IMH100
Medical Insulation Monitor
User Manual

Version: V1.0

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The information contained in this manual is believed to be accurate at the time of publication; however, CET assumes no responsibility for any errors which may appear here and reserves the right to make changes without notice. Please consult CET or your local representative for the latest product specifications.

Standards Compliance

CE

DANGER

This symbol indicates the presence of danger that may result in severe injury or death and permanent equipment damage if proper precautions are not taken during the installation, operation or maintenance of the device.

CAUTION

This symbol indicates the potential of personal injury or equipment damage if proper precautions are not taken during the installation, operation or maintenance of the device.

DANGER

Failure to observe the following instructions may result in severe injury or death and/or equipment damage.

- Installation, operation and maintenance of the meter should only be performed by qualified, competent personnel that have the appropriate training and experience with high voltage and current devices. The meter must be installed in accordance with all local and national electrical codes.
- Ensure that all incoming AC power and other power sources are turned OFF before performing any work on the meter.
- Before connecting the meter to the power source, check the label on top of the meter to ensure that it is equipped with the appropriate power supply, and the correct voltage and current input specifications for your application.
- During normal operation of the meter, hazardous voltages are present on its terminal strips and throughout the connected potential transformers (PT) and current transformers (CT). PT and CT secondary circuits are capable of generating lethal voltages and currents with their primary circuits energized. Follow standard safety precautions while performing any installation or service work (i.e. removing PT fuses, shorting CT secondaries, …etc).
- Do not use the meter for primary protection functions where failure of the device can cause fire, injury or death. The meter should only be used for shadow protection if needed.
- Under no circumstances should the meter be connected to a power source if it is damaged.
- To prevent potential fire or shock hazard, do not expose the meter to rain or moisture.
- Setup procedures must be performed only by qualified personnel familiar with the instrument and its associated electrical equipment.
- DO NOT open the instrument under any circumstances.

Limited warranty

- CET offers the customer a minimum of 12-month functional warranty on the meter for faulty parts or workmanship from the date of dispatch from the distributor. This warranty is on a return to factory for repair basis.
- CET does not accept liability for any damage caused by meter malfunctions. CET accepts no responsibility for the suitability of the meter to the application for which it was purchased.
- Failure to install, set up or operate the meter according to the instructions herein will void the warranty.
- Only CET's duly authorized representative may open your meter. The unit should only be opened in a fully anti-static environment. Failure to do so may damage the electronic components and will void the warranty.

Table of Contents

Chapter 1 Introduction

Medical facilities are sensitive to power outages, since interruption of the electricity supply at the wrong time can lead to irreversible damage to technical equipment and, in particular, to endanger the health of patients. Therefore, electrical distribution in operating theatres, intensive care units and in other critical rooms is implemented as ungrounded systems, which in terms of safety brings a huge benefit in the possibility of continuing operation even in the event of the first fault. In order to ensure the medical IT power supply system is sufficiently isolated from the ground's potential, insulation monitoring devices for health sectors are used.
CET offers a complete Insulation Monitoring Solution that is capable of identifying which particular circuit is contributing to a ground fault for hospital Medical IT Systems, which mainly applied to medical type 2 facilities such as Operating Rooms, Intensive Care Units, Emergency Rooms and other particularly sensitive areas of a hospital. The solution consists of Isolation Transformer, Insulation Monitor (IMH100), Fault Locator (ILH100), Alarm and Control HMI (ID100), Power Supply module, as well as CTs and/or CT Strips.

The IMH100 continuously monitors the insulation resistance of IT systems (unearthed systems), and an alarm will be issued if the value falls below a response value, while the ILH100 locates the faults quickly, and the medical staff and maintenance staff can implement supervision via the ID100.

