Shared power bank Serial Port Communication Protocol

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1. Physical Layer Interface

The physical layer uses UART serial port with baud rate 115200, 8 data bits, no parity bit, and one stop bit.

2. Data Packet Format

Start Character	Sub-board Address	@	Command	,	Data1	,	Data n	,	Checksum	,	End Character
{	0	@	CQ	,	0	,	0	,	5436	,	}

All are in ASCII format, separated by English commas. All letters in the protocol are uppercase, and all symbols are in English format. The host computer serial port receive buffer should be greater than 4096 bytes.

Field Definitions

(1) Start Character: "{"

(2) End Character: "}"

(3) Sub-board Address: Used for compatibility with 485 bus addressing, default address "0".

(4) Command Word:

- **CQ:** Query command for all slot status
- **AC:** Active report or reply with all slot information (Note: automatically reports every 3 minutes by default, maximum packet length 4096 bytes)
- **BW:** power bank autonomous rental command
- **FB:** power bank specified rental command
- **RS:** power bank return result report and host computer confirmation
- **FA:** Force unlock command
- **CM:** power bank rental/return rule configuration and query command

(5) Checksum:

CRC16_MODBUS of the content from the command word to the comma after data, plus the key string, represented in ASCII format.

Example: {0@CQ,0,0,5436}

Default Key: GZXJ

Note: The checksum "XXXX" below represents the CRC value to be calculated.

3. Rental and Return Process

Autonomous Rental Process (BW):

Host computer sends BW command → Station judges message ID and order ID → Station selects power bank with highest charge level above 60% → Checks return confirmation status is 1 → Unlocks power bank charging output → Ejects power bank → Station replies with BW command result

Note 1: If the message ID of the BW command sent by the host computer is not incremental, the station will ignore and discard the BW command.

Note 2: If the order number of the BW command sent by the host computer is the same as the previous one, the station will resend the previous BW reply result.

Specified Rental Process (FB):

Host computer specifies a slot and sends FB command → station judges message ID and order ID → Unlocks power bank charging output → Ejects power bank → station replies with FB command result

Note 1: If the message ID of the BW command sent by the host computer is not incremental, the station will ignore and discard the BW command.

Note 2: If the order number of the FB command sent by the host computer is the same as the previous one, the station will resend the previous FB reply result.

Note 3: For FB command, the station only checks the power bank ID, not the charge level or return status.

Normal Return Process (RS):

Return to empty slot → station actively reports RS command → Host computer determines if the power bank has ongoing orders → Replies with RS confirmation.

Supplementary Return Process (AC):

station actively reports AC information → Host computer determines if each slot's return confirmation status is "0" → Determines if the power bank has ongoing orders → Replies with RS confirmation.

Note: If the station does not receive any message from the host computer within 10 minutes, it will automatically reset and restart, and can also power-cycle the host computer (host computer power must come from this station).

4. Command Data Protocol

1. CQ: Query Command for All Slot Status

Host Computer Command:

```
{0@CQ,[Message ID],[Slot ID],[Checksum]}
```

station Reply:

```
{0@AC, [Same Command Message ID], [station ID], [Firmware Version], [Slot Count], [IOT Login Domain], [IOT Login Username], [IOT Login Password], [Slot ID]:[Power Bank Return Status]:[Power Bank ID]:[Power Bank Charge Level]:[Slot Status], .... [Checksum]}
```

Example:

Station Side	Host Computer
	{0@CQ,1543720090,0,XXXX}
{0@AC,1543720090,TH100001,TH1000_ES_V1.210420.1A,10,iot.gzxj-smart.com,admin,123456, 1:1:NULL:0:010, 2:1:PF1907010000005💯000, 3:1:BDCDB200121913:31:000, 4:1:WS19100100721:45:001, 5:1:PF19100103063:98:001, 6:1:XC1909210030:96:101, 7:1:BD19100105897:76:101, 8:1:BDCDB200126839:50:000, 9:1:CRC1909012565:99:000, 10:1:BDCDB200126992:41:000, XXXX}	

Command Field Description:

- **Message ID:** Timestamp (in seconds).

