Selectric

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User Manual
Optical Temperature Monitoring Devices

Selectric - STP-OD

This equipment must be installed by qualified personnel only. The manufacturer is not responsible for any malfunctions resulting from failure to follow the instructions in this manual.

Electric shock hazard

■ Equipment installation and maintenance must be performed by qualified personnel only.

■ The signal processing unit is designed for indoor installation. Do not install it outdoors where it may be exposed to adverse weather conditions.

■ The signal processing unit must be protected from moisture.

■ The signal processing unit is a high-precision optical instrument. Avoid dropping or impacting the unit. The mounting bracket must be secure.

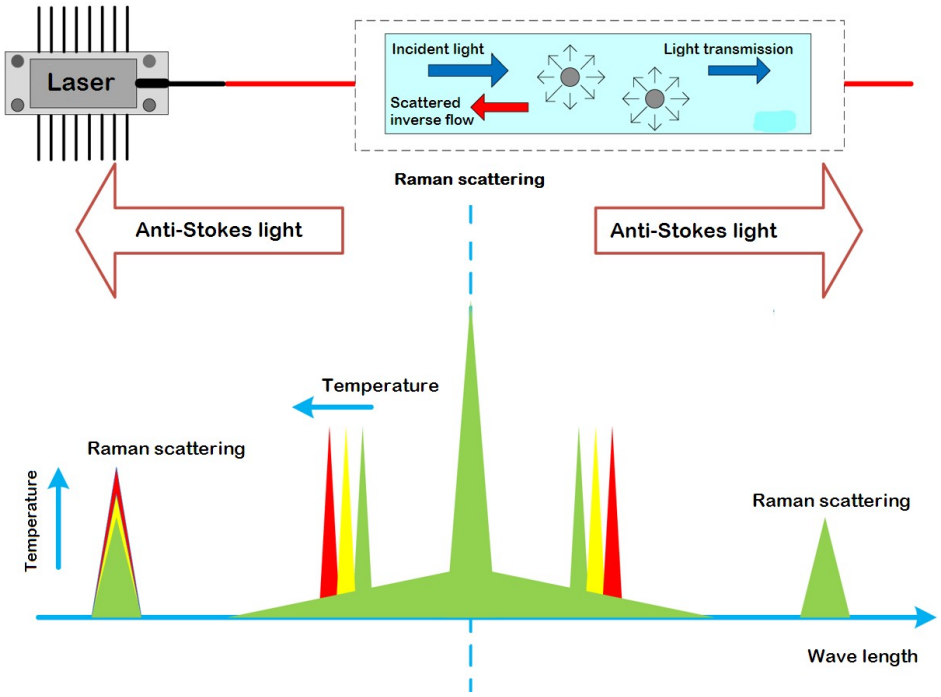
■ The signal processing unit enclosure must be grounded.

■ Failure to observe these precautions could result in serious injury.

Contents

1. Introduction

1.1. General information



The STP-OD Distributed Fiber Optic Temperature Sensor is a distributed temperature detection system based on spontaneous Raman scattering and time-domain optical reflectance technology. The system utilizes the Raman backscatter signal generated by laser light propagating through the optical fiber to obtain spatial temperature distribution and spatial positioning information based on the principle of time-domain optical reflectance and radar operation. The system enables continuous temperature monitoring over several kilometers of fiber optic cable (the optical fiber serves both as the signal transmission medium and as the signal detection and reception medium). This enables continuous measurement and precise temperature determination along the cable at various points in space to determine its spatial location and pinpoint temperature anomalies.

1.2. Device Features

■ Continuous distributed measurement –distributed fiber optic sensors enable continuous measurement data acquisition over several kilometers of fiber optic cable for temperature measurement, with a low rate of false alarms and dropouts, while providing real-time monitoring;

■ Low sensitivity to electromagnetic interference. The system can operate reliably in an electromagnetic environment –the optical fiber consists of quartz material, which is completely electrically insulated. At the same time, the fiber optic sensor signal is transmitted over an intrinsically safe optical fiber, unaffected by interference from the external electromagnetic environment;

■ Internal lightning protection – lightning often disables large numbers of electrical measurement sensors. Fiber optic sensors are resistant to high voltages and currents due to electrical insulation.

■ Measurement distances suitable for remote monitoring – two advantages of fiber optics are the large volume of data transmitted and low losses, which allows remote monitoring over distances of several kilometers without the need for retransmission;

■ High sensitivity and measurement accuracy – most optical fiber sensors theoretically even surpass conventional sensors in sensitivity and measurement accuracy.

Previously released and already used sensors are proving their effectiveness.

■ Long service life, low cost, simplicity – the optical fiber is made of quartz glass, which is corrosion-resistant, fire-resistant, waterproof, and has a long service life of up to 30 years.

The STP-OD distributed fiber optic temperature sensor is a temperature measurement device with high detection sensitivity, good consistency and repeatability, and ensures high accuracy of distributed measurement. This sensor is used for localized detection of electrical current loss and features electromagnetic interference and lightning protection. The system is particularly suitable for oil and natural gas pipelines, chemical industries, metallurgy, electric power, fire protection, energy, warehousing, military, and nuclear industries, and others.

2. Product Type and Composition

The STP-OD distributed fiber optic temperature sensor is designed, developed, and manufactured in accordance with GB 16280-2014. According to the national standard product classification requirements, this sensor is classified as a differential temperature, resettable, distributed position detection device. The distributed fiber optic sensor is equipped with a built-in buzzer that sounds an audible signal when a fault or fire alarm occurs. In accordance with GB 16280-2014, the sound pressure level is greater than 65 dB, and less than 115 dB at a distance of 1 m from the signal processing unit. The fiber optic temperature measurement system consists of a temperature-measuring optical cable, a signal processing unit, and a fire alarm controller. The figure below shows the schematic diagram of the product.

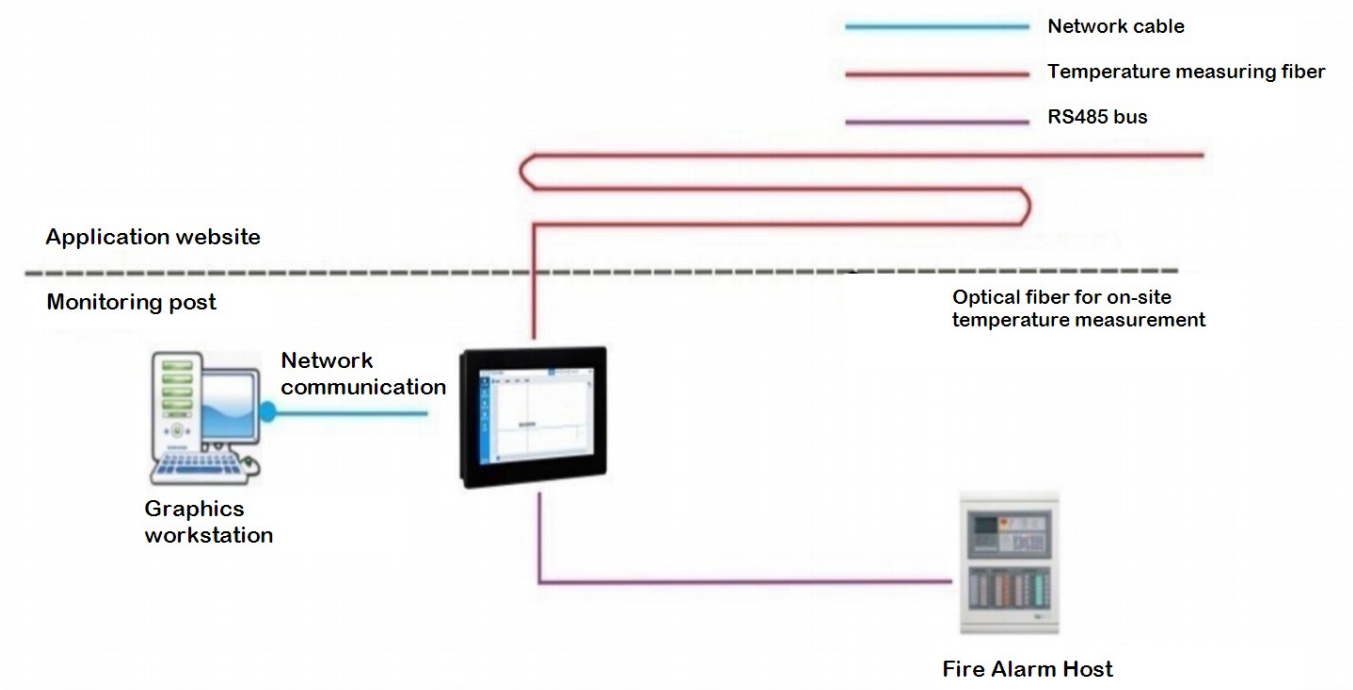


Figure 2.1. Schematic diagram of the STP-OD distributed fiber-optic temperature measurement system

The temperature-sensitive fiber optic cable consists of a temperature-sensitive fiber optic cable and jumper wires. Due to the intrinsic safety of the temperature-sensitive fiber optic cable, it can be installed in hazardous areas (e.g., petrochemical tanks) to obtain temperature information on the facility. A signal processing unit can be located in the control room to demodulate signals transmitted by the temperature-sensitive fiber optic cable and output the corresponding signals.

3. Technical Parameters

3.1. Environmental Conditions

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

3.2. Working capacity

Power Voltage: DC 24V.
Power Consumption: <15W

3.3. Switching Outputs (DO)

3 electromagnetic relay outputs
Connection capacity: 5 A continuous, 250 VAC/30 VDC
Breaking capacity: L/R=40 ms, 10,000 times
220 VDC, 0.1 A
110 VDC, 0.3 A
48 VDC, 1 A
Response/Release time: <10 ms

3.4. Communication Interface

(1) 2 RS-485 interfaces
Interface type: RS-485, 2-wire mode
Operating mode: half-duplex
Data transfer rate: 1200, 2400, 4800, 9600, 19200, 38400 bps
Data transfer protocol: MODBUS-RTU

(2) 2 Ethernet interfaces
Interface type: electrical interface (RJ-45 interface)
Data transfer rate: 10/100M
Communication protocols: MODBUS-RTU, MODBUS TCP

3.5. Terminal screw tightening torque

Power terminal: 0,5 N/m
Other terminals: 0,5 N/m

3.6. Enclosure Protection Rating

Protection Class: IP30

3.7. Pollution Level:

Pollution Level: 2

3.8. System Accuracy

Measurement	Maximum Permissible Error and Accuracy Class
Temperature	±1°C (up to 100°C)
Positions	1 meter
Spatial Temperature Resolution	0.5°C

3.9. Insulation Properties

Test	Standard
Electrical Insulation Resistance	GB/T 13729-2002, 3.6.1 (insulation resistance greater than 100 M Ω)
Impulse Voltage Test	GB/T 4793.1-2007 (IEC 61010.1:2001), 6.8 (6 kV peak voltage, 1.2/50 μs)
Alternating Voltage Test	GB/T 4793.1-2007 (IEC 61010.1:2001), 6.8 (2 kV RMS, 1 min)

3.10. Mechanical Parameters

Test Subject		Standard	Result
Vibration Test (Sinusoid)	Vibration Test	GB/T 7676.1-1998 (IEC 51-1:1984)	Level 1
	Vibration Test	GB/T 7676.1-1998 (IEC 51-1:1984)	Level 1
Impact Test	Impact Reaction Test	GB/T 7676.1-1998 (IEC 51-1:1984)	Level 1
	Impact Test	GB/T 7676.1-1998 (IEC 51-1:1984)	Level 1
Impact Test		GB/T 7676.1-1998 (IEC 51-1:1984)	Level 1

3.11. Electromagnetic Compatibility

Test	Standard	Result
Electrostatic Discharge Immunity Test	GB/T 17626.2-2006; IEC 61000-4-2:2001	Level 4
Radio-Frequency Radiated Electromagnetic Field Immunity Test	GB/T 17626.3-2006; IEC 61000-4-3:2002	Level 3
Burst Fast Transient Test	GB/T 17626.4-2008; IEC 61000-4-4:2004	Level 4
Surge (Impact) Immunity Test	GB/T 17626.5-2008; IEC 61000-4-5:2005	Level 4
Conducted Disturbance Immunity Test for Radio-Frequency Field Sensors	GB/T 17626.6-2008; IEC 61000-4-6:2006	Level 3
Power-Frequency Magnetic Field Immunity Test	GB/T 17626.8-2006; IEC 61000-4-8:2001	Level 4
Ring-Wave Immunity Test	GB/T 17626.12-2013; IEC 61000-4-12: 2006	Level 3
Limit Value for Radioactive Pollution	GB 9254-2008; CISPR 22: 2006	Level B

3.12. Temperature Measurement Fiber Optic

The main technical specifications of the STP-OD distributed fiber optic temperature sensor are listed below.

