**JK-BMS: Communication Protocol Between Monitoring Platform and BMS**

Version Information

| **Version** | **Date** | **Description** | **Author** |
| --- | --- | --- | --- |
| V20191124 | Initial Draft |  |  |
| V20200325 | Updated some descriptions, changed 0xA10 to 0xD2, specialized charger switch command |  |  |
| V20200325 | Confirmed the data transfer baud rate to be 115200 |  |  |
| V20200329 | Updated and optimized the instruction table, redefined data identifiers |  |  |
| V20200329 | Added command to read all data at once |  |  |
| V20200427 | Added explanation for writing ID and manufacturing date |  |  |
| V20200429 | Added 0xB7 address for software version number |  |  |
| V20200429 | Detailed description for addresses 0x8B and 0x8C |  |  |
| V20200508 | Optimized address 0x84; unit changed from 0.1A to 0.01A |  |  |
| V20200512 | Redefined the name for address 0x81 as internal battery box temperature |  |  |
| V20200512 | Redefined the names for 0xA0 and 0xA1 |  |  |
| V20200512 | Added alarm bits to address 0x8B |  |  |
| V20200526 | Added system restart identifier 0xBB |  |  |
| V20200615 | Added 0xB8 identifier, version changed to V2.0 |  |  |
| V20200713 | Added 0xBC identifier for factory reset, version changed to V2.1, added 309 fault information |  |  |
| V20200825 | Added 0xBE and 0xBF |  |  |
| V2.4 20201204 | Added 0xC0, redefined current field data | echo |  |
| V2.5 20201217 | Added necessary fields for reporting explanation | echo |  |

Table of Contents

Overview 3

Referenced Standards ....3

Network Topology ...3

Protocol Content ....3

4.1 Communication Rules ...3

4.2 Frame Format 3

4.2.1 Frame Start Symbol Field ..3

4.2.2 Length Field ..3

4.2.3 Terminal Number ..3

4.2.5 Command Word Explanation ....3

4.2.6 Frame Origin Explanation ...4

4.2.7 Transmission Type ......4

4.2.10 End Code Field ...4

4.2.11 Checksum Field ..4

4.3 Communication Data Format 4

### 1. Overview

This protocol defines the communication standards between the monitoring platform and the battery terminal, specifying message formats, transmission methods, and communication modes.

### 2. Referenced Standards

Communications use 2G's GPRS for TCP transmission, 4G's GAT1, SOCKET interface methods, RS232 TTL serial port, with customized communication formats and a baud rate of 115200.

### 3. Network Topology

This protocol employs a point-to-point or bus architecture involving BMS (Battery Management System), GPS, Bluetooth endpoints, and PC master stations.

### 4. Protocol Content

#### 4.1 Communication Rules

During communication, the devices have both proactive reporting frames and passive response frames, details of which are as per the communication data format. The minimum interval between each packet is 100 milliseconds, and the longest response packet does not exceed 5 seconds. If the device is in sleep mode, the control end sends activation information to activate the BMS before resuming communication.

#### 4.2 Frame Format

A frame is the basic unit for transmitting information. It includes a start symbol, length, command word, transmission type, information field, end symbol, and checksum. The specific format is as shown in Table 1. Unless explicitly stated, the least significant byte is on the right and the most significant byte on the left. Transmission begins with the most significant bit followed by the least significant bit.

##### Table 1: Frame Format

**Table: Frame Format**

| **Field Number** | **Frame Unit** | **Length** | **Remarks** |
| --- | --- | --- | --- |
| 1 | STX | 2 | Start Frame: 0x4E (78 "N") 0x57 (87 "W") |
| 2 | LENGTH | 2 | Frame Length |
| 3 | BMS Terminal No. | 4 | 4-byte ID |
| 4 | Command Word | 1 | Refer to command word explanation |
| 5 | Frame Origin | 1 | 0. BMS, 1. Bluetooth, 2. GPS, 3. PC Master Station |
| 6 | Transmission Type | 1 | 0. Read Data, 1. Response Frame, 2. BMS Active Upload |
| 7 | Frame Info Unit | N | Information field: BMS setting data identification code |
| 8 | Record Number | 4 | The most significant byte is a random code with no meaning (reserved for encryption), the least significant three bytes are the record number |
| 9 | End Symbol | 1 | 0X68 |
| 10 | Checksum | 4 | Accumulative checksum (the most significant two bytes are for CRC and are not activated, filled with 0; the least significant two bytes are for accumulative checksum) |

#### 4.2.1 Frame Start Symbol Field

Two bytes. The first byte is 0x4E and the second byte is 0x57.