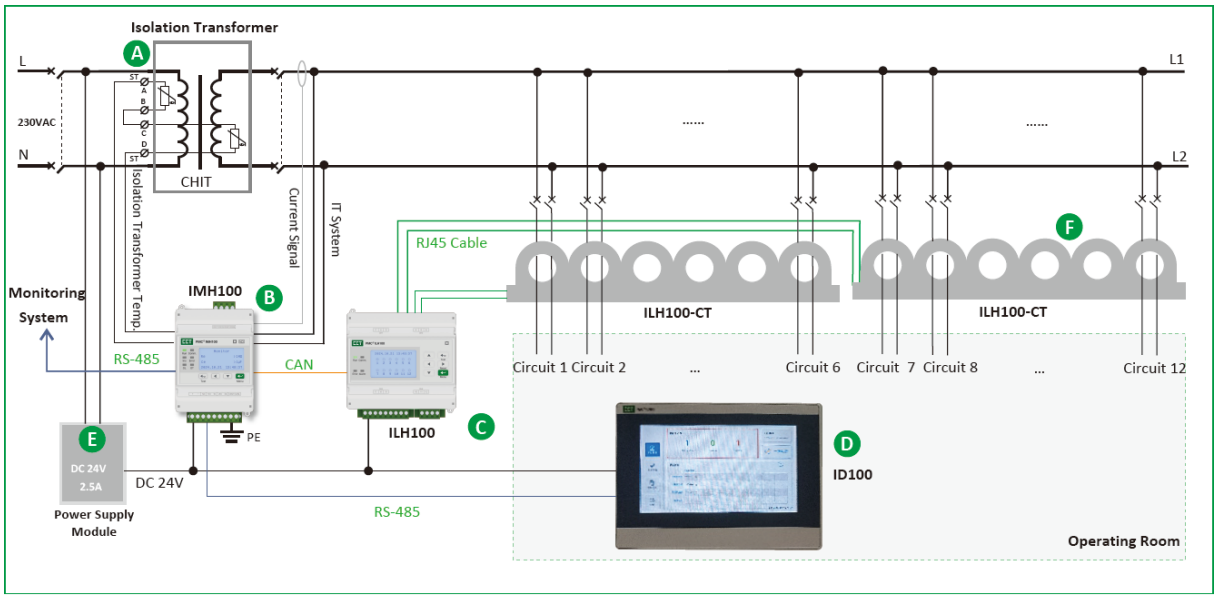
1.1 Overview

This manual explains how to use the IMH100 Insulation Monitor. Throughout the manual the term "monitor" generally refers to all models.
This chapter provides an overview of the IMH100 and summarizes many of its key features.
With an industrial-grade microprocessor, the IMH100 Insulation Monitor employs premium hardware design coupled with specialized measurement algorithms. It injects a low-frequency AC pulse signal (with frequency varying according to leakage capacitance levels) between the Medical IT power supply system and ground, enabling precise measurement of both the insulation resistance value and leakage capacitance value to ground in the IT power supply system. It continuously monitors the entire insulation resistance of an Medical IT system during operation and triggers an alarm when the value falls below a preset response value.
It realizes data exchange and fault location with the ILH100 Medical Fault Locator via CAN2.0 communication, and data exchange with the upper computer via RS-485 communication, enabling intelligent power distribution management.

1.2 Features

- Large, backlit, easy to read LCD display
- Insulation monitoring in accordance with IEC 61557-8 for medical IT systems
- Generate pulse signals for fault location
- 1xVoltage Input for Single-phase IT Systems, 1xLoad Current Input + 1xTemperature Input for Isolation Transformers
- The monitoring range for Insulation Resistance is between 10KΩ and 1MΩ
- 1xCAN, 2xRS-485 and 2xDO
- Device Operating Time (Running Hours)
- Disconnection detection for system wiring, PE, CT and Temperature Input
- 256 SOE events time-stamped to 1ms resolution
- Time Sync. via Modbus and battery-backed RTC
- Easy installation with DIN-Rail mounting, no tools required

1.3 Typical Application



Chapter 2 Installation

Caution

Installation of the IMH100 should only be performed by qualified and competent personnel who have the appropriate training and experience with high voltage and current devices. The device must be installed in accordance with all local and national electrical codes.

During the operation of the device, hazardous voltages are present at the input terminals. Failure to observe precautions can result in serious or even fatal injury and equipment damage.

Front View **Bottom View**

Figure 2-1 Appearance

Area	Label	Description
1	+, -	DC 24V Power Supply Input
	1D+, 1D-	1st RS-485 Port, for communicating with ID100 Alarm and Control HMI
	2D+, 2D-	2nd RS-485 Port, for communicating with upper computer
	CANH, CANL	CAN port, for communicating with ILH100 Fault Locator
2	DO11, DO12, DO21, DO22	2 Digital Outputs DO1 for cooling start/stop fan DO2 for alarming
3	L1, L2	System Terminals for connecting with monitored IT system
	⏚(FE), KE	Ground Terminal
4	*I11, I12	Current Input for Isolation Transformer
	TC11, TC12	RTD Input for Isolation Transformer

Note: NC - Reserved terminals

2.2 Installation

The IMH100 should be installed in a dry environment with no dust and kept away from heat, radiation and electrical noise sources.

- Before installation, make sure that the DIN Rail is already in place
- Move the installation clips at the back of the IMH100 downward to the “unlock” position
- Align the top of the mounting channel at the back of the IMH100 at an angle against the top of the DIN Rail as shown in the figure below
- Rotate the bottom of the IMH100 towards the back while applying a slight pressure to make sure that the device is completely and securely fixed on to the DIN Rail
- Push the installation clips upward to the “lock” position to secure the IMH100 on to the DIN Rail

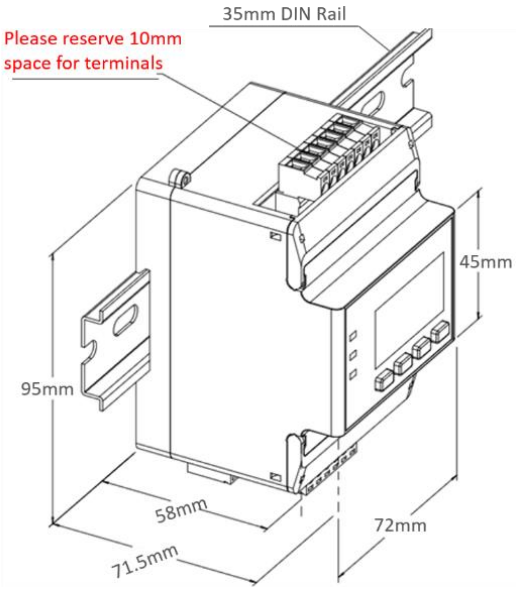


Figure 2-2 Installation

Caution

Only skilled persons are permitted to carry out the work necessary to install, put into service and run a device or system.

