508

ABAT100 Series Battery Online Monitoring System

installation and operation manual V1.1

Acrel Co., Ltd.

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Declare

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1 Overview

Acrel ABAT100 series battery online monitoring system can provide battery operation information such as voltage, internal resistance and internal temperature, including SOC and SOH, and can provide early warning and battery equalization for failed batteries to guarantee battery pack backup time and extend battery pack life. The system has monitoring functions, and is easy to install, maintain and access. The system mainly consists of ABAT100-S single battery monitoring module, ABAT100-C group battery monitoring module, ABAT100-HS collector module and touch screen, etc. The alarm and real-time data can be queried and parameters can be set through the touch screen, and the monitoring platform can be selected to realize networked centralized management.

2 Product Module

Model	Function Description
ABAT100-HS	DC24V input, one to manage a group of batteries, up to 120 batteries in a group.
ABAT100-S-02	Monitor one 2V battery, monitor battery voltage, internal resistance and negative terminal temperature.
ABAT100-S-06	Monitor one 6V battery, monitor battery voltage, internal resistance and negative terminal temperature.
ABAT100-S-12	Monitor one 12V battery, monitoring battery voltage, internal resistance and negative terminal temperature.
ABAT100-C	Monitor one charge/discharge current with an ambient temperature with a maximum current range of 1000A.

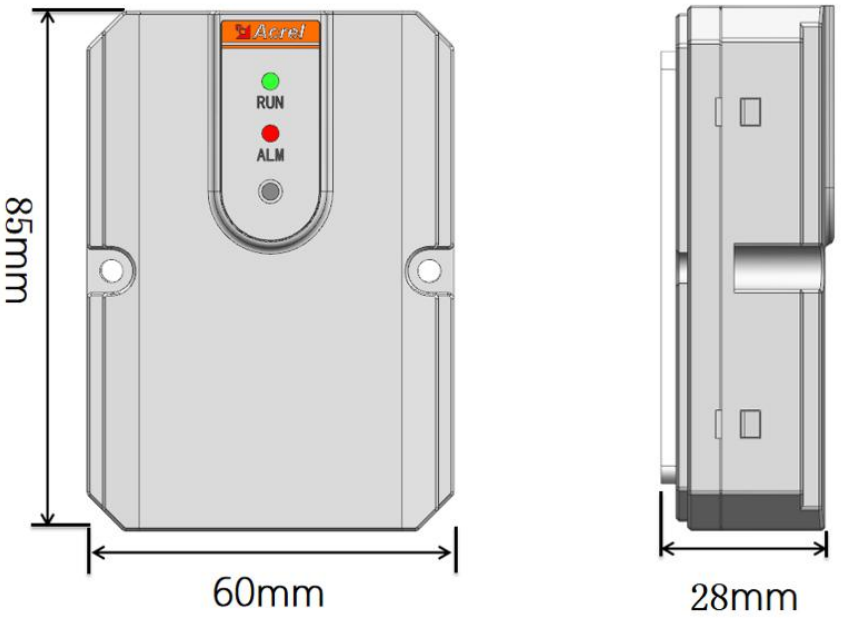


Fig.1 Dimensions of ABAT100 series module

3 Product Description

3.1 ABAT100-HS Collector Module

Introduction

The ABAT100-HS collector module is used as a management module for a group of battery packs to read the battery monitoring data from the front-end single battery monitoring sub-module and analyze and process the data, which can estimate the remaining capacity of each battery and the whole group of batteries. The operation parameters can be set directly by matching with the touch screen, and the collected data can be viewed directly. The collector module will automatically save the key battery data periodically and can be sent to the third party monitoring system through RS485 port, supporting MODBUS protocol. One collector module manages one group of batteries, and the maximum number of manageable modules is 120.

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Network solution 1: Touch screen serial port acquisition network solution

