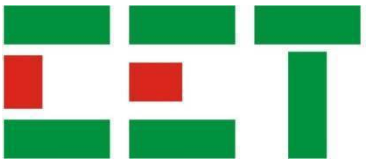
# PMC - 3601F

# Distributed Temperature Sensing

# User Manual



## Dangers and warnings

***This equipment must be installed by professional personnel. The manufacturer shall not be liable for any faults caused by failure to comply with the instructions in this manual.***

## Danger of electric shock, burning or explosion

- **Installation and maintenance of the equipment must be performed by qualified personnel.**
- **The equipment is an indoor-only device and shall not be used in outdoor harsh environments.**
- **Keep the equipment away from liquids.**
- **The signal processing unit is a precision optical instrument and must not be subjected to severe impact or dropping. The mounting bracket must be firm and reliable.**
- **The casing of the signal processing unit must be grounded.**

***Neglect of these precautions may cause serious injury.***



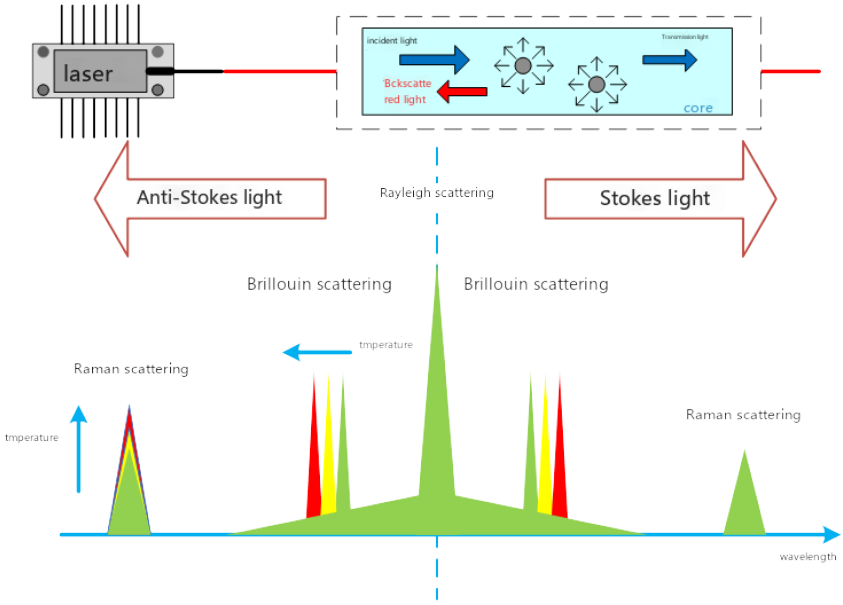
Every effort has been made to ensure consistency between this manual and the hardware/software. However, errors may exist, and we cannot guarantee absolute accuracy. The data in this manual will be periodically reviewed, and necessary revisions will be made in new editions. Suggestions for improvements are welcome. Changes in subsequent versions will not be notified separately.

# Table of Contents

# 1 Introduction to the Device

## 1.1 Overview

The PMC-3601F Distributed Temperature Sensing is a distributed temperature detection system based on the spontaneous Raman scattering effect and optical time-domain reflectometry (OTDR) technology. The system utilizes backscattered Raman signals generated by laser transmission in optical fibers to obtain spatial temperature distribution and positioning information through OTDR principles. It can continuously monitor the temperature along the optical fiber. By laying a several-kilometer-long optical fiber (serving as both a transmission medium and a sensing medium) in the area to be measured, it can continuously measure and accurately locate the temperature at each point along the fiber, detect environmental changes through temperature variations, and identify the position of temperature anomalies..




## 1.2 Product Features

- **Continuous Distributed Measurement:** The distributed optical fiber sensor enables true distributed measurement, providing continuous measurement information along kilometers of optical fiber cable, supporting real-time monitoring.
- **Electromagnetic Interference Resistance:** Made of quartz, optical fibers are completely electrically insulated. The signal transmission via optical fibers is intrinsically safe and immune to external electromagnetic interference, ensuring normal operation in high-electromagnetic environments.
- **Intrinsic Lightning Protection:** Fiber optic sensors are fully electrically insulated, capable of withstanding high voltage and current surges, making them resistant to lightning strikes that often damage electrical sensors.

- **Long Measurement Range:** Optical fibers offer high data transmission capacity and low loss, enabling remote monitoring over several kilometers without repeaters, suitable for long-distance applications.
- **High Sensitivity and Accuracy:** Fiber optic sensors exhibit higher sensitivity and accuracy than conventional sensors, which is proven by mature commercial products.
- **Long Lifespan, Low Cost, Simple System:** Constructed from quartz glass, optical fibers are corrosion-resistant, fireproof, waterproof, and have a service life of up to 30 years.

The PMC-3601F distributed optical fiber sensor has high detection sensitivity, good consistency and repeatability, capable of performing distributed measurements with high measurement accuracy; it can be used for on-site non-electrical detection, is inherently safe, resistant to electromagnetic interference, and lightning protection; it is particularly suitable for use in oil, natural gas pipelines, chemical, metallurgy, power, fire protection, energy, storage, military, and nuclear industries.

# 2 Product Types and Composition

The PMC-3601F Distributed Temperature Sensing is classified as a differential temperature, recoverable, distributed positioning detection product. The sensor incorporates a built-in buzzer that sounds in case of faults or fire alarms. According to the requirements of electrical fire standards, the sound pressure level should be greater than 65 dB and less than 115 dB at a distance of 1 m directly in front of the signal processing unit.

The optical fiber temperature measurement system primarily consists of a temperature-sensing optical cable, a signal processing unit, and a fire alarm controller. The product structure diagram is as follows:

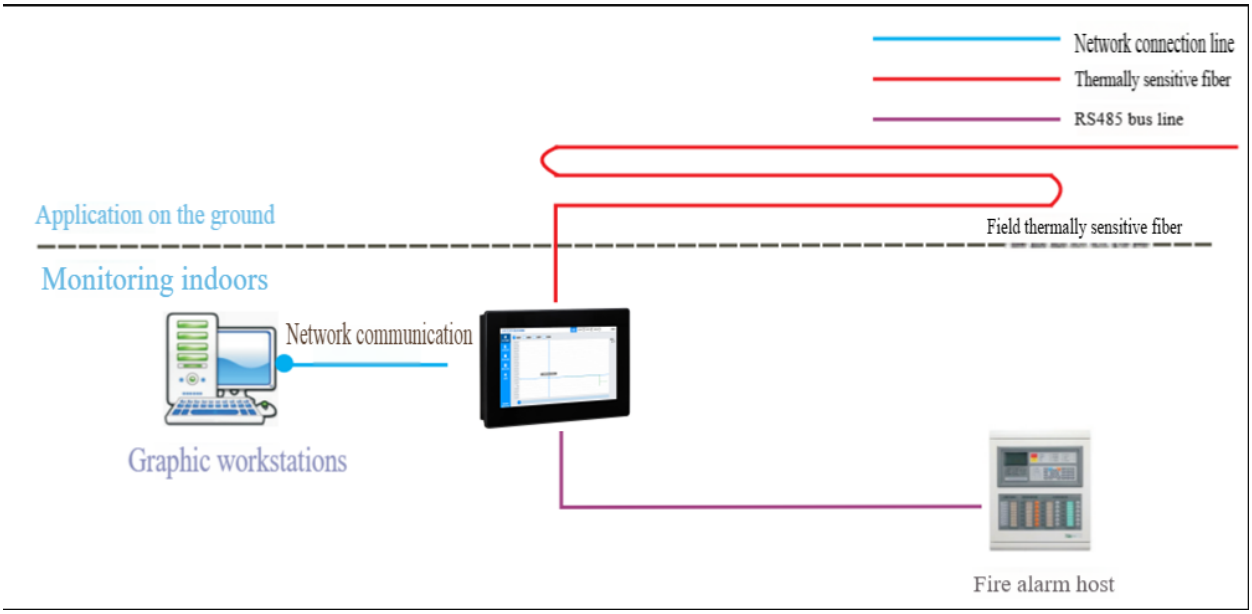



Figure 2.1 Composition Schematic of Distributed Optical Fiber Temperature Measurement System

The temperature-sensing optical cable includes the sensing cable and fiber optic patch cord. Due to its intrinsic safety, explosion-proof, and lightning-proof properties, the cable can be installed in hazardous areas (e.g., petrochemical storage sites) to sense temperature information. The signal processing unit, located in the control room, demodulates signals from the temperature-sensing cable and outputs corresponding signals.

# 3 Technical Specifications

## 3.1 Environmental Condition

- Ambient Temperature: -10°C ~ +50°C
- Storage Temperature: -40°C ~ +85°C
- Relative Humidity: 5% ~ 95% (non-condensing)
- Atmospheric Pressure: 70 kPa ~ 106 kPa
- Altitude: ≤3000m

## 3.2 Power Supply

- Power Supply Voltage: DC 24 V
- Power Consumption: <15 W

## 3.3 Switch Output (DO)

- 3-way electromagnetic relay outputs
- Switching Capacity: 5A continuous, 250V AC/30V DC
- Breaking Capacity: L/R=40ms, 10,000 cycles
  - 220V DC, 0.1A
  - 110V DC, 0.3A
  - 48V DC, 1A
- Action/Return Time: <10ms

## 3.4 Communication Interface

### 3.4.1 2-Way RS-485 interfaces

- Interface Type: RS-485, two-wire
- Operation Mode: Half-duplex
- Communication Rates: 1200, 2400, 4800, 9600, 19200, 38400 bit/s
- Protocol: MODBUS-RTU

### 3.4.2 2-Way Ethernet ports

- Interface Type: Electrical interface (RJ-45 interface)
- Communication Rate: 10/100M auto-negotiation
- Protocols: MODBUS-RTU, MODBUS-TCP

## 3.5 Terminal Screw Tightening Torque

- Power Supply Terminals: 0.5N·m
- Other Terminals: 0.5N·m

## 3.6 Enclosure Protection Rating

- Protection level: IP30

## 3.7 Class of Pollution

- Pollution Degree: Level 2

## 3.8 Accuracy

| Measurand | Maximum Allowable Error & Accuracy Class |
|---|---|
| Temperature Accuracy | ±1°C (≤100°C) |
| Positioning Accuracy | 1 meter |
| Spatial Resolution | 2 meter |

## 3.9 Insulating Tests

| Test Item | Standard Reference |
|---|---|
| Insulation Resistance | IEC 62052-11: 2020 |
| Impulse Test | IEC 61010.1:2010 |

| | |
|---|---|
| AC Voltage Test | IEC 61010.1:2010 |

## 3.10 Mechanical Tests

| Test Item | | Standards basis | Severe level |
|---|---|---|---|
| Vibration test (Sinusoidal) | Vibration Response Test | IEC 60051-1:2016 | Level 1 |
| | Vibration Endurance Test | IEC 60051-1:2016 | Level 1 |
| Shock Test | Shock Response Test | IEC 60051-1:2016 | Level 1 |
| | Shock Endurance Test | IEC 60051-1:2016 | Level 1 |
| Collision test | | IEC 60051-1:2016 | Level 1 |

## 3.11 Electromagnetic Compatibility

| Test Item | Standards basis | Severe level |
|---|---|---|
| Electrostatic Discharge Immunity Test | IEC 61000-4-2:2008 | Level 4 |
| Radiated, Radio-frequency, Electromagnetic Field Immunity Test | IEC 61000-4-3:2020 | Level 3 |
| Electrical Fast Transient/Burst Immunity Test | IEC 61000-4-4:2012 | Level 4 |
| Surge Immunity Test | IEC 61000-4-5:2014 | Level 4 |
| Immunity to Conducted Disturbances, Induced by Radio-frequency Fields | IEC 61000-4-6:2023 | Level 3 |
| Power Frequency Magnetic Field Immunity Test | IEC 61000-4-8:2009 | Level 4 |
| Ring Wave Immunity Test | IEC 61000-4-12:2017 | Level 3 |

## 3.12 Temperature Measurement Performance

| | |
|---|---|
| Type of fiber | Standard 62.5/125mm multimode fiber |
| Temperature Measurement Range | -40~150℃ (depending on the material of the optical fiber) |
| Maximum Measurement Distance | 10km |
| Single-channel Measurement Time | <5 seconds/channel |
| Number of Measurement Channels | 4 |
| Power Consumption | <15W |
| Operating Temperature Range | -10~50℃ |

# 4 Installation and Wiring

## 4.1 Mounting Diagram

### 4.1.1 Environment

The device should be installed in a dry, clean location away from heat sources and strong electromagnetic fields, with an enclosure protection level of IP30.

### 4.1.2 Mounting location

Typically installed on a cabinet or wall surface to protect the device from oil, dirt, dust, corrosive gases, or other harmful substances. Ensure convenient maintenance and sufficient space for cables, terminal blocks, fiber optic patch cords, and other necessary equipment.