#### 4.2.2 Length Field

L: Two bytes, including all data bytes except for the initial two characters, inclusive of the checksum and the length field itself.

#### 4.2.3 BMS Terminal Number

Four bytes in total: FF FF FF FF. The most significant 8 bits are reserved for management backup numbers, and the least significant 24 bits are for the terminal number (the most significant byte is reserved and defaulted to 00, the least significant three bytes are the unique ID number).

**4.2.3 BMS Terminal Number**

* Consists of four bytes: FF FF FF FF
  + The highest 8 bits are reserved as a management spare number.
  + The lower 24 bits serve as the terminal number.
* Note: The highest byte is reserved and set to default 00, while the lower three bytes serve as a unique ID number.

**4.2.4 Command Word Explanation**

* A single byte, which defines the transmission function of the frame.

| **Command Code** | **Command Function** | **Remarks** |
| --- | --- | --- |
| 0x01 | Activation Instruction | Used to activate the BMS when in sleep mode. Subsequent operations may proceed once a reply is received. |
| 0x02 | Write Instruction | Used to configure BMS parameters. |
| 0x03 | Read Instruction | Used to read BMS identification data. |
| 0x05 | Password Instruction | Must be sent and verified before parameters can be modified. |
| 0x06 | Read All Data | Reads the complete set of identification table data in one operation. |

**4.2.5 Frame Origin Explanation**

* A single byte that varies depending on both the sender and receiver.
  + 0: BMS, 1: Bluetooth, 2: GPS, 3: PC Master Station

**4.2.6 Transmission Type**

* A single byte:
  + 0 represents a request frame.
  + 1 represents a response frame.
  + 2 represents proactive reporting.
* Note: Regardless of who initiates first—whether it be Bluetooth, GPS, PC Master Station, or BMS—the response will always use 1.

**4.2.7 Record Number**

* The most significant byte is a random code with no meaning (reserved for encryption), and the least significant three bytes are the record number.

**4.2.8 End Symbol**

* A single byte 0x68

**4.2.9 Checksum Field**

* The most significant two bytes are for CRC16 and are temporarily unused.
* The checksum is calculated as the sum of all the data bytes from the start symbol to the end symbol.

**4.3 Communication Data Format**

**Example: GPS Read (All, Single) Data Reference**

| **Field No.** | **Frame Unit** | **Byte Length** | **Description** |
| --- | --- | --- | --- |
| 1 | STX | 2 | Start frame: 0x4E (78 "N") 0x57 (87 "W") |
| 2 | LENGTH | 2 | Frame length |
| 3 | BMS Terminal No. | 4 | 4-byte ID |
| 4 | Command Word | 1 | Refer to command word explanation |
| 5 | Frame Source | 1 | 0. Data Box, 1. Bluetooth, 2. GPS, 3. PC Workstation |
| 6 | Transmission Type | 1 | 0. Read data, 1. Response frame, 2. Data Box initiates upload |
| 7 | Data Identifier | 1 | Refer to single data in table 5.1; For all data, fill 0x00 |
| 8 | Record No. | 4 | High 1-byte is a random code (reserved for encryption), low 3-bytes are the record sequence number |
| 9 | End Identifier | 1 | 0x68 |
| 10 | Checksum | 4 | Accumulative checksum |

BMS Response

| **Field No.** | **Frame Unit** | **Byte Length** | **Description** |
| --- | --- | --- | --- |
| 1 | STX | 2 | Start frame: 0x4E (78 "N") 0x57 (87 "W") |
| 2 | LENGTH | 2 | Frame length |
| 3 | Terminal No. | 4 | 4-byte terminal ID |
| 4 | Command Word | 1 | Command word |
| 5 | Frame Source | 1 | 0. Data Box, 1. Bluetooth, 2. GPS, 3. PC Workstation |
| 6 | Transmission Type | 1 | 0. Read data, 1. Response frame, 2. Data Box initiates upload |
| 7 | Identifier + Data | 1 + N | Identifier + Data |
| 8 | Record No. | 4 | High 1-byte is random (reserved for encryption), low 3-bytes are the record sequence number |
| 9 | End Identifier | 1 | 0x68 |
| 10 | Checksum | 4 | Checksum |