Fiber Type:	Standard 62.5/125 mm multimode fibers
Temperature Measurement Range:	-40~150°C (Depends on the temperature measurement fiber)

Maximum Measurement Distance:	10 km
Cycle Measurement Time:	<5 seconds/channel
Number of Measurement Channels:	4
Power Loss:	<15W
Wide Operating Temperature Range:	-10~50°C

Table 3-1 STP-OD Distributed Fiber Optic Temperature Sensor

4. Installation and Connection

4.1 Installation Diagram

4.1.1. Environmental Conditions

The device should be installed in a dry, clean place, away from heat sources and strong electromagnetic fields.

Protection Rating: IP30

4.1.2. Installation Location

The device is typically mounted on a cabinet or along a wall, protecting it from oil, dirt, dust, corrosive gases, and other harmful substances. When installing, ensure ease of access and sufficient space for the appropriate wiring, terminal blocks, contactors, and other necessary equipment.

4.1.3. Installation

Use snap-in mounting in a panel cutout or wall mounting. 4.1.4. Mounting Dimensions

(1) Appearance

Figure 4.1.1 Distributed air temperature sensor STP-OD. Appearance

Panel cutout for embedded mounting

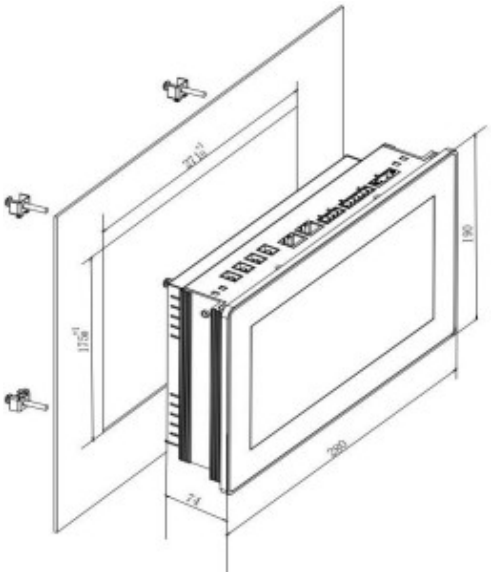


Figure 4.1.2 STP-OD Distributed Fiber Optic Temperature Sensor Embedding Diagram

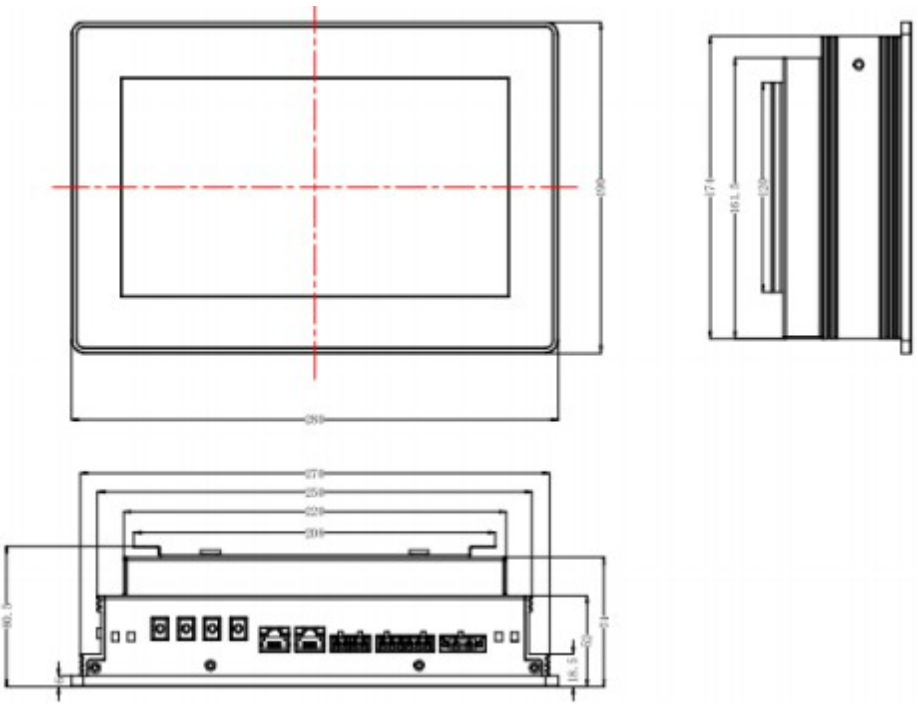


Figure 4.1.3 STP-OD Distributed Fiber Optic Temperature Sensor Dimensional Drawing for Embedded Elements

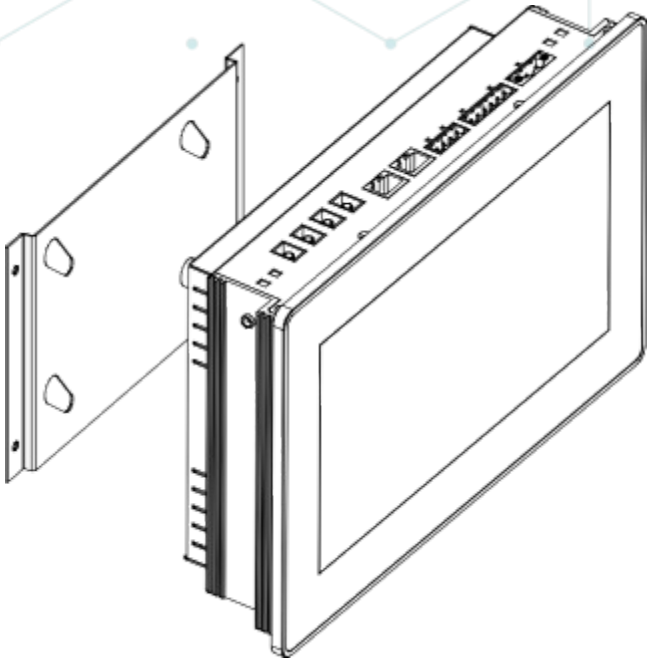


Figure 4.1.4 STP-OD Distributed Fiber Optic Temperature Sensor Wall Mounting Diagram

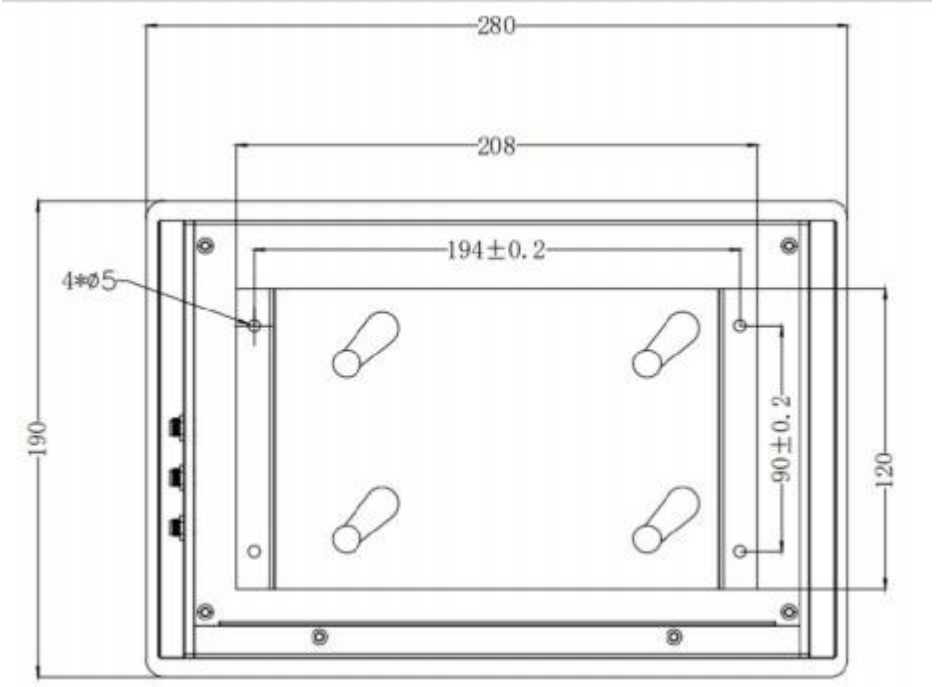


Figure 4.1.5 STP-OD Distributed Fiber Optic Temperature Sensor Wall Mounting Dimensions

4.2. Pinout

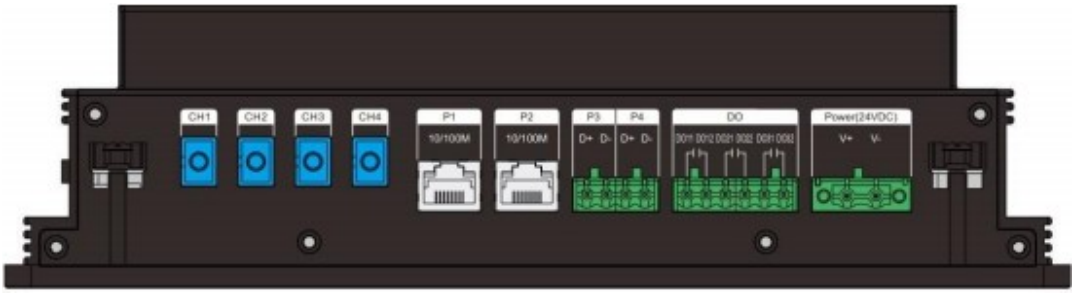


Figure 4.2 STP-OD Pinout (Bottom View)

Designation	Description
CH1~CH4	Fiber Optic Temperature Measurement Channel
P1, P2	RJ45 Network Communication Port (2 Channels)
P3, P4	RS485 Serial Communication Port (Bidirectional)
do11, do12, do21, do22, do31, do32	Electromagnetic Relay Output
V+, V-	Power Input

4.3. Power terminal wiring
24 VDC power supply.

Communication wiring

(1) Ethernet communication

Adaptive Ethernet port 10/100M, 10/100M; standard RJ-45 connector.

(2) RS-485 communication

RS-485 communication port with terminals labeled D+, D-.

RS-485 communication allows connecting up to 32 SEC series devices to a host computer via an RS-232/RS-485 converter on a single bus. A standard shielded twisted-pair cable can be used as the communication cable. The total length should not exceed 1200 meters. The positive and negative polarities of the RS-485 port of each device must be correctly connected, and the cable shield must be grounded at one end. If the shielded twisted-pair cable is long, it is recommended to connect a resistor of approximately 120 ohms to its end to improve communication reliability. The communication wires are connected as follows:

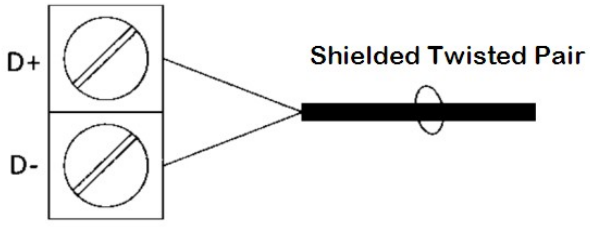


Figure 4.3.1 Enclosure Communication Wiring

The unit contains three solenoid relays with terminal blocks DO11, DO12, DO21, DO22, DO31, DO32, which can directly disconnect 250VAC/5A or 30VDC/5A loads. For high load currents it is recommended to add intermediate relays.

