MAXimum]	
Parameter	<NRf>	0~105% of the rated current output level.
	MINimum	The minimum value of the maximum charging current.
	MAXimum	The maximum value of the maximum charging current.
Return parameter	<NRf>	Returns the maximum charging current value.
Example	BATT:TEST:SENS:AH:ILIM? >+1.0000 Returns the maximum charging current is +1.0000A.	

:BATTery:TEST[:SOURce]:CURRent:END

Set → / → Query

Description	This command sets and queries the end current for stopping the charging in the battery test function.	
Syntax	:BATTery:TEST[:SOURce]:CURRent:END <NR1>|MINimum|MAXimum	
Query Syntax	:BATTery:TEST[:SOURce]:CURRent:END? [MINimum|MAXimum]	
Parameter	<NRf>	0 ~ 0.1A
	MINimum	Minimum end current value.
	MAXimum	Maximum end current value.
Return parameter	<NRf>	Returns the end current value in A.
Example	BATT:TEST:CURR:END MAX Set the end current for stopping the charging to 0.1A.	

:BATTery:TEST:SENSe:AH:ESRinterval

Set → / → Query

Description	This command sets and queries the ESR sample interval in the battery test function.	
Syntax	:BATTery:TEST:SENSe:AH:ESRinterval <NR1>|S10|S30|S60|S120|S600	
Query Syntax	:BATTery:TEST:SENSe:AH:ESRinterval?	
Parameter	<NR1>	0 ~ 4
	0|S10	10 seconds
	1|S30	30 seconds
	2|S60	60 seconds
	3|S120	120 seconds
	4|S600	600 seconds

Return parameter	S10	10 seconds
	S30	30 seconds
	S60	60 seconds
	S120	120 seconds
	S600	600 seconds

Example BATT:TEST:SENS:AH:ESR S10

Sets the ESR sample interval to 10 seconds.

:BATTery:TEST:SENSe:ESR:DELay

Set → / → Query

Description	This command sets and queries the ESR delay in the battery test function.
Syntax	:BATTery:TEST:SENSe:ESR:DELay <NR1>|MINimum|MAXimum
Query Syntax	:BATTery:TEST:SENSe:ESR:DELay? [MINimum|MAXimum]

Parameter	<NRf>	0.1 ~ 3.6 second
	MINimum	0.1 second
	MAXimum	3.6 second
Return parameter	<NRf>	Returns the ESR delay value in second.

Example :BATT:TEST:SENS:ESR:DEL 0.1

Sets the ESR delay to 0.1 second.

:BATTery:TEST:SENSe:AH:GMODel:RANGe

Set → / → Query

Description	This command sets and queries the range of the open-circuit voltage for generating a battery model in the battery test function.
Syntax	:BATTery:TEST:SENSe:AH:GMODel:RANGe <NRf>,<NRf>
Query Syntax	:BATTery:TEST:SENSe:AH:GMODel:RANGe?

Parameter	<NRf>	0%~105% of the rated voltage output in volts.
Return parameter	<NRf>	Returns the voltage level in volts
Example	BATT:TEST:SENS:AH:GMOD:RANG 3.2,4.2 Set the open-circuit voltage range as 3.2 to 4.2 V.	

:BATTery:TEST:SENSe:AH[:LEVel] → Query

Description	This command queries the real-time value of the battery capacity.
Query Syntax	:BATTery:TEST:SENSe:AH[:LEVel]?
Return parameter	<NRf> Returns the battery capacity in AH.
Example	:BATT:TEST:SENS:AH? >0.500 The real-time battery capacity is 0.50AH.

:BATTery:TEST:SENSe:AH:GMODel:SAVE Set →

Description	This command saves the measurement results to the internal memory as a battery model.
Syntax	:BATTery:TEST:SENSe:AH:GMODel:SAVE <NR1>
Parameter	<NR1> 6~10
Example	BATT:TEST:SENS:AH:GMOD:SAVE Save the measurement results as battery model 7.

:BATTery:TEST:PROGram:STATe Set → / → Query

Description	Change the execution status of the battery test program.
Syntax	:BATTery:TEST:PROGram:STATe <NR1>|STOP|RUN
Query Syntax	:BATTery:TEST:PROGram:STATe?

Parameter/ Return parameter	0 | STOP	Stop battery test.
	1 | RUN	Run battery test.
Example	BATT:TEST:PROG:STAT?	
	>STOP	
	Return the battery test execution status.	

Battery model commands

:BATTery:MODel<6|10>:RESistance:SIMPlify

Set → / → Query

Description	This command sets and queries 11 points of the resistance value for a battery model in a rough form.	
Syntax	:BATTery:MODel<6|10>:RESistance:SIMPlify <string>	
Query Syntax	:BATTery:MODel<6|10>:RESistance:SIMPlify?	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	<string>	Eleven resistance values separated by commas.
Return parameter	<string>	Eleven resistance values separated by commas.
Note	If the point number is not 11, error "-151, Invalid string data" occurs.	
Example	BATT:MOD8:RES:SIMP "2.1, 2.0, 1.9, 1.8, 1.7, 1.6, 1.5, 1.4,1.3, 1.2, 1.0" Set 11 points of value for resistance.	