**Example: GPS Write Data Reference**

| **Field No.** | **Frame Unit** | **Byte Length** | **Description** |
| --- | --- | --- | --- |
| 1 | STX | 2 | Start frame: 0x4E (78 "N") 0x57 (87 "W") |
| 2 | LENGTH | 2 | Frame length |
| 3 | BMS Terminal No. | 4 | 4-byte BMS terminal ID |
| 4 | Command Word | 1 | Refer to the command word description |
| 5 | Frame Source | 1 | 0. Data Box, 1. Bluetooth, 2. GPS, 3. PC Workstation |
| 6 | Transmission Type | 1 | 0. Read data, 1. Response frame, 2. Data box initiates upload |
| 7 | Identifier + Data | 1 + N | Identifier + Data |
| 8 | Record No. | 4 | High 1-byte is random (reserved for encryption), low 3-bytes are the record sequence number |
| 9 | End Identifier | 1 | 0x68 |
| 10 | Checksum | 4 | Checksum |

MS Response

| **Field No.** | **Frame Unit** | **Byte Length** | **Description** |
| --- | --- | --- | --- |
| 1 | STX | 2 | Start frame: 0x4E (78 "N") 0x57 (87 "W") |
| 2 | LENGTH | 2 | Frame length |
| 3 | Terminal No. | 4 | 4-byte terminal ID |
| 4 | Command Word | 1 | Command Word (Refer to specific command descriptions) |
| 5 | Frame Source | 1 | 0. BMS, 1. Bluetooth, 2. GPS, 3. PC Workstation |
| 6 | Transmission Type | 1 | 0. Read Data, 1. Response Frame, 2. BMS Initiates Upload |
| 7 | Identifier | 1 | Write single data (Refer to Table 5.1) |
| 8 | Record No. | 4 | High 1-byte is random (reserved for encryption), low 3-bytes are record number |
| 9 | End Identifier | 1 | 0x68 |
| 10 | Checksum | 4 | Checksum |

Notice for the flag code: (When reading all data, fill the data identification code with 0x00).

