PHU Battery Function Programming Manual

PHU Series

USER MANUAL

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

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Command List

Battery simulation commands

Note	Prior to executing the battery simulation command, specify the program by issuing the following command: BATTery:PROGram:NAME

: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? >RUN Return the battery simulation execution status.

: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: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>	
Query Syntax	:BATTery:SIMulator:VOC:EMPTy?	
Parameter	<NRf>	V_{oc_min} ~ V_{oc_max}
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.	

Set → Query

:BATTery:SIMulator:CURRent:LIMit

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.	

Set → Query

:BATTery:SIMulator:CAPacity:LIMit

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:VOC

Set → / → Query

Description	This command sets or queries the open circuit voltage value for the battery simulator function.	
Syntax	:BATTery:SIMulator:VOC <NRf> |MINimum| MAXimum	
Query Syntax	: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	:BATTery:SIMulator:SOC <NRf> |MINimum|MAXimum	
Query Syntax	: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: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 ~ 100Ω
	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:VOC:PROTection[:LEVel]

Set → / → Query

Description	This command sets and queries the battery's overvoltage protection level in the battery simulation function.	
Syntax	:BATTery:SIMulator:VOC:PROTection[:LEVel] <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:SIMulator:VOC:PROTection[:LEVel]? [MINimum|MAXimum]	
Parameter	<NRf>	OVP range in volts.
	MINimum	Minimum the OVP level.
	MAXimum	Maximum the OVP level.
Return parameter	<NRf>	Returns the OVP level value in V.
Example	:BATTery:SIMulator:VOC:PROTection:LEVel 100 Sets the battery's overvoltage protection level to 100V.	

:BATTery:SIMulator:CURRent:PROTection[:LEVel]

Set → / → Query

Description	This command sets and queries the battery's overcurrent protection level in the battery simulation function.	
Syntax	:BATTery:SIMulator:CURRent:PROTection[:LEVel] <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:SIMulator:CURRent:PROTection[:LEVel]? [MINimum|MAXimum]	
Parameter	<NRf>	OCP range in volts.
	MINimum	Minimum the OCP level.
	MAXimum	Maximum the OCP level.
Return parameter	<NRf>	Returns the OCP level value in A.

Example	:BATTery:SIMulator:CURRent:PROTection:LEVel 10 Sets the battery's overcurrent protection level to 10 A.

:BATTery:SIMulator:OUTPut:OFF:AUTO

Set / Query

Description	Sets or queries whether the output turns off automatically when SOC reaches 0%	
Syntax Query Syntax	:BATTery:SIMulator:OUTPut:OFF:AUTO <bool>|DISable|ENABle :BATTery:SIMulator:OUTPut:OFF:AUTO?	
Parameter	0 | DISable	The output turns off automatically.
	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 turns off automatically when the SOC is equal to 0%.	

: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: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}	+3.775V
Current	+1.000A
ESR	+0.075Ω
SOC	10.00%
Capacity	0.50AH

Battery test commands

⚠ Note	Prior to executing the battery test command, specify the program by issuing the following command: BATTery:PROGram:NAME
⚠ Note	The Charge or Discharge and Generate Model commands belong to the Battery Test command group.

: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? >1 Return the battery test execution status.

: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? >+1.000 Returns the maximum charging current is +1.000A.

:BATTery:TEST:TIME:END

Set → Query

Description	This command sets and queries the end time for stopping the charge or discharge in the battery test function.	
Syntax	:BATTery:TEST:TIME:END <NR1>|MINimum|MAXimum	
Query Syntax	:BATTery:TEST:TIME:END? [MINimum|MAXimum]	
Parameter	<NRf>	0 ~ 86400
	MINimum	Minimum end time value.
	MAXimum	Maximum end time value.
Return parameter	<NRf>	Returns the end time in sec.
Example	BATT:TEST:TIME:END 60 Set the end time for stopping the charging or discharge to 60 sec.	

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

Set → Query

Description	This command sets and queries the end current for stopping the charge or discharge 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>	0A ~ 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.