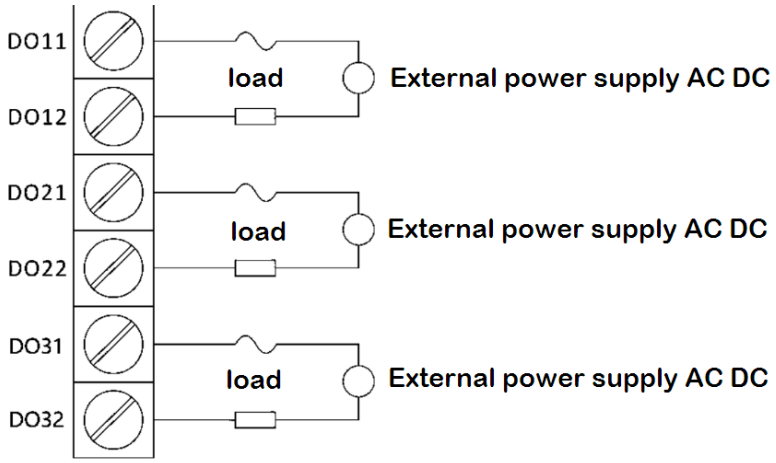


Figure 4.3.2 DO Connection Diagram

5. **Temperature-Sensing Optical Cable**

The SCJKBH-1A1b-3.0-R temperature-sensing optical cable (including the fiber optic/adapter cable and its jumpers) is an important part of the STP-OD distributed fiber optic temperature sensing system. The armored temperature-sensing optical cable with spiral steel tube is a universal optical cable for detecting distributed temperature measurement systems. It can be applied in most temperature measurement environments, such as transportation tunnels, electric power, petrochemical, steel, coal, etc. The optical cable features a high-strength armored structure and offers the following performance characteristics:

■ Armored protection with good mechanical properties;
■ Simple design, small outer diameter, rapid heat penetration, and fast temperature measurement response;
■ Environmentally friendly, flame-retardant PVC or LSZH (low smoke, zero halogen) sheath with good shielding properties;
■ The optical cable offers excellent flexibility and is easy to manufacture and install;

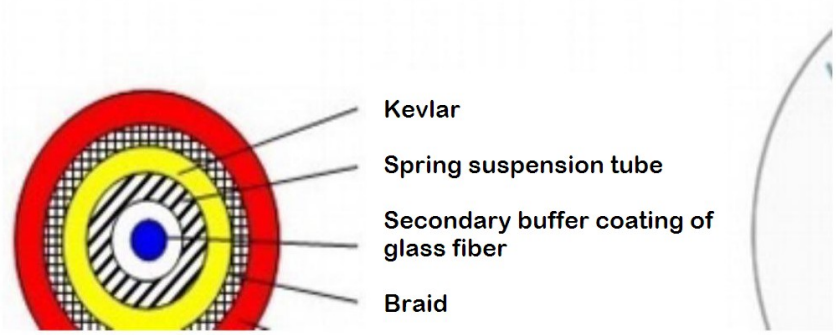


Figure 5.1.1 Sketch of the temperature-sensing fiber optic cable structure

In the STP-OD distributed fiber optic temperature detection system, the fiber optic cable with a temperature sensor is marked with the model number of the fiber optic cable with a temperature sensor at each meter.

The temperature-sensing fiber optic cables of individual channels are connected to the main unit using patch cables.

Figure 5.1.2 SCJKBH-1A1b-3.0-R Temperature-Sensing Optical Cable

6. Device Operation

The STP-OD LCD display is intuitively comprehensible; it displays the sensor's operating status, as well as the channels and locations of faults and fire alarms.

6.1 Fiber Optic Channel Interface

During normal operation of the signal processing unit, the LCD displays the sensor's temperature curve, the horizontal coordinate is the distance to the optical fiber, and the vertical coordinate is the fiber temperature, as shown in the figure below.

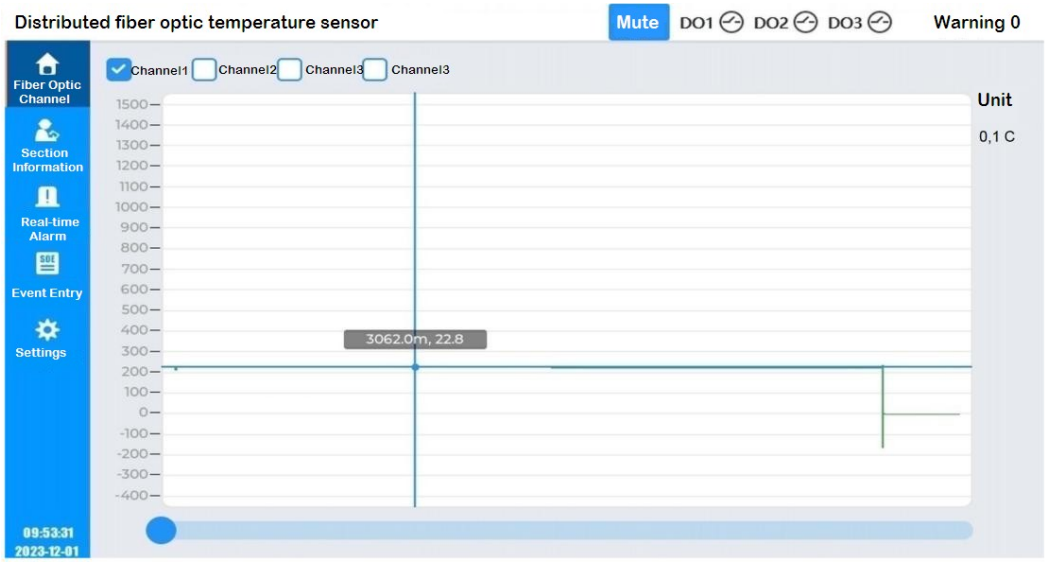


Figure 6.1 Fiber Optic Channel Interface

The temperature profile can be scaled by manually sliding it.

6.2 Monitored Segment Information Screen

The section interface primarily displays the temperature status of each segment under the fiber optic channel, with the maximum, minimum, and average temperatures of each segment displayed below each section. A total of 50 sections can be configured, and up to 100 segments can be configured within each section.

Each segment display interface has a status indicator, the color of which indicates different values: green indicates normal operation, red indicates an alarm, yellow indicates a warning event, and gray indicates a communication failure.

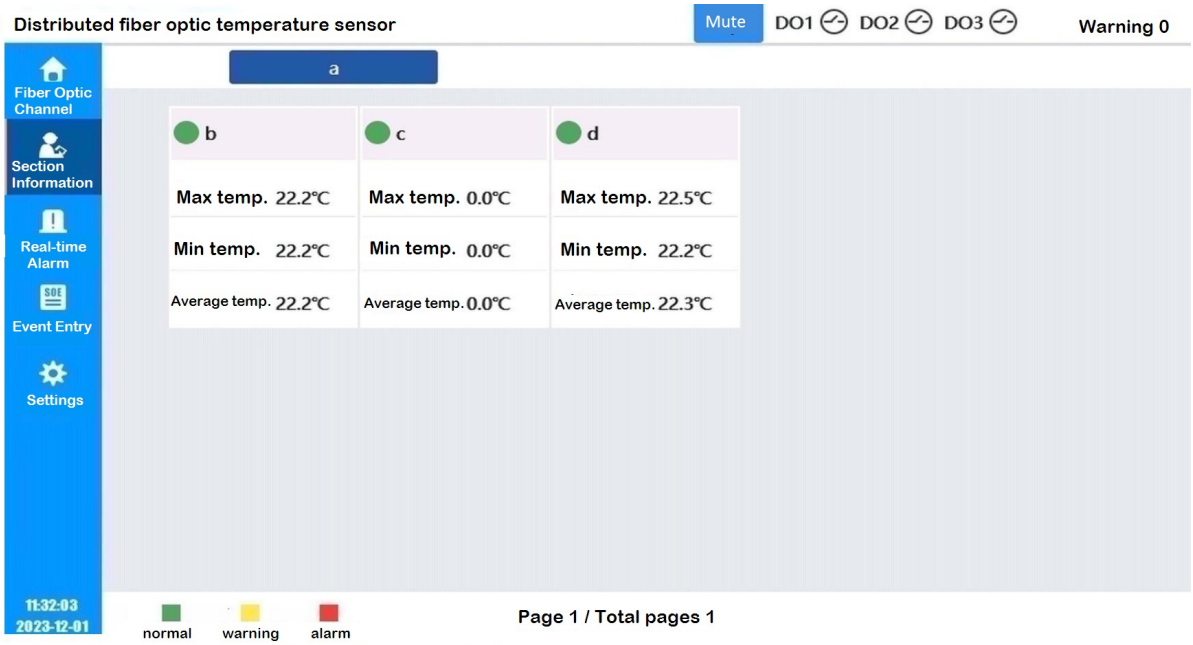


Figure 6.2.1 Section Temperature Display Interface

Each segment has a corresponding temperature curve displaying the maximum value and distance to the temperature in the segment, the minimum value and distance, and the average value. The temperature resolution is 0.1°C.

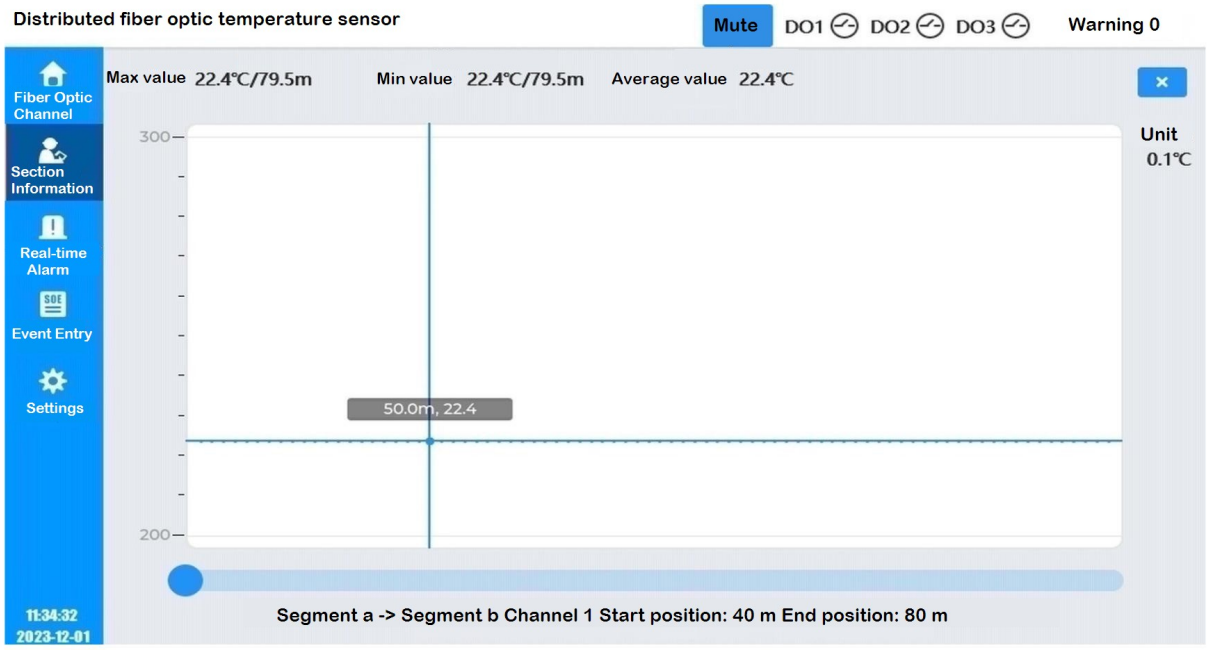


Figure 6.2.2 Section Temperature Display Interface

6.3 Real-Time Alarm Interface

When an alarm occurs on a sensor, the LCD display displays the current alarm location, event type, event description, and alarm type in real time.

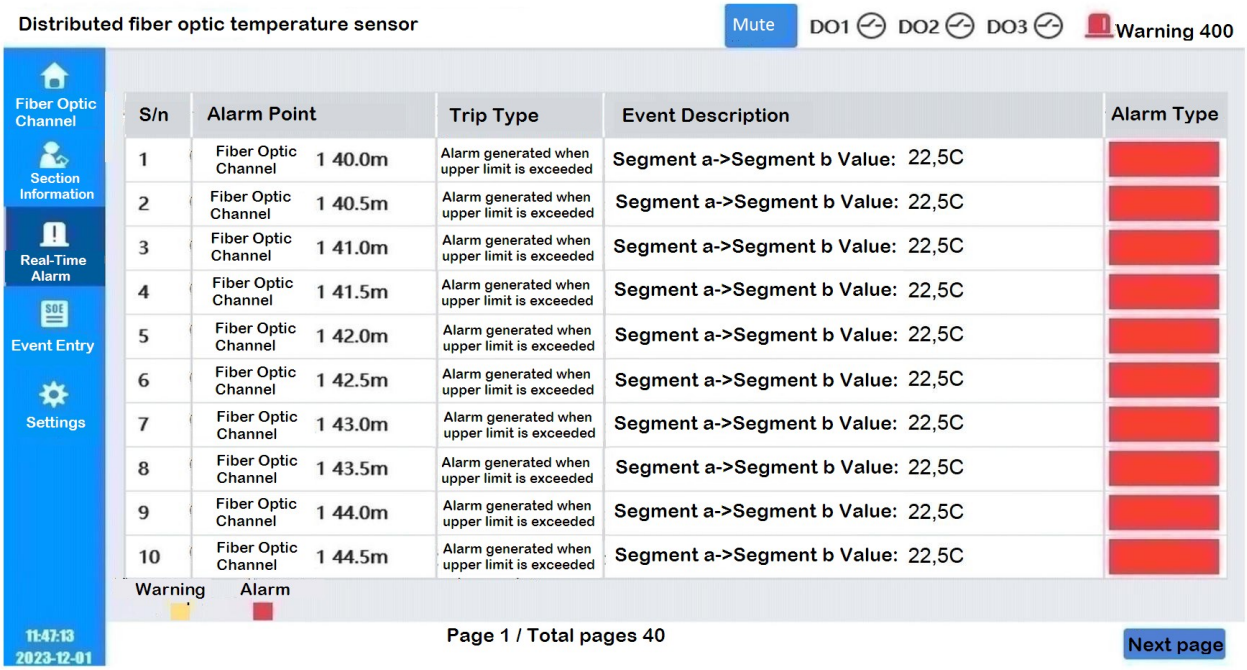


Figure 6.3 Real-Time Alarm Interface

6.4 Event Logging Screen

If the sensor has triggered a fault, the LCD display will show the fault time, fault type, event description, and other information in chronological order. If you do not want to display records of events that have already occurred and are no longer relevant, you can click the "Clear Record" button in the lower left corner.