### 4.1.3 Mounting size

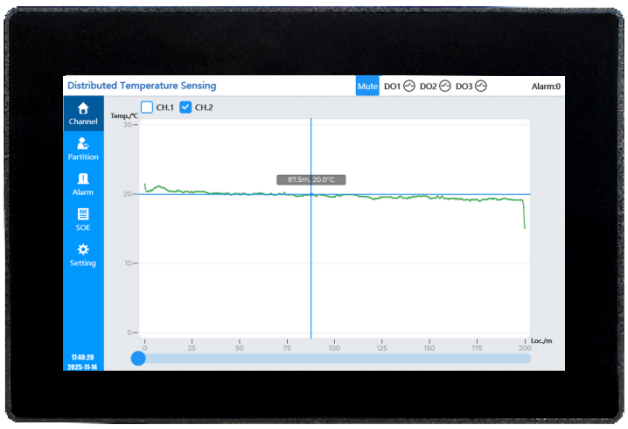



Figure 4.1.1 Front View of PMC-3601F

1) Panel-Mounted Embedded Installation

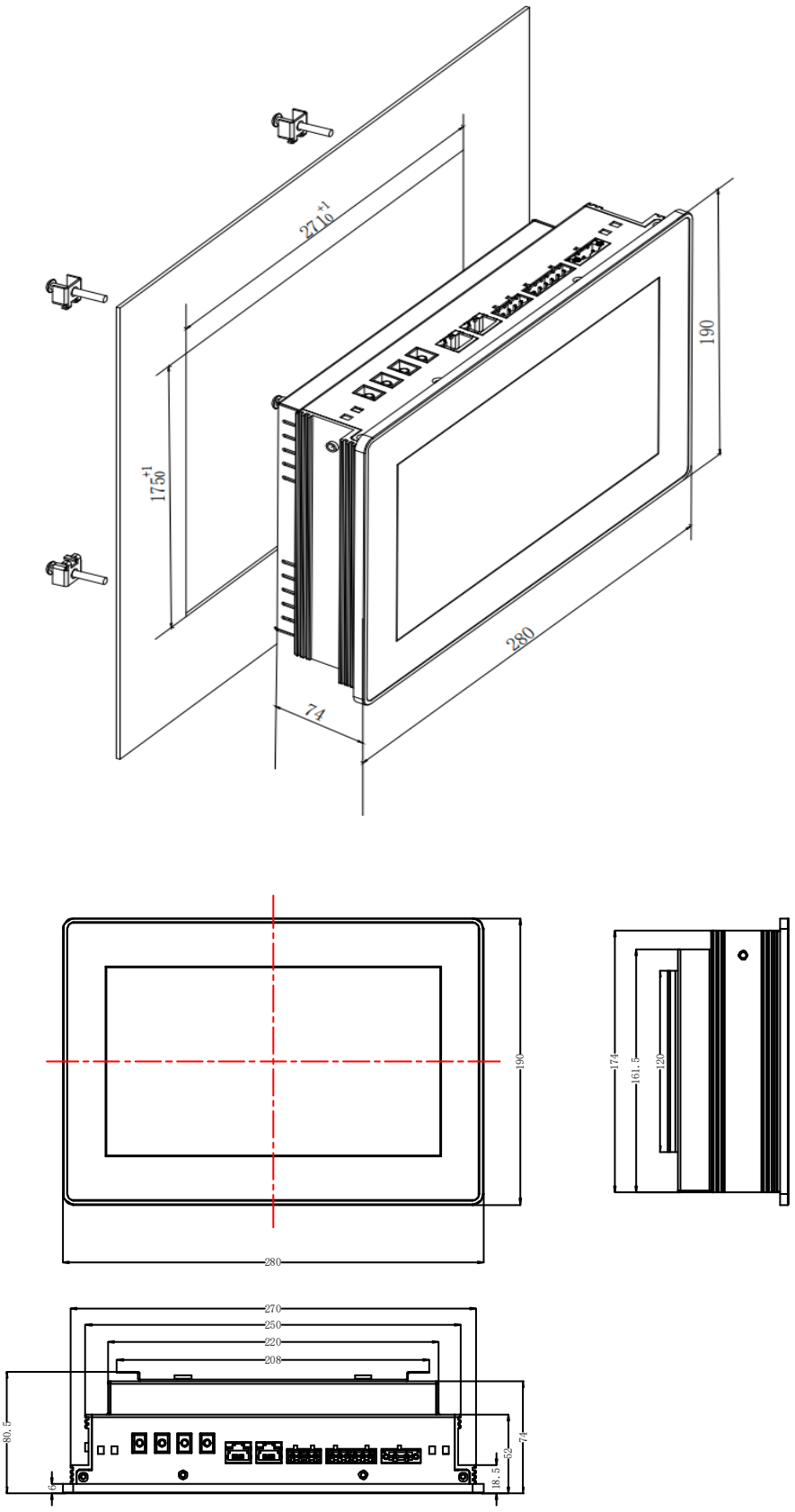
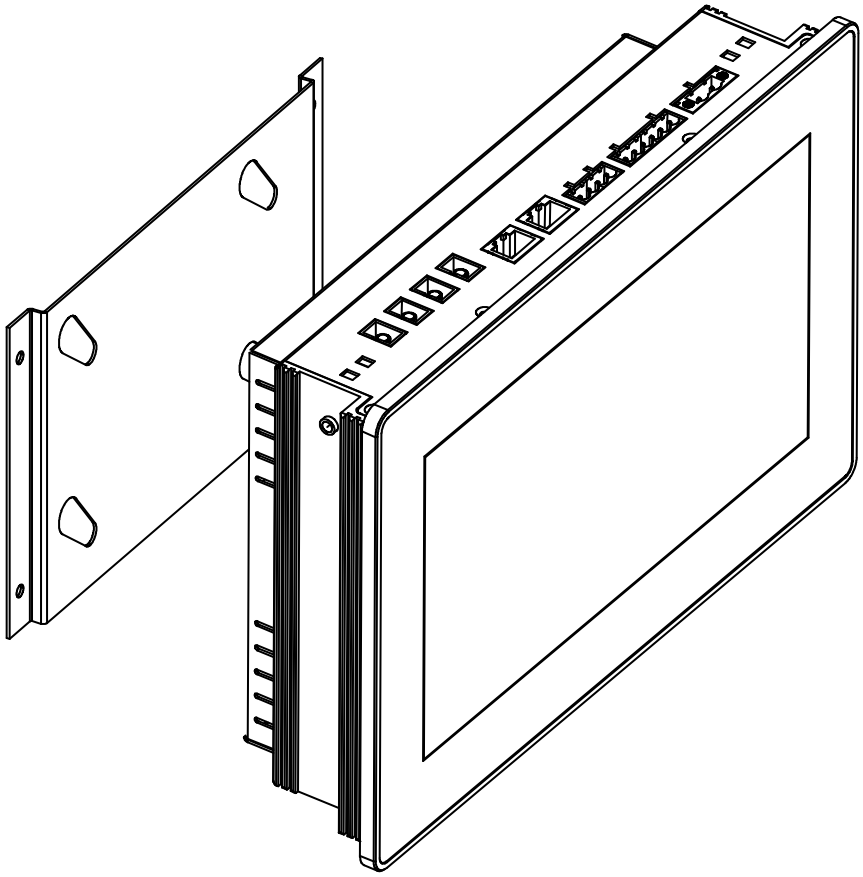