:BATTery:MODel<6|10>:VOC:SIMPlify

Set → / → Query

Description	This command sets and queries 11 points of the open-circuit voltage value for a battery model in a rough form.	
Syntax	:BATTery:MODel<6|10>:VOC:SIMPlify <string>	
Query Syntax	:BATTery:MODel<6|10>:VOC:SIMPlify?	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	<string>	Eleven the open-circuit voltage values separated by commas.
Return parameter	<string>	Eleven the open-circuit voltage values separated by commas.
⚠ Note	If the point number is not 11, error "-151, Invalid string data" occurs.	
Example	BATT:MOD9:VOC:SIMP? >+1.1320,+1.3350,+1.3490,+1.3590,+1.3680,+1.3730,+1.3780,+1.3830,+1.3880,+1.3930,+1.3969 Returns the open-circuit voltage value for a battery model of rough form.	

:BATTery:MODel<6|10>:RESistance:STEPs

→ Query

Description	This command queries the length of the resistance of the specified model.	
Query Syntax	:BATTery:MODel<6|10>:RESistance:STEPs?	
Return parameter	<NR1>	0 ~ 101 The length of the resistance of the specified model.
Example	BATT:MOD6:RES:STEP? >101 The number of resistance values in the battery model 6 is returned.	

:BATTery:MODel<6|10>:VOC:STEPs

Query

Description	This command queries the length of the open circuit voltage of the specified model.	
Query Syntax	:BATTery:MODel<6|10>:VOC:STEPs?	
Return parameter	<NR1>	0 ~ 101 The length of the resistance of the specified model.
Example	BATT:MOD6:VOC:STEP? >6 The number of open circuit voltage values in the battery model 6 is returned.	

:BATTery:MODel<6|10>:RESistance

Set
Query

Description	This command sets and queries a list of custom resistance values for a specified battery model.	
Syntax	:BATTery:MODel<6|10>:RESistance <string>	
Query Syntax	:BATTery:MODel<6|10>:RESistance?	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	<string>	The resistance values separated by commas.
Return parameter	<string>	The resistance values separated by commas.
Example	BATT:MOD8:RES “2.0,1.9,1.8” Sets custom resistance 2.0, 1.9 and 1.8 in model 8.	

:BATTery:MODel<6|10>:VOC

Set → / → Query

Description	This command sets and queries a list of custom open circuit voltage values for a specified battery model.	
Syntax	:BATTery:MODel<6|10>:VOC <string>	
Query Syntax	:BATTery:MODel<6|10>:VOC?	
Parameter	<6|10>	Model index. (model6 ~ model10)
	<string>	The open-circuit voltage values separated by commas.
Return parameter	<string>	The open-circuit voltage values separated by commas.
Example	BATT:MOD6:VOC?	
	>0.9990, 1.1112, 1.2234, 1.3356, 1.4478, 1.5600, 1.6722, 1.7844, 1.8966, 2.0088, 2.1210, 2.1289, 2.1368, 2.1447, 2.1526, 2.1605, 2.1684, 2.1763, 2.1842, 2.1921, 2.2000, 2.2100, 2.2200, 2.2300, 2.2400, 2.2500, 2.2600, 2.2700, 2.2800, 2.2900, 2.3000, 2.3100, 2.3200, 2.3300, 2.3400, 2.3500, 2.3600, 2.3700, 2.3800, 2.3900, 2.4000, 2.4100, 2.4200, 2.4300, 2.4400, 2.4500, 2.4600, 2.4700, 2.4800, 2.4900, 2.5000, 2.5100, 2.5200, 2.5300, 2.5400, 2.5500, 2.5600, 2.5700, 2.5800, 2.5900, 2.6000, 2.6100, 2.6200, 2.6300, 2.6400, 2.6500, 2.6600, 2.6700, 2.6800, 2.6900, 2.7000, 2.7100, 2.7200, 2.7300, 2.7400, 2.7500, 2.7600, 2.7700, 2.7800, 2.7900, 2.8000, 2.8100, 2.8200, 2.8300, 2.8400, 2.8500, 2.8600, 2.8700, 2.8800, 2.8900, 2.9000, 2.9100, 2.9200, 2.9300, 2.9400, 2.9500, 2.9600, 2.9700, 2.9800, 2.9900, 3.0000	
	Return 101 open circuit voltage values in model 6.	

:BATTery:MODel<6|10>:RESistance:END Set

Description	This command adds resistance values to the specified model. The new values are added to the end of the existing values.	
Syntax	:BATTery:MODel<6|10>:RESistance:END <string>	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	<string>	The resistance values separated by commas.
Example	BATT:MOD6:RES:END "0.9990,0.98,0.97" Add the resistance values of 0.9990, 0.98 and 0.97 in model 6.	