The record is cleared. The password for "Clear Record" is 111111. If other pages are displayed, you can use the "Go" button to go to the page, and you can also toggle the interface between "Next Page," "First Page," and "Last Page."

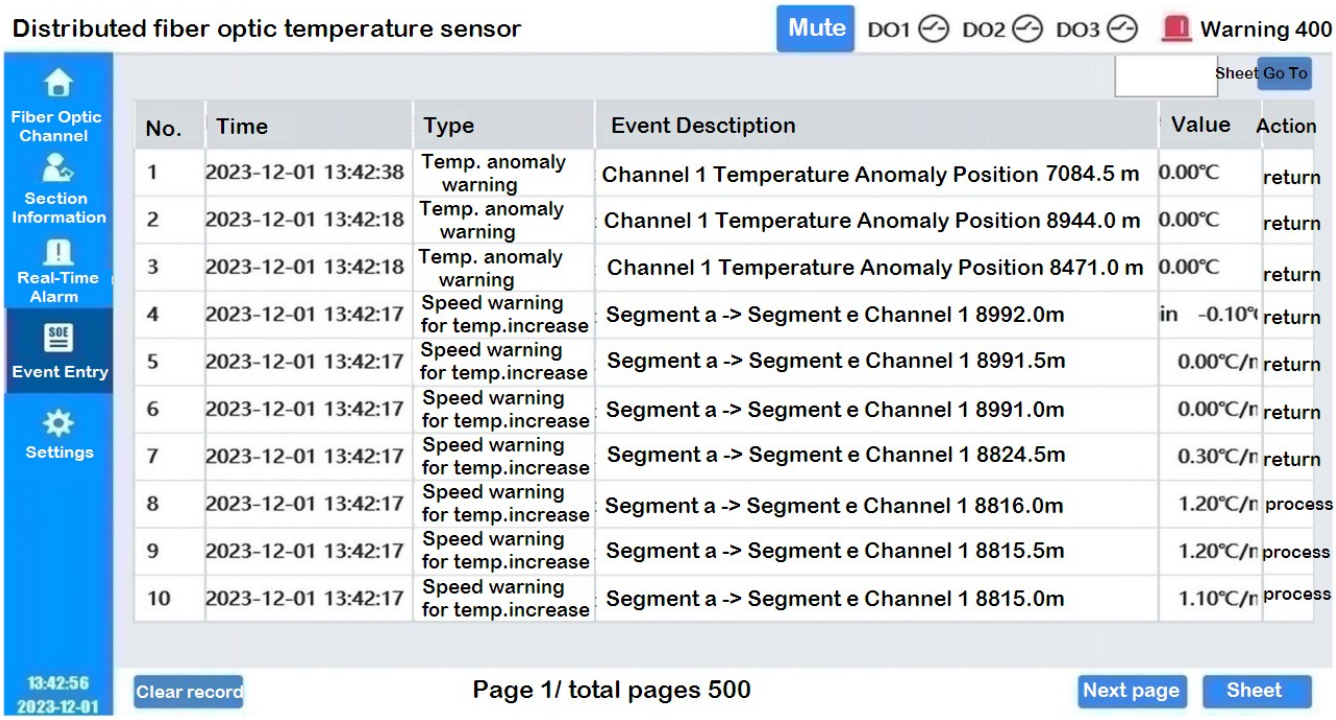
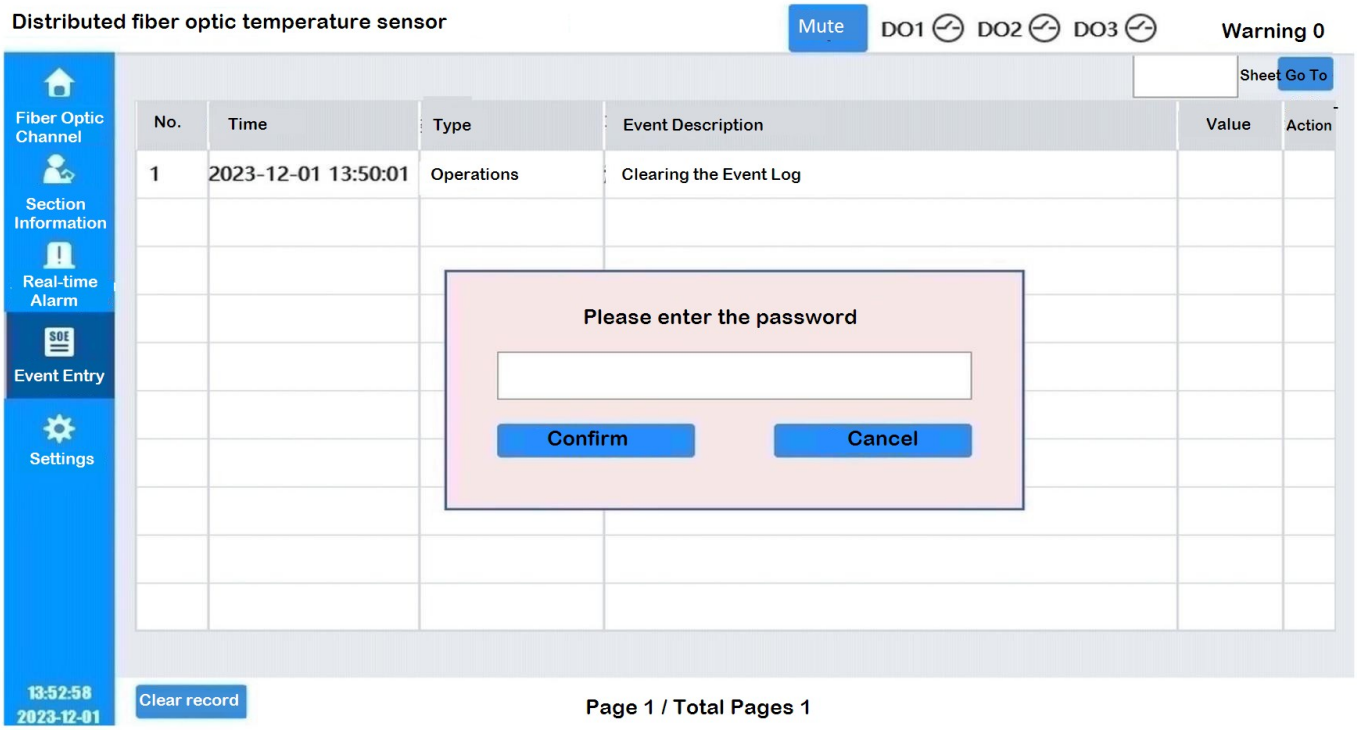


Figure 6.4.1 Event Logging Screen

Figure 6.4.2 Clear Event Log Screen



6.5 Settings Screen

A password is required to enter the settings screen. The general user password is 111111.

Figure 6.5.1 Password Login Screen

The settings interface can be set to "Fiber Optic Channel," "Optical Separation," "Fiber Optic Segmentation," "Limit Value," and "Serial Port Parameters." These parameters are related to the fiber optic temperature measurement application; the setup interface can also set the "Time and Date," "Display," "Audio and Visual Alarm Outputs," "Access Key," "Local IP," and "Device Info" of the device itself.

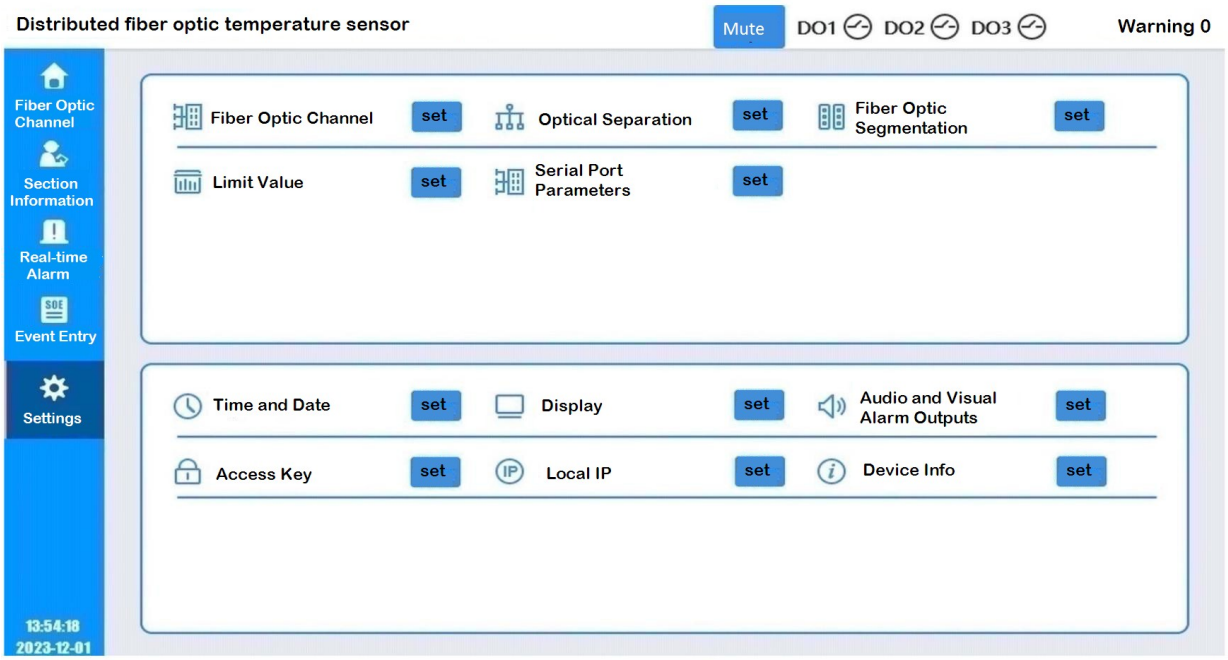


Figure 6.5.2 General Settings Screen

The fiber channel setting interface allows you to configure the relevant parameters of fiber channel 1 to fiber channel 4 separately, including fiber length, temperature coefficient, standard meter position coefficient, and standard meter position offset. The temperature coefficient, meter-calibrated position coefficient, and meter-calibrated position offset typically use the factory default value and do not require calibration.

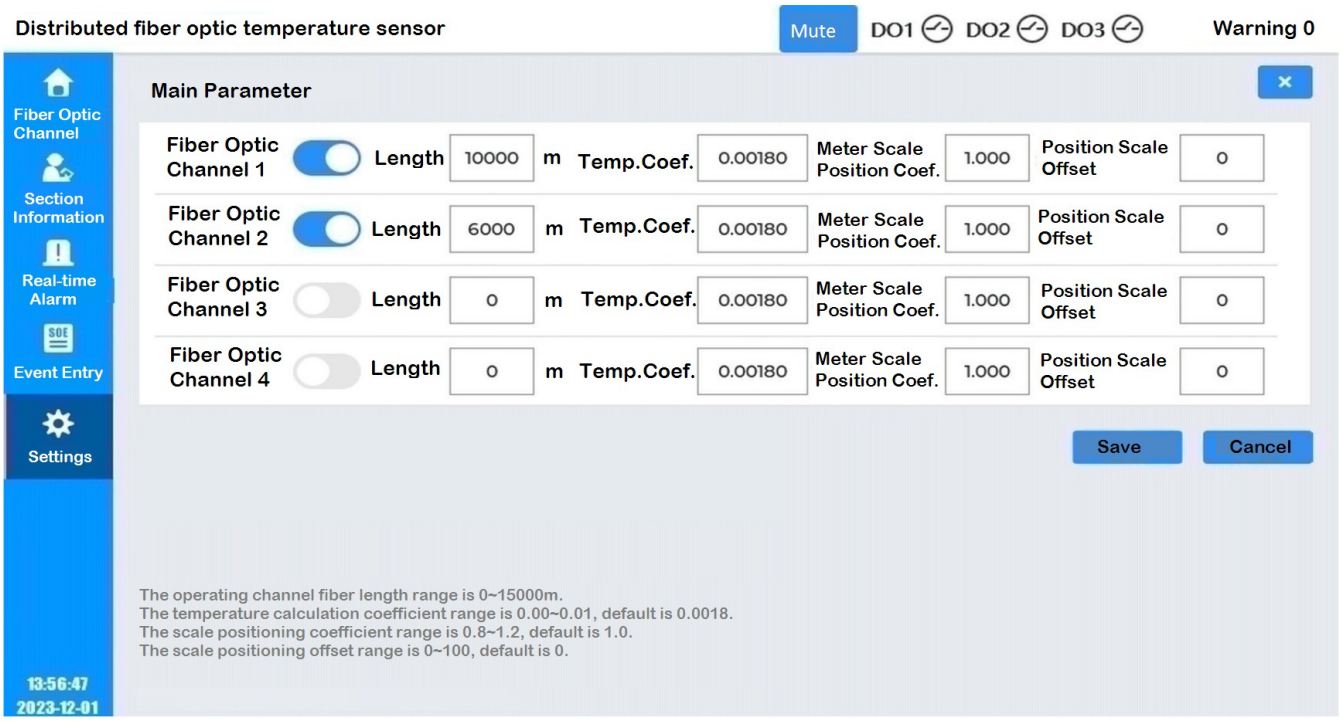


Figure 6.5.3 Fiber Channel Setting Screen

The fiber optic cable segment setup interface allows you to add or delete segments using the "Add Segment" or "Delete Segment" buttons in the lower left corner. Up to 50 segments can be configured. By clicking on the segment serial number, you can enter the segment editing interface, which is used to change the fiber optic segment name.

