matismart
AIoT Electric

MT99BT Battery String Monitoring Device

Installation & Operation Manual

V1.00

⚠ Danger and warning!

This device can be installed only by professionals.

The manufacturer shall not be held responsible for any accident caused by the failure to comply with the instructions in this manual.

⚠ Risks of electric shocks, burning, or explosion

- This device can be installed and maintained only by qualified people.
- Before operating the device, isolate the voltage input and power supply and short-circuit the secondary windings of all current transformers.
- Use appropriate voltage tester to make sure the voltage has been cut-off.
- Put all mechanical parts, doors, or covers in their original positions before energizing the device.
- Always supply the device with the correct working voltage during its operation.

Failure to take these preventive measures could cause damage to equipment or injuries to people.

Content

Chapter 1. Description

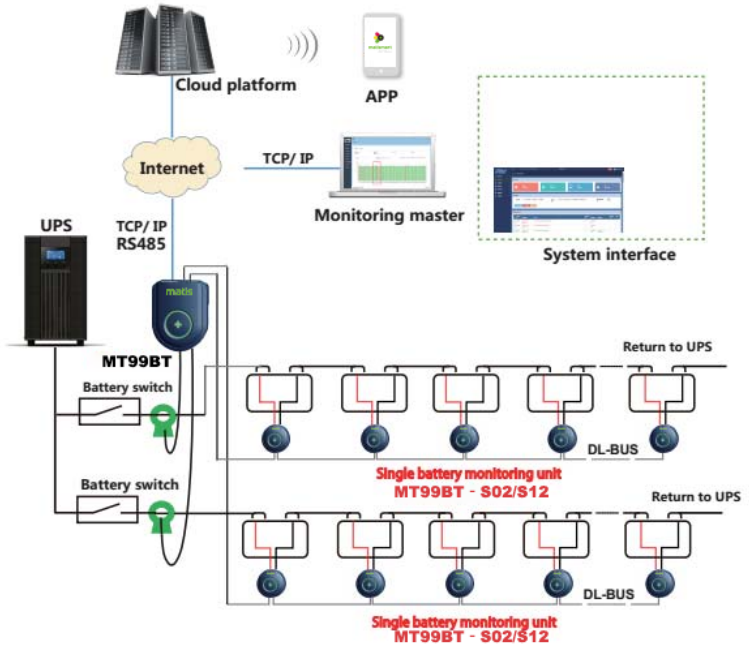
MT99BT battery string sensor is specially designed as highly integrated smart sensor module for VRLA batteries, can quickly and accurately measure the VRLA's charge and discharge current,environment temperature and other parameters,support monitoring two battery string independently. String sensor uses specified isolated communication bus, equipped with MT99BT series battery cell sensor, to realize the real-time monitoring of the entire string of batteries.Real-time know the actual operation and health status of the battery string , and discover the battery string existing problems during using, and realize automatic maintenance functions. It helps the battery string to keep voltage balance under float status, so that each unit of the battery to maintain the best active status, improve the battery run life, timely find out the problem battery and maintenance, reduces labor cost and other maintenance costs, improve the safety of battery use to reduce the accident rate.Effectively carry out energy conservation and emission reduction, and create good economic and social benefit for the users.

Device can achieve the following functions:

- Real-time on-line monitoring the string voltage(cell sensor's voltage summation) of battery string(two independent battery string),charge and discharge current, judge current charge and discharge status,string SOC and environment temperature.
- Equipped with MT99BT series cell sensor,real-time on-line monitoring voltage,internal,temperature,SOC, SOH of every battery through isolate bus.

- Advanced One-click deploy cell sensor address function,without excessive manual intervention and configuration, reducing engineering effort.
- Through MT99BT can upgrade program for cell sensor locally.
- Advanced measurement algorithm, no need for high current discharge, to achieve non-destructive measurement.
- Balancing function, the battery string keep voltage balance under floating status, this allows each battery to maintain the best active state, improve the battery backup time and operating life.
- Equipped with cell collector, save the data collected by cell collector into Modbus register, for background devices or system use.
- Using RS485 communication with isolated power, safely and stably
- By the circular alarm LED with breathing light, users can quickly locate the fault batteries in the machine room
- With the external linked Hall sensor, M T 9 9 B T - S x x easure M T 9 9 B T
- different ranges of charge and discharge current
  Communication interface insulation voltage is AC 3750V.