Set / Query

:BATTery:TEST[:SOURce]:VOLTage:END

Description	This command sets and queries the end voltage for stopping the charge or discharge in the battery test function.	
Syntax	:BATTery:TEST[:SOURce]:VOLTage:END <NR1>|MINimum|MAXimum	
Query Syntax	:BATTery:TEST[:SOURce]:VOLTage:END? [MINimum|MAXimum]	
Parameter	<NRf>	Voltage range in volts.
	MINimum	Minimum end voltage value.
	MAXimum	Maximum end voltage value.
Return parameter	<NRf>	Returns the end voltage value in V.

Example BATT:TEST:VOLT:END 10

Set the end voltage for stopping the charge or discharg to 10V.

Set / Query

:BATTery:TEST:CAPacity:LIMit

Description	This command sets and queries the end capacity for stopping the charge or discharge in the battery test function.	
Syntax	:BATTery:TEST:CAPacity:LIMit <NR1> |MINimum|MAXimum	
Query Syntax	:BATTery:TEST:CAPacity:LIMit? [MINimum|MAXimum]	
Parameter	<NRf>	Voltage range in volts.

	MINimum	Minimum end capacity value.
	MAXimum	Maximum end capacity value.
Return parameter	<NRf>	Returns the end capacity value in AH.
Example	:BATTery:TEST:CAPacity:LIMit 90 Set the end capacity for stopping the charge or discharge to 90AH.	

: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: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	<NR1>	Returns the ESR sample interval value.

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:SAVE

Set / Query

Description	This command sets and queries the indexes for the generated model.
Syntax	:BATTery:TEST:SENSe:AH:GMODel:SAVE <NR1>
Query Syntax	:BATTery:TEST:SENSe:AH:GMODel:SAVE?

Parameter	<NR1>	6~10
Return parameter	<NR1>	6~10

Example
BATT:TEST:SENS:AH:GMOD:SAVE:INTE 7
Sets the indexes for the generated model is 7.

:BATTery:TEST:VOLTage:PROTection[:LEVel]

Set → / → Query

Description	This command sets and queries the battery's overvoltage protection level in the battery test function.	
Syntax	:BATTery:TEST:VOLTage:PROTection[:LEVel] <NR1>|MINimum|MAXimum	
Query Syntax	:BATTery:TEST:VOLTage:PROTection[:LEVel]? [MINimum|MAXimum]	
Parameter	<NRf>	OVP range in volts.
	MINimum	Minimum the OVP level.
	MAXimum	Maximum the OVP level.
Return parameter	<NRf>	Returns the OVP level value in V.
Example	:BATTery:TEST:VOLTage:PROTection:LEVel 500 Sets the battery's overvoltage protection level to 500V.	

:BATTery:TEST:CURRent:PROTection[:LEVel]

Set → / → Query

Description	This command sets and queries the battery's overcurrent protection level in the battery test function.	
Syntax	:BATTery:TEST:CURRent:PROTection[:LEVel] <NR1>|MINimum|MAXimum	
Query Syntax	:BATTery:TEST:CURRent:PROTection[:LEVel]? [MINimum|MAXimum]	
Parameter	<NRf>	OCP range in Amps.
	MINimum	Minimum the OCP level.
	MAXimum	Maximum the OCP level.
Return parameter	<NRf>	Returns the OCP level value in A.

Example	:BATTery:SIMulator:CURRent:PROTection:LEVel 5 Sets the battery's overcurrent protection level to 5A.

: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? >0.50 The real-time battery capacity is 0.50AH.