**5.1 BMS Setting Data Identifier**

| **Direction** | **Data ID** | **Description** | **Bytes** | **Type** | **Notes** |
| --- | --- | --- | --- | --- | --- |
| R | 0x79 | Single cell voltage | 3\*n | HEX | The text describes a protocol for reading battery data, specifically battery number and voltage. The first byte represents the battery number, and the following byte represents the voltage value in millivolts (mV). When reading all the data, the data that follows **0x79** is a byte indicating the length of the data, after which sets of three bytes each represent a battery's voltage.  In summary, the protocol arranges data as follows:   * The first byte indicates the battery number. * The next byte represents the voltage in millivolts. * If you're reading all the data (presumably starting with an identifier of **0x79**), the next byte will specify the length of the data. * This is followed by groups of three bytes, each of which describes the voltage of a different battery. |
| R | 0x80 | Power management temperature | 2 | HEX | -40 to 100℃ The text describes a temperature range mapping scheme that spans from -40 to 100 degrees Celsius. The range is represented by integers from 0 to 140. Values above 100 indicate negative temperatures, with 100 serving as the baseline or reference point. For example, a value of 101 would correspond to -1 degree Celsius.  The scale is designed as follows:   * Values from 0 to 100 map directly to temperatures from -40 to 100°C. * Values greater than 100 are used to represent negative temperatures. To interpret these, you would subtract 100 from the value to find the negative temperature. For instance, a value of 101 would translate to -1°C, as it is one unit above the baseline of 100. |
| R | 0x81 | Internal battery box temperature | 2 | HEX | -40 to 100℃ |
| R | 0x82 | Battery temperature | 2 | HEX | -40 to 100℃ |
| R | 0x83 | Total battery voltage | 2 | HEX | The text describes a voltage measurement unit. In this scheme, the smallest unit for voltage is 10 millivolts (MV). To convert a given value to volts, one multiplies it by 0.01V. For example, a value of 3500, when multiplied by 0.01, equals 35.0V.   * The multiplication factor for conversion is 0.01V. * A value of 3500, when converted using the multiplication factor, results in 35.0V. * The smallest unit for voltage measurement is specified as 10 millivolts (MV). |
| R | 0x84 | Current data | 2 | HEX | Discharge and charge currents The text describes a method for calculating and representing current values for both discharging and charging processes, with precise units and calculations outlined.   1. For discharging (放电): The calculation **(10000 - 11000) \* 0.01** results in -10.00A, indicating a discharge current of 10.00A. 2. For charging (充电): The calculation **(10000 - 9500) \* 0.01** results in 5.00A, indicating a charging current of 5.00A. 3. Precision and Unit: The text specifies a precision level of 10 milliamperes (MA) and a unit of 0.01A. 4. Special Notation for Data: It uses hexadecimal notation to represent current values. For example, 0x07D0 (in hex) is equivalent to 2000 (in decimal), which corresponds to a discharge current of 20A when applying the unit and calculation logic. 5. High Bit Representation: The highest bit being '0' signifies discharging, and '1' signifies charging. For instance, the hex value 0x87D0 signifies a charging current of 20A.   The notation "注 ： C0:0x01 重 新定义 0x84 电 流 数 据 ， 单 位 10MA， 最高位 为 0" indicates the following:   1. "C0:0x01" and "0x84" seem to be hexadecimal addresses or identifiers. The text suggests that the address or identifier "0x84" is being redefined, presumably in the context of some embedded or low-level programming where such addresses are significant. 2. "电 流 数 据" translates to "current data," indicating that this address/identifier is associated with electrical current data. 3. "单 位 10MA" translates to "unit 10MA," indicating that the unit for this current data is in 10 milliamperes. 4. "最高位 为 0" translates to "the highest bit is 0," which could mean that the most significant bit (MSB) of this data is set to 0. This may be significant in terms of how the data is interpreted or processed.   In summary, the note indicates that there is a redefinition of data corresponding to the identifier or address "0x84." This redefined data is associated with electrical current measurements, has a unit of 10 milliamperes, and should have the highest bit set to 0 for proper interpretation or processing. |
| R | 0x85 | Remaining battery capacity | 1 | HEX | SOC 0-100% |
| R | 0x86 | Number of temperature sensors | 1 | HEX | 2 sensors by default |
| R | 0x87 | Battery cycle count | 2 | HEX |  |
| R | 0x89 | Total battery cycle capacity | 4 | HEX | Ah |
| R | 0x8a | Total number of battery series | 2 | HEX |  |
| R | 0x8b | Battery warning information | 2 | HEX | Various alarms and warnings   * 0th bit: Low Capacity Alarm, 1 for alarm, 0 for normal. Only a warning. * 1st bit: MOSFET Over-Temperature Alarm, 1 for alarm, 0 for normal. Alarm. * 2nd bit: Charging Over-Voltage Alarm, 1 for alarm, 0 for normal. Alarm. * 3rd bit: Discharging Under-Voltage Alarm, 1 for alarm, 0 for normal. Alarm. * 4th bit: Battery Over-Temperature Alarm, 1 for alarm, 0 for normal. Alarm. * 5th bit: Charging Over-Current Alarm, 1 for alarm, 0 for normal. Alarm. * 6th bit: Discharging Over-Current Alarm, 1 for alarm, 0 for normal. Alarm. * 7th bit: Cell Voltage Difference Alarm, 1 for alarm, 0 for normal. Alarm. * 8th bit: Internal Over-Temperature Alarm, 1 for alarm, 0 for normal. Alarm. * 9th bit: Battery Low Temperature Alarm, 1 for alarm, 0 for normal. Alarm. * 10th bit: Single Cell Over-Voltage Alarm, 1 for alarm, 0 for normal. Alarm. * 11th bit: Single Cell Under-Voltage Alarm, 1 for alarm, 0 for normal. Alarm. * 12th bit: 309\_A Protection, 1 for alarm, 0 for normal. Alarm. * 13th bit: 309\_B Protection, 1 for alarm, 0 for normal. Alarm. * 14th bit: Reserved * 15th bit: Reserved   Example:   * 0x0001: Low Capacity Alarm * 0x0002: Power Board Over-Temperature Alarm * 0x0003: Low Capacity Alarm AND Power Board Overtemperature Alarm |