Before installing the device and before working on its connections, make sure that the installation has been de-energised. The rules for working on electrical systems must be observed.

- Only operate the device with mounted and locked terminal covers.
- If the terminals L1 and L2 of the device are connected to a live IT system, do not disconnect terminals KE and E from the protective conductor PE.
- Connect terminals KE and ⏚ individually to the protective earth conductor PE.

2.3 Wiring

> **Caution**
>
> The secondary side of the CT must not be left open-circuited. Before disconnecting the CT from the monitoring circuit, its secondary side must be short-circuited using a shorting block.

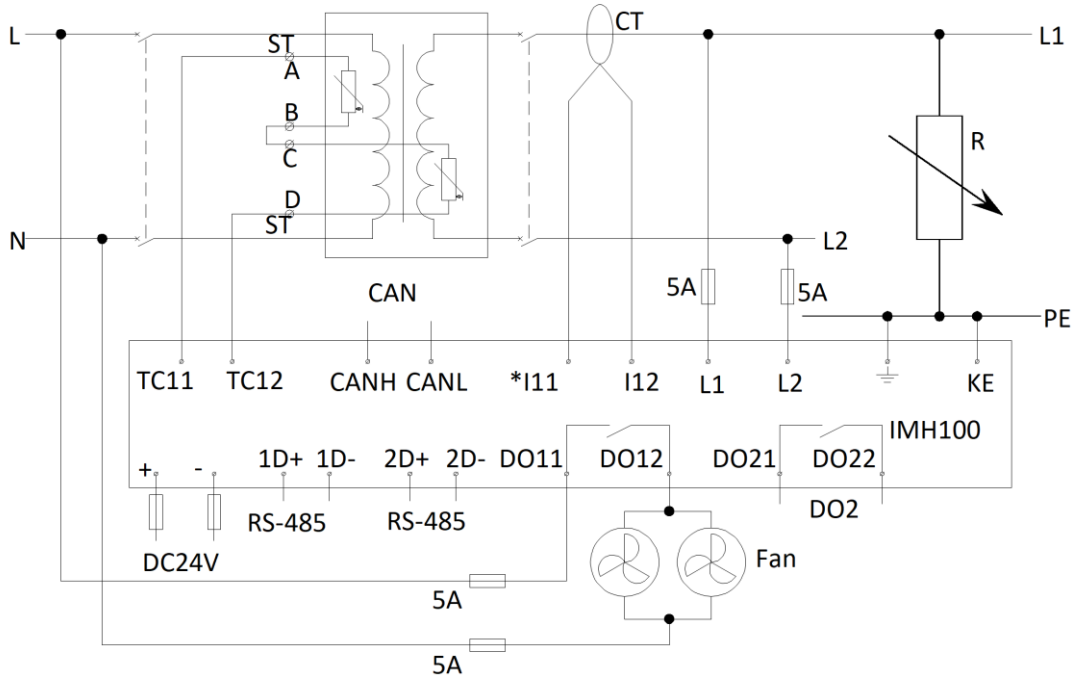
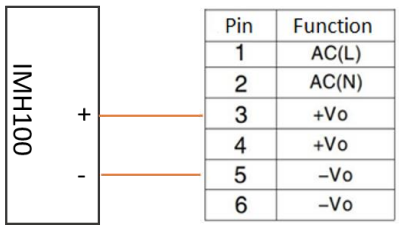


Figure 2-3 Wiring Diagram

2.1 Terminal Wiring

- **24V DC Power Supply**
  Connect Positive + and - to Power Supply Module (AI60-B24PT)'s 3(4) and 5(6), respectively.

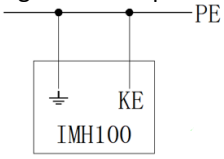
Power Supply Module



Pin	Function
1	AC(L)
2	AC(N)
3	+Vo
4	+Vo
5	-Vo
6	-Vo

- **Current Input Wiring**
  Use shielded two-core wires, with the shield layer grounded.

- **Ground Wires**
  Two ground terminals and KE must be grounded separately with two yellow-green ground wires.