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 <List>	
Query Syntax	:BATTery:MODel<6|10>:RESistance:SIMPlify?	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	<List(11,11)>	Eleven resistance values separated by commas.
Return parameter	<List(11,11)>	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 <List>	
Query Syntax	:BATTery:MODel<6|10>:VOC:SIMPlify?	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	<List(11,11)>	Eleven the open-circuit voltage values separated by commas.
Return parameter	<List(11,11)>	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? >+1.132,+1.335,+1.349,+1.359,+1.368,+1.373,+1.378,+1.383,+1.388,+1.393,+1.396 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 Query Syntax	:BATTery:MODel<6|10>:RESistance <NRf>|<List(1,101) > :BATTery:MODel<6|10>:RESistance?	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	<NRf>|<List(1,101)>	The resistance values separated by commas.
Return parameter	<NRf>|<List(1,101)>	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 <NRf>|< List(1,101) >	
Query Syntax	:BATTery:MODel<6|10>:VOC?	
Parameter	<6|10>	Model index. (model6 ~ model10)
	<NRf>|<List(1,101)>	The open-circuit voltage values separated by commas.
Return parameter	<NRf>|<List(1,101)>	The open-circuit voltage values separated by commas.
Example	BATT:MOD6:VOC?	
	>12.010,12.400,12.800,13.200,13.610,13.830,13.900, 13.980,14.050,14.120,14.180,14.230,14.280,14.330, 14.380,14.430,14.470,14.510,14.550,14.590,14.620, 14.650,14.680,14.720,14.750,14.780,14.800,14.820, 14.850,14.870,14.880,14.900,14.910,14.920,14.930, 14.940,14.950,14.960,14.970,14.980,14.990,15.000, 15.010,15.020,15.030,15.040,15.050,15.060,15.080, 15.090,15.100,15.110,15.120,15.130,15.140,15.150, 15.160,15.170,15.180,15.190,15.200,15.210,15.220, 15.230,15.240,15.250,15.270,15.280,15.290,15.300, 15.300,15.310,15.310,15.310,15.320,15.320,15.320, 15.330,15.330,15.330,15.340,15.340,15.340,15.350, 15.350,15.350,15.360,15.360,15.360,15.370,15.370, 15.370,15.370,15.380,15.380,15.380,15.390,15.390, 15.390,15.400,15.440\n	
	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 <NRf> |<List(1,101) >	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	< List(1,101)>	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 <NRf> |<List(1,101)>	
Parameter	<6|10>	Model index. (model 6~model 10)
	< List(1,101)>	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><NRf>,<NRf>	
Query Syntax	:BATTery:MODel<6|10>:ROW<0|100>?	
Parameter	<6|10>	Model index. (model 6 ~ model 10)
	<0|100>	0 ~ 100
	<NRf>	The open circuit voltage and resistance separated by commas.
Return parameter	<NRf>	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:SIMulation:DATA

Set →
→ Query

Description	The command uploads and downloads data from battery simulation files.	
Syntax	:MEMory:BATTery:SIMulation:DATA <string>,<block>	
Query Syntax	:MEMory:BATTery:SIMulation: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:SIMulation:DATA? "8" #3246Note, This Battery model is intended for lithium-ion battery simulation., Method,Model,Empty V (V),I limit (A),Capacity	

	(AH),VOC (V),SOC (%),ESR offset (ohm),OVP (V),OCP (A),Output auto off, 0,1,3.003,1.500,3.100,3.860,20.000,0.00,500.000, 33.000,1 Return the data simulation 8.

Set → Query

:MEMory:BATTery:CHARge:DATA

Description	The command uploads and downloads data for charge files.	
Syntax	:MEMory:BATTery:CHARge:DATA <string>,<block>	
Query Syntax	:MEMory:BATTery:CHARge: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:CHARge:DATA "8",#3203Note, Used for lithium battery charge testing.,,,,,, Vset (V),I limit (A),Cut off time (sec),Cut off current (A),Cut off voltage (V),Stop at Capacity (AH),OVP (V),OCP (A) 5,2.2,60,0.1,0.02,0.02,500,33 Write the data in charge files 8.	

Set → Query

:MEMory:BATTery:GMODel:DATA

Description	The command uploads and downloads data for generate model files.	
Syntax	:MEMory:BATTery:GMODel:DATA <string>,<block>	
Query Syntax	MEMory:BATTery:GMODel: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:GMODel:DATA "7",#3329Note, Settings for Creating a Lithium Battery Model. Vset (V),I limit (A),Cut off time (sec),Cut off current (A),Cut off voltage (V),Stop at Capacity (AH),Voc_max (V),Voc_min (V),ESR sampling period,Delay time (sec),Save battery model,OVP (V),OCP (A), 4.200,2.000,0.100,0.100,5.000,99.990,4.000,3.000,0,0.100,6,550.000,33.000, Write the data in generate model files 7.	