1.1. System Structure



Battery monitoring system composed of MT99BT , cell sensor collector module,current hall sensor,each module' s function show as below:

Module	Description
MT99BT	Achieve functions of data collect,control,upload and alarm of battery.One MT99BT can monitor two battery strings,each string can monitor cell sensor up to 60 (1-1 solution monitoring 60 batteries,1-2 monitoring 120 batteries)
Cell Sensor	Measuring the voltage,temperature,internal resistance

Collector Module	and alarm indicate of unit battery.
Current Sensor	The sensor that measuring current

1.2. Apply Range

（1）、Support monitoring 2V or 12V battery；

（2）、Support monitoring battery string which number of unit string is 1~120（1-1 is 1-60）,can monitor two battery strings separately；

（3）、Support measuring current -1000A~1000A；

Chapter 2. Installation and Wiring

2.1. Environment

2.1.1. Environment Requirement

◇Standard operating temperature：0℃ ~ +45℃

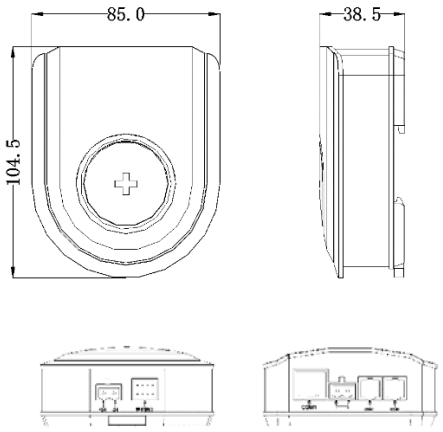
◇Operating temperature limit：-10℃ ~ +55℃

◇ Storage temperature：-40℃ ~ +70℃

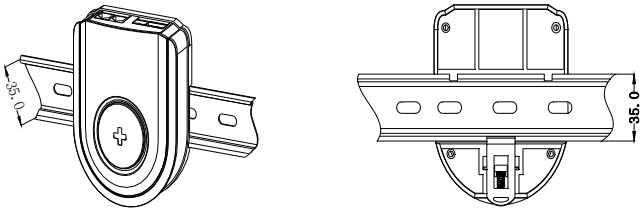
◇ Working humidity：5% ~ 95%RH，Non-condensing

2.1.2. Installation and Dimensions

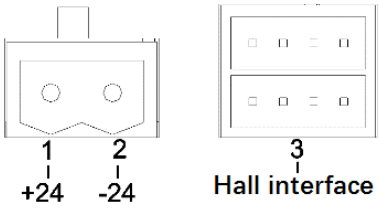
（1）Dimensions（Unit：mm）

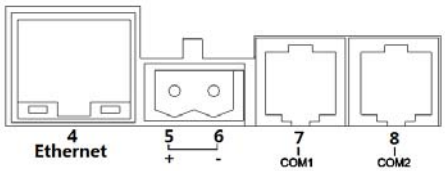


（2）Installation Figure（Unit：mm）



2.1.3. Structure and Terminals





Main-body Terminals Definition:

No.	Code	Definition
1	+24V	Device power supply positive

2	-24V	Device power supply negative
3	Hall Interface	2 string current sensor input
4	Ethernet	Ethernet Interface
5	485+	RS-485 Communication Port
6	485-	RS-485 Communication Port
7	COM1	DL-BUS Communication，RJ11 Interface
8	COM2	DL-BUS Communication，RJ11 Interface

Note： The “+” & “-”terminals of RS485 cannot be changed.

2.2. Order Information

The complete specifications of MT99BT show as below:

Model： MT99BT		
MT99BT	Use for battery string	✓ Real-time voltage measuring ✓ Charge&discharge current measuring ✓ DL-BUS Communication ✓ Collector information centralized processing

2.3. Power Supply

MT99BT is supplied by 24VDC with the range from DC 12V to DC 36V，and its power loss is less than 2W.

Chapter 3. Function Description

3.1. Voltage

The real-time voltage of the lead-acid battery string is calculated by superimposing the cell sensor voltage, and the MT99BT measurement voltage range is DC 0 ~800V.