- **Communication Ports Wiring**
  1. Ethernet Port:
     - Use standard Ethernet cable.
     - Connect to network switch, HMI, or coupled IMH100 devices as required.
  2. RS-485 Port:
     - Terminals D+ (A) and D- (B).
     - Use shielded twisted pair cable.
     - Maximum 32 devices on one bus, max bus length 1200m. Ensure correct polarity. Install a 120Ω termination resistor at the far end of the bus.
  3. CAN Port:
     - Terminals CANH (High) and CANL (Low).
     - Use shielded twisted pair cable.
     - Maximum 32 devices on one bus, max bus length 500m. Ensure correct polarity. Install a 120Ω termination resistor at each end of the bus.

Chapter 3 Front Panel

After all installation and wiring are completed and checked, the device can be powered on. The device adopts a dot-matrix LCD display, which can display 2 lines of real-time measurement data.

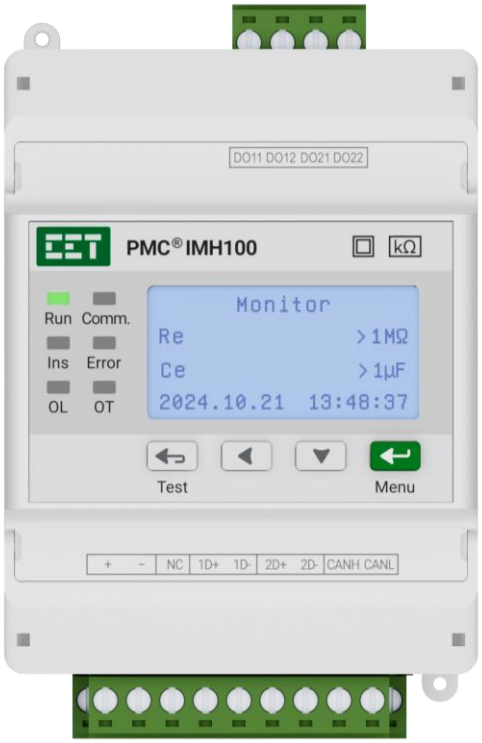


Figure 3-1 Main Display

3.1 Indicators

LED Indicator	Color	Status	Description
Run	Green	Blinking	Device is running normally, blinks once per second
		Off	Device is powered off or working abnormally
Comm.	Green	Blinking	The device is receiving data communication
		Off	No data received
Error	Yellow	On	Device self-test error or disconnection alarm
		Off	Device normal
Ins	Yellow	On	Low insulation alarm
		Off	Insulation normal
OL	Yellow	On	Isolation transformer is overloaded
		Off	Isolation transformer overload is normal
OT	Yellow	On	Isolation transformer is over-temperature
		Off	Isolation transformer temperature is normal

Table 3-1 Front Panel LED Indicators Description

3.2 Buttons

Buttons	Data Display	Setup Menu
↩	Pressing this button goes back to previous level menu. When inside the first page, long-pressing this button to execute self-diagnostic.	Pressing this button cancel the entered value or current operation.
◀	Pressing this button to move left/right circularly.	If a numeric parameter is already selected, pressing this button shifts the cursor to left. If the Curson is shifted to the end of the left, pressing this button returns to the first right position.
▼	Pressing this button to move up/down	If a numeric parameter is already selected,

	circularly or move to next page.	pressing this button decrements a numeric value. If an enumerated parameter is already selected, pressing this button advances to to next enumerated value in the selection list.
↵	Before a sub-menu or operation is selected, pressing this button enters sub-menu or execute the chosen operation.	After changing the parameter, pressing this button saves the new settings into memory.

Table 3-2 Button Function

3.3 Display and Configuration

The IMH100's front panel display consists of five sub-menus: Real-time Data, Parameters Setting, Device Information, Device Maintenance and Event Recorders.