:MEMory:BATTery:MODel:DATA

Set → / → Query

Description	The command uploads and downloads battery model.	
Syntax	:MEMory:BATTery:MODel:DATA <string>,<block>	
Query Syntax	:MEMory:BATTery:MODel: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:MODel:DATA? "4" >#41639PHU_SERIES,, Capacity=0.063AH,, SOC(%),Open Voltage(V),ESR(ohm) 0,3.122,0.105 1,3.144,0.105 2,3.166,0.104 3,3.187,0.104	

4,3.209,0.103
5,3.231,0.103
6,3.253,0.102
.
.
.
92,3.875,0.105
93,3.877,0.105
94,3.88,0.105
95,3.882,0.105
96,3.884,0.105
97,3.887,0.105
98,3.889,0.105
99,3.892,0.105
100,3.894,0.106

Return the data in model 4.

:MEMory:DELete:BATTery:SIMulation:ALL

Set →

Description	This command deletes all configuration files for simulation.
Syntax	:MEMory:DELete:BATTery:SIMulation:ALL
Example	:MEMory:DELete:BATTery:SIMulation:ALL Deletes all battery simulation files.

:MEMory:DELete:CHARge:ALL

Set →

Description	This command deletes all configuration files for charging.
Syntax	:MEMory:DELete:BATTery:CHARge:ALL
Example	:MEMory:DELete:BATTery:CHARge:ALL Deletes all battery charge files.

:MEMory:DELete:BATTery:GMODel:ALL

Set

Description	This command deletes all configuration files for model generation.
Syntax	:MEMory:DELete:BATTery:GMODel:ALL
Example	:MEMory:DELete:BATTery:GMODel:ALL Deletes all battery generate model files.

:MEMory:DELete:BATTery:MODel:ALL

Set

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

:MEMory:DELete:BATTery:SIMulation

Set

Description	This command deletes the specified configuration file for simulation.
Syntax	:MEMory:DELete:BATTery:SIMulation <string>
Parameter	< string > File index. (1~10)
Example	:MEMory:DELete:BATTery:SIMulation “6” Deletes configuration file 6.

:MEMory:DELete:BATTery:CHARge

Set

Description	This command deletes the specified configuration file for charging.
Syntax	:MEMory:DELete:BATTery:CHARge<string>
Parameter	< string > File index. (1~10)
Example	:MEMory:DELete:BATTery:CHARge “7” Deletes configuration file 7.

:MEMory:DELete:BATTery:GMODel Set

Description	This command deletes the specified configuration file for model generation.	
Syntax	:MEMory:DELete:BATTery:GMODel <string>	
Parameter	< string >	File index. (1~10)
Example	:MEMory:DELete:BATTery:GMODel "2" Deletes configuration file 2.	

:MEMory:DELete:BATTery:MODel Set

Description	This command deletes the specified battery model.	
Syntax	:MEMory:DELete:BATTery <string>	
Parameter	< string >	Model index.(model6~model10)
Example	:MEMory:DELete:BATTery:MODel "6" Deletes battery model 6.	

:MEMory:BATTery:SIMulation:STATe Query

Description	This command queries the status of specified configuration file for simulation.	
Syntax	:MEMory:BATTery:SIMulation:STATe? <string>	
Parameter	< string >	File index. (1~10)
Return parameter	0	File does not exist.
	1	File exists.
Example	:MEMory:BATTery:SIMulation:STATe? "8" >1 Return to configuration file 8 status.	

:MEMory:BATTery:CHARge:STATe → Query

Description	This command queries the status of specified configuration file for charging.	
Syntax	:MEMory:BATTery:CHARge:STATe? <string>	
Parameter	< string >	File index. (1~10)
Return parameter	0	File does not exist.
	1	File exists.
Example	:MEMory:BATTery:CHARge:STATe? "2" >0 Return to configuration file 2 status.	