3.2. Current

Measuring lead-acid batteries charge&discharge current , the maximum measuring range of MT99BT is -1000A ~ +1000A.

3.3. Battery String Status

MT99BT support judge function for battery string status,battery string status mainly include five status:equal charge,floating charge,rest,abnormal.The basis of MT99BT judgment is mainly based on the current string voltage, string current and battery characteristic parameters.Show as below：

Status	Condition
Abnormal	Hall connection abnormal
Equal charge	Hall connection normal,and string current absolute value bigger than floating current,and string current is positive
Discharge	Hall connection normal,and string current absolute value bigger than floating current,and string current is negative
Floating charge	Hall connection normal,and string current absolute value less than floating current,and string voltage bigger than floating voltage
Rest	Hall connection normal,and string voltage absolute value less than floating current,and string voltage less than floating voltage

3.4. Cell Sensor Data Collect

MT99BT uses DL-BUS bus communication for the collector unit, and collects information through RJ11 of COM1 (string 1) and COM2 (string 2) respectively. Each COM port (that is every string) can connect up to 60 cell sensors, that is, every string can monitor up to 120 batteries (1- 1 solution is 60). The acquired data is saved in an internal register.

For the normal operation of the data communication collection function, the SN address code of the cell sensor needs to be correctly configured into the MT99BT device. The MT99BT provides two SN address code configuration modes, one is manual entry type (import configuration file), and the other one is One-click setting address type,which is faster and more convenient. The specific steps refer to the inventory meter configuration in "MT99BT-Data Monitoring Software-Instructions".

3.5. Voltage Balancing

MT99BT provides voltage balancing function, let the battery string keep voltage balancing under floating status, So that each battery to maintain the best active status, improve the battery backup time and operating life. This function needs to meet certain conditions to proceed. (Select 4 highest voltage batteries for equalization each time) :

1、The battery string status is floating charge;

2、Balancing function on (default is off, Software configurable);

3、The battery voltage is greater than the average voltage of the battery string;

4、The balancing of battery voltage is less than set target

balancing(Default is 0,can be set through soft-ware);

5、Meet time interval of the two balancing （default is 2 minutes, Software configurable）;

When the battery string status is floating, if the balancing function is on, when the balancing period is reached, MT99BT will calculate the balancing of all battery voltages in the string. If the balancing of the voltage is higher than the setting value, then MT99BT will send a balanced command to the battery cell sensor (the most maximum voltage of cells in line). After Cell sensor receive balancing orders, its LED light will flashes three times in a row for balancing discharge. The balancing current is 0.2A, and the balancing process is about 1 minute.

Note: Battery voltage balancing= (1 - $|Vi - Vavg| \div Vavg$) × 100 %

Vi：Battery voltage

Vavg：Average voltage of the battery string

Please refer to "MT99BT - Data Monitoring Software Manual" to the balancing configuration

3.6. Internal Resistance Measuring

When the battery string is in the floating state, the MT99BT will issue the internal resistance measurement command to the cell sensor during each cycle (can be set), and measure the internal resistance of battery (the internal resistance is not measured in other states).

At the same time, the MT99BT debugging software also provides commands for manually measuring internal resistance. The MT99BT-data monitoring software provides this function button.

Note: The measurement period of the internal resistance and the

manual measurement internal resistance are specifically referred to the [Internal Resistance Measurement] in the MT99BT-Data Monitoring Software-Instructions.

3.7. Over-limit Alarm

The MT99BT has a user-definable alarm system that monitors all electrical parameters of the battery system and provides parallel alarms. It supports all measurement points over-limit alarms and has an infinite-level upper-limit alarm and an infinite-level lower-limit alarm.

The alarm system can monitor almost all of the electrical parameters in the battery system, a total of 12, as shown in the following table:

Over-limit Type	Parament Type
Cell Sensor	Cell Sensor Voltage Upper-limit
	Cell Sensor Voltage Lower-limit
	Cell Sensor Temperature Upper-limit
	Cell Sensor Internal Resistance Upper-limit
	Cell Sensor SOC Lower-limit
	Cell Sensor SOH Lower-limit
String Sensor	String Current Upper-limit
	String Current Lower-limit
	String Voltage Upper-limit
	String Voltage Lower-limit
	String SOC Lower-limit
	Reserve
	Hall Disconnect Alarm
	Reserve

When the alarm object is generated, the alarm lights corresponding

to the cell sensor and the string are illuminated. When the cell sensor is alarmed, the corresponding cell sensor's alarm light will be illuminated. When the string alarms, the alarm lights of the string will be illuminated.