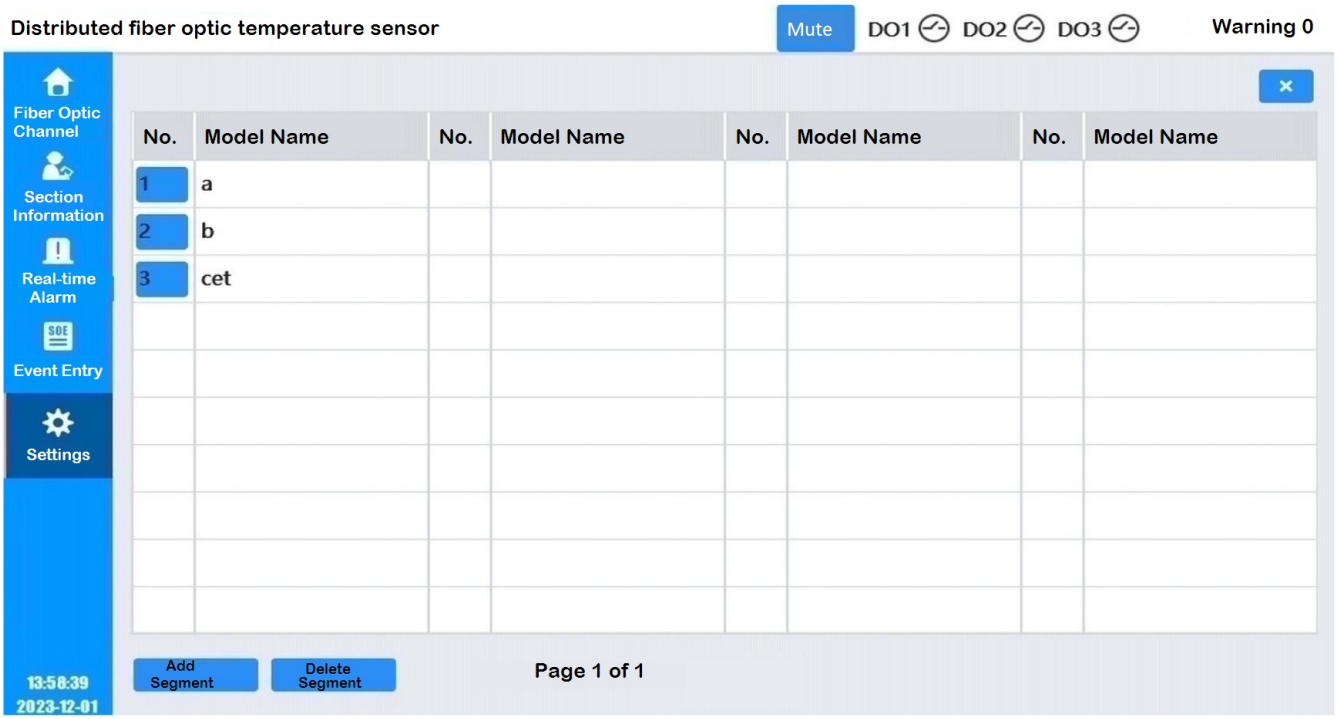


Figure 6.5.4 Fiber Optic Segment Setup Screen

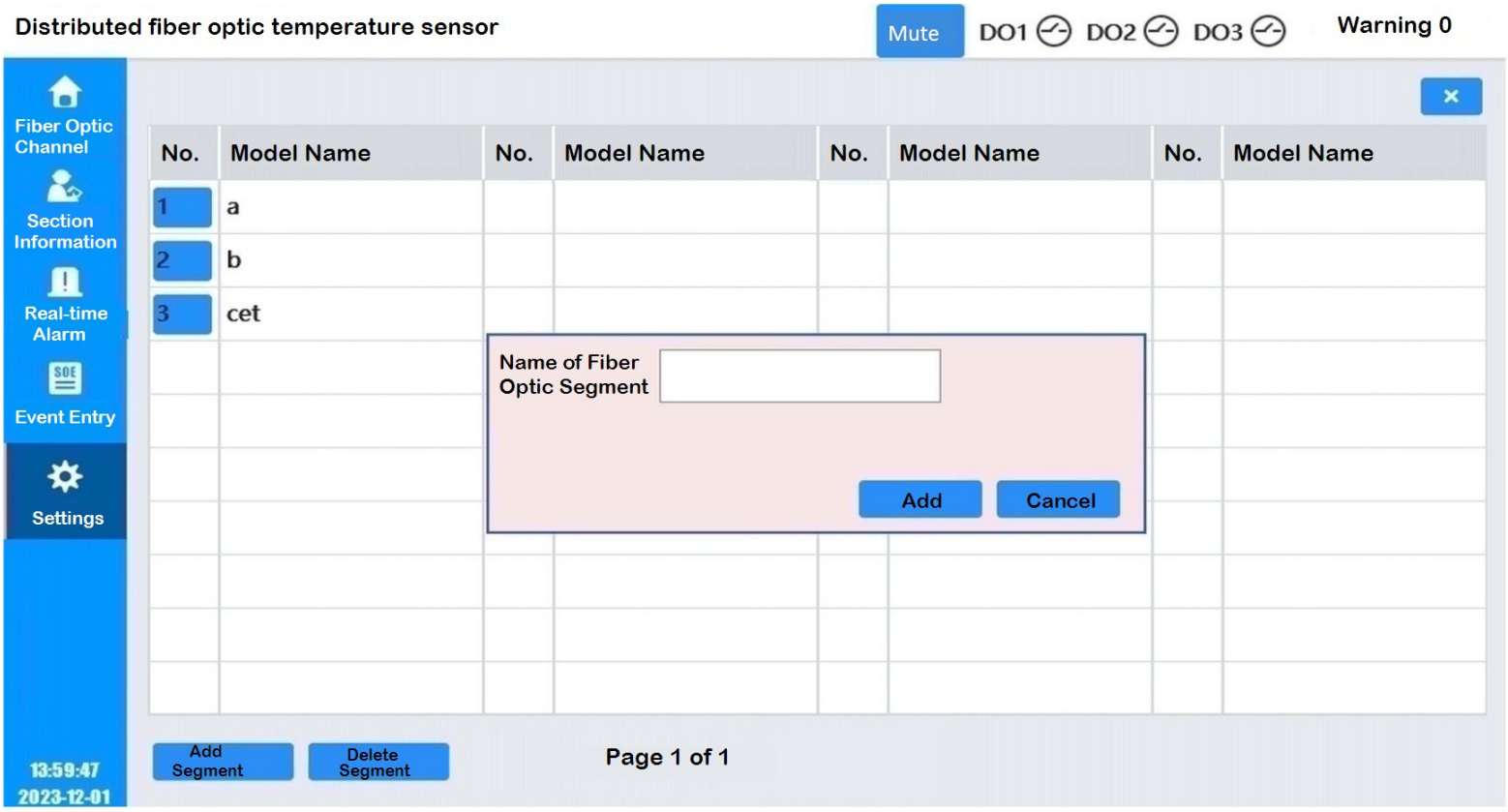


Figure 6.5.5 Fiber Optic Segment Adding Screen

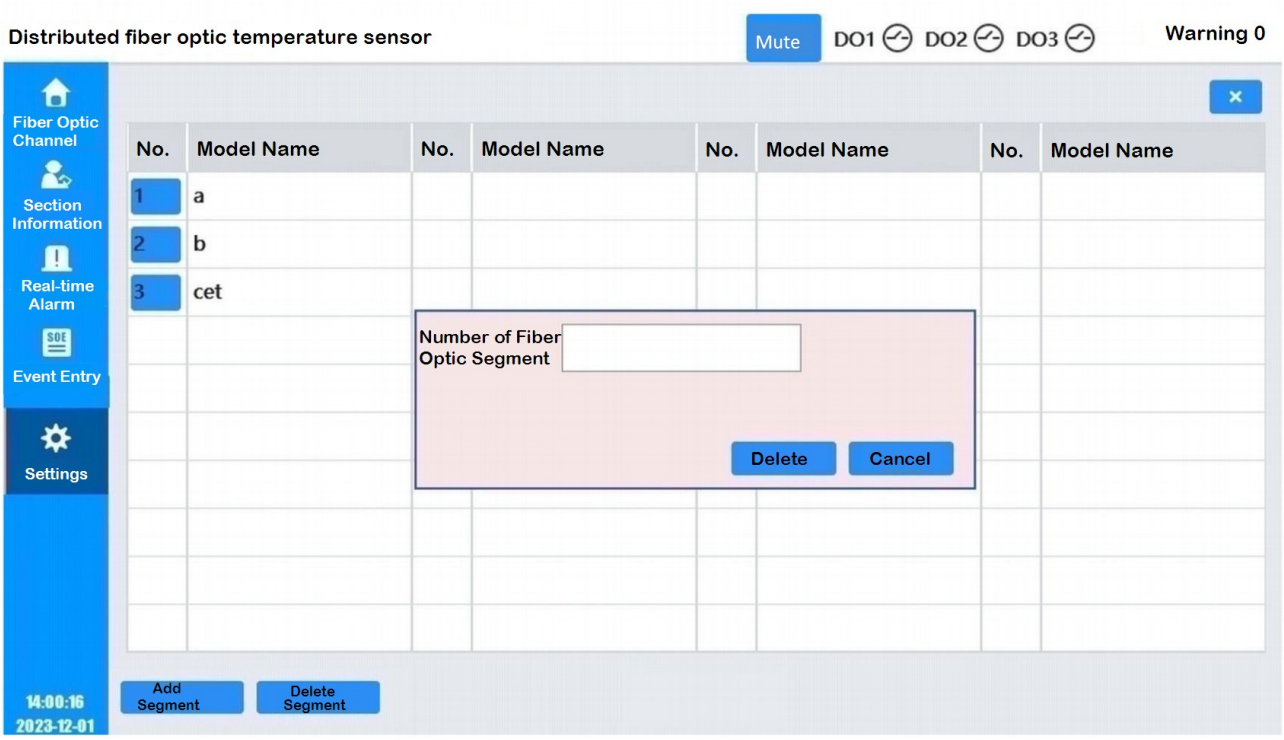


Figure 6.5.6 Fiber Optic Segments Deleting Screen

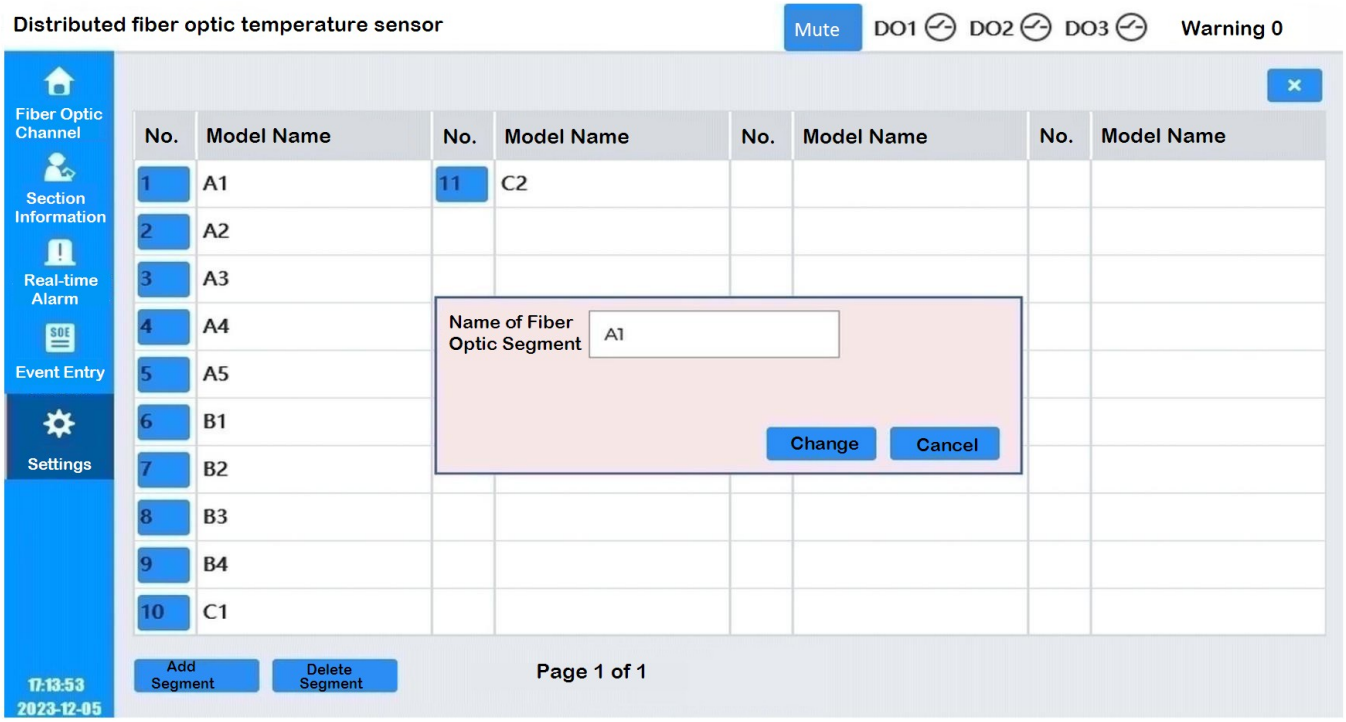


Figure 6.5.7 Fiber Optic Segments Changing Screen

The segment configuration interface allows you to add or remove segments using the "Add Segment" or "Delete Segment" buttons in the lower left corner. Up to 100 segments can be configured for each section. You must specify the segment name, start and end distance, and select the fiber optic channel and signaling parameters.