:MEMory:BATTery:GMODel:STATe → Query

Description	This command queries the status of specified configuration file for model generation.	
Syntax	:MEMory:BATTery:GMODel:STATe? <string>	
Parameter	< string >	File index. (1~10)
Return parameter	0	File does not exist.
	1	File exists.
Example	:MEMory:BATTery:GMODel:STATe? "4" >1 Return to configuration file 4 status.	

:MEMory:BATTery:MODel:STATe → Query

Description	This command queries the status of battery model.	
Syntax	:MEMory:BATTery:MODel:STATe? <string>	
Parameter	< string >	File index. (6~10)

Return parameter	0	Battery model does not exist.
	1	Battery model exist.
Example	:MEMory:BATTery:MODel:STATe? "8"	
	>1	
	Return to battery model 8 status.	

Battery data log commands

: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.
Example	BATT:DLOG:STAT 1 Set the data log status is stored in the USB storage.	

:BATTery:DLOG:FOLder

Set → Query

Description	This command sets and queries the folder name used for data log storage.	
Syntax	:BATTery:DLOG:FOLder <string>	
Query Syntax	:BATTery:DLOG:FOLder?	
Parameter/ Return parameter	<string>	"0000" ~ "9999"
Example	:BATTery:DLOG:FOLde "0001" Set the data log folder name is 0001.	

:BATTery:DLOG:PERiod

Set → / → Query

Description	This command sets and queries the interval time used for data log sampling.	
Syntax	:BATTery:DLOG:PERiod <NRf>|MINimum|MAXimum	
Query Syntax	:BATTery:DLOG:PERiod? [MINimum|MAXimum]	
Parameter	<NRf>	0.1 ~ 3600 sec.
	MINimum	Minimum the interval time.
	MAXimum	Maximum the interval time.
Return parameter	<NRf>	Interval time in second.
Example	:BATTery:DLOG:PERiod 1 Set the data log interval time is 1second.	

:FETCh:BATTery:DLOG

→ Query

Description	This command queries battery dlog data.
Query Syntax	:FETCh:BATTery:DLOG?
Example	:FETCh:BATTery:DLOG?
Note	For details of the returned data packet format, please refer to the **PHU Battery Function User Manual.pdf**

Other commands

:BATTery:PROGram:NAME

Set → Query →

Description	This command sets and queries the currently selected battery program.
Syntax	:BATTery:PROGram:NAME SIMulation|CHARge|GMODel,<NR1>
Query Syntax	:BATTery:PROGram:NAME?
Paramete	<NR1> 1 ~ 10
Return parameter	<NR1> 1 ~ 10
Example	:BATTery:PROGram:NAME SIM,1 Set the currently selected battery program to SIM1.