Figure 4.1.2 Panel-Mounted Embedded Installation Dimensions

2) Wall-Mounted Installation



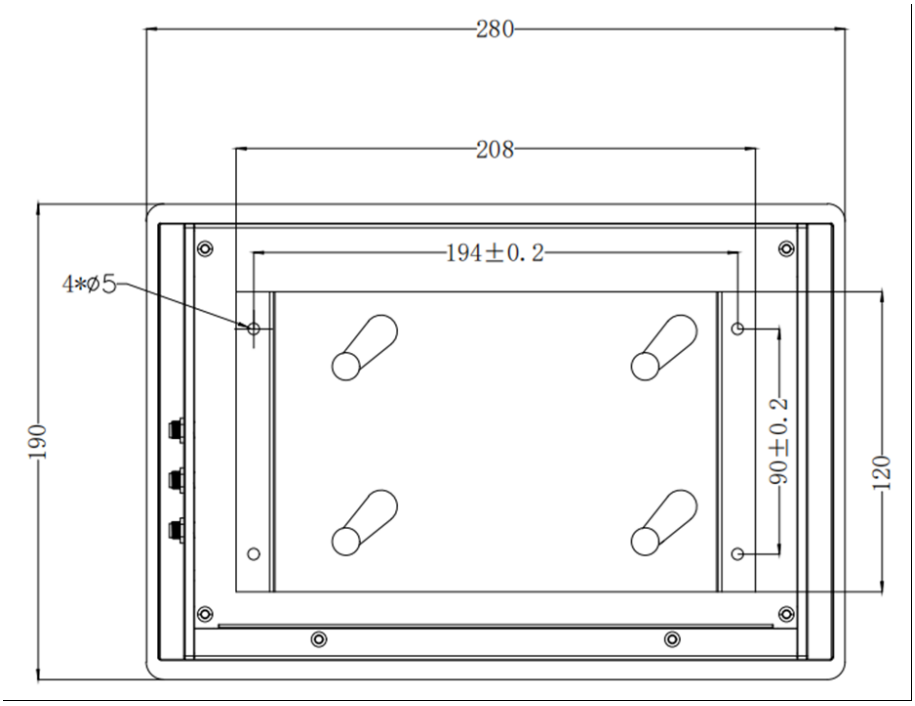



Figure 4.1.5 Wall-Mounted Installation Dimensions

## 4.2 Terminal Diagram

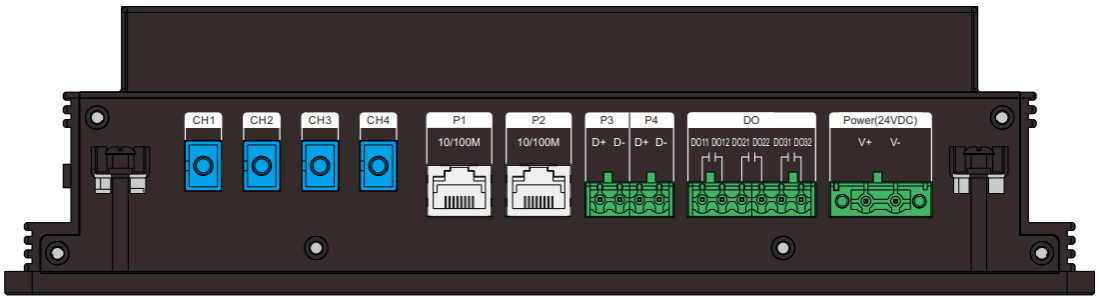



Figure 4.2 PMC-3601F terminal diagram

| symbol | explain |
|---|---|
| CH1~CH4 | Optical fiber temperature measurement channel |
| P1,P2 | RJ45 network communication port (2 channels) |
| P3,P4 | RS-485 serial port (2 channels) |
| DO11, DO12, DO21, DO22, DO31, DO32 | Electromagnetic relay output |
| V+,V- | 24VDC power supply |

## 4.3 Terminal Wiring

### 4.3.1 Power Supply

Power supply: DC 24V.

### 4.3.2 Communication wiring

1) Ethernet Communication

10/100M auto-negotiation Ethernet ports with standard RJ-45 connectors.

2) RS-485 Communication

RS-485 communication port, terminal marked as D+ and D-

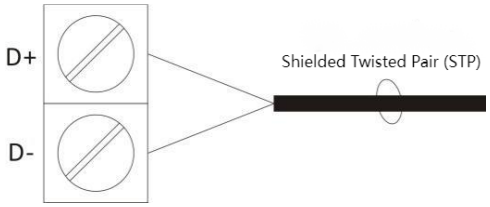



Figure 4.3.1 Communication Wiring Diagram

### 4.3.3 DO wiring

The device integrates 3 electromagnetic relays, with terminal blocks labeled DO11、DO12、DO21、DO22、DO31、DO32. They can directly switch 250VAC/5A or 30VDC/5A loads. For high-current loads, add intermediate relays.

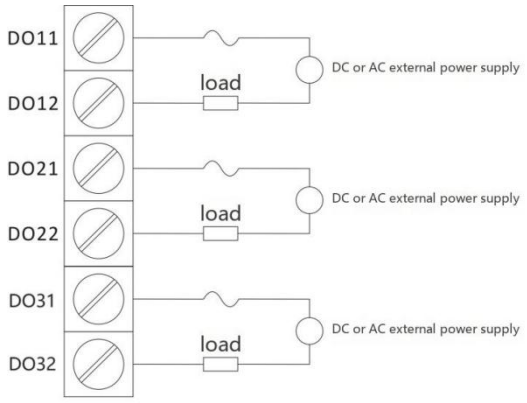



Figure 4.3.2 DO wiring diagram

# 5 Optical Fiber Cable for Temperature Measurement

The temperature-sensing optical cable (including optical fibers/cables and their patch cords) is a vital component of the PMC-3601F distributed optical fiber temperature sensor system. The system employs a spiral steel tube armored temperature-sensing cable, a universal distributed temperature measurement system detection cable suitable for most temperature measurement environments such as traffic tunnels, electric power, petrochemical, steel, and coal industries. The cable features a high-strength armored design with the following performance characteristics:

- **Armored Protection:** Ensures excellent mechanical properties.
- **Simple Structure:** With a small outer diameter, it enables fast heat penetration and rapid temperature measurement response.
- **Environmentally Friendly Flame-Retardant Sheath:** Made of PVC or LSZH, providing good protection performance.
- **Excellent Flexibility:** Facilitates easy construction and laying.

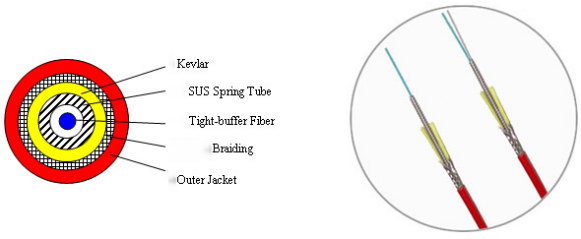



Figure 5.1.1 Structural Schematic of Temperature-Sensing Optical Cable

In the PMC-3601F distributed optical fiber temperature sensor system, the optical fiber is marked with a meter scale every meter to indicate the fiber length, which is used to determine the relative position of the temperature measurement points. The optical fiber of each channel needs to be connected to the host via an ST fiber optic patch cord. It is not recommended that the number of fusion splice points of the temperature-sensing optical fiber for each channel exceed 5.

Figure 5.1.2 Fiber Optic Patch Cord

# 6 Device Operation

The LCD screen of the PMC-3601F intuitively displays the sensor's working status, as well as the channels and locations of faults or fire alarms.

## 6.1 Optical Fiber Channel Interface

the LCD screen displays the sensor's temperature curve, with the horizontal axis representing the fiber distance and the vertical axis representing the fiber temperature. The temperature curve can be zoomed in or out by manual sliding.