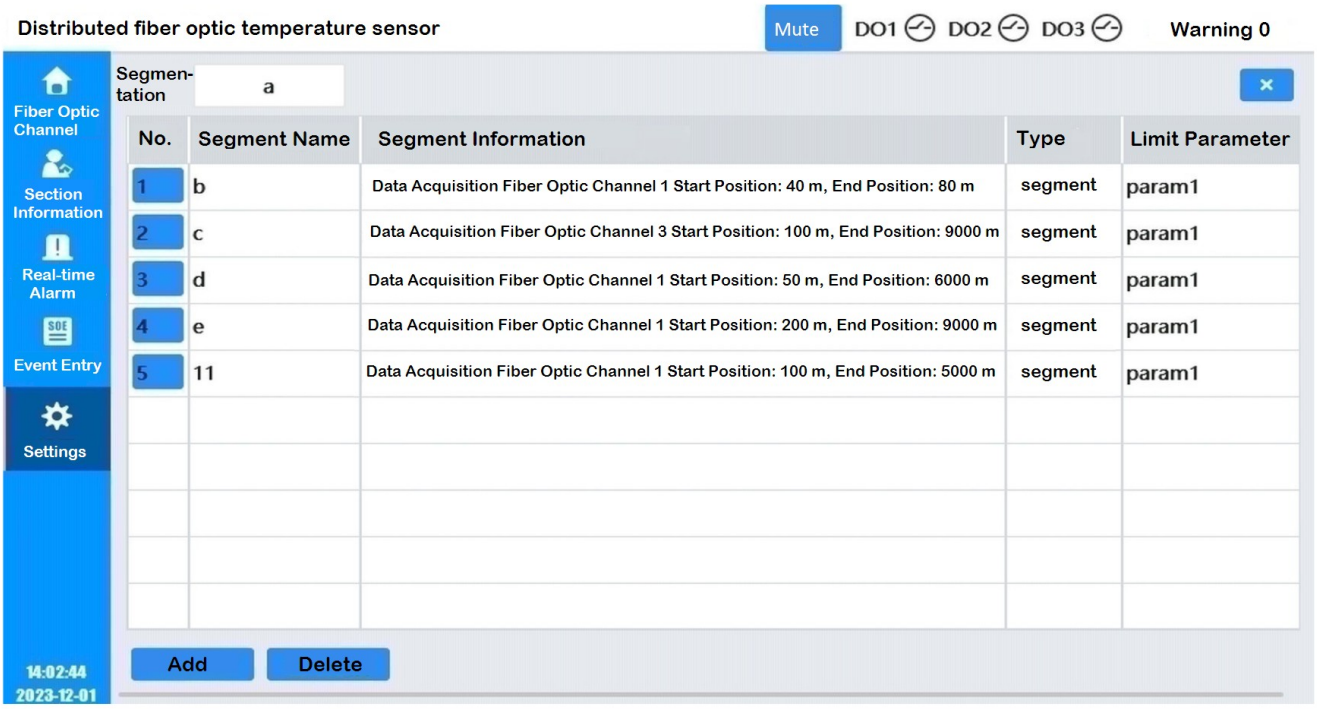


Figure 6.5.8 Segmentation Settings Screen

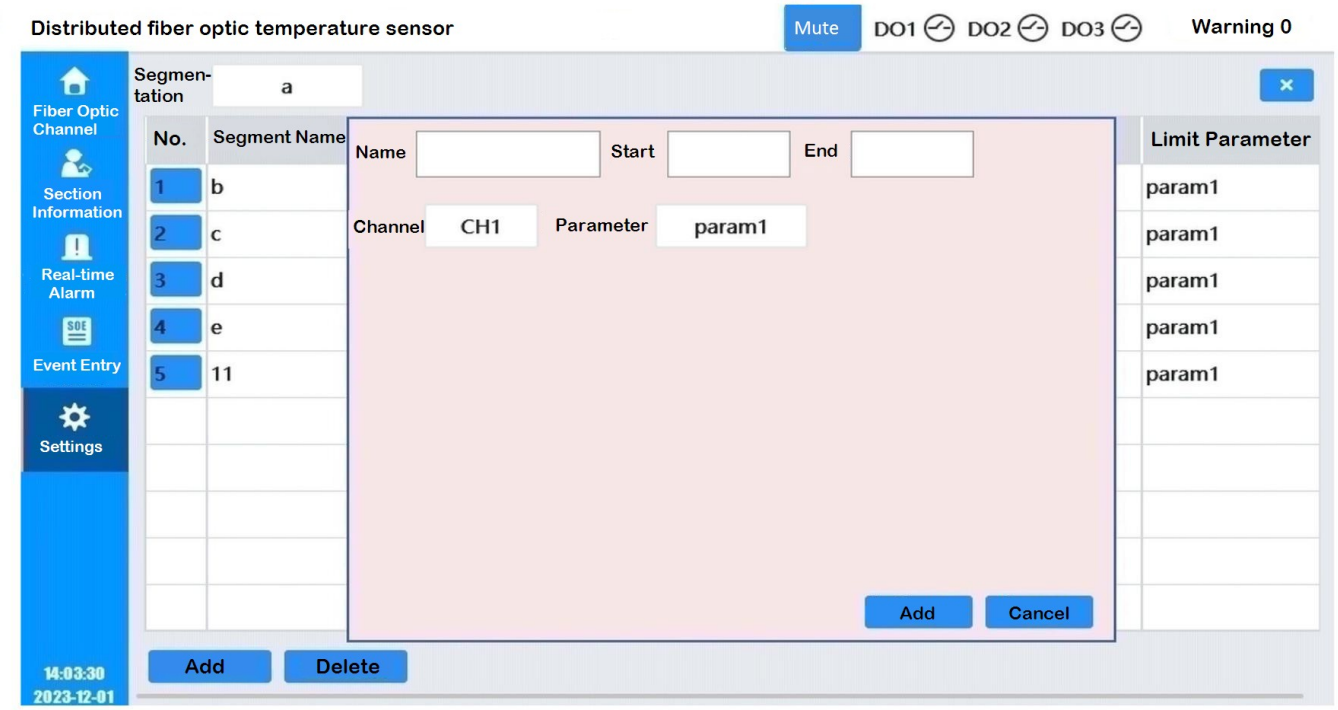


Figure 6.5.9 Fiber Optic Segments Adding Screen

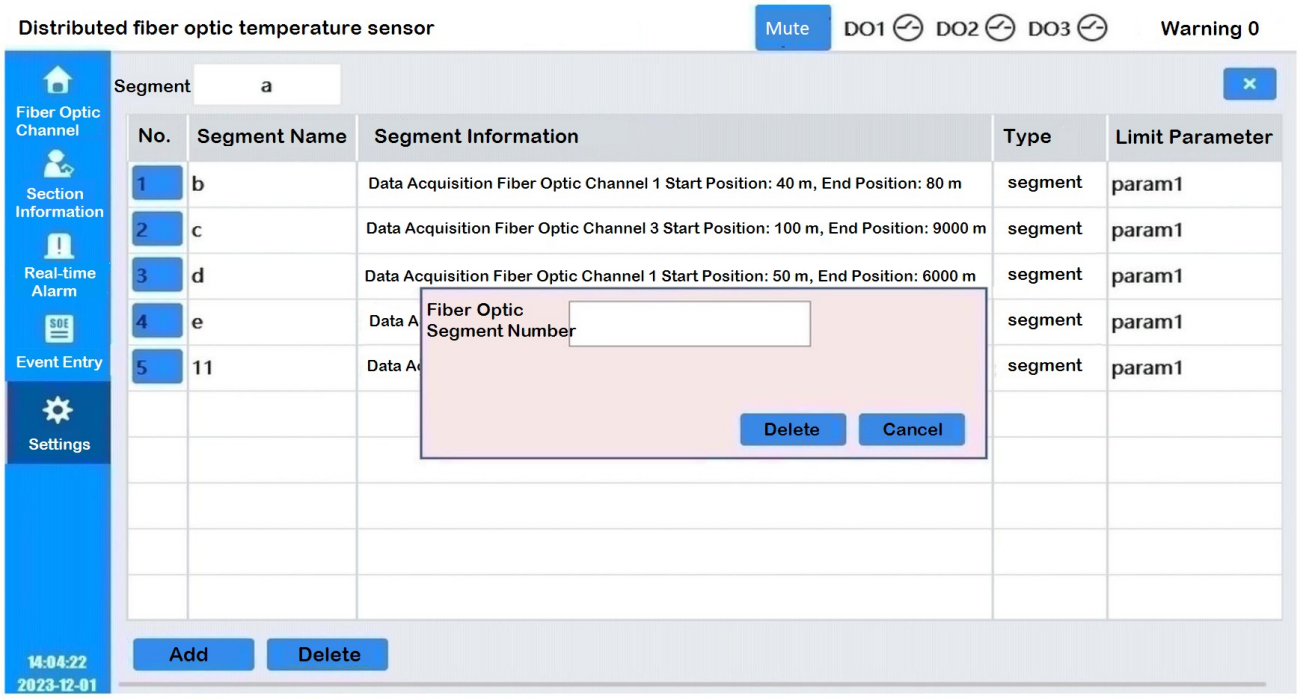


Figure 6.5.10 Fiber Optic Segment Deleting Screen

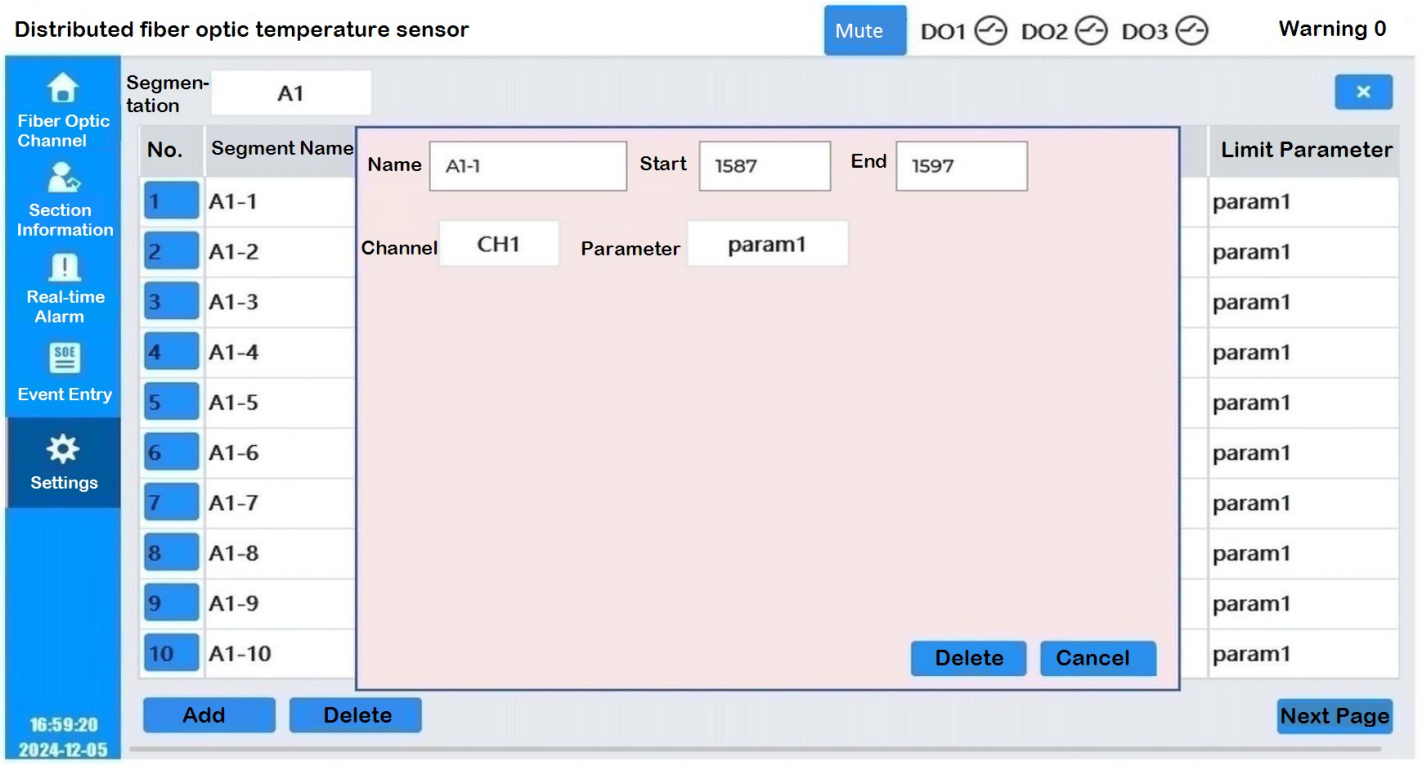


Figure 6.5.11 Fiber Optic Segmentation Changing Screen

Setting limit values allows you to set the upper and lower temperature values, the temperature rise rate for exceeding the limit value, the temperature difference value for exceeding the limit value, and the temperature anomaly value when exceeding the limit value. These values are used to set the warning action value and the non-action value. The temperature rise rate is the temperature that increases in 1-minute increments.

Upper temperature alarm: When the temperature exceeds the set value, an alarm is triggered. For an outside fiber optic temperature measurement cable, the recommended temperature alarm value is 50℃. For an embedded fiber optic temperature measurement cable, the set temperature alarm value should be determined according to the maximum allowable temperature of the structural layer in which the fiber optic temperature measurement cable is located.

Lower temperature alarm: When the temperature drops below the set value, an alarm is triggered.

Rate of temperature increase alarm: An alarm is triggered when the monitored temperature change exceeds the set value for a specified period of time. The recommended temperature rise alarm value is determined by the following calculation: during the next measurement cycle, the temperature rises by more than 4°C.

Temperature Difference Exceeded: An alarm is triggered when the difference between the maximum temperature at a specific point in the cable line and the average temperature along the line exceeds the set value. The recommended temperature difference alarm value is when the temperature difference exceeds 15°C.

Temperature Anomaly Alarm: An alarm is triggered when the difference between the temperature at a specific point in the cable line and the temperature at other points within a 5-meter radius exceeds the set value. The recommended temperature anomaly alarm value is when the temperature difference exceeds 10°C.

