Communication Protocol between arrangement and KCG3 smart battery charger
Version 1.1.0002

1. General

This protocol shows how to get data and operate KCG3 smart battery charger by an arrangement, such as PC, which has a 9-pin RS-232 port. We call the arrangement as “Master” and KCG3 smart battery charger as “Charger” for short in this file.

1.1 System Requirement

Charger with RS-232 interface.
Standard 9-pin RS-232 cable.
Master, which has 9-pin RS-232 port.

1.2 RS-232 setting

3 basic signals, TX, RX and GND.
Baud rate: 2400bps,
Stop bit: 1,
Data bit: 8,
Parity bit: None.

1.3 Communication

There are 3 kinds of communication: **getting data**, **setting data** and **operation**. One successful communication includes 2 parts, **command string** from Master to Charger and **response string** from Charger to Master.

The timeout of every communication is 3 seconds. If there is not a whole response string from Charger in 3 second, this communication is failed.
Time interval between 2 communication commands should be longer than 0.7 second.

2. String format

The string is ASCII. In this file, we use 0x00 to 0xFF in HEX.

2.1 Command string

Format: Start byte, Charger Number byte, Command byte, [parameter1, [parameter2, [parameter3,…,]]] Sum byte, End byte.

Start byte: 0x51 as getting data, 0x5C as setting data.

Charger Number byte: 0x01.

Command byte and parameter bytes, see Part 3 for details.

Sum byte: the low 8 bits of the sum of all the bytes from the Start byte to the byte before Sum byte,

End byte: 0xF0

2.2 Response string

Format: Start byte, Charger Number byte, Command byte, [parameter1, [parameter2, [parameter3,…,]]] Sum byte, End byte.

Start byte: 0x51 as getting data, 0x5C as setting data.

Charger Number byte: 0x01.

Command byte and parameter bytes, see Part 3 for details.

Sum byte: the low 8 bits of the sum of all the bytes from the Start byte to the byte before Sum byte,

End byte: 0xF0 as successful, 0xFF as failure.

3. Commands and Responses details

PBL: Parameter byte length. The number of parameter byte.

In the following examples, Command byte is in bold and Parameter bytes are underlined.

3.1 Get data commands

1. get basic information

Master sends, 0x51, 0x01, **0x01**, SUM, 0xF0

Charger sends, 0x51, 0x01, **0x01**, …… , SUM, 0xF0

PBL: 20.

The 1-16 byte is charger model;

17 byte: **voltage coefficient**. The actual voltage value = voltage data / voltage coefficient.

18 byte: **current coefficient**. The actual current value = current data / current coefficient.

Note: All the voltage and current values should be calculated by the coefficient, expect the nominal voltage and nominal current.

19, 20 byte, reserved.

E.g., Charger sends 0x51, 0x01, **0x01**, 0x20, 0x20, 0x20, 0x4B, 0x43, 0X47, 0X31, 0X38, 0x30, 0x33, 0x36, 0x33, 0x 47, 0x20, 0x20, 0x20, 0x0A, 0x01, 0x20, 0x20, 0xCB, 0xF0

1-16 byte string is “ KCG180363G ”
17 byte, voltage coefficient is 0x0A. 18 byte, current coefficient is 1. These will be used in all the following examples.
And if the actual voltage value is 44.1V, Charger will send voltage data 441.
If the actual current value is 180A, Charger will send current data 180.

2. get nominal voltage and current
Master sends, 0x51, 0x01, **0x02**, SUM, 0xF0
Charger sends, 0x51, 0x01, **0x02**, 0x00, 0x24, 0x00, 0XB4, SUM, 0xF0 (e.g. 36V 180A)
PBL: 4.
The 1-2 byte is nominal voltage. Do not use voltage coefficient.
The 3-4 byte is nominal current; Do not use current coefficient.