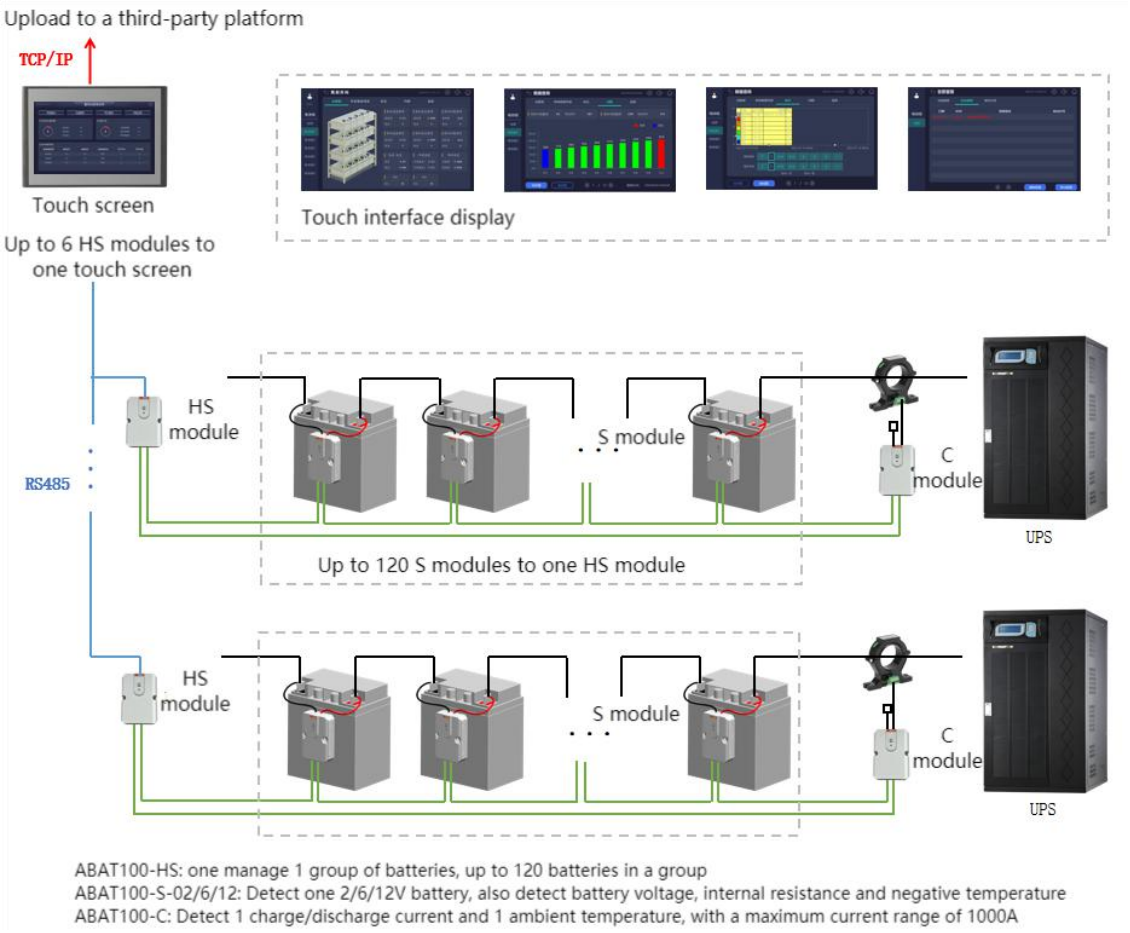


Fig.2 Network plan 1

Network solution 2: AcrelEMS, EIOT platform network solution

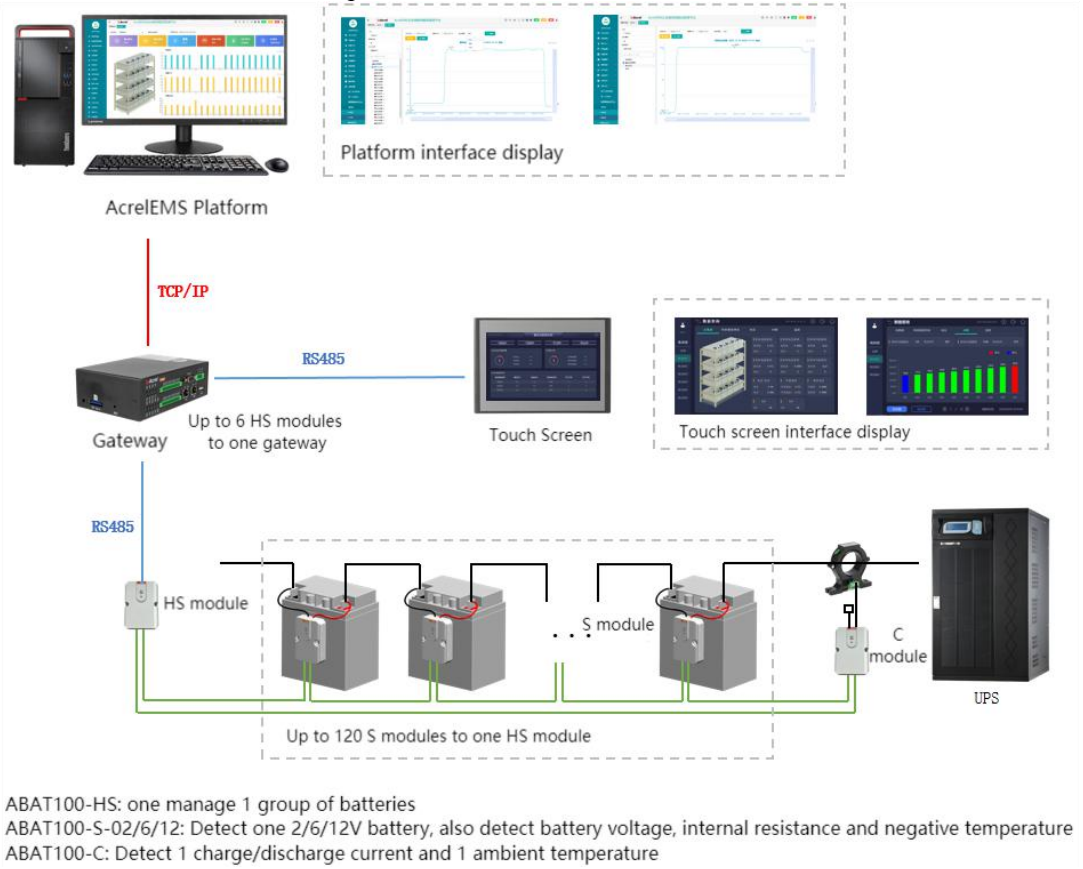


Fig.3 Network plan 2

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Function	Description
Display	Real-time data display, graphs, histogram display
Historical Data	Query and export of equipment operation history, charging and discharging records and monitoring events
Parameter Configuration	Provide basic information management functions
Communication protocol	MODBUS-RTU
Alarm mode	Local audible and visual alarm, indicator alarm, SMS alarm, etc.
Capacity estimation	Group batteries SOC, SOH estimation; single battery SOC, SOH estimation
Regular inspection	Intelligent judgment of the current state and automatic issuance of test commands
Indicator light	Red and green LED lights, green light as the power light, red light as the indicator light



Fig.4 ABAT100-HS module

Technical parameters	Description
Working Environment	Operating temperature: -10℃～50℃ Relative humidity: 5%~95% Atmospheric pressure intensity: 80~110kPa
Management Capability	One collector can monitor a maximum of total 120 batteries
Alarm Type	Group voltage overcharge/discharge, single voltage overcharge/discharge, current overcharge/discharge, high internal resistance of single unit, abnormal communication, etc.
Power Supply	DC24V
Protection	With overvoltage and short circuit protection
Communication Interface	With RS485 communication port, support MODBUS/RTU
Insulation withstand voltage	2000VAC
Installation method	Tie-down mounting or adhesive mounting
Weight	90g

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3.2 ABAT100-S Single Battery Monitoring Module

Introduction

ABAT100-S single battery monitoring module (S module) can be embedded into existing monitoring system to achieve online monitoring of each backup battery voltage, internal resistance and negative battery temperature, in accordance with ANSI/TIA-942 standard requirements. The monitoring system controls and reads data by sending MODBUS commands to the S-module, and performs internal resistance testing, each S-module has a settable address. S-modules are extremely simple and easy to install and wire, and can be directly attached to the battery with detachable connecting wires, which does not affect the battery operation during construction.