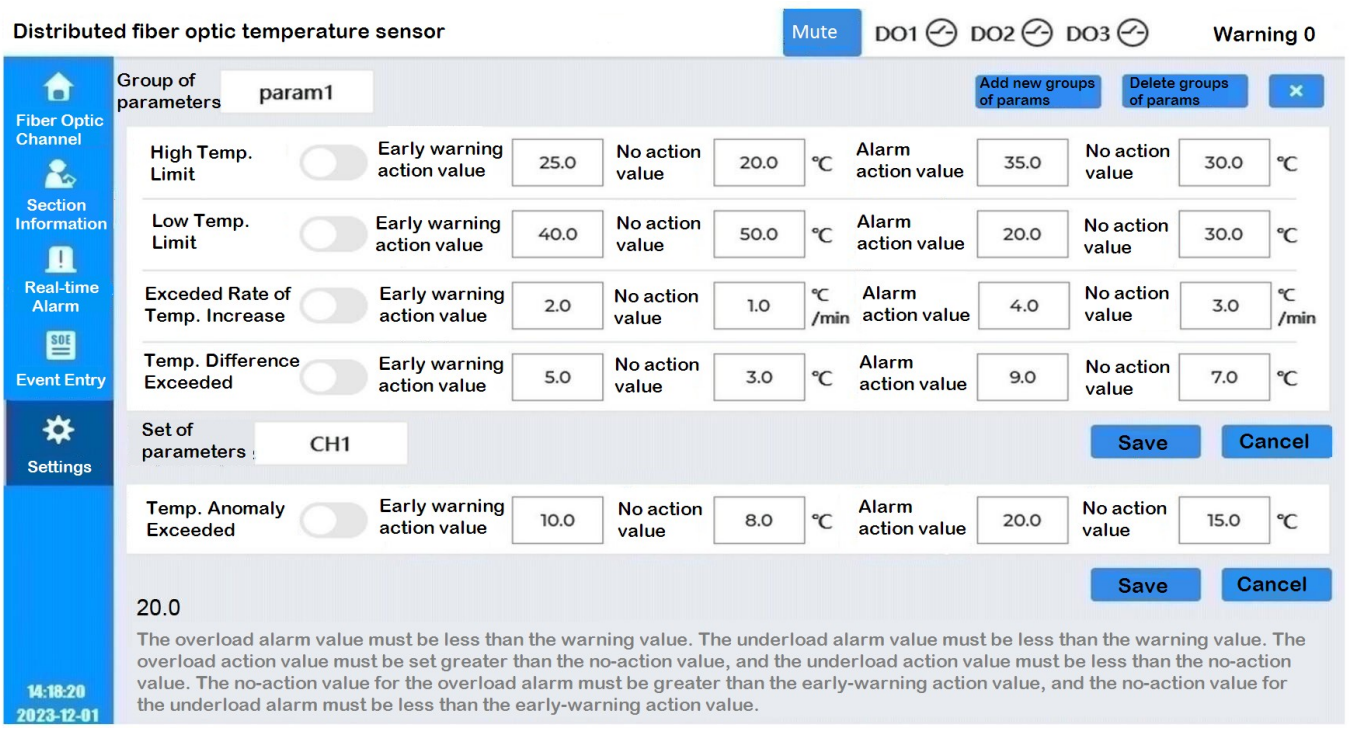


Figure 6.5.11 Parameter Group Settings Screen

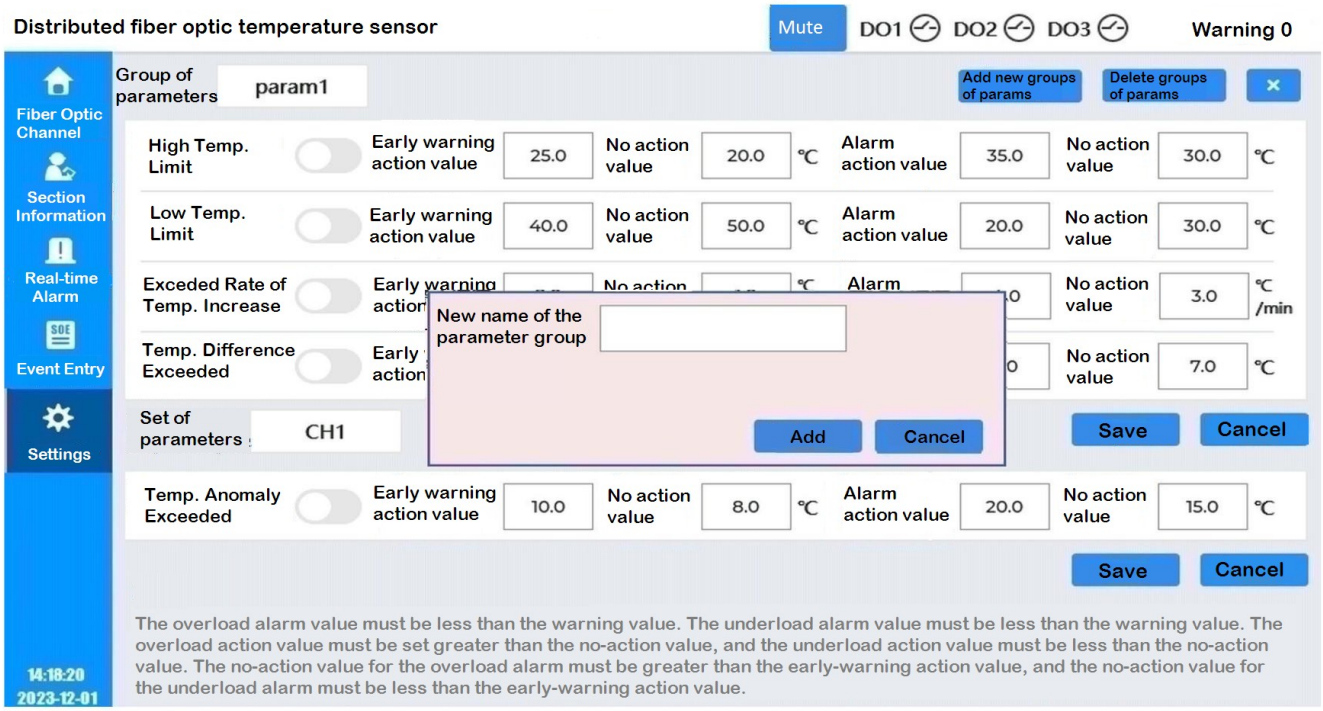


Figure 6.5.12 New Parameter Group Screen

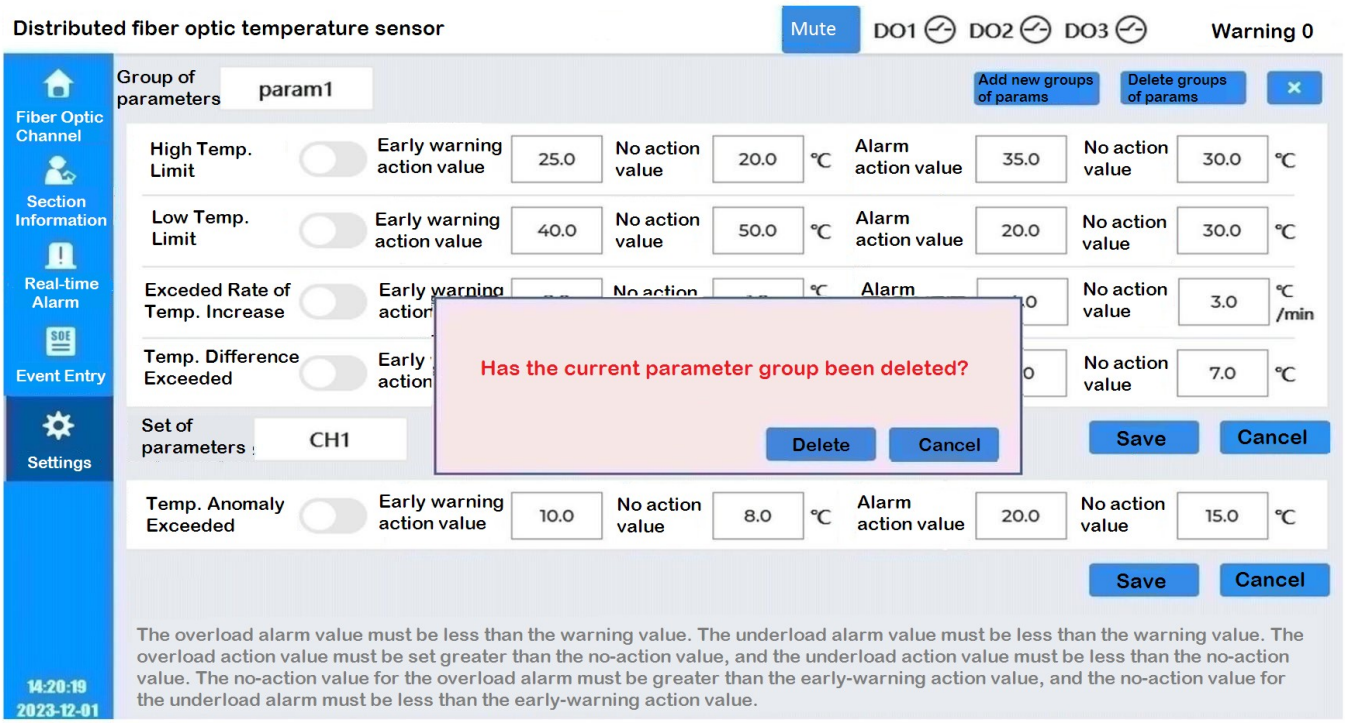


Figure 6.5.13 Parameter Group Deleting Interface

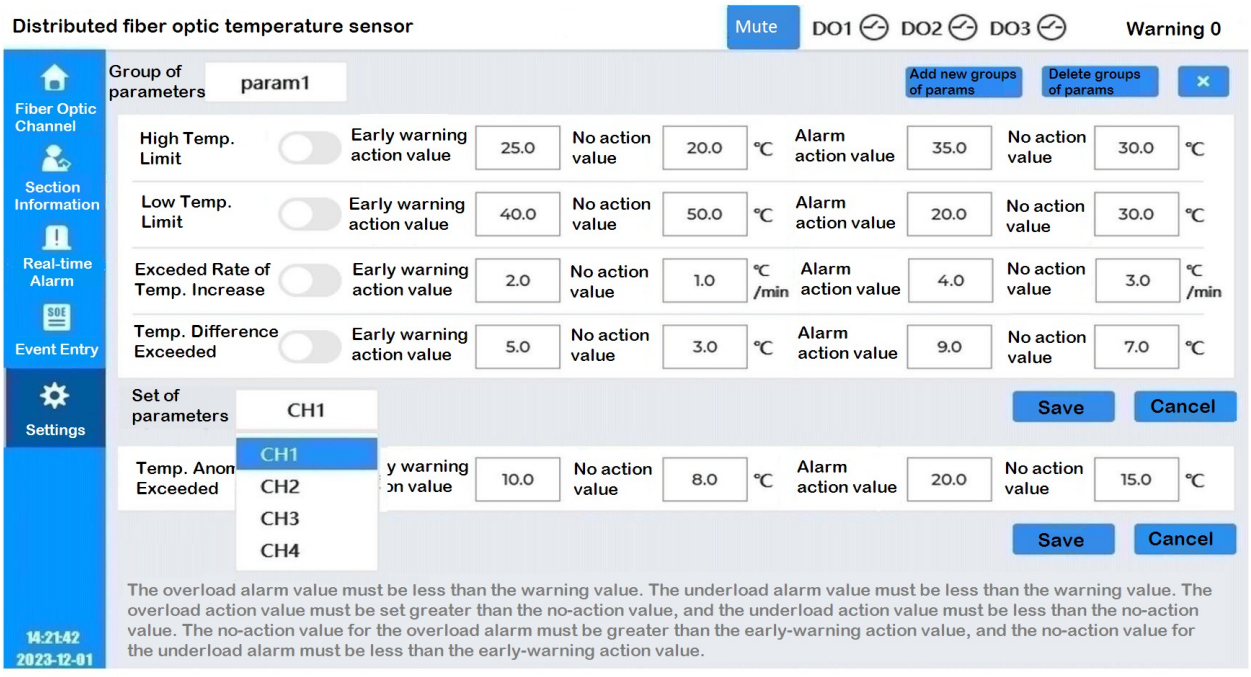


Figure 6.5.14 Channel Interface Associated with a Parameter Group

The serial port settings interface allows you to set the serial port baud rate and bit rate.

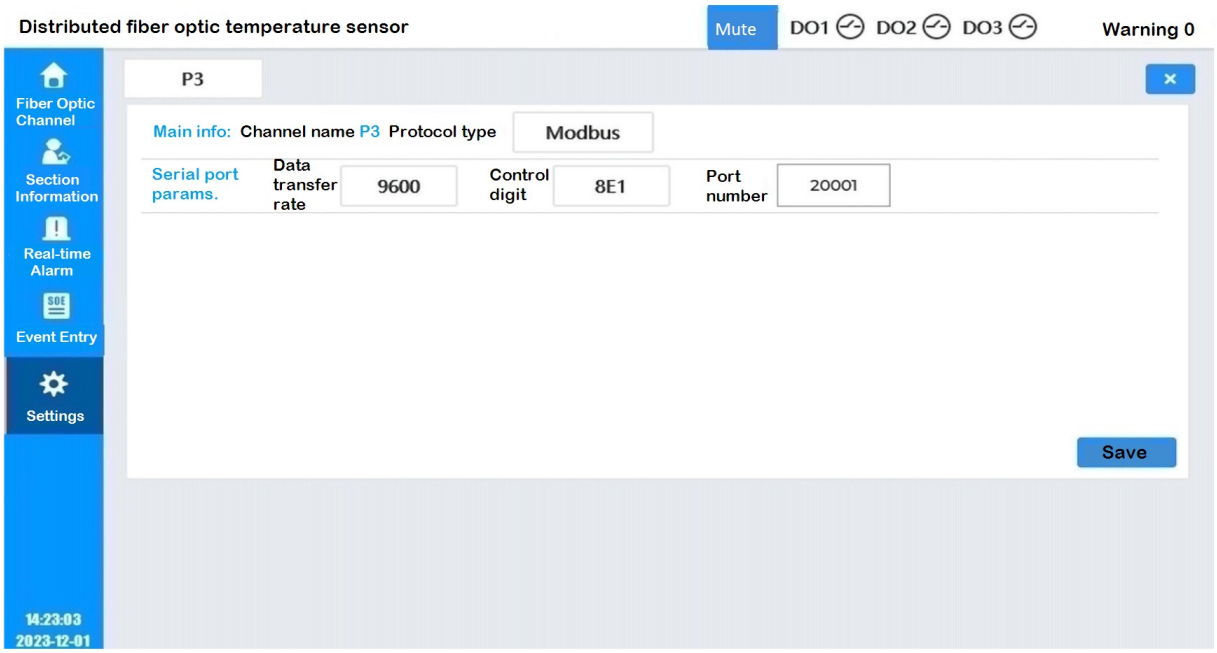


Figure 6.5.15 Serial Port Setup Screen