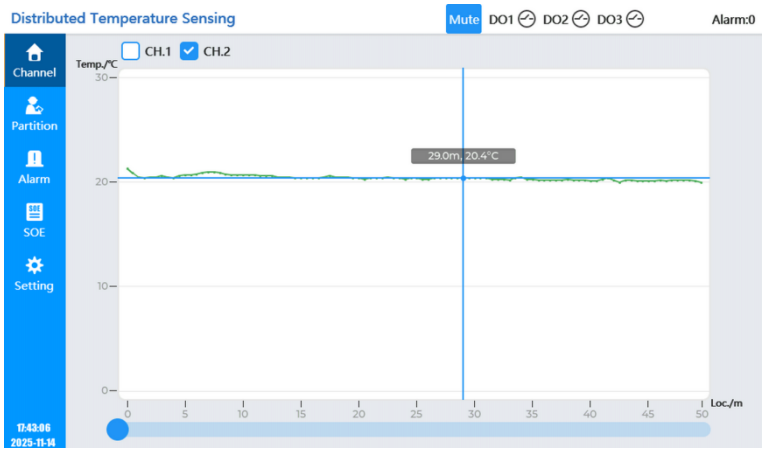



Figure 6.1 Optical Fiber Channel Interface

## 6.2 Partition information interface

The partition interface mainly displays the temperature status of partitions under each optical fiber channel, with the maximum temperature, minimum temperature, and average temperature of each segment shown under each partition. A total of 50 partitions can be set, and each partition can be divided into 100 segments.

Each segment display interface has a status light, whose color indicates different meanings: green for normal operation, red for alarm events, yellow for early warning events, and gray for communication failures.

Each segment is accompanied by a temperature curve showing the maximum temperature and distance, minimum temperature and distance, and average value of the segment. The temperature resolution is 0.1°C.

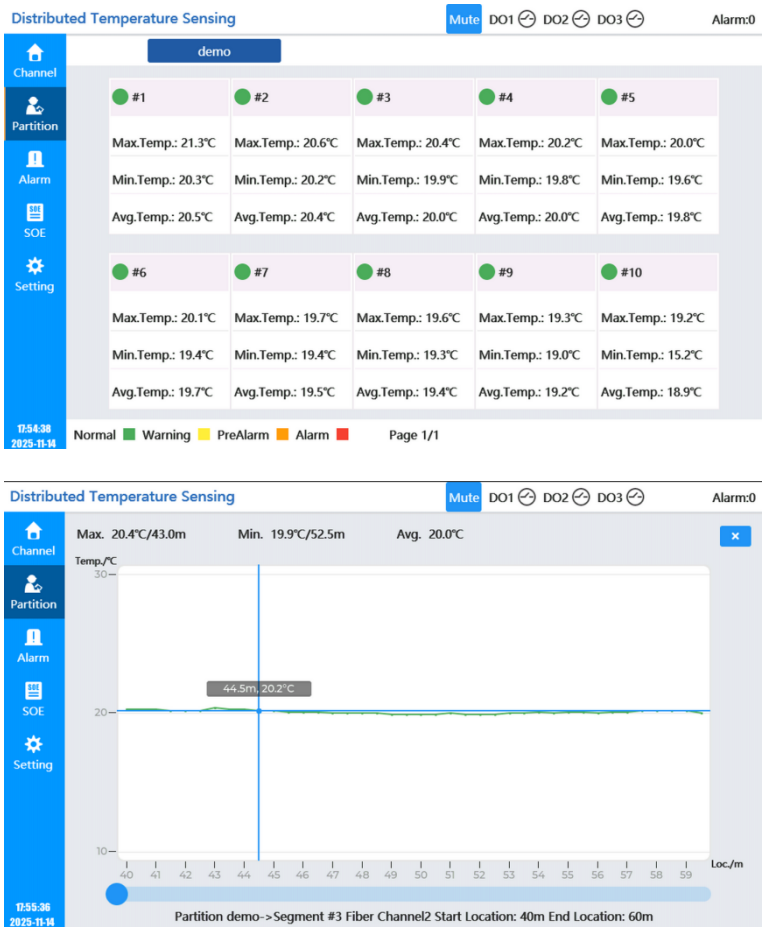



Figure 6.2 Partition temperature display interface

## 6.3 Real-Time Alarm Interface

When the sensor triggers a fault alarm, the LCD screen immediately displays the location of the current fault alarm, event type, event description, and alarm category.

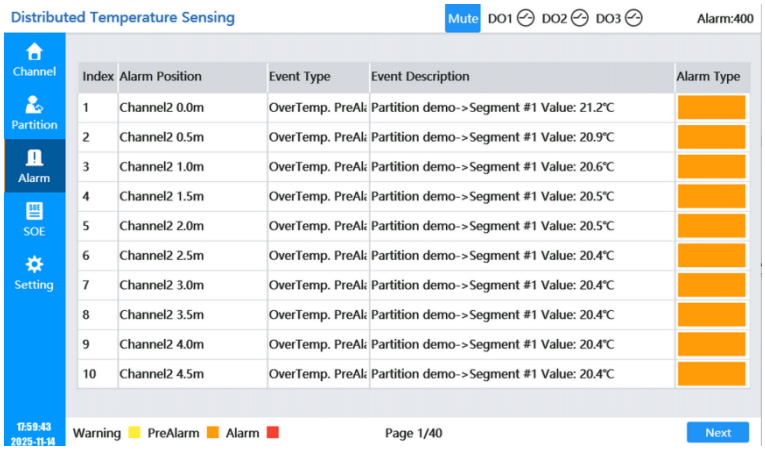



Figure 6.3 Real-Time Alarm Interface

## 6.4 Event Log Interface

For fault alarms that have occurred, the LCD screen records the occurrence time, fault type, event description, and other information in chronological order. To clear old event records, use the "Clear" button (password: 111111). For multi-page displays, use the "Jump," "Next", “Prev”, "Home" or "Last" buttons for navigation.

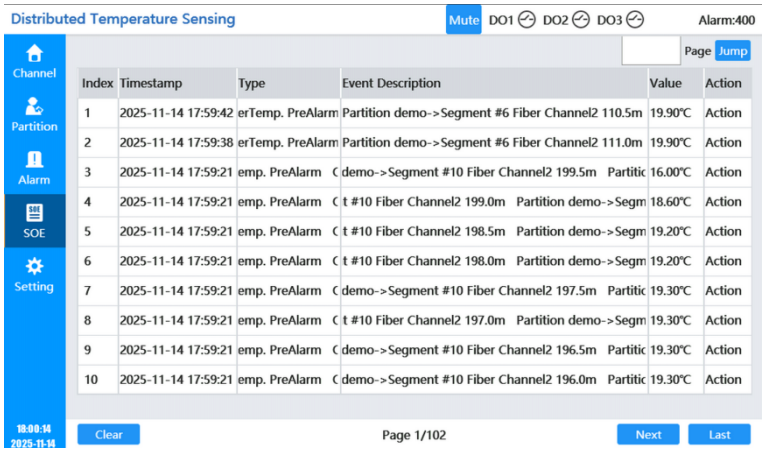



Figure 6.4.1 Event Log Interface

## 6.5 Settings Interface

Access to the settings interface requires entering a password (default user password: 111111).