Function	Description
Online monitoring	Online monitoring 24 hours a day, one battery per module, monitoring voltage, internal resistance and negative terminal temperature
High accuracy measurement	Internal resistance measurement error as low as 1%
Battery internal resistance test	Automatic periodic measurement of the internal resistance of each battery controlled by the collector
Low power design	Manual entry into low power mode, S-module draws current from the battery down to 0.5mA
Anti-jamming design	High anti-interference design, can block the ripple interference of high power high frequency UPS
Communication protocol	MODBUS-RTU protocol
Installation method	Tie-down mounting or adhesive mounting
Indicator light	Red and green LED lights, green light as the power light, red light as the indicator light



Fig. 5 ABAT100-S module

Technical parameters	Description		
Working Environment	Operating temperature: -10℃～50℃ Relative humidity: 5%~95% Atmospheric pressure intensity: 80~110kPa		
Monitoring Capability	One S-module monitors one battery		
Monitoring Scope	2V, 6V, 12V battery with capacity less than 3000AH		
Measurement range and accuracy	Measurement content	Scope	Accuracy
	Single Voltage	2V, 6V, 12V	±0.1%
	Single internal resistance	50～65535uΩ	(Resolution) 1uΩ

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	Negative temperature	-5℃～+105℃	±1℃
Power requirements	Directly from the monitored battery, 2V module normal operation of the absorption current of 10mA, the maximum is not more than 13mA, 6V, 12V module normal operation of the absorption current of 5mA, the maximum is not more than 7mA, different modules absorption current consistency is very high		
Protection	Measuring circuit and power circuit with two levels of protection, with reverse connection protection and opto-isolation		
Communication Interface	UART port, support MODBUS protocol		
Insulation withstand voltage	2000VAC		
Weight	90g		

3.3 ABAT100-C Module

Introduction

The ABAT100-C battery monitoring module (C module) can be embedded into existing monitoring systems for online monitoring of battery charge and discharge current and ambient temperature. The monitoring system controls and reads data by sending MODBUS commands to the C-module, and each C-module has a settable address. the C-module is extremely simple and easy to install and wire, and can be directly attached to the battery with removable connection cable, which does not affect the battery operation during construction.

Function	Description
High stability	Reliable and stable long-term operation
Anti-jamming design	High anti-interference design, can block the ripple interference of high power high frequency UPS
Communication protocol	MODBUS-RTU Protocol
Installation method	Tie-down mounting or adhesive mounting
Indicator light	Red and green LED lights, green light as the power light, red light as the indicator light.



Fig.6 ABAT100-C module

Technical parameters	Description
Working Environment	Operating temperature: -10℃～50℃ Relative humidity: 5%~95% Atmospheric pressure intensity: 80~110kPa

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Monitoring Capability	One C-module monitors the charge and discharge current of a group of batteries against the ambient temperature		
Monitoring Scope	2V, 6V, 12V battery pack		
Measurement range and accuracy	Measurement content	Scope	Accuracy
	Charging and discharging current	0~1000A	±1%
	Ambient temperature	-5℃～+105℃	±1°C
Power requirements	DC24V, 1W		
Protection	Measurement circuit and power circuit with two levels of protection		
Communication Interface	UART port, support MODBUS protocol		
Insulation withstand voltage	2000VAC		
Weight	90g		

3.4 Hall Sensor

Introduction

AHKC-EKC series open type Hall current sensor powered by ABAT100-C module is a new generation of current sensor developed by applying Hall effect principle, which can measure DC, AC, pulse and various irregular waveform currents under galvanic isolation conditions.



Fig.7 AHKC-EKC series open type Hall current sensor

Parameters	Indicators
Rated input current	0~(500-1500)A
Rated output voltage	±5V
Accuracy class	1.0
Supply voltage	DC±15V (Allowed fluctuation ±20%)
Zero point out-of-tune voltage	±20mV
Out-of-tune voltage drift	≤±2.0mV/°C
Linearity	≤0.2%FS
Response time	≤5us
Bandwidth	0~20kHz
Insulation voltage	2.5kV/50Hz/1min
Operating temperature	-40℃~85℃

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Storage temperature	-40℃~85℃
Power consumption	≤0.5W