3.3.1 Real-Time Data

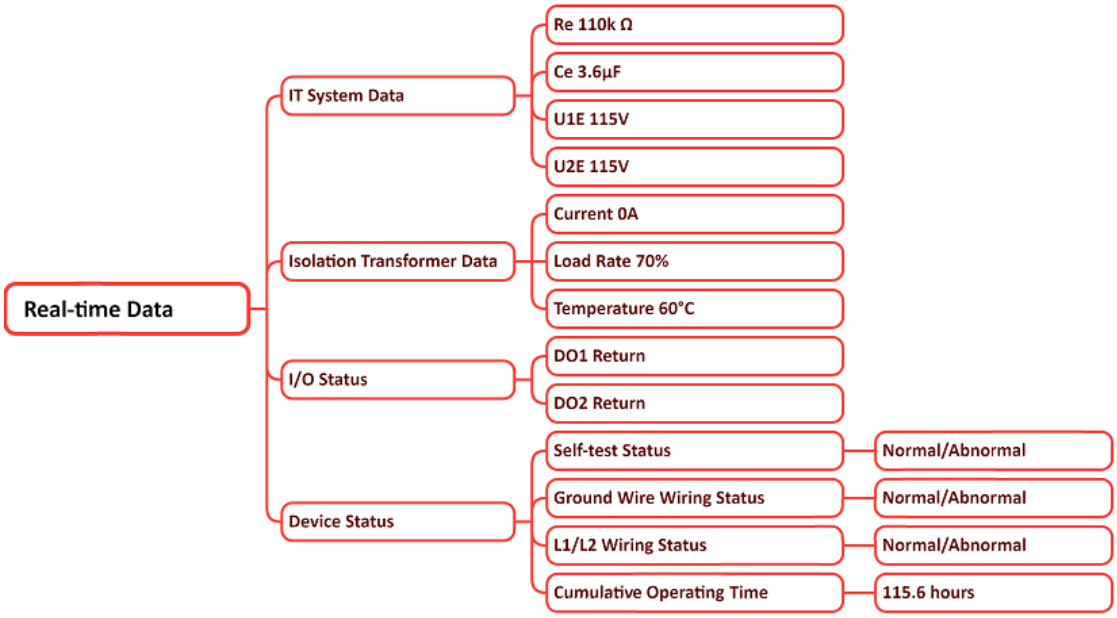


Figure 3-2 Real-time Data

3.3.2 Configuration

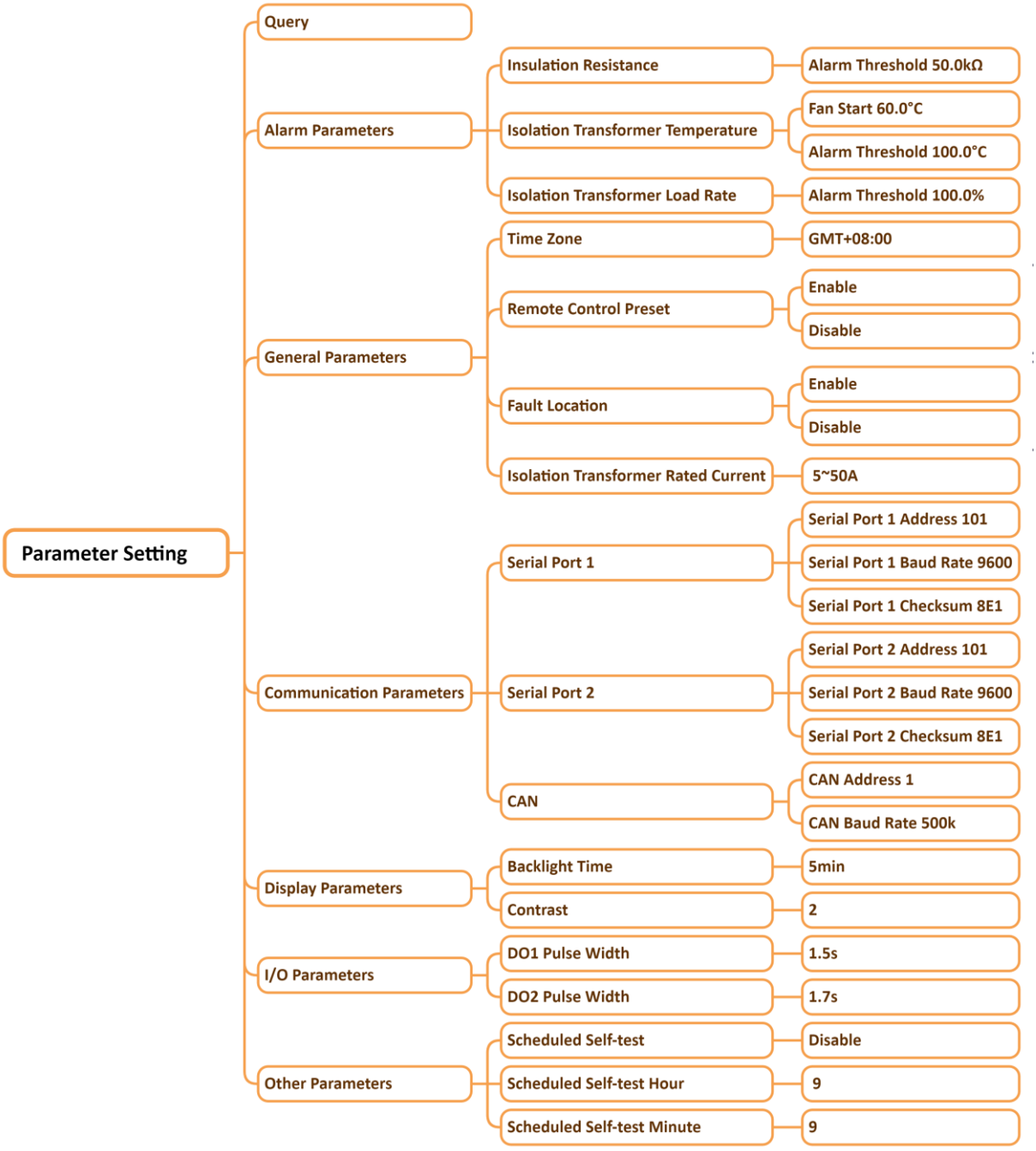


Figure 3-3 Parameters Setting

3.3.3 Device Information

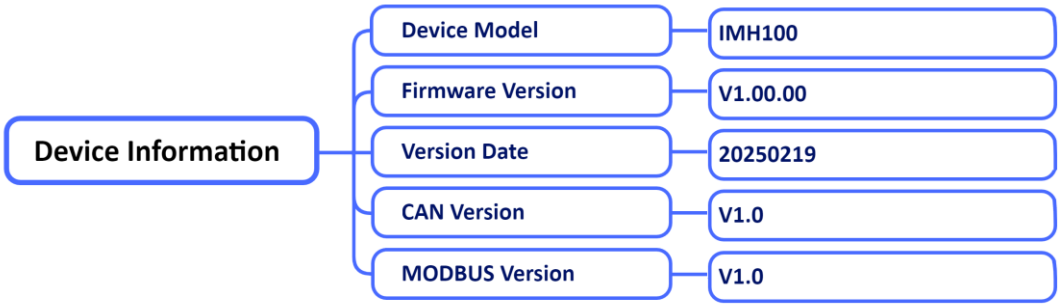


Figure 3-4 Device Information

3.3.4 Maintenance

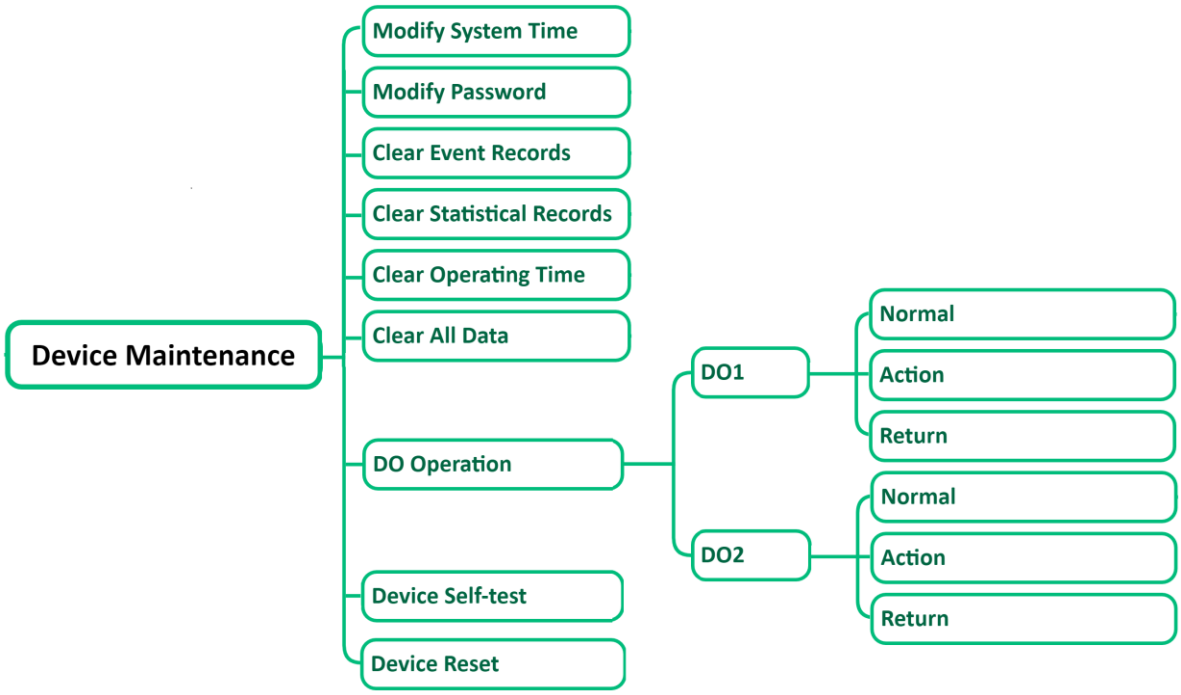


Figure 3-4 Device Maintenance

Menu				
2nd	3rd	Description	Range/Options	Default
Enter Password	-	Enter password	0000~9999	0000
Insulation Resistance	Alarm Threshold	-	50~500kΩ	50kΩ
Isolation Transformer Temperature	Fan Start	Temperature threshold for cooling fan start	40~140℃	40℃
Isolation Transformer Temperature	Alarm Threshold	Isolation transformer over-temperature alarm threshold	40~140℃	120℃
Isolation Transformer Load Rate	Alarm Threshold	Isolation transformer overload alarm threshold	80~120%	100%
Time Zone	-	-	-	GMT+8:00
Remote Control Preset	-	-	Enable/Disable	Disable
Fault Location	-	-	Enable/Disable	Disable
Isolation Transformer Rated Current	-	-	5~50A	45A
RS-485 Port 1	Address	Modbus Address	1~247	100
	Baud Rate	Date Rate (kbps)	1200/2400/4800 9600/9200/38400	9600
	Data Format	Data Format	8N2/8O1/8E1/ 8N1/8O2/8E2	8E1
RS-485 Port 2	Address	Modbus Address	1~247	101
	Baud Rate	Date Rate (kbps)	1200/2400/4800 9600/19200/38400	9600
	Data Format	Data Format	8N2/8O1/8E1/ 8N1/8O2/8E2	8E1
CAN Port	Address	-	1~3	1
	Baud Rate	-	100K/125K/250K 500k	100K
Backlight Time	-	Backlight Timeout	0~60min 0 means backlight never turns off	5min
Contrast	-	Display Contrast	0~9	3
DO1 Pulse Width	-	Specifies the duration for which the relay output will be active when a	0.0~600.0s	1