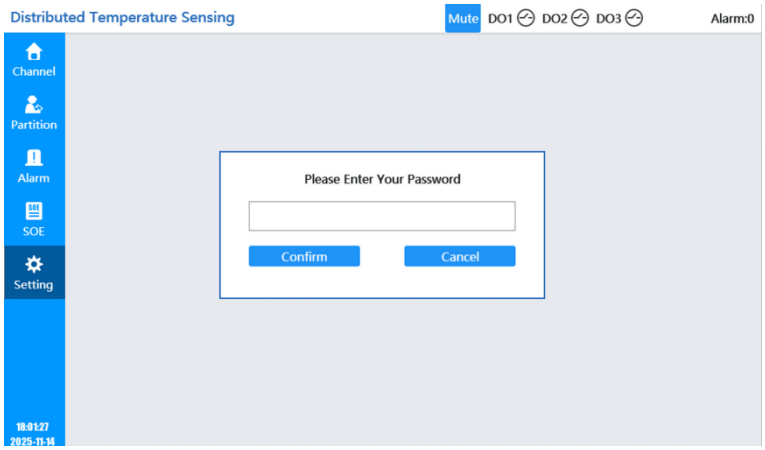



Figure 6.5.1 Password Entry Interface

The settings interface allows configuration of "Channel," “Partition" "Segment," "Limits," and "Serial related to optical fiber temperature measurement, as well as device parameters such as "Time," "Display," "Voice" "Password," "IP," and "Information"

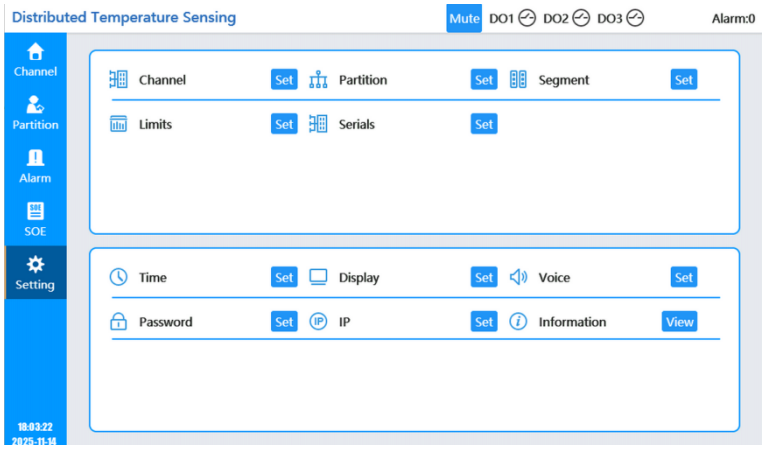



Figure 6.5.2 Overall Settings Interface

### 6.5.1 Optical Fiber Channel Settings

The optical fiber channel settings interface configures parameters for Optical Fiber Channels 1 to 4, including fiber length, temperature coefficient, meter mark positioning coefficient, and meter mark positioning offset. The temperature coefficient, meter mark positioning coefficient, and meter index offset typically use factory default values and do not require adjustment.


Figure 6.5.3 Optical Fiber Channel Settings Interface

### 6.5.2 Optical Fiber Partition Settings

The optical fiber partition settings interface allows adding or deleting partitions using the "Add" or "Delete" buttons at the lower left. A maximum of 50 partitions can be set. Clicking on a partition serial number enters the partition modification interface to change the optical fiber partition name.

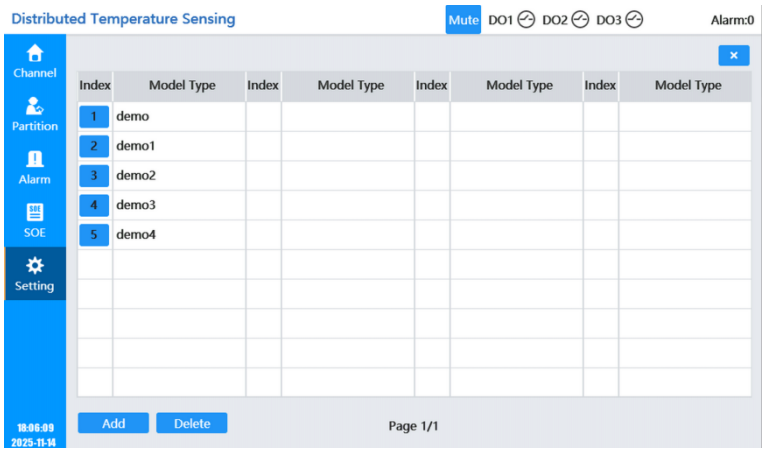



Figure 6.5.4 Optical Fiber Partition Settings Interface

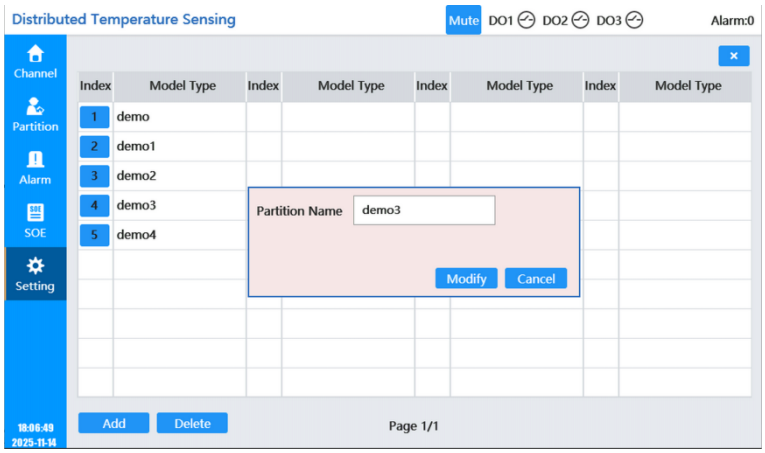



Figure 6.5.5 Optical Fiber partition Modification Interface

### 6.5.3 Optical Fiber Segment Settings

The optical fiber segment settings interface allows adding or deleting segments using the "Addt" or "Delete" buttons at the lower left. Each partition can have up to 100 segments. Settings include segment name, start distance, end distance, selection of optical fiber channel, and alarm parameters.