3.8. SOC Remaining Capacity

The MT99BT has a unit battery and battery string SOC(Battery remaining capacity) estimation function. The SOC is mainly calculated based on the characteristic parameters of the battery , Including the battery voltage level, recovery voltage, cut-off voltage, battery SOC calculation. The default battery characteristic parameters are as follows:

Battery Voltage Class	2V	12V
Cutoff Voltage	1.75V	10.8V
Recovery Voltage	2.12V	12.68V
Floating Voltage	2.23V	13.38V
Floating Current Range	-0.02C ~ +0.02C	-0.02C ~ +0.02C

Note:

1. C is the battery capacity
2. The default recovery voltage is the optimal value obtained through a large number of experiments. If there is no special situation (such as battery manufacturers to provide reference values, etc.), do not change.
3. Please refer to"MT99BT - Data Monitoring Software Manual" to configure the battery parameters.

3.9. SOH Health Status

MT99BT supports the estimation of SOH (Battery Health Status) for unit battery. One of the important basis for SOH estimation is the internal resistance reference value of the battery. The user needs to set the internal resistance reference value of the battery according to the actual information of the battery.

Note: For the setting of the internal resistance of the battery, refer to the battery characteristic parameter setting in "MT99BT-Data Monitoring Software-Instructions".

3.10. RS485 Interface

MT99BT provides one RS485 interface to support the international MODBUS-RTU protocol, which is convenient for background system access. Please refer to the corresponding "MT99BT MODBUS Communication Protocol" manual for the specific agreement.

3.11. RJ45 Net-port

MT99BT provides one RJ45 interface to support international MODBUS TCP/IP communication, allowing up to five clients to access at the same time, facilitating the access of background systems. For details on how to find the IP address of the device, refer to "Soft-ware Communication Connection" and "Introduction to the Main Interface of Debugging Software" in "MT99BT-Data Monitoring Software-Instructions".

3.12. SNMP Forwarding Function

3.12.1. SNMP Description

SNMP is a network management standard based on the TCP/IP protocol suite. It is a standard protocol for managing network nodes

(such as servers, workstations, routers, switches, etc.) in an IP network. SNMP enables network administrators to improve network management performance, identify and resolve network problems, and plan network growth in a timely manner. The network administrator can also receive notification messages of network nodes and alarm event reports through SNMP to learn about network problems.

The communication string mainly contains two types of commands: the GET command and the SET command. The GET command reads data from the device, which is usually an operational parameter such as connection status, interface name, and so on.

The most common default communication strings are public (read-only) and private (read/write), in addition to many vendor-specific default communication strings. Some form of default communication string can be found on almost all network devices running SNMP.

This device only supports the use of the GET command for security reasons, and only supports the use of public communication strings.

3.12.2. OID Definition

The snmp protocol of the device implements an extension module based on net-snmp, starting OID node address 1.3.6.1.4.1.8072.1, string data subnode starting address is 1.3.6.1.4.1.8072.1.1, cell data subnode The starting address is 1.3.6.1.4.1.8072.1.2, the starting address of the string 1 string data sub-nodes is 1.3.6.1.4.1.8072.1.1.1, the starting address of the string 2 string data sub-node is 1.3.6.1.4.1.8072.1.1.2, string 1 cell data subnode starting address 1.3.6.1.4.1.8072.1.2.1, string 2 cell data subnode starting address is 1.3.6.1.4.1.8072.1.2.2

OID detail setting please refer to“MT99BT-Lwip-Snmp-OID.xlsx”.