| R | 0x8c | Battery status information | 2 |  | * 0th bit: Charging MOSFET state, 1 for ON, 0 for OFF. This is for upload and notification. * 1st bit: Discharging MOSFET state, 1 for ON, 0 for OFF. This is for upload and notification. * 2nd bit: Balancing switch state, 1 for ON, 0 for OFF. This is for upload and notification. * 3rd bit: Battery connection state, 1 for normal, 0 for disconnected. This is for upload and notification. * 4th to 15th bits: Reserved.   Example:   * 00 01: Indicates the Charging MOSFET is ON. |
| RW | 0x8e | Over-voltage protection | 2 | HEX | 1000-15000 (10MV) |
| RW | 0x8f | Under-voltage protection | 2 | HEX | 1000-15000 (10MV) |
| RW | 0x90 | Cell over-voltage protection | 2 | HEX | 1000-4500 MV |
| RW | 0x91 | Cell over-voltage recovery | 2 | HEX | 1000-4500 MV |
| RW | 0x92 | Cell over-voltage protection delay | 2 | HEX | 1-60 seconds |
| RW | 0x93 | Cell under-voltage protection | 2 | HEX | 1000-4500 MV |
| RW | 0x94 | Cell under-voltage recovery | 2 | HEX | 1000-4500 MV |
| RW | 0x95 | Cell under-voltage protection delay | 2 | HEX | 1-60 seconds |
| RW | 0x96 | Cell voltage difference protection | 2 | HEX | 0-1000 MV |
| RW | 0x97 | Discharge over-current protection | 2 | HEX | 1-1000 A |
| RW | 0x98 | Discharge over-current delay | 2 | HEX | 1-60 seconds |
| RW | 0x99 | Charge over-current protection | 2 | HEX | 1-1000 A |
| RW | 0x9a | Charge over-current delay | 2 | HEX | 1-60 seconds |
| RW | 0x9b | Balance start voltage | 2 | HEX | 2000-4500 MV |
| RW | 0x9c | Balance start voltage difference | 2 | HEX | 10-1000 MV |
| RW | 0x9d | Active balance switch | 1 | HEX | 0 off, 1 on |
| RW | 0x9e | Power management temperature protection | 2 | HEX | 0-100℃ |
| RW | 0x9f | Power management temperature recovery | 2 | HEX | 0-100℃ |
| RW | 0xa0 | Internal battery box temperature protection | 2 | HEX | 0-100℃ |
| RW | 0xa1 | Internal battery box temperature recovery | 2 | HEX | 0-100℃ |
| RW | 0xa2 | Battery temperature protection | 2 | HEX | 0-100℃ |
| RW | 0xa3 | Battery temperature recovery | 2 | HEX | 0-100℃ |
| RW | 0xa4 | Battery temperature protection delay | 2 | HEX | 1-60 seconds |
| RW | 0xa5 | Maximum charging voltage | 2 | HEX | 1000-15000 MV |
| RW | 0xa6 | Minimum discharge voltage | 2 | HEX | 1000-15000 MV |
| RW | 0xa7 | Balance voltage | 2 | HEX | 2000-4500 MV |
| RW | 0xa8 | Temperature sensor calibration | 2 | HEX | -500 to 500 |
| RW | 0xa9 | Total capacity calibration | 2 | HEX | -1000 to 1000 |
| RW | 0xaa | Temperature protection | 2 | HEX | 0-100℃ |
| RW | 0xab | Temperature protection recovery | 2 | HEX | 0-100℃ |
| ??? | 0xba | Manufacturer Id | 24 | char | Example: "BT3072020120000200521001"   * Product Name: Battery BT * Material System: Iron-Lithium represented by 1; Manganese Acid represented by 2; Ternary represented by 3 * Voltage Level: 48V series uses 48; 60V series uses 60; 72V series uses 72 * Capacity Level: 20AH specification uses 20 * Cycle Life: 400 cycles marked as 04 for cycle use, 1200 cycles marked as 12 * Manufacturer Code: Manufacturer's English code for low-speed vehicle batteries; if the manufacturer's English code is not four digits, pad with the character 0 * Production Year: Take the last two digits according to the actual production year; for batteries produced in 2019, the year code is "19" * Production Month: 1 to 12 months * Production Date: 01 to 31 * Production Serial Number: According to the manufacturing date of the manufacturer, the Nth group of this model produced on that day, the number is represented as N (for example: for the first group of a certain model, it is 001) |
| W | 0xBB | System Reboot | 1 | HEX | 1 to initiate system reboot |
| W | 0xBC | Restore Factory Settings | 1 | HEX | 1 to restore factory settings (restores baseline parameters set during manufacturing) |
| W | 0xBD | Remote Upgrade Flag | 1 | HEX | 1 to signal the start of remote upgrade (response upon receiving upgrade file) |
| W | 0xBE | Low Cell Voltage Shutdown for GPS | 2 | HEX | Specifies voltage threshold (in millivolts, mV) below which GPS power is shut down |
| W | 0xBF | Low Cell Voltage Recovery for GPS | 2 | HEX | Specifies voltage threshold (in millivolts, mV) for GPS power recovery upon voltage increase |
| R | 0xC0 | Protocol Version Number | 1 | HEX | Default value: 0x00; 0x01: Redefines 0x84 Current Data with unit 10mA, highest bit indicates discharge (0) or charge (1); e.g., discharge of 20A is transmitted as 2000 (0x07D0), charge of 20A as 34768 (0x87D0) |

1. For fields ranging from **0x79** to **0xb9**, any field marked with 'R' or 'RW' should be reported. For older versions of the product that haven't implemented this, upgrading is advised. If upgrading is inconvenient, you are suggested to contact technical support at the given phone numbers: 13755639263 or 13480924112.
2. The field **0xBA** is designated for Manufacturer ID naming. This field is primarily intended for use with battery exchange cabinets. If such a requirement exists, this field must be included.