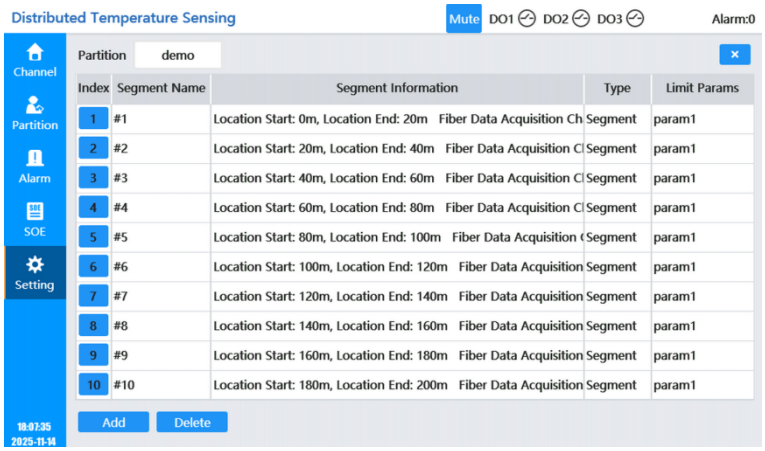



Figure 6.5.8 Optical Fiber Segment Settings Interface

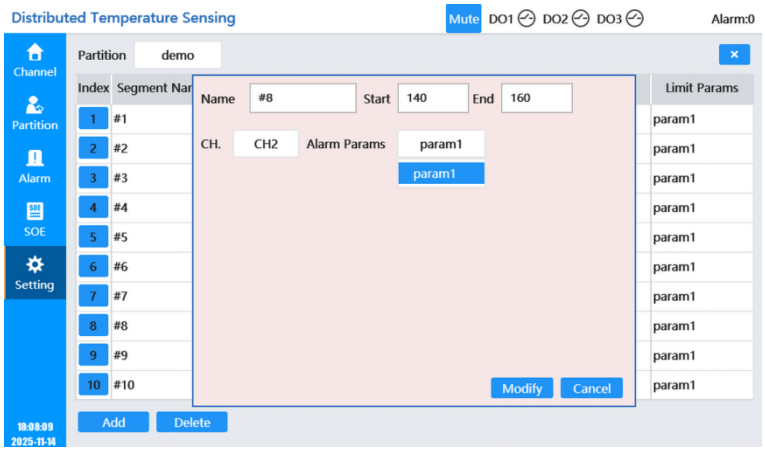



Figure 6.5.11 Optical Fiber Segment Modification Interface

### 6.5.4 Limit Settings

Configurable limits include temperature upper/lower thresholds, temperature rise rate, temperature difference, and abnormal temperature point values:

- **Over Temperature Limit Alarm:** Activates when temperature exceeds the set value .
- **Under Temperature Limit Alarm:** Activates when temperature falls below the set value.
- **Exceed Temperature Rise Rate Alarm:** Activates when temperature change exceeds the set value within a period.
- **Exceed Temperature Difference Alarm:** Activates when the difference between segment maximum temperature and line average exceeds the set value.
- **Exceed Temperature Abnormal Alarm:** Activates when a point's temperature differs from adjacent points (within 5m) by >10°C (recommended).

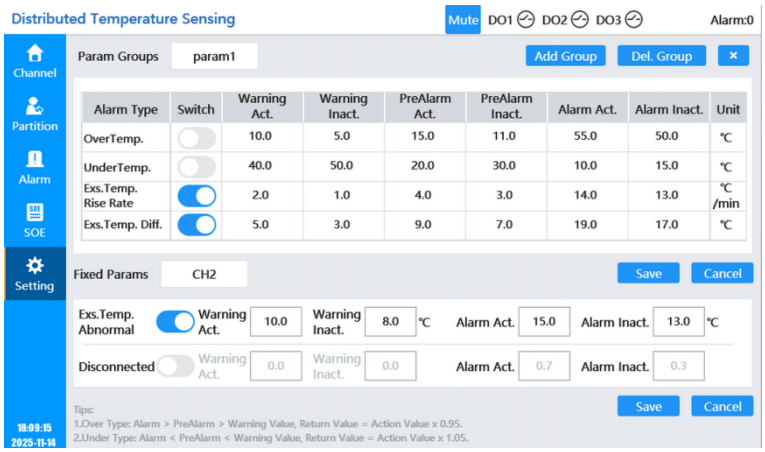



Figure 6.5.12 Parameter Group Settings Interface

### 6.5.5 Serial Parameters Settings

Configures baud rate and parity for serial ports (RS-485).