- **Slot ID:** "0" means query all slot status

Reply Field Description:

- **station ID:** Slot mainboard number or gateway board number. For example "TH100001"
- **Firmware Version:** Slot mainboard or gateway board program version, for example "TH1000_ES_V1.210420.1A"
- **Slot Count:** Maximum number of power bank slots supported by the station
- **IOT Login Domain:** Optional domain for default IOT connection (configured before factory shipment)
- **IOT Login Username:** Optional username for default IOT connection (configured before factory shipment)
- **IOT Login Password:** Optional password for default IOT connection (configured before factory shipment)
- **Slot ID:** Range 1 to 48.
- **Power Bank Return Status:** 1 indicates host computer has confirmed return information, 0 indicates host computer has not confirmed return information. (Note: BW command only operates on slots with status 1)
- **Power Bank ID:** For example "PF1907010000005", "NULL" indicates empty slot.
- **Power Bank Charge Level:** Range 0~100, for example "80" indicates current charge level 80%
- **Slot Status:** First character indicates if charging, 0 means not charging, 1 means charging; Second character indicates if power bank is in contact, 0 means in contact, 1 means not in contact; Third character indicates if lock is in place, 1 means lock is in place, 0 means lock is not in place.

2. BW: Power Bank Autonomous Rental Command

Host Computer Command:

```
{O@BW,[Message ID],[Order ID],[Checksum]}
```

station Reply:

```
{O@BW,[Message ID],[Order ID],[Result Code],[Slot ID],[Power Bank ID],[Power Bank Charge Level],[Power Bank Lock Status],[Power Bank Wire Status],[Checksum]}
```

Host Computer BW Confirmation:

```
{O@BR,[New Message ID],[Order ID],[Checksum]}
```

Example:

station station Side	Host Computer
	{0@BW,1543720173,ORD1812001,XXXX}
{0@BW,1543720173,ORD1812001,1,3,RIP0A00001,83,1,1,XXXX} {0@BW,1543720173,ORD1812001,0,0,NULL,0,0,0,XXXX}	
	{0@BR,1543720174,ORD1812001,XXXX}

Field Description:

- **Message ID:** Composed of numbers, cannot exceed 10 bytes, can use timestamp in seconds, station reply uses the same message ID as host computer command.
- **Order ID:** Composed of numbers and letters, cannot exceed 30 bytes, new operations must use different order IDs, otherwise returns previous result information.
- Result Code:

  "1" indicates successful operation; other values indicate error codes for failed operations

  - "0" indicates no available power bank for rental (e.g., all return statuses are "0", or charge level does not meet requirements)
  - "100" indicates station operation timeout
  - "110" indicates lock abnormality
- **Slot ID:** Successfully rented slot ID, range 1~12, starting from "1", "0" indicates no qualifying power bank
- **Power Bank ID/Power Bank Charge Level/Power Bank Lock Status/Power Bank Wire Status:** Information of successfully rented power bank.
- **Order ID:** For example "B0001", station caches the reply result of the most recent order number, if receiving BW command with the same order number, returns the cached result to host computer

3. FB: power bank Specified Rental Command

Host Computer Command:

```
{O@FB,[Message ID],[Order ID],[Slot ID],[Operation Parameters][Checksum]}
```

station Reply:

```
{O@FB,[Same Message ID],[Order ID],[Result Code],[Slot ID],[Power Bank ID],[Power Bank
Charge Level],[Power Bank Lock Status],[Language Type],[Checksum]}
```

Host Computer BW Confirmation:

```
{O@BR,[New Message ID],[Order ID],[Checksum]}
```

Example:

Station Side	Server Side
	{0@FB,1543720176,ORD1812001,2,XXXX}
{0@FB,1543720176,ORD1812001,1,2,RIP1A00001,85,1,1,XXXX} {0@FB,1543720176,ORD1812001,0,2,NULL,0,0,0,XXXX}	
	{0@BR,1543720177,ORD1812001,2,XXXX}

Field Description:

- **Message ID:** Composed of numbers, cannot exceed 10 bytes, can use timestamp in seconds, station reply uses the same message ID as host computer command.
- **Order ID:** Composed of numbers and letters, cannot exceed 30 bytes, new operations must use different order IDs, otherwise returns previous result information.
- **Slot ID:** Specified rental slot ID, starting from "1".
- **Operation Parameters:** Numeric type, controls language type (ODM915 project specific)
- Result Code:

  "1" indicates successful operation; other values indicate error codes for failed operations:

  - "0" indicates no available power bank for rental (e.g., the slot cannot identify correct power bank ID)
  - "100" indicates station operation timeout
  - "110" indicates lock abnormality
- **Power Bank ID/Power Bank Charge Level/Power Bank Lock Status/Power Bank Wire Status:** Status of successfully rented power bank, or reason for failed rental.
- **Order ID:** For example "B0001", station caches the reply result of the most recent order number, if receiving FB command with the same order number, returns the cached result to host computer
- **Language Type:** Current language type value

4. RS: power bank Return Report

station Initiated:

```
{O@RS,[Message ID],[Result Code],[Slot ID],[Power Bank ID],[Power Bank Charge Level],
[Power Bank Lock Status],[Power Bank Wire Status][Checksum]}
```

Host Computer Reply:

```
{O@RS,[Message ID],[Slot ID],[Confirmation Code],[Checksum]}
```

Example:

Station Side	Host Computer
{0@RS,1543720173,1,2,RIP1A00002,80,1,1,XXXX} {0@RS,1543720173,1,3,RIP1A00003,89,0,1,XXXX}	
	{0@RS,1543720173,3,1,XXXX}

Field Description:

- **Message ID:** Uses the most recent message ID sent by the host computer.
- **Result Code:** "1" indicates successful return, "0" indicates failed return, error codes can be extended.
- **Slot ID:** Slot ID for reporting return result, range 1~12, starting from "1".
- **Power Bank ID/Power Bank Charge Level/Power Bank Lock Status/Power Bank Wire Status:** Status of successfully returned power bank, or reason for failed return.
- **Confirmation Code:** "1" indicates normal backend confirmation, "0" indicates abnormal backend confirmation.

5. FA: Force Unlock Command

Host Computer Command:

```
{0@FA,[Message ID],[Slot Number],[Checksum]}
```

station Reply:

```
{0@FA,[Same Message ID],[Result Code],[Checksum]}
```

Example:

Station Side	Host Computer
	{0@FA,1543720173,0,XXXX}
{0@FA,1543720173,1,XXXX}	

Field Description:

- **Slot Number:** "0" indicates ejecting all slots, greater than 0 indicates force ejecting the corresponding slot.
- **Result Code:** "1" accepts operation, "0" rejects operation

6. CM: power bank Rental/Return Rule Configuration and Query Command

Host Computer Command:

```
{0@CM,[Message ID],[Minimum Rentable Charge Level],[Rental Operation Code],[Return Operation Code],[Lock Exception Operation Code],[Wire Exception Operation Code],[Power Bank ID Exception Operation Code],[Checksum]}
```

station Reply:

```
{0@CM,[Message ID],[Minimum Rentable Charge Level],[Rental Operation Code],[Return Operation Code],[Lock Exception Operation Code],[Wire Exception Operation Code],[Power Bank ID Exception Operation Code],[Checksum]}
```

Example:

station station Side	Host Computer
	{0@CM,1543720095,80,1,1,1,1,1,XXXX} {0@CM,1543720095,0,XXXX}
{0@CM,1543720095,80,1,1,1,1,1,XXXX}	

Field Description:

- **Minimum Rentable Charge Level:** Range 0~100, for example "80", indicates power banks with charge level above 80% can be rented, default value is 80
- **Rental Operation Code:** "1" indicates authorization is required during rental, otherwise cannot charge mobile phones; "0" indicates no authorization required during rental, default value is "1"
- **Return Operation Code:** "1" indicates authorization must be requested during return, otherwise return is not provided; "0" indicates no authorization required during return, station controls return autonomously, default value is "1"
- **Lock Exception Operation Code:** "1" indicates lock exception prohibits rental and return; "0" indicates this condition is not judged, default value is "1"
- **Wire Exception Operation Code:** "1" indicates wire exception prohibits rental and return; "0" indicates this condition is not judged, default value is "1"