3. get floating voltage (CV1) and Equalize voltage (CV2)
Master sends, 0x51, 0x01, **0x03**, SUM, 0xF0
Charger sends, 0x51, 0x01, **0x03**, 0x01, 0x0B, 0x01, 0x1A, SUM, 0xF0 (e.g. 26.7V, 28.2V)
PBL: 4.
The 1-2 byte is floating voltage;
The 3-4 byte is Equalize current;

4. get constant current(CC1) and Current to Floating charge(CC2)
Master sends, 0x51, 0x01, **0x04**, SUM, 0xF0
Charger sends, 0x51, 0x01, **0x04**, 0x00, 0x32, 0x00, 0x0A, SUM, 0xF0 (e.g. 50A, 10A)
PBL: 4.
The 1-2 byte is constant current; value range, 27-180.
The 3-4 byte is Current to Floating charge; 2-60

5. get delay time and cycle time of equalize charge.
Master sends, 0x51, 0x01, **0x05**, SUM, 0xF0
Charger sends, 0x51, 0x01, **0x05**, 0x00, 0x00, 0x00, 0x00, SUM, 0xF0
PBL: 4.
The 1-2 byte is delay time. 0,1,2,3,4 hours. If charging curve is 3-stage, 4 is “NO STOP”.
The 3-4 byte is cycle time of equalize charge; 3-30 days.

6. get temperature compensation data and over voltage protection value
Master sends, 0x51, 0x01, **0x06**, SUM, 0xF0
Charger sends, 0x51, 0x01, **0x06**, 0x00, 0x00, 0x01, 0x38, SUM, 0xF0 (e.g. 31.2V)
PBL: 4.
The 1-2 byte is constant current;
The 3-4 byte is over voltage protection value;

7. get output voltage and current

Master sends, 0x51, 0x01, **0x07**, SUM, 0xF0
Charger sends, 0x51, 0x01, **0x07**, 0x00, 0xFA, 0x00, 0x32, SUM, 0xF0 (e.g. 25.0V, 50A)
PBL: 4.
The 1-2 byte is output voltage;
The 3-4 byte is output current;

8. get charging time, charger status and battery temperature
Master sends, 0x51, 0x01, **0x08**, SUM, 0xF0
Charger sends, 0x51, 0x01, **0x08**, 0x00, 0x02, 0x00, 0x06, SUM, 0xF0 (e.g. 2 minutes, 0 degree centigrade, Equalize charge/CC1)
PBL: 4.
The 1-2 byte is charging time, in minute.
The 3 byte is battery environment temperature; 0x00 to 0x7F means 0 to + 127, 0x80 to 0xFF means -1 to -127. Unit: degree centigrade.
The 4 byte is charger status;

Charger status value	Status
0x00	Over load protect
0x01	Over voltage protect
0x02	Charging completed
0x03	Over heat protect
0x04	Input abnormal
0x05	Stop charge
0x06	Equalize charge/ CC1
0x07	Constant voltage/ CV1
0x08	CC2
0x09	CV2
0x0A	Floating charge
0x0B	Reset

9. get battery type, charging curve and battery capacity
Master sends, 0x51, 0x01, **0x09**, SUM, 0xF0
Charger sends, 0x51, 0x01, **0x09**, 0x02, 0x02, 0x64, 0x00, SUM, 0xF0 (e.g. GEL, 4-Stage, 1000Ah)
PBL: 4.
The 1st byte is battery type;
If 3-stage, 0x01 is LA battery, 0x02 is GEL battery;
If 4-stage, 0x01 is Flooded LA battery, 0x02 is GEN GEL LA battery; 0x03 is AGM Sealed LA battery, 0x04 is Tubular LA battery
The 2nd byte is charging curve; 0x01 is 3 stage, 0x02 is 4 stage.
The 3rd byte is battery capacity. The actual capacity is data value * 10. Unit: Ah.

3.2 Set data commands

The Master command string length is 7. The 4th and 5th bytes are parameter bytes.
***Note**: if the 5th byte is 0xF0, the most significant bit of 4th byte should be 1, and change the 5th byte to 0x00.*
For example, set the floating voltage to 24.0V. Master should change 4th byte and 5th byte to 0x80, 0x00. Master should send 0x5C, 0x01, **0x11**, 0x80, 0x00, SUM, 0xF0. **NOT** 0x5C, 0x01, **0x11**, 0x00, 0xF0, SUM, 0xF0
If the End byte in Charger response string is 0xF0, setting successful. If 0xFF, setting failed.