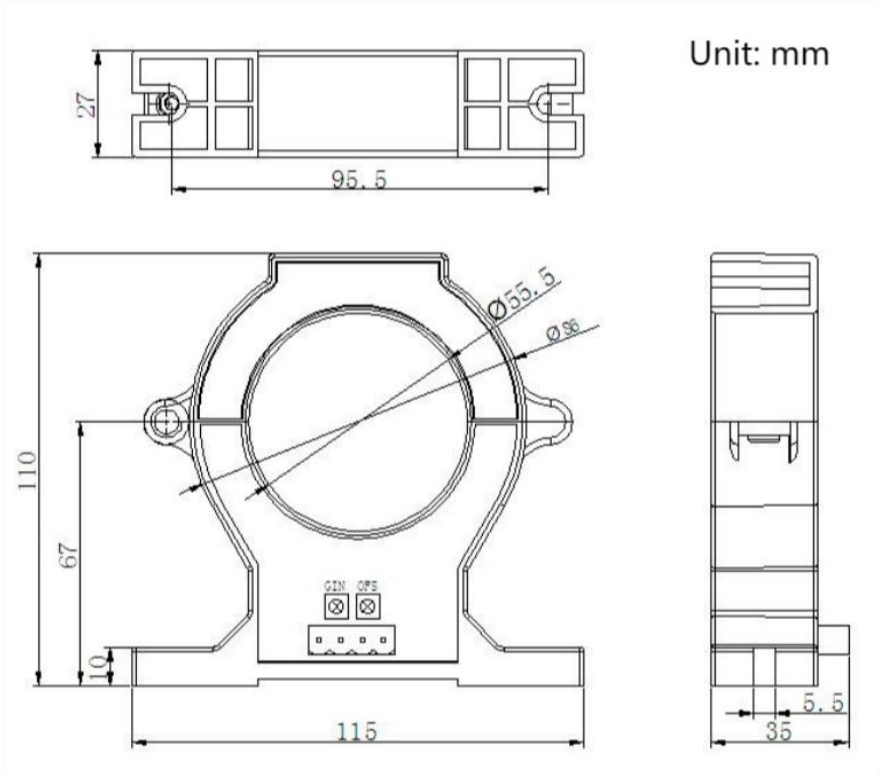


Fig.8 Dimensions of AHKC-EKC series open type Hall current sensor

3.5 Switching Power Supply

Introduction

The KDYA-DG1502-12K switching power supply is used to power the ATP010KT touch panel and ABAT100-HS module.



Fig.9 KDYA-DG1502-12K switching power supply

Name		KDYA-DG1502-12K
Input	Voltage and current	AC 85 - 264V or DC 100 - 230V 0.3A / 230VAC
	Frequency	47-63Hz or DC
	Gush	28A / 230VAC / 20ms Initial power-on time
	Leakage current to	--

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	ground	
	Typical efficiency value	80%
Output	Voltage	±12.0V ±1%
	Current	0 - 0.6A
	Ripple noise	≤ 45mV
	Voltage regulation	--
	Temperature stability	300ppm/°C -Vrate
	Adjustment rate	< 0.5%
	Rated power	15W
	Overshoot	Overshoot <5% when the power is on or off, and <2% for every 30% change in load
	Response	Response time is 1ms for every 30% change in load with a change rate of 1A/us
Time Response		300ms/20ms/16ms start, build, hold
Protection	Over-voltage protection	16V
	Overload	When the output power exceeds 18--30W, the output voltage will start to drop, and then enter into foldback protection when the load is heavier.
	Short Circuit	Output is foldback protection
	Overheat protection	Built-in temperature protection on the chip
Environment	Work	-25--+70℃, 10--90%RH (no condensation), full load use. Temperature higher than 70℃ reduced use
	Storage	-35--+85℃, 5--95%RH (no condensation)
	Vibrations	10--500Hz, 2G 10 minutes/1 cycle, along X, Y, Z axis, each axis direction for a total of 60 minutes
Security	Insulation resistance	Input to output ≥ 50MΩ (500VDC)
	Pressure resistance	Input to output: AC3.0KV/10mA/1min
	Standard	Comply with the relevant provisions of UL508, GB4943, TUV, EN60950 and other standards
EMC	EMS	Level 4
	EMI	Class B
MTBF		100 000 hours
Dimension		72×63×27
Weight		90g
Cautions		1. The test is in the specified conditions, the input voltage is the rated voltage, the test environment is conventional laboratory conditions.
		2. Ripple and noise are measured directly at the 20MHz bandwidth terminal.
		3. Considering that the power supply may be installed on the final equipment, the equipment shall comply with EMC related regulations.

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Dimensional drawing

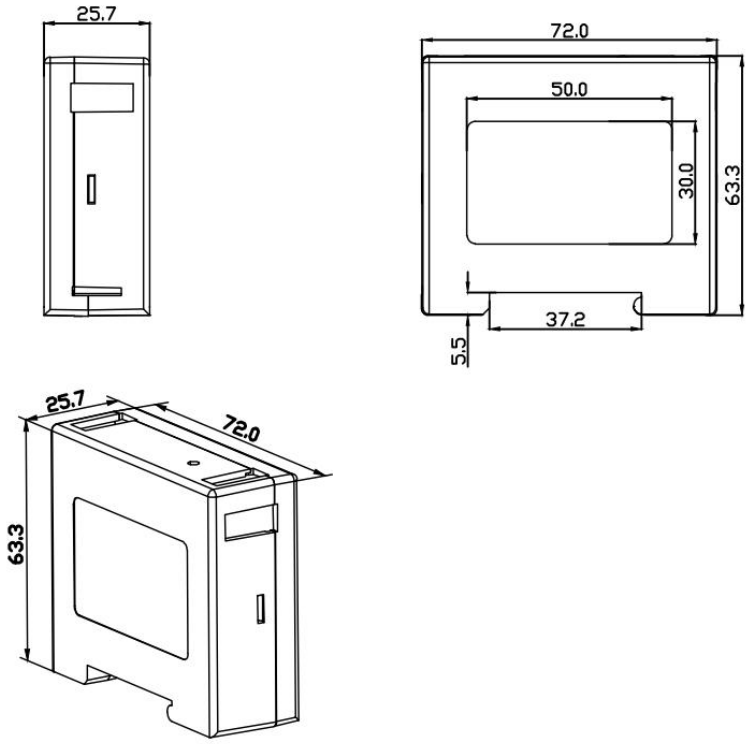


Fig.10 Dimensions of KDYA-DG1502-12K switching power supply

4 Communication Description

4.1 Overview

The ABAT100-S single battery monitoring module and the ABAT100-C group battery monitoring module are only used for TTL communication with the ABAT100-HS collector module using the Modbus-RTU protocol: the default parameters are listed in the following table:

Communication method	Baud rate	Data bits	Check digit
TTL	9600	8	N

The ABAT100-HS collector module communicates with the host PC with RS485, using the Modbus-RTU protocol: the default parameters are listed in the table below:

Communication method	Baud rate	Data bits	Check digit
485	19200	8	N

Note: n means no parity bit; error detection: CRC16 (cyclic redundancy parity)

4.2 Protocol

The protocol is the standard Modbus-RTU protocol, which reads as follows

4.2.1 Data frame format

Address	Function	Data	Calibration
8-Bits	8-Bits	NX8-Bits	16-Bits

4.2.2 Address domain

The address domain is at the beginning of the frame and consists of one byte (8-Bits, 8-bit binary code), decimal 0 to 255, in our system only 1 to 247 are used, other addresses are reserved. These bits mark the address of the user-specified terminal device that will receive data from the host to which it is connected. The address of each terminal device on the same bus must be unique, and only the terminal addressed will respond to a query containing that address. When a terminal sends back a response, the slave address data in the response tells the host which terminal is communicating with it.

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4.2.3 Function domain

The function domain codes tell the terminal being addressed what function to perform. The following table lists the function codes used by this family of instruments, along with their meaning and function.

Code (hexadecimal)	Meaning	Behavior
03H	Read Holding Register	Get the current binary value in one or more holding registers
10H	Preset multi register	Load the specific binary value into a series of holding registers

4.2.4 Data domain

The data domain contains data required by the terminal to perform a specific function or data captured by the terminal in response to a query. These data may be numeric values, parametric addresses, or setting values.

For example, the function domain tells the terminal to read a register, while the data domain needs to specify which register to start from and how many data to read, with embedded addresses and data varying by type and slave.

4.2.5 Error check domain

The domain uses CRC16 cyclic redundancy checks to allow hosts and terminals to check for errors during transmission. Sometimes due to electrical noise and other interferences, a set of data may change on the line when it is transmitted from one device to another. Error checks can ensure that the host or slave does not respond to those changed data, which improves the security, reliability and efficiency of the system.

4.2.6 Methods of error checking

The error check domain occupies two bytes and contains a 16-bit binary value. the CRC value is calculated by the transmitting device and then appended to the data frame. the receiving device recalculates the CRC value when accepting the data and then compares it with the value in the received CRC domain. if the two values are not equal, an error has occurred.

In CRC operation, first a 16-bit register is preset to all 1s, then 8 bits of each byte in the data frame are successively operated with the current value of the register, only the 8 data bits of each byte are involved in generating the CRC, the start and stop bits and the parity bits that may be used do not affect the CRC. 8 bits of each byte are iso-ored with the contents of the register when generating the CRC. Then the result is shifted to the lower bit, the higher bit is supplemented with "0", the lowest bit (LSB) is shifted out and detected, if it is 1, the register performs an iso-or operation with a preset fixed value (0A001H), if the lowest bit is 0, no processing is done. CRC generation flow:

1) Preset a 16-bit register as 0FFFFH (all 1s), called CRC register.

The 8 bits of the first byte in the CRC register are iso-or operated with the low byte in the CRC register, and the result is stored back in the CRC register.

2) The 8 bits of the first byte in the data frame are iso-or operated with the low byte in the CRC register, and the result is stored back in the CRC register.

3) Shift the CRC register one bit to the right, fill the highest bit with 0 and shift the lowest bit out and detect.

4) If the lowest shift out is 0: repeat step 3 (next shift); if the lowest shift out is 1: connect the CRC register with a preset fixed

The fixed value (0A001H) is used to perform the different or operation.

5) Repeat step 3 and step 4 until 8 shifts. This finishes processing a complete 8 bits.

6) Repeat step 2 to step 5 to process the next 8 bits until all bytes are processed.

7) The final CRC register value is the value of CRC. There is also a method to calculate CRC using table lookup, its main feature is fast calculation, but the table requires a large storage space, the method is not repeated here, please consult the relevant information.

4.3 Communication Address Table

4.3.1 HS module parameter address

Overview

HS module parameter address mainly contains 4 parts, for communication parameter address, status parameter address, group parameter threshold address, single data address, using MODBUS-RTU protocol, supporting 0x03, 0x06, 0x10 commands, where up to 127 registers are continuously read and up to 20 registers are continuously written.

4.3.1.1 Communication parameter addresses

Serial number	Address	Variables	Remarks	Length (Bytes)	Description	Type
0	0000H	Reserved				
1	0001H	Reserved				
2	0002H	Address	R/W	2	Default 1	U16
3	0003H	Downstream TTL communication Baud rate	R/W	2	0 :4800 1 :9600 2 :19200	U16

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					Default 9600	
4	0004H	TTL parity stop bit	R	2	1 Stop bit No calibration	U16
5	0005H	485 communication baud rate	R/W	2	0:1200 1:2400 2:4800 3:9600 4:19200 5:38400 19200	U16
6	0006H	485 check stop bit	R/W	2	High 8 bits 0:None 1:Even 2:Odd Lower 8 bits 0:1 stop bit 1:2 stop bits Default None, 1 stop bit	U16
7~19	0007H~0013H	Reserved				
20	0014H	Types of single modules	R/W	2	2V 6V 12V	U16
21	0015H	Number of groups	R	2	Default value 1	U16
22	0016H	Group 1 Number of single modules	R/W	2	1~120	
23	0017H	Group 1 single battery capacity	R/W	2	Unit:AH	U16
24~34	0018H~0022H	Reserved				
35	0023H	Automatic testing of internal resistance cycle	R/W	2	(1~30)	U16
36	0024H	Automatic testing of internal resistance time	R/W	2	High 8:Time Lower 8 bits:minutes	U16