:BATTery:PROGram:STATe

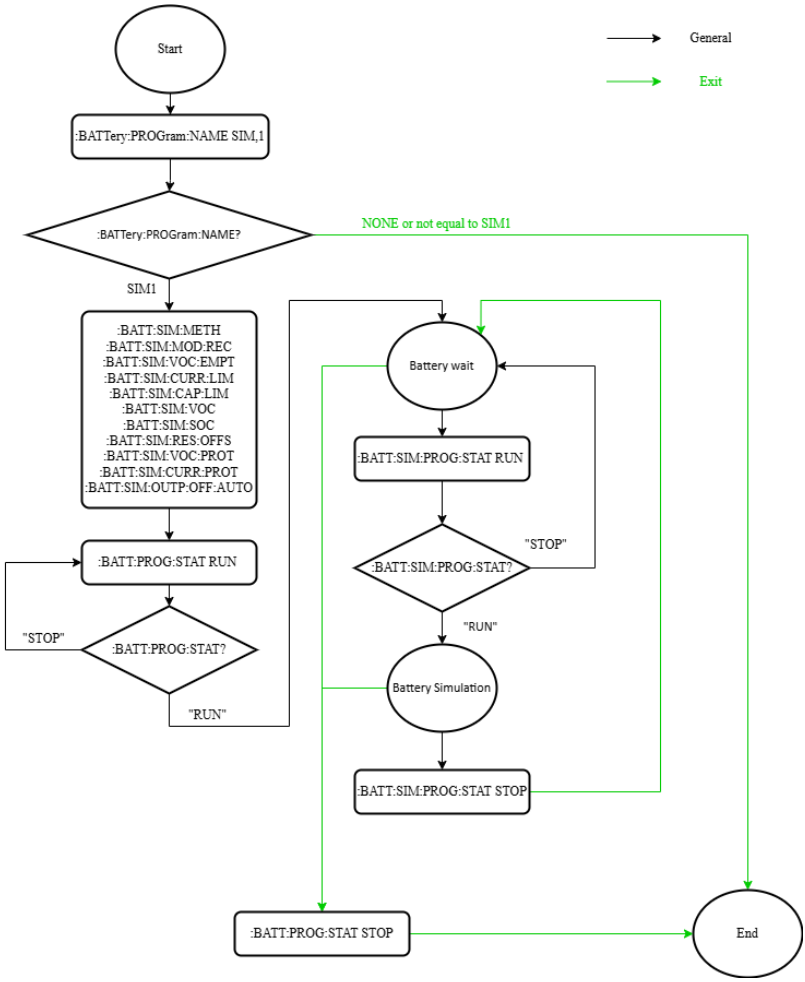
Set → Query →

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? >RUN Returns the value of the Battery Function Execution Status.	

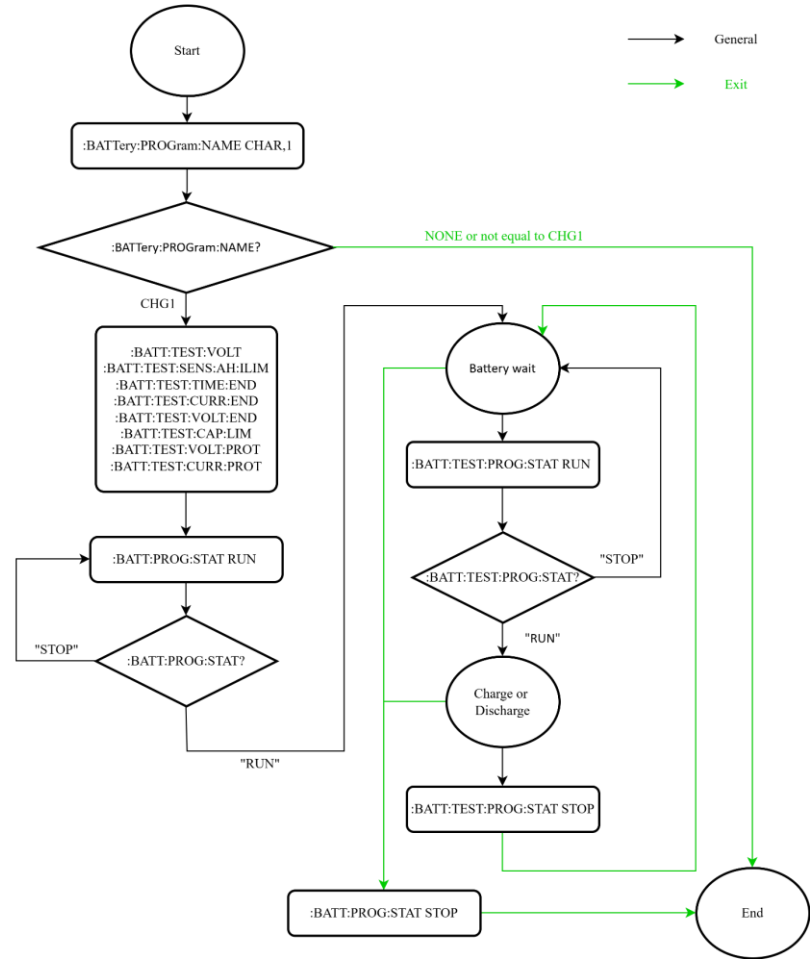
Appendix

Operation flow chart

Battery Simulation



Charge or Discharge



Generate a battery model