:BATTery:MODel<6|10>:VOC:END Set

Description	This command adds open circuit voltage values to the specified model. The new values are added to the end of the existing values.	
Syntax	:BATTery:MODel<6|10>:VOC:END <string>	
Parameter	<6|10>	Model index. (model 6~model 10)
	<string>	The open circuit voltage values separated by commas.
Example	BATT:MOD8:VOC:END "2.1, 2.0, 1.9, 1.8, 1.7, 1.6, 1.5, 1.4,1.3, 1.2, 1.0" Add the open circuit voltage values of 2.1, 2.0, 1.9, 1.8, 1.7, 1.6, 1.5, 1.4, 1.3, 1.2 and 1.0 in model 8.	

:BATTery:MODel<6|10>:SAVE:INTernal Set

Description	This command saves a battery model to the internal memory.
Syntax	:BATTery:MODel<6|10>:SAVE:INTernal

Parameter	<6|10>	Model index. (model 6 ~ model 10)
⚠ Note	If the open circuit voltage and the resistance number is not 101, error "-231, Data questionable" occurs.	
Example	BATT:MOD8:SAVE:INT Save a battery model into the internal memory as model 8.	

:BATTery:MODel<6|10>:ROW<0|100>

Set → / → Query

Description	This command sets and queries the values of open-circuit voltage and resistance for a specified battery model.	
Syntax	:BATTery:MODel<6|10>:ROW<0|100> <string>	
Query Syntax	:BATTery:MODel<6|10>:ROW<0|100>?	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	<0|100>	0 ~ 100
	<string>	The open circuit voltage and resistance separated by commas.
Return parameter	<string>	The open circuit voltage and resistance separated by commas.
Example	BATT:MOD1:ROW0 "1.2, 1" Set the open-circuit voltage to 1.2V. Set the resistance to 1Ω.	

Battery file commands

:MEMory:BATTery:DATA

Set → / → Query

Description	The command uploads and downloads battery model.	
Syntax	:MEMory:BATTery:DATA <string>,<block>	
Query Syntax	:MEMory:BATTery:DATA? <string>	
Parameter	<string>	Model index.(model 6 ~ model 10)
	<block>	#<number digits in byte count><byte count><Byte1><Byte2>...<ByteN>+NL.
Return parameter	<block>	#<number digits in byte count><byte count><Byte1><Byte2>...<ByteN>+NL.

Example

:MEMory:BATTery:DATA? "4"

>#41307PSU30-50,,

Capacity=0.56789AH,,

SOC(%), Open Voltage(V), ESR(ohm)

0, 5, 0.194

1, 5.3, 0.194

2, 5.31, 0.194

3, 5.32, 0.194

4, 5.33, 0.194

5, 5.34, 0.193

.

.

.

96, 10.8, 0.179

97, 11, 0. 179

98, 11.2, 0.178

99, 11.4, 0.177

100, 11.6, 0.173

Return the data in model 4.

:MEMory:DELete:BATTery:ALL

Set

Description	This command deletes all battery models.
Syntax	:MEMory:DELete:BATTery:ALL
Example	MEM:DEL:BATT:ALL Deletes all battery models.

:MEMory:DELete:BATTery

Set

Description	This command deletes the specified battery model.	
Syntax	:MEMory:DELete:BATTery <string>	
Parameter	< string >	Model index. (model 6 ~ model 10)
Example	MEM:DEL:BATT “6” Deletes battery model 6.	

:MEMory:BATTery:STATe

Set / Query

Description	This command queries the status of the specified battery model.	
Syntax	:MEMory:BATTery:STATe? <string>	
Parameter	< string >	Model index. (model 6 ~ model 10)
Return parameter	0	Battery model does not exist.
	1	Battery model exist.

Example MEM:BATT:STAT? “8”

>1

Return to battery model 8 status.

Battery data log command

:BATTery:DLOG:STATe

Set / Query

Description	This command sets and queries the data log status of the battery type.
Syntax	:BATTery:DLOG:STATe <NR1>
Query Syntax	:BATTery:DLOG:STATe?
Parameter/ Return parameter	<NR1> 0 ~ 2 0 Disable. 1 Stored in the USB storage. 2 Remote control.
Note	The sampling time is in accordance with the menu F-83. Save to USB folder name according to menu F-84.
Example	BATT:DLOG:STAT 1 Set the data log status is stored in the USB storage.

Other commands

:BATTery:MODE

Set → / → Query

Description	This command sets and queries the battery function mode.	
Syntax	:BATTery:MODE <NR1>	
Query Syntax	:BATTery:MODE?	
Parameter/ Return parameter	<NR1>	0 ~ 2
	0	Disable
	1	Battery Simulation
	2	Battery Test
Example	BATT:MODE 1 Sets the function mode is Battery Simulation.	

:BATTery:PROGram:STATe

Set → / → Query

Description	Change the execution status of the battery program.	
Syntax	:BATTery:PROGram:STATe<NR1>|STOP|RUN	
Query Syntax	:BATTery:PROGram:STATe?	
Parameter	0| STOP	Stop battery.
	1| RUN	Run battery.
Return parameter	<NR1>	Returns the execution status of the battery program.