DO2 Pulse Width	-	remote control command is received to activate it.	0.0~600.0s	1
Scheduled Self-test	-	-	Enable/Disable	Disable
Scheduled Self-test Hour	-	-	0~24	1
Scheduled Self-test Minute	-	-	0~60	0

Table 3-2 Front Panel Display

Chapter 4 Function Description

4.1 Measurements

The IMH100 provides Insulation Resistance to ground (Riso) and Leakage Capacitance to ground (Ce) of the Medical IT system.
In addition, the IMH100 is capable of measuring load current and temperature of the Isolation Transformer.
The measurements can be retrieved through the Front Panel or communications.

Parameters	Description	Range
Insulation Resistanc	Insulation resistance of IT system to Earth	10kΩ~1MΩ
Leakage Capacitance	Leakage capacitance of IT system to Earth	0~5μF
Load Current	Load current of isolation transformer	1~120%
Temperature	Temperature of isolation transformer	-50~+200℃
L1 to L2 Voltage	Voltage of medical IT system	0~250V
L1 to Earth Voltage	L1 to Earth voltage, for auxiliary judgment of grounded phase line	0~250V
L2 to Earth Voltage	L2 to Earth voltage, for auxiliary judgment of grounded phase line	0~250V

Table 4-1 Measurement

4.2 Digital Outputs

The IMH100 comes with two Form A Electrometrical Relays. Digital Outputs are normally used for setpoint alarming, load control, or remote control applications. Digital Outputs on the IMH100 can be used in the following applications:
1) Front Panel Control Manually operated from the front panel.
2) Remote Control Remotely operated over communications.
Since there are multiple ways to trigger the Digital Outputs on the IMH100, a prioritized scheme has been developed to avoid conflicts between different applications. In general, Front Panel Control has the highest priority and can override other control schemes.

4.3 Communications

The IMH100 comes standard with one Ethernet Port, two RS-485 port and one CAN port for integration into power monitoring networks:

- The Ethernet port and RS-485 ports are used for integrating the IMH100 to a monitoring system, including the ID100.
- The CAN port is used for communications between ILH100 Fault Locator.

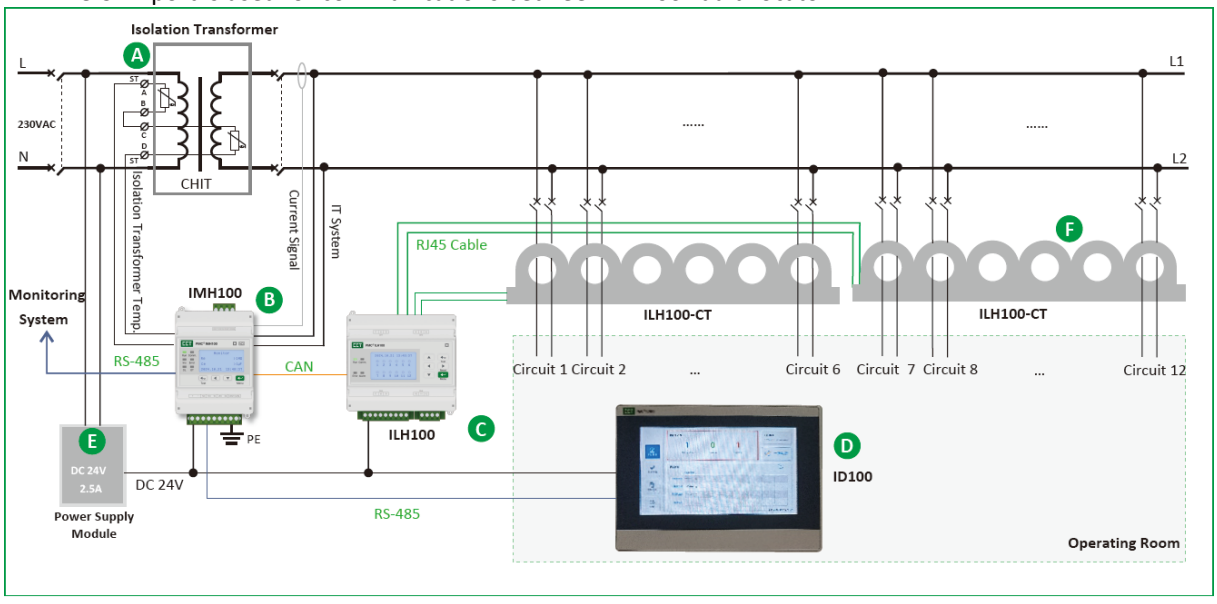


Figure 4-1 Wiring

4.4 SOE Log

The IMH100's SOE Log can store up to 64 events such as Power-on, Power-off, Warnings, Alarms, Setup changes and Self-Diagnostics in its non-volatile memory. If there are more than 64 events, the newest event will replace the oldest event on a First-In-First-Out basis. The SOE Logs are available via communications and can be reset through both Front Panel and communications.