4.3.1.2 Status parameter addresses

Serial number	Address	Variables	Remarks	Length (Bytes)	Description	Type
100	0064H	Reserved				
101	0065H	Initialization	R/W	2	High Byte:0xF0 Initialization group parameter threshold Low byte:0xF0 Clear event logs	U16
102	0066H	Device Reset	R/W	2	0xf0f0 Reset HS module	U16
103	0067H	Year/month	R/W	2		U16
104	0068H	Day/Hour	R/W	2		U16
105	0069H	Minutes/second	R/W	2		U16
106	006AH	Low power consumption	R/W	2	0xf1f1: Turn on whole group low power 0xf0f0: Turn off the whole group of low power consumption	U16
107	006BH	Automatic testing of internal resistance	R/W	2	0xf0f0: Turn on all tests 0xF1mm: Turn on the current group of 0xmm size battery test	U16
108	006CH	Equipment working status	R/W	2	2:Working state 3:Internal resistance test	U16

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109	006DH	Battery Status	R/W	2	0:Floating charge 1:Discharge 2:Charging	U16
110~111	006EH~006FH	Reserved				
112	0070H	Manual equalization function activated	R/W	2	0xf0f0: Whole group balance	U16
113	0071H	Manual equalization Single number	R/W	2	0xmm: Balanced 0xmm monoblock	U16
114	0072H	Longitudinal internal resistance reference value reset mark	R/W	2	0xf0f0: Setting the current value of the internal resistance of all batteries to the reference value; 0xmm: Set the current internal resistance of the 0xmm number as the reference for that single module; 0x0101: The average value of the current internal resistance of all batteries is used as the reference for the whole group.	U16
115	0073H	Reserved				
116	0074H	Modify the current direction flag/Hall calibration zero	R/W	2	0x6400: Enabling Hall zero drift calibration; 0x6401: Turn off Hall zero drift calibration; 0xf0f0: Change the direction of the current.	U16

4.3.1.3 Group parameter threshold address

Serial number	Address	Variables	Remarks	Length (Bytes)	Description	Type
1000	3E8H	Single voltage overcharge alarm value	R/W	2	Unit: mV	U16
1001	3E9H	Reserved				
1002	3EAH	Single voltage over discharge alarm value	R/W	2	Unit: mV	U16
1003	3EBH	Reserved				
1004	3ECH	Single floating charge voltage too high alarm value	R/W	2	Unit: mV	U16
1005	3EDH	Reserved				
1006	3EEH	floating charge voltage too low alarm value	R/W	2	Unit: mV	U16
1007	3EFH	Reserved				
1008	3F0H	Uneven voltage alarm value for a single unit	R/W	2	Unit: mV	U16
1009	3F1H	Reserved				
1010	3F2H	Single voltage extreme difference value alarm value	R/W	2	Unit: mV	U16
1011	3F3H	Reserved				
1012	3F4H	Overall voltage overcharge alarm value	R/W	2	Unit: 0.1V	U16
1013	3F5H	Reserved				

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1014	3F6H	Overall voltage overdischarge alarm value	R/W	2	Unit: 0.1V	U16
1015	3F7H	Reserved				
1016	3F8H	Overall floating charge voltage over protection alarm value	R/W	2	Unit: 0.1V	U16
1017	3F9H	Reserved				
1018	3FAH	Overall low float voltage alarm value	R/W	2	Unit: 0.1V	U16
1019	3FBH	Reserved				
1020	3FCH	Charging overcurrent alarm value	R/W	2	Unit: 0.1A Default 536	U16
1021	3FDH	Reserved				
1022	3FEH	Discharge overcurrent alarm value	R/W	2	Unit: 0.1A Default 500	U16
1023	3FFH	Reserved				
1024	400H	Ambient high temperature alarm value	R/W	2	Unit: 0.1℃ Default 500	S16
1025	401H	Reserved				
1026	402H	Ambient low temperature alarm value	R/W	2	Unit: 0.1℃ Default 0	S16
1027	403H	Reserved				
1028	404H					
1029	405H					
1030	406H	Battery high temperature alarm value	R/W	2	Unit: 0.1℃ Default 500	S16
1031	407H	Reserved				
1032	408H	Battery low temperature alarm value	R/W	2	Unit: 0.1℃ Default 0	S16
1033	409H	Reserved				
1034	40AH	Uneven battery temperature alarm value	R/W	2	Unit: 0.1℃ Default 50	S16
1035	40BH	Reserved				
1036	40CH	Excessive internal resistance level 2 alarm factor	R/W	2	Unit 0.1% Default 1500	U16
1037	40DH	Excessive internal resistance level 1 alarm factor	R/W	2	Unit 0.1% Default 1300	U16
1038	40EH	Uneven internal resistance alarm factor	R/W	2	Unit 0.1% Default 300	U16
1039	40FH	Reserved				
1040	410H	Small internal resistance alarm factor	R/W	2	Unit 0.1% Default 50	U16
1041	411H	Reserved				
1042	412H					
1043	413H					
1044	414H					
1045	415H					
1046	416H					
1047	417H					
1048	418H	SOC low alarm value	R/W	2	Unit 0.1% Default 300	U16
1049	419H	Reserved				
1050	41AH	SOH low alarm value	R/W	2	Unit 0.1% Default 400	U16
1051	41BH	Reserved				
1052	41CH	Internal resistance reference value 1#	R/W	2	Unit:μΩ Default 0	U16
1053	41DH	Internal resistance reference value 2#	R/W	2	Unit:μΩ Default 0	U16
1054	41EH	Internal resistance reference value	R/W	2	Unit:μΩ	U16

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		3#			Default 0	
.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....
1171	493H	Internal resistance reference value 120#	R/W	2	Unit:μΩ Default 0	U16