Example BATT:PROG:STAT?

>1

Return the battery execution status.

Error Message

The following error messages may appear on the PSU screen during operation.

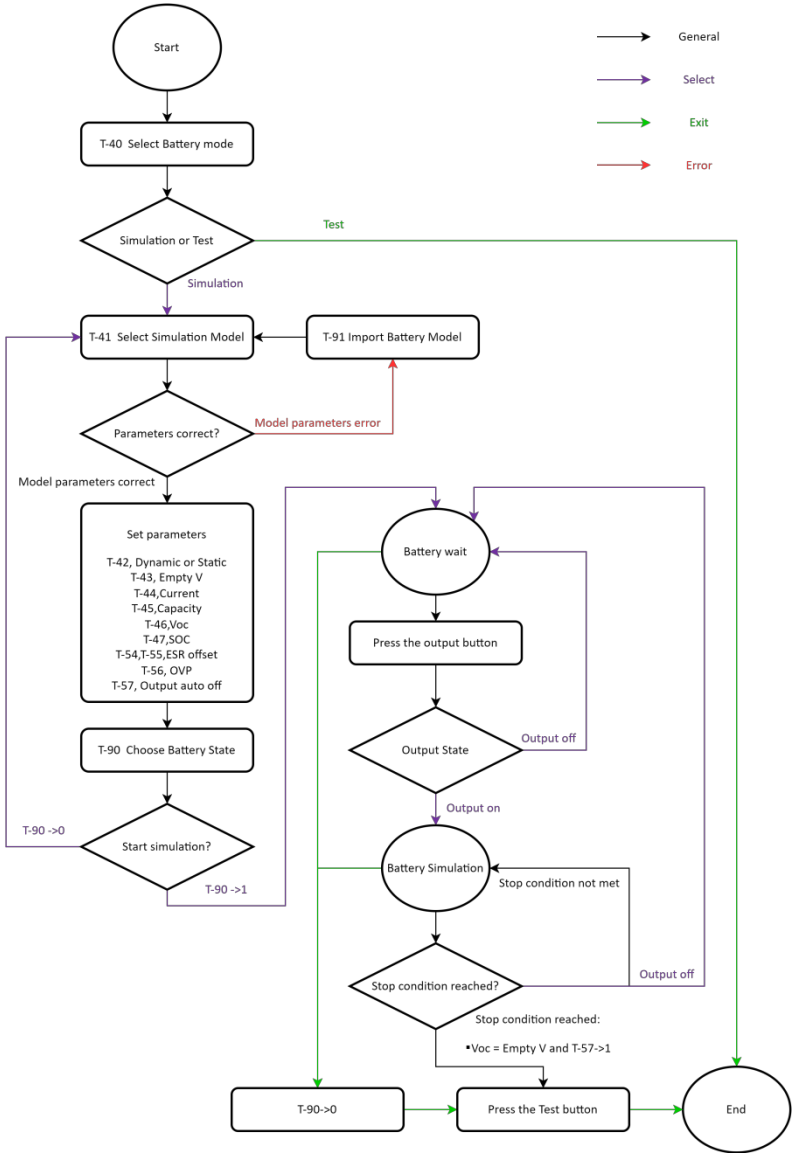
Error Code	Description
BATT ER01	File not found
BATT ER02	File is too large
BATT ER03	Allocate memory error
BATT ER04	File open error
BATT ER05	Read data error
BATT ER06	Format error
BATT ER07	Parameter is too large
BATT ER08	Wrong quantity of row
BATT ER09	Not enough sample data
BATT ER20	Capacity data error
BATT ER21	Capacity missing
BATT ER22	Capacity is too large
BATT ER23	Capacity is too small
BATT ER25	SOC data error
BATT ER26	SOC missing
BATT ER27	SOC duplication
BATT ER28	End SOC greater then start SOC
BATT ER30	Voc data error
BATT ER31	Voc is negative
BATT ER32	Voc is too large
BATT ER33	Voc is too small
BATT ER34	Voc missing
BATT ER35	ESR data error

BATT ER36	ESR is negative
BATT ER37	ESR is too large
BATT ER38	ESR is too small
BATT ER39	ESR missing
BATT ER40	Capacity AH data error
BATT ER41	Capacity AH is negative
BATT ER42	Capacity AH is too large
BATT ER43	Capacity AH is too small
BATT ER45	Capacity WH data error
BATT ER46	Capacity WH is negative
BATT ER47	Capacity WH is too large
BATT ER48	Capacity WH is too small