4.5 Time Synchronization

The Monitoring System is configured to provide regular time synchronization by broadcasting time-sync packets over the Ethernet or RS-485 of the IMH100. Further, the IMH100 is equipped with a battery-backed real-time clock. If the supply power is lost or removed, the internal back-up battery keeps the real-time clock running until power is restored.

4.6 Diagnostics

The IMH100 is equipped with a simple wire breakage diagnosis function, which is used to remind users of potential wiring errors during installation. This function serves only as a reference for debugging, and the authenticity of the detected wire breakage conditions needs to be verified through further checking. Examples of such wire breakage scenarios include: wire breakage in the L1 and L2 system wiring, wire breakage in the CT current signal, wire breakage in the temperature signal, and wire breakage in the grounding wire.

Chapter 5 Technical Specifications

IT System		
Nominal Voltage *U*n		70~250V AC
(AC) Nominal Frequency *f*n		47~63Hz
Power Supply		
Standard		24V DC (By Power Supply Module)
Burden		<6W
Inputs and Outputs		
Temperature Input (TC11, TC12)		2 channels, 24VDC internally powered
Digital Output (DO1, DO2) Break capacity Operating time Release time		5A @ 250VAC or 30VDC, Normally Open (NO) contact L/R=40ms, 10000 operations 220V DC, 0.1A 110V DC, 0.3A 48V DC, 1A < 10ms < 10ms
Communications		
RS-485		2xRS-485
	Baud rate	1200, 2400, 4800, 9600, 19200, 38400 bps
	Protocols	Modbus
CAN		1xCAN
	Baud rate	100k, 125k, 250k, 500 kbps
	Protocols	Modbus
USB		1xUSB
Insulation Monitoring		
Insulation Resistance	Range	10KΩ~1MΩ
	Accuracy	±10%
Leakage Capacitance	Range	1~5uF
	Accuracy	±10%
	Response Time (Ce=1μF)	<5s
	Warning & Alarm Range	10KΩ~1MΩ
Isolation Transformer	Current Range and Accuracy	0~60A, ±1%, 45~65Hz
	Temp. Range and Accuracy	-50-200°C, ±1°C
Measuring Circuit		
Permissible Extraneous DC voltage *U*fg		≤DC 300V
IT system leakage capacitance Ce		≤5μF
Measuring Voltage *U*m		≤±12V
Measuring Current *I*m		≤50μA
Location current IL		≤1mA
Internal DC Resistance *R*i		≥240kΩ
Insulation Response Time		< 5s when Rf=0.5×Ran and Ce=0.5μF
Insulation Resistance Range		10kΩ~1MΩ
Environmental Conditions		
Operating Temp.		-25°C~+70°C
Storage Temp.		-40°C ~+85°C
Humidity		5%~95%
Atmospheric Pressure		70 kPa~110 kPa
Impulse Voltage/Pollution Degree		6.4kV/III
Altitude		< 2000m
IP Rating		IP30
Pollution Degree		2

Accuracy

Parameters	Accuracy	Resolution
Insulation resistance	±10%	0.1kΩ
Isolation transformer load rate	±5%	0.1%
Leakage capacitance	±10%	0.1μF
Isolation transformer temperature	±1℃	0.1℃

Chapter 6 Standards Compliance

IEC 61557-8: 2007 Electrical safety in low-voltage distribution systems up to 1000 Va.c. and 1500 Vd.c.- Equipment for testing, measuring or monitoring of protective measures - Part 8: Insulation monitoring devices for IT systems

IEC 61557-9: 2009 Electrical safety in low-voltage distribution systems up to 1000 Va.c. and 1500 Vd.c.- Equipment for testing, measuring or monitoring of protective measures - Part 9: Equipment for insulation fault location in IT systems

IEC 60364-7-710: 2021 Electrical installations in medical locations. Applies to electrical installations in medical locations so as to provide safety of patients and medical staff.

IEC 61558-1: 2017 Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests. deals with safety aspects of transformers, reactors, power supply units and combinations thereof such as electrical, thermal and mechanical safety.

IEC 61558-2-15: 2022 deals with safety of isolating transformers for medical IT systems for the supply of medical locations.

Insulation Test		
Pulse voltage test		IEC61010-1:2010
AC voltage test		IEC61010-1:2010
Mechanical Test		
Vibration	Vibration response	IEC 255-2-1:1989
	Vibration endurance	IEC 255-2-1:1989
Shock	Shock response	IEC 255-2-2
	Shock withstand	IEC 255-2-2
Bump	Bump	IEC 255-2-2
Electromagnetic Electromagnetic		
EMC		IEC 61326-2-4:2020

Chapter 7 Contact Us

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