3.12.3. OID Query

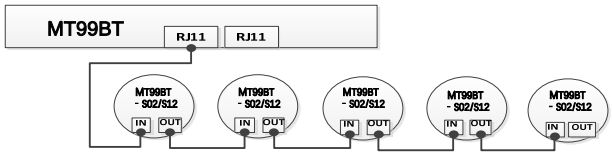
Use the snmpwalk command to traverse all sub-nodes under the node. To traverse all sub-data under a string data node, use snmpwalk -v 2c -c public 192.168.1.XX .1.3.6.1.4.1.8072.1. 1.1

Use the snmpget command to get the data of the specified node. To obtain the data of a string voltages under a string data nodes, use snmpget -v 2c -c public 192.168.1.XX .1.3.6.1.4.1.8072.1. 1.1.1.0

3.13. One-click Setting Cell Sensor Address

MT99BT support “One-click deploy cell sensor address” function,only need to cooperate with the MT99BT debugging software will be able to collect and configure all the address information of cells. Without the need for engineers to record and configure the cells one by one, convenience of the installation site and reduce the configuration process of the error.

Note：1、The COM1 port is the entrance of data communication(left ,entrance)，the COM2 port is the export of data communication(right ,export)，to “One-click configuration cell sensor address”function is normal, provided that all battery monitoring cell sensor communication lines are left in and right out，show as below：



2、One-click deploy cell sensor address can refer to the “Inventory meter configuration-One-click search address” of MT99BT Data Monitoring Soft-ware.

Chapter 4. LED Description

LED	Status	Light Status
Run Light L1（Green）	Normal Working	Breathing Mode
Alarm Light L2（Red）	String Voltage/Current Over Upper/Lower Limit,String SOC Over Lower-limit,Hall Connect Abnormal	Constantly bright

Note： The running light and the warning light switch to each other. When the running light works, the warning light does not work, and vice versa.

Chapter 5. Maintenance and Fault Remove

Problem	Causes	Solutions
Running LED is off after power on	Power can not input to the device	Check whether the proper power is supplied on the sensor
Cannot communicate with device when add upper machine	The address of device is incorrect	Check if the address of device is corresponding to the definition
	The baud rate of device is incorrect	Check if the baud rate of device is corresponding to the definition
	Communication line being interrupted	Check if the communication shield is good grounding
	Communication line interruption	Check if the communication cable is disconnected
Unable to see the collection of data	Communication line interruption	Check if the communication cable with M T 9 9 B T - S X X is disconnected
	The inventory and configuration of meter is incorrect	Re-edit the inventory and configuration of meter
	Parameter configuration	Protocol：extend and standard Cell sensor type：1-1 and 1-2 setting Whether the setting of COM cell sensor number is right

SOC	Battery feature parameters are incorrect	Whether the setting of voltage level, cutoff voltage, recovery voltage and floating voltage are incorrect
SOH	Battery feature parameters are incorrect	whether the setting of reference internal resistance is incorrect

Chapter 6. Technical Specifications

Size	Main Body：104.5mm（L）×85mm（W）×38.5mm（H）
Power Supply	The rated voltage of MT99BT is DC 24V with the normal range from DC18V to DC36V,power loss is 2W.

Item	Range	Accuracy	Note
Voltage	DC 20~800V	±0.5%	Resolution ：0.01V
Current	DC-1000A~1000A	±2%（15℃~35℃）	Resolution ：0.01A

Item	Testing Condition
Insulation Resistance	Testing voltage is 1000V and insulation resistance more than 10MΩ
Medium Strength	Testing voltage is AC 2kV, testing time is 1 minute ,leakage current is less than 5mA
Impact Withstand Voltage	Standard lightning strike of 1.2/50us，testing voltage 5kV, plus or minus 3 times

Item	Standard	Class
Electrostatic discharge immunity	GB/T17626.2-2006 (IEC61000-4-2:2001)	III
RF electromagnetic field radiation immunity	GB/T17626.3-2006 (IEC61000-4-3:1998)	IV
Electrical fast transient burst immunity	GB/T17626.4-2008 (IEC61000-4-4:1998)	III
Surge immunity	GB/T17626.5-2008 (IEC61000-4-5:2005)	III
RF conducted immunity	GB/T17626.6-2008 (IEC61000-4-6:1998)	III
Power frequency magnetic field immunity	GB/T17626.8-2008 (IEC61000-4-6:2001)	IV
Electromagnetic emission limit	GB/T14598.16-2002 (IEC60255-25:2000)	Correspond

Notice:

- Matis reserves the right to modify this manual without prior notice in view of continued improvement.
- Tech Support Email:info@matismart.com