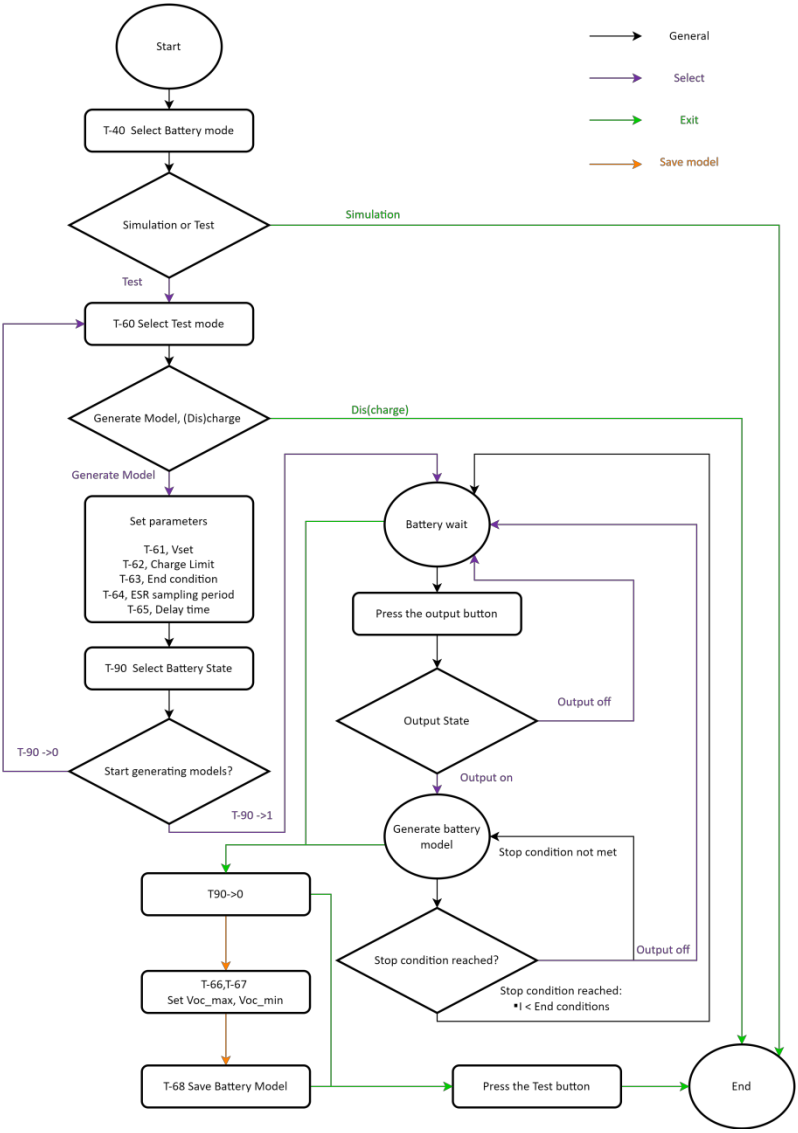
Appendix

Front Panel Operation flow chart

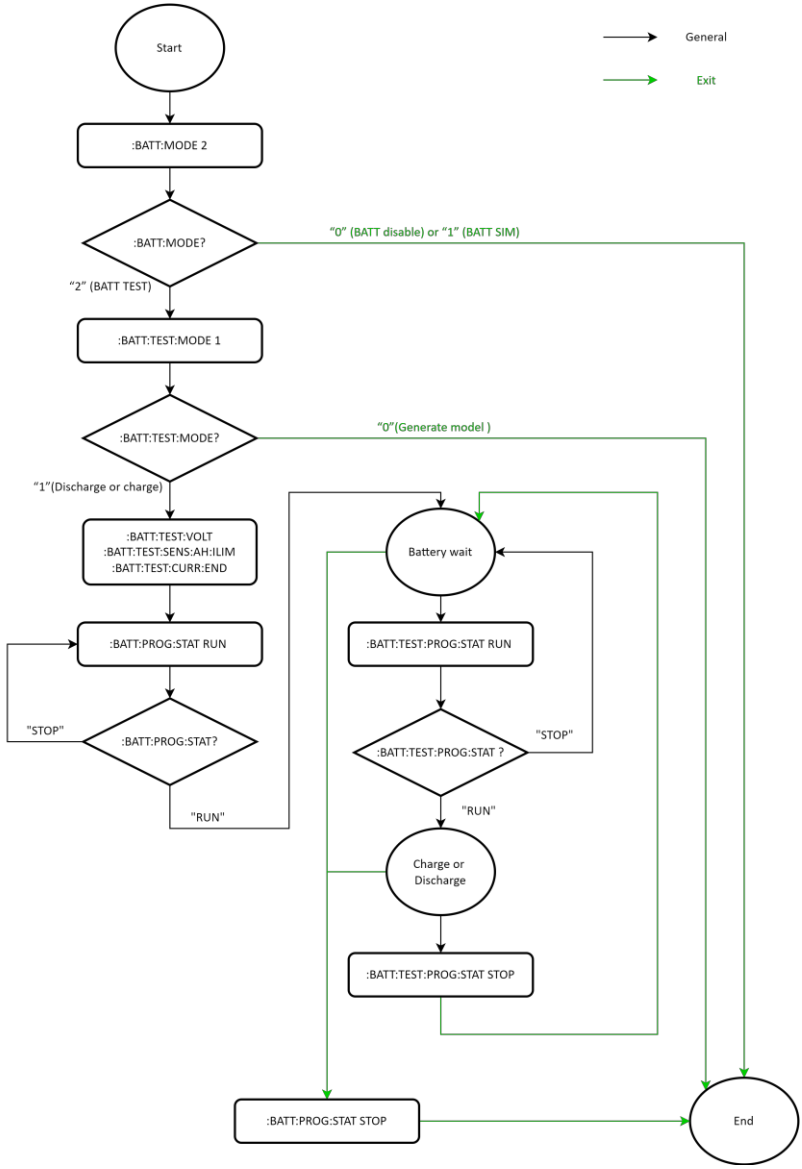
Battery Simulation



Generate a battery model

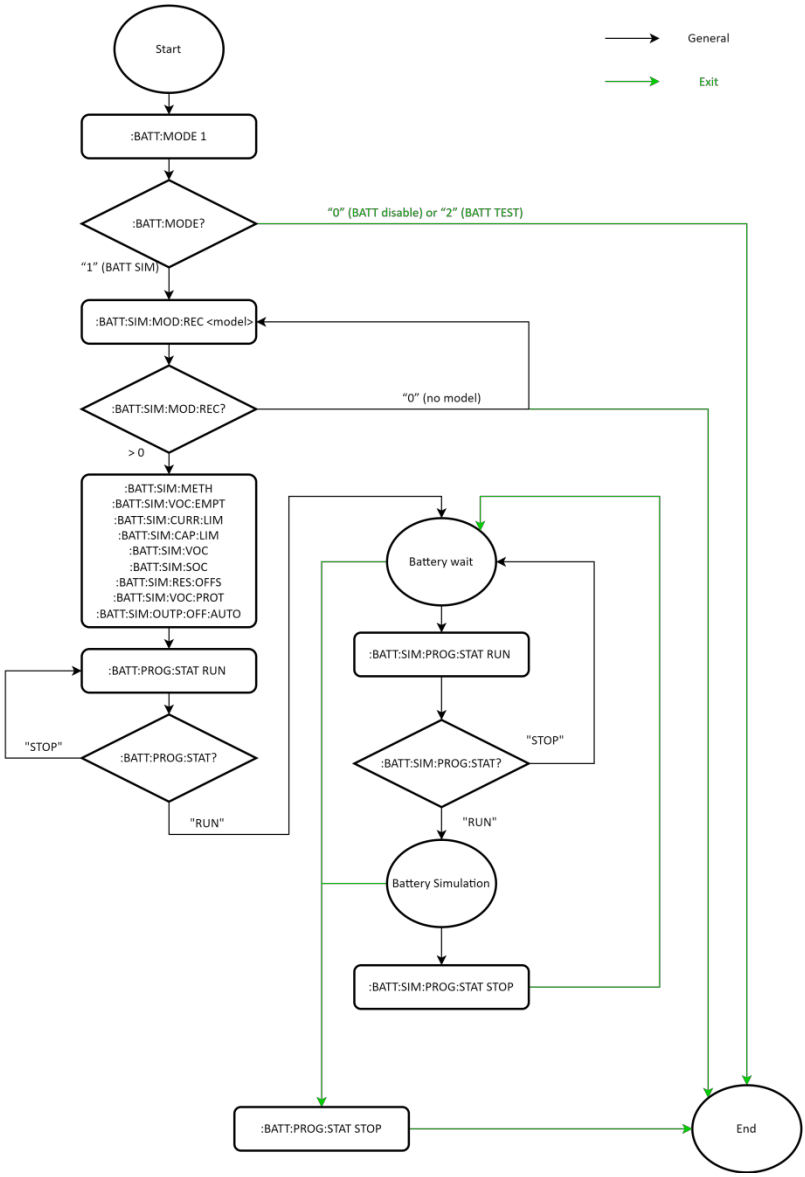


Charge or Discharge

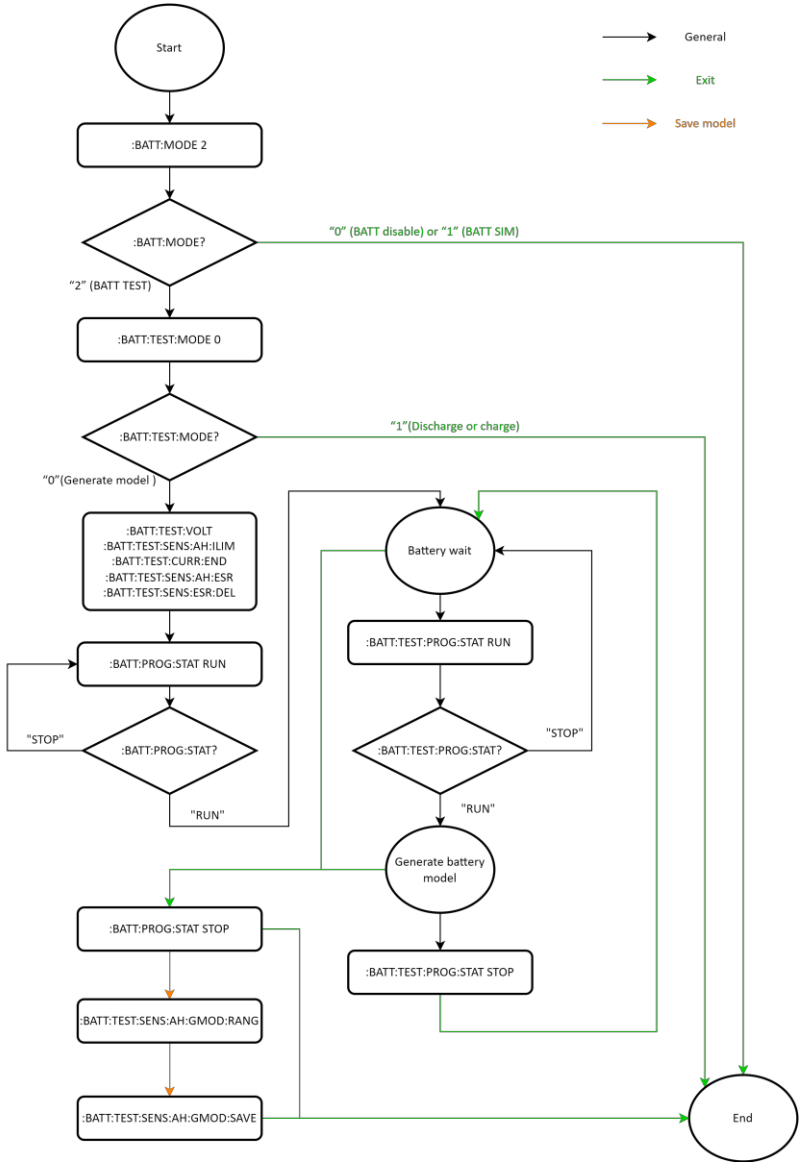