4.3.1.4 Single data address

Category	Serial number	Address	Variables	Remarks	Length (Bytes)	Description	Type
Single Voltage Data	10001	2711H	Voltage 1#	R	2	Unit mV	U16
	10002	2712H	Voltage 2#	R	2		U16
	10003	2713H	Voltage 3#	R	2		U16
	.....	.....	.....	.....	.....		.....
	10120	2788H	Voltage 120#	R	2		U16
	10121	2789H	Voltage update time: year/month	R	2		U16
	10122	278AH	Day/Hour	R	2		U16
	10123	278BH	Minutes/second	R	2		U16
	10124~ 10130	.....					
Single internal resistance data	10131	2793H	Internal resistance 1#	R	2	Unit μΩ	U16
	10132	2794H	Internal resistance 2#	R	2		U16
	10133	2795H	Internal resistance 3#	R	2		U16
	.....	.....	.....	.....	.....		.....
	10250	280AH	Internal resistance 120#	R	2		U16
	10251	280BH	Internal resistance update time: year/month	R	2		U16
	10252	280CH	Day/Hour	R	2		U16
	10253	280DH	Minutes/second	R	2		U16
	10254~ 10260	.....					
Single temperature data	10261	2815H	Single temperature 1#	R	2	Unit 0.1℃	S16
	10262	2816H	Single temperature 2#	R	2		S16
	10263	2817H	Single temperature 3#	R	2		S16
	.....	.....	.....	.....	.....		.....
	10380	288CH	Single temperature 120#	R	2		S16
	10381	288DH	Temperature update time: year/month	R	2		U16
	10382	288EH	Day/Hour	R	2		U16
	10383	288FH	Minutes/second	R	2		U16
	10384~ 10390	.....					
Single alarm fault 1	10391	2897H	Battery alarm status 1-1#	R	2	Each bit represents a state that A value of 0 indicates normal and a value of 1 indicates an alarm. Starting from B0, the sequence is expressed as Single voltage alarm (0), Single voltage 0:high/1:low (1), Single voltage alarm level (2-3), the Single internal resistance alarm (4), Single internal resistance 0:high/1:low (5), Single internal resistance alarm level (6-7),	U16
	10392	2898H	Battery alarm status 1-2#	R	2		U16
	10393	2899H	Battery alarm status 1-3#	R	2		U16
	.....	.....	.....	.....	.....		.....
	10510	290EH	Battery alarm status 1-120#	R	2		U16

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						Single temperature alarm (8), Single temperature 0:high/1:low (9), Single temperature alarm level (10-11), the Reservation (12-15)	
Single alarm failure 2	10511	290FH	Battery alarm status 2-1#	R	2	Each bit represents a state that A value of 0 indicates normal and a value of 1 indicates protection. Starting from B0, the sequence is expressed as Uneven voltage of Single (0), Uneven temperature of the Single (1), the Uneven internal resistance of the Single (2), the High float charging voltage (3), Low floating charge pressure (4), Battery open circuit (5), Reservation (6), Battery ground alarm (7), Retention (8-15)	U16
	10512	2910H	Battery alarm status 2-2#	R	2		U16
	10513	2911H	Battery alarm status 2-3#	R	2		U16
	.....	.....	.....	.....	.....		.....
	10630	2986H	Battery alarm status 2-120#	R	2		U16
Single Status	10631	2987H	Equipment operation status 1#	R	2	Each bit represents a state that A value of 0 indicates normal and a value of 1 indicates abnormal. From B0 onwards, it is expressed as Single voltage (0), Battery temperature(1), Reservation (2), Single internal resistance test (3), Internal resistance test battery voltage abnormality (4), Internal resistance test discharge current is abnormal (5), S module communication abnormality (6), Retention (7-15)	U16
	10632	2988H	Equipment operation status 2#	R	2		U16
	10633	2989H	Equipment operation status 3#	R	2		U16
	.....	.....	.....	.....	.....		.....
	10750	29FEH	Equipment operating status 120#	R	2		U16
Group measure ment data	10751	29FFH	Group pressure	R	2	Unit:0.1V	U16
	10752	2A00H	External group pressure	R	2	Unit: 0.1V Valid for SV module	U16
	10753	2A01H	Charging and discharging current	R	2	Unit:0.1A Charging is negative Discharge is positive	S16
	10754	2A02H	Floating charge flow	R	2	Unit:0.001A	U16
	10755	2A03H	Ambient temperature1	R	2	Unit:0.1℃	S16
	10756	2A04H	Ambient temperature 2	R	2	Unit:0.1℃ Valid for TR module	S16
	10757	2A05H	Maximum voltage	R	2		U16

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			battery number				
	10758	2A06H	Maximum battery voltage value	R	2	Unit:mV	U16
	10759	2A07H	Minimum voltage battery number	R	2		U16
	10760	2A08H	Minimum battery voltage value	R	2	Unit:mV	U16
	10761	2A09H	Average battery voltage per battery	R	2	Unit:mV	U16
	10762	2A0AH	Average difference of battery voltage	R	2	Unit:mV	U16
	10763	2A0BH	Battery voltage polarity value	R	2	Unit:mV	U16
	10764	2A0CH	Maximum internal resistance battery number	R	2		U16
	10765	2A0DH	Maximum internal battery resistance value	R	2	Unit:μΩ	U16
	10766	2A0EH	Minimum internal resistance battery number	R	2		U16
	10767	2A0FH	Minimum battery internal resistance value	R	2	Unit:μΩ	U16
	10768	2A10H	Average battery internal resistance value	R	2	Unit:μΩ	U16
	10769	2A11H	Maximum temperature battery number	R	2		U16
	10770	2A12H	Maximum battery temperature value	R	2	Unit:℃	S16
	10771	2A13H	Minimum temperature battery number	R	2		U16
	10772	2A14H	Minimum battery temperature value	R	2	Unit:℃	S16
	10773	2A15H	Average battery temperature value	R	2	Unit:℃	S16
	10774	2A16H	Group SOC	R	2	Unit:0.1%	U16
	10775	2A17H	Group SOH	R	2	Unit:0.1%	U16
	10776	2A18H	Reserved				
	10777	2A19H	Reserved				
	10778	2A1AH	Insulation positive resistance	R	2	Unit:KΩ	U16
	10779	2A1BH	Insulation negative resistance	R	2	Unit:KΩ	U16
	10780	2A1CH	Reserved				
	10781	2A1DH	Reserved				
	10782	2A1EH	Maximum rate of change of internal resistance battery number	R	2		U16
	10783	2A1FH	Maximum rate of change of internal resistance value	R	2	Unit:0.01%	U16
	10784~ 10790	2A20H~ 2A26H	Reserved				
Single internal resistance change rate data	10791	2A27H	Single internal resistance change rate 1#	R	2	Unit:0.01%	U16
	10792	2A28H	Single internal resistance change rate 2#	R	2	Unit:0.01%	U16