1. Set floating voltage/CV1

Master sends, 0x5C, 0x01, **0x11**, 0x01, 0x0B, SUM, 0xF0 (e.g. 26.7V。)
Charger sends, 0x5C, 0x01, **0x11**, SUM, 0xF0

2. Set equalize voltage/CV2

Master sends, 0x5C, 0x01, **0x12**, 0x01, 0x1A, SUM, 0xF0 (e.g. 28.2V。)
Charger sends, 0x5C, 0x01, **0x12**, SUM, 0xF0

3. Set constant current / CC1

Master sends, 0x5C, 0x01, **0x13**, 0x00, 0x30, SUM, 0xF0 (e.g. 0x00,0x30: 48A。)
Charger sends, 0x5C, 0x01, **0x13**, SUM, 0xF0

4. Set current to floating charge / CC2

Master sends, 0x5C, 0x01, **0x14**, 0x00, 0x0A, SUM, 0xF0 (e.g. 10A。)
Charger sends, 0x5C, 0x01, **0x14**, SUM, 0xF0

5. Set delay time

Master sends, 0x5C, 0x01, **0x15**, 0x00, 0x01, SUM, 0xF0 (e.g. delay 1 hour)
Charger sends, 0x5C, 0x01, **0x15**, SUM, 0xF0

6. Set cycle time of equalize charge

Master sends, 0x5C, 0x01, **0x16**, 0x00, 0x10, SUM, 0xF0 (e.g. floating charge 16 days, then equalize charge)
Charger sends, 0x5C, 0x01, **0x16**, SUM, 0xF0

7. Set over voltage protect value

Master sends, 0x5C, 0x01, **0x17**, 0x01, 0x38, SUM, 0xF0 (e.g. 31.2V)
Charger sends, 0x5C, 0x01, **0x17**, SUM, 0xF0

8. Set to default value

Not available. Please set to default by buttons on charger front panel.

9. Set temperature compensation

Master sends, 0x5C, 0x01, **0x19**, 0x00, 0x00, SUM, 0xF0

The 1st byte: 0x01 means the compensation unit is 1mV/degree centigrade.

0x0A means the compensation unit is 10mV/ degree centigrade

0x64 means the compensation unit is 100mV/ degree centigrade

This byte should equal to the 1st byte of response string of Command 0x06.

The 2nd byte is compensation value, from 0x01 to 0x0A.

0x01, 0x05 means 5mV/ degree centigrade

0x0A, 0x04 means 40mV/ degree centigrade

0x64, 0x02 means 200mV/ degree centigrade

Charger sends, 0x5C, 0x01, **0x19**, SUM, 0xF0

10. Set charging curve

Master sends, 0x5C, 0x01, **0x1A**, 0x00, 0x01, SUM, 0xF0 (e.g. 3 stage curve)

0x01 is 3 stage, 0x02 is 4 stage.

Charger sends, 0x5C, 0x01, **0x1A**, SUM, 0xF0

11. Set battery nominal voltage

Master sends, 0x5C, 0x01, **0x1B**, 0x00, 0x0C, SUM, 0xF0 (e.g. 12V)

Please check the "nominal voltage" item by LCD to get the available values.

Charger sends, 0x5C, 0x01, **0x1B**, SUM, 0xF0

12. Set battery type

Master sends, 0x5C, 0x01, **0x1C**, 0x00, 0x01, SUM, 0xF0

If 3-stage, 0x01 is LA battery, 0x02 is GEL battery;

If 4-stage, 0x01 is Flooded LA battery, 0x02 is GEN GEL LA battery; 0x03 is AGM Sealed LA battery, 0x04 is Tubular LA battery

Charger sends, 0x5C, 0x01, **0x1C**, SUM, 0xF0

13. Set battery capacity

Master sends, 0x5C, 0x01, **0x1D**, 0x00, 0xB4, SUM, 0xF0 (e.g. 180Ah)

The unit digit of capacity value will be rounded down and kept in charger. For example, Master sets 180-189Ah, 180Ah will be kept. Set 195Ah, 190Ah will be kept.

Charger sends, 0x5C, 0x01, **0x1D**, SUM, 0xF0

Setting values range

	Data value(actual value)
Floating voltage / CV1	[120, 441] ([12.0V, 44.1V])
Equalize voltage / CV2	[135, 486] ([13.5V, 48.6V])
Constant current / CC1	[27, 180] ([27A, 180A])
Current to floating / CC2	[2,60] ([2A, 60A])
Delay time	{0, 1, 2, 3, 4}

Cycle time of equalize charge	[3, 30]
Over voltage protect value	[165, 525] ([16.5V, 52.5V])
Battery capacity	[180,1000] ([180Ah, 1000Ah])

3.3 Operation commands

1. Stop charge

Master sends, 0x5C, 0x01, **0x31**, SUM, 0xF0

2. Start/Equalize charge

Master sends, 0x5C, 0x01, **0x32**, SUM, 0xF0

It does not work when charger protects and alarm or the STOP button pressed.