Using SCPI Command Operation Flow

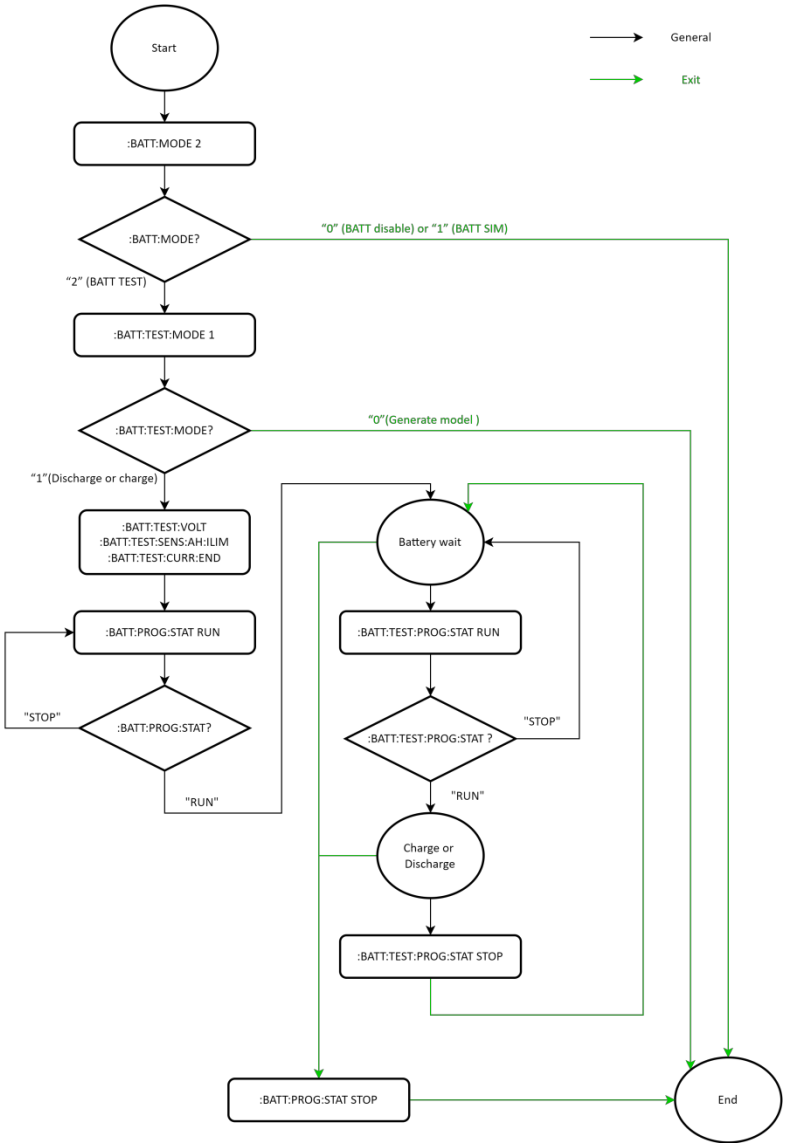
Battery Simulation



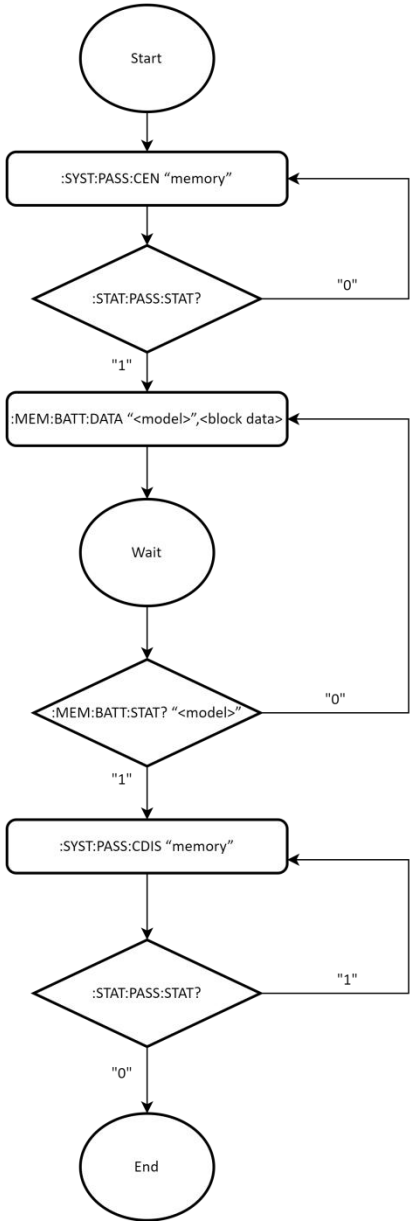
Generate a battery model



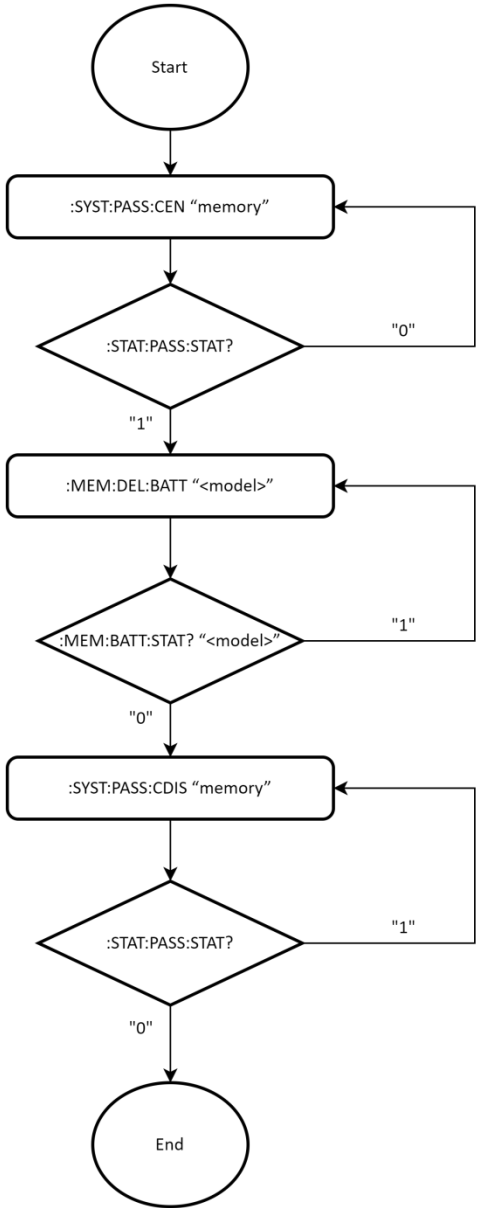
Charge or Discharge



Upload battery file

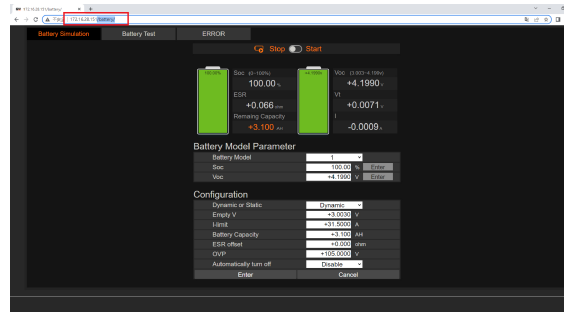


Delete battery file



Web Server Remote Control Battery Function

Overview	The web server allows you to remote control the battery function settings of the PSU.
Configure	Enter the IP address of the power supply in a web browser after the instrument has been configured as a web server. **http:// AAA.BBB.CCC.DDD/battery/** You can check the IP address by checking F-39 to F-42. F-39 = AAA IP Address part 1 of 4 F-40 = BBB IP Address part 2 of 4 F-41 = CCC IP Address part 3 of 4 F-42 = DDD IP Address part 4 of 4 The web browser interface appears. • Battery simulation



- Generate model

- Charge or Discharge