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	10793	2A29H	Single internal resistance change rate 3#	R	2	Unit:0.01%	U16
	.....	.....	.....	.....	.....	.....	.....
	10910	2A9EH	Single internal resistance change rate 120#	R	2	Unit:0.01%	U16
Group 1 alarm status	10911	2A9FH	Alarm 1	R	2	Two registers are one unit, each representing an alarm, a 1 means that this level of alarm is defined, and a 0 vice versa. Starting from B0, the sequence is expressed as Group pressure high (0), Group pressure is low (1), High charging current (2), High discharge current (3), High ambient temperature (4), Low ambient temperature (5), Floating charge group pressure high (6), Floating charge group depression (7), Excessive differential pressure (8), Low SOC (9), SOH is low (10), the Battery thermal runaway (11), Reserved (12-15)	U16
	10912	2AA0H	Alarm 2	R	2	High Single voltage (0), Single voltage is low (1), High Single internal resistance (2), Low Single internal resistance (3), High battery temperature (4), Low battery temperature (5), Uneven voltage (6), Uneven temperature of the Single (7), the Uneven internal resistance of the Single (8), the High float charging voltage (9), Floating charge depression (10), Reservation (11-15)	U16
	10913	2AA1H	Alarm 3	R	2	SV group voltage module communication (0), C charging and discharging current	U16

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						module communication (1), TR floating charge flow module communication (2), Ambient temperature module communication (3), Retention (4-9) Insulation module communication (10), Retention (11-12), Internal resistance test floating charge current abnormality (13), Retention (14-15)	
	10914	2AA2H	Alarm 4	R	2	Single voltage (0), Battery temperature(1), Reservation (2), Single internal resistance test (3), Retention (4-5), S module communication abnormality (6), Retention (7-15)	U16
	10915~ 11000	2AA3H ~ 2AF8H	Reserved				
Single SOC data	11001	2AF9H	SOC1# Single SOC1#	R	2	Unit:0.1%	U16
	11002	2AFAH	SOC2# Single SOC2#	R	2		U16
	11003	2AFBH	SOC3# Single SOC3#	R	2		U16
	.....	.....	.....	.....	.....		.....
	11120	2B70H	SOC120# Single SOC120#	R	2		U16
	11121	2B71H	SOC updated on: Year/month	R	2		U16
	11122	2B72H	Day/Hour	R	2		U16
	11123	2B73H	Minutes/second	R	2		U16
	11124~ 11130	Reserved					
Single SOH data	11131	2B7BH	SOH1# Single SOH1#	R	2	Unit:0.1%	U16
	11132	2B7CH	SOH2# Single SOH2#	R	2		U16
	11133	2B7DH	SOH3# Single SOH3#	R	2		U16
	.....	.....	.....	.....	.....		.....
	11250	2BF2H	SOH120# Single SOH120#	R	2		U16
	11251	2BF3H	SOH updated on: Year/month	R	2		U16
	11252	2BF4H	Day/Hour	R	2		U16
	11253	2BF5H	Minutes/second	R	2		U16
	11254~ 11260	Reserved					

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4.4 Communication Application

The examples given in this section are in the format of the following table whenever possible (data in hexadecimal)

Addr	Fun	Data start		Data #of		CRC16	
		reg Hi	reg Lo	reg Hi	reg Lo	Lo	Hi
01H	03H	00H	00H	00H	06H	CRC_L	CRC_H
Address	Function Code	Data start address		Number of data reads		Cyclic redundancy check code	

4.4.1 Data reading

Example 1: Read voltage #1 data

Query data frame	01 03 27 11 00 01 DE BB
Return data frame	01 03 02 34 BC AF 35

Description:

01: Slave address

03: Function Code

27 11: Voltage #1 register address

02: Hexadecimal, decimal is 2, which means 2 bytes of data follow

DE BB: Cyclic redundancy check code

The data processing method is shown in the communication parameter address table

Process as follows: 34 BC(hex) = 13500(decimal) Voltage 13500mV

4.4.2 Data writing

Example 2: Sett a single overcharge alarm value (3E8H)

Write data frame	01 10 3E E8 00 01 02 3A 98 7D 81
Return data frame	01 10 3E E8 00 01 8C 15

Description:

Set the single overcharge alarm value to 15000, i.e. 15000mV

4.5 Solutions to diagnose and troubleshoot common faults

4.5.1 Abnormal data after device power up

Module power-off restart

4.5.2 Abnormal RS-485 communication

1. Check whether the communication baud rate, ID and communication protocol settings of the upper computer are consistent with the device.

2. Please check whether the settings of data bits, stop bits and check bits are consistent with the upper unit.

4.5.3 No data for single modules

1. Check whether the communication wires at both ends of the module are connected tightly.

2. Disconnect the module and check if it is caused by address conflict.

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Instruction manual revision record

Date	Old Version	New Version	Modified content
2023.2.6		V1.0	1、First time authoring
2023.5.29	V1.0	V1.1	1、update moduel images and add pictures of switch power supply

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