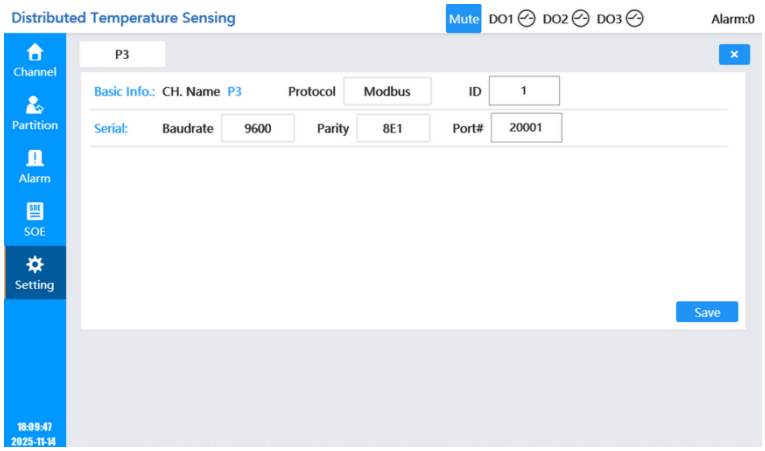



Figure 6.5.16 Serial Port Settings Interface

### 6.5.6 System Settings

**Time:** Sets device time/date, supporting IRIG-B, NTP and PTP time synchronization.

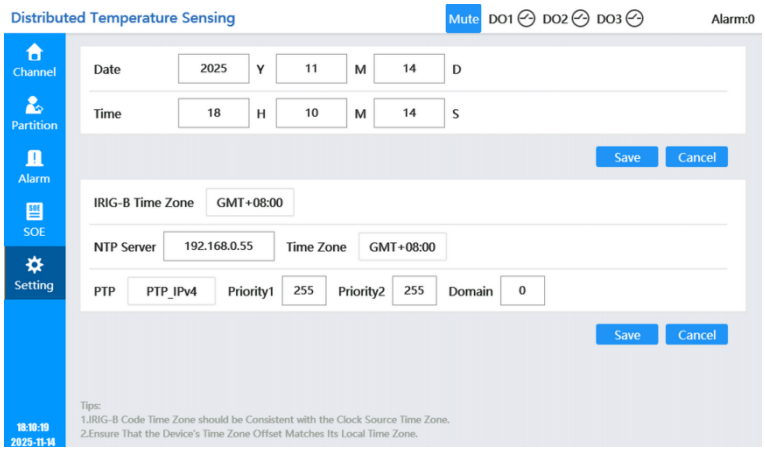



Figure 6.5.17 Time Settings Interface

**Display:** Adjusts screen brightness (default 5) and backlight timeout (default 5 minutes).

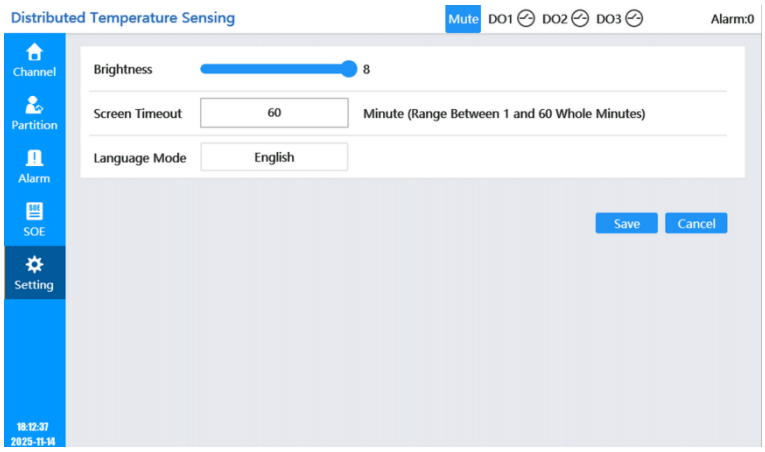



Figure 6.5.18 Display Settings Interface

**Voice:** Configures buzzer/screen flash modes and associates alarms with DO outputs.

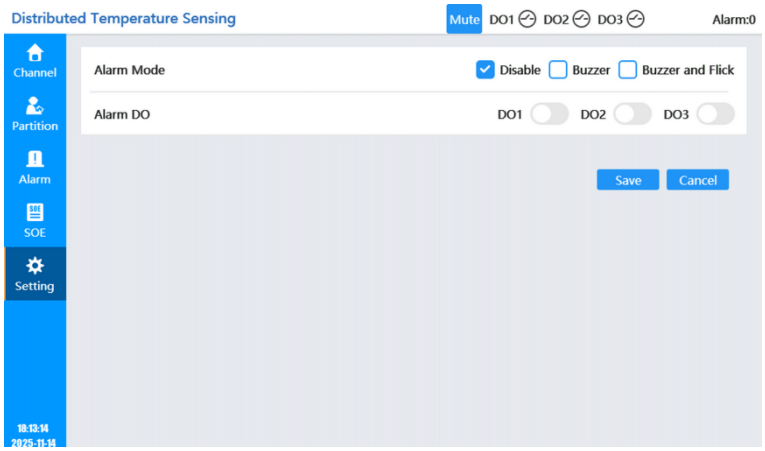



Figure 6.5.19 Voice Settings Interface

**IP:** Sets IP addresses and subnet masks for network ports (10/100M Ethernet).

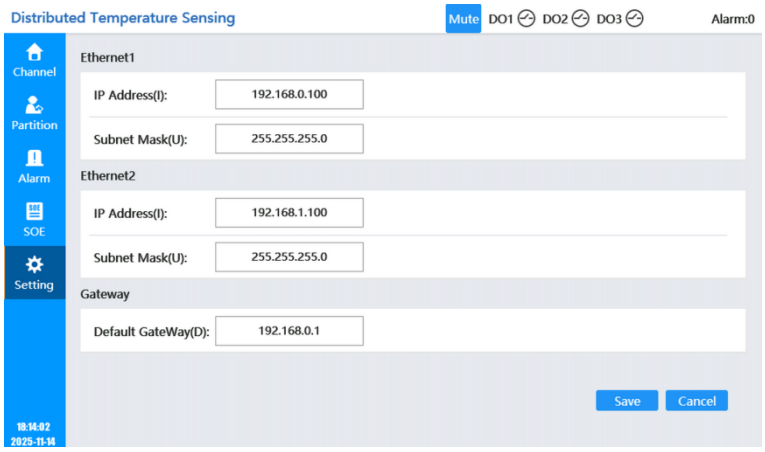



Figure 6.5.20 IP Address Settings Interface

**Password:** Changes the access password for the settings interface.

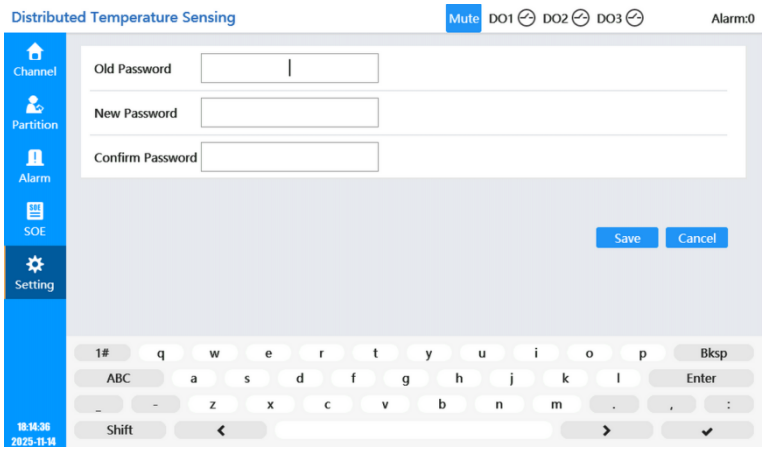



Figure 6.5.21 Password Settings Interface

**Information:** Displays version information, manufacturing date, and contact details.

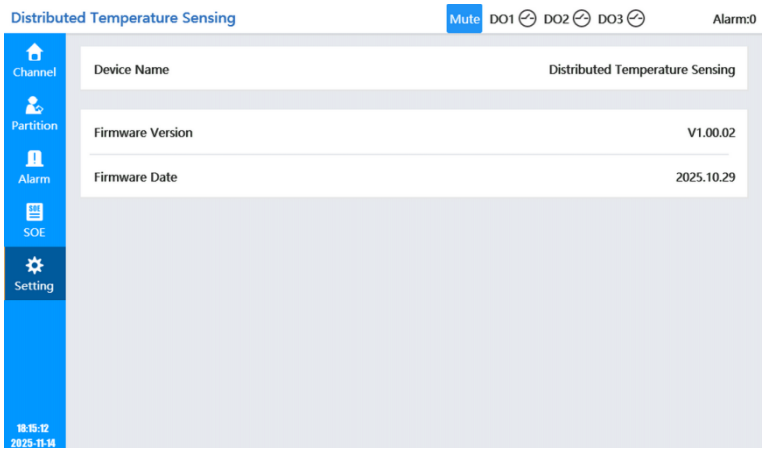



Figure 6.5.22 Device Information Interface

# 7 Quality Assurance

## 7.1 Quality assurance

All new devices sold to users are covered by a quality assurance period from the date of sale, during which defects in design, materials, or workmanship will be repaired or replaced free of charge. The supplier may request the device be returned to the factory for warranty validation.

## 7.2 Quality Assurance restrictions

Warranty does not cover:

- Damage from improper installation, use, or storage.
- Operation beyond specified environmental/operational conditions.
- Modifications by unauthorized personnel.
- Devices outside the warranty period.

# 8 Contact us

CET Electric Technology Inc.

Address: Floor 33-35, Building #6,Shenzhen International Innovation Valley,Dashi First Road, Nanshan District, Shenzhen,Guangdong, P.R. China

Postal code: 518055

Shenzhen:+86.755.83415187

Hong Kong:+852.94801059

Fax: 0755-83410306

Technical service (after-sales) phone: 400-9916-2 18

URL:www.cet-electric.co m