System settings include parameters such as time and date, display, sound, local IP address, password, and device information.

Time and Date: Set the time and date on the STP-OD. GPS, IRIG-B, and 1588 synchronization are supported.

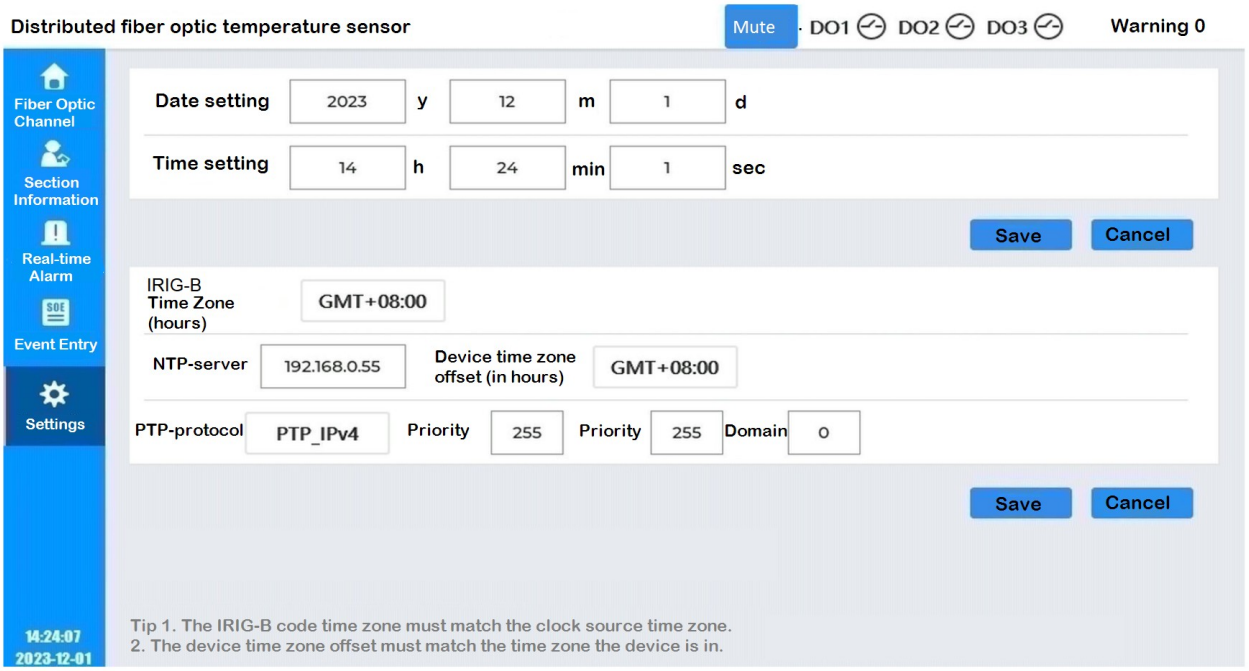


Figure 6.5.16 Time and Date Setting Screen

Display: Set the screen brightness and backlight time for this device. The initial screen brightness is 5, and the backlight time is 5 minutes.

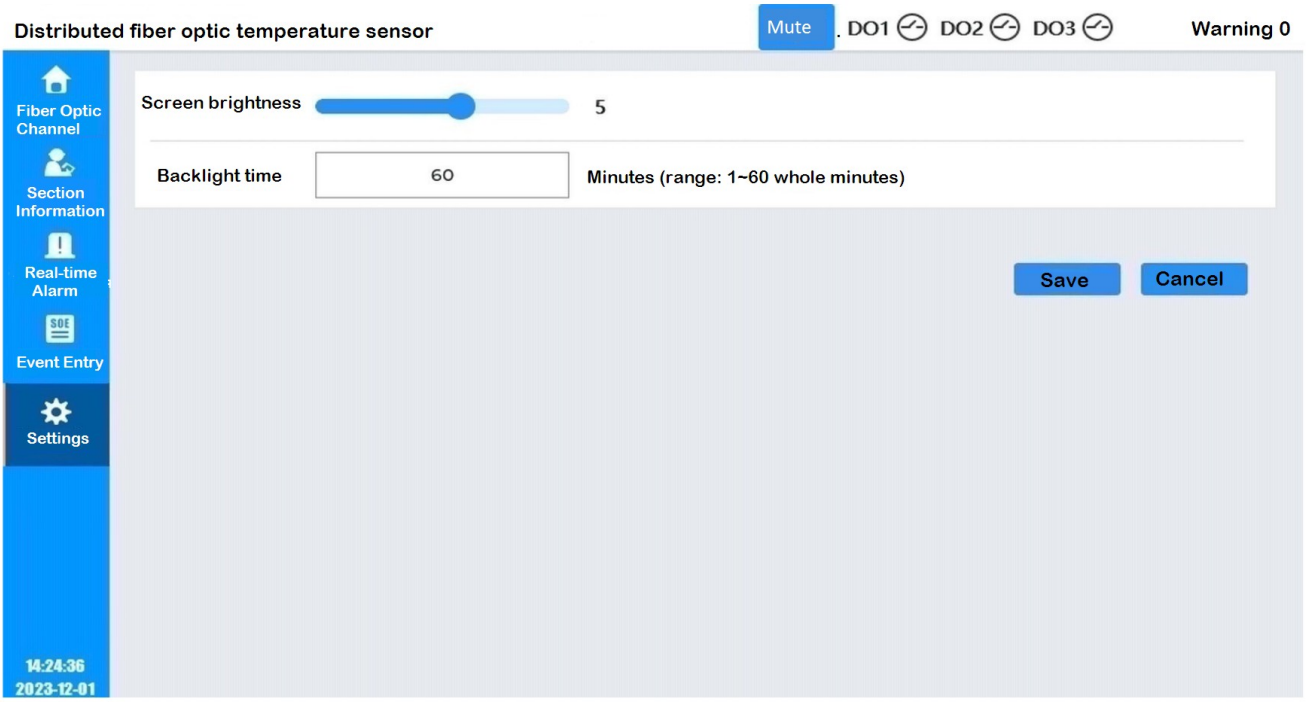


Figure 6.5.17 Screen Settings Display Screen

Sound: Set the sound and light alarm parameters for this device, as well as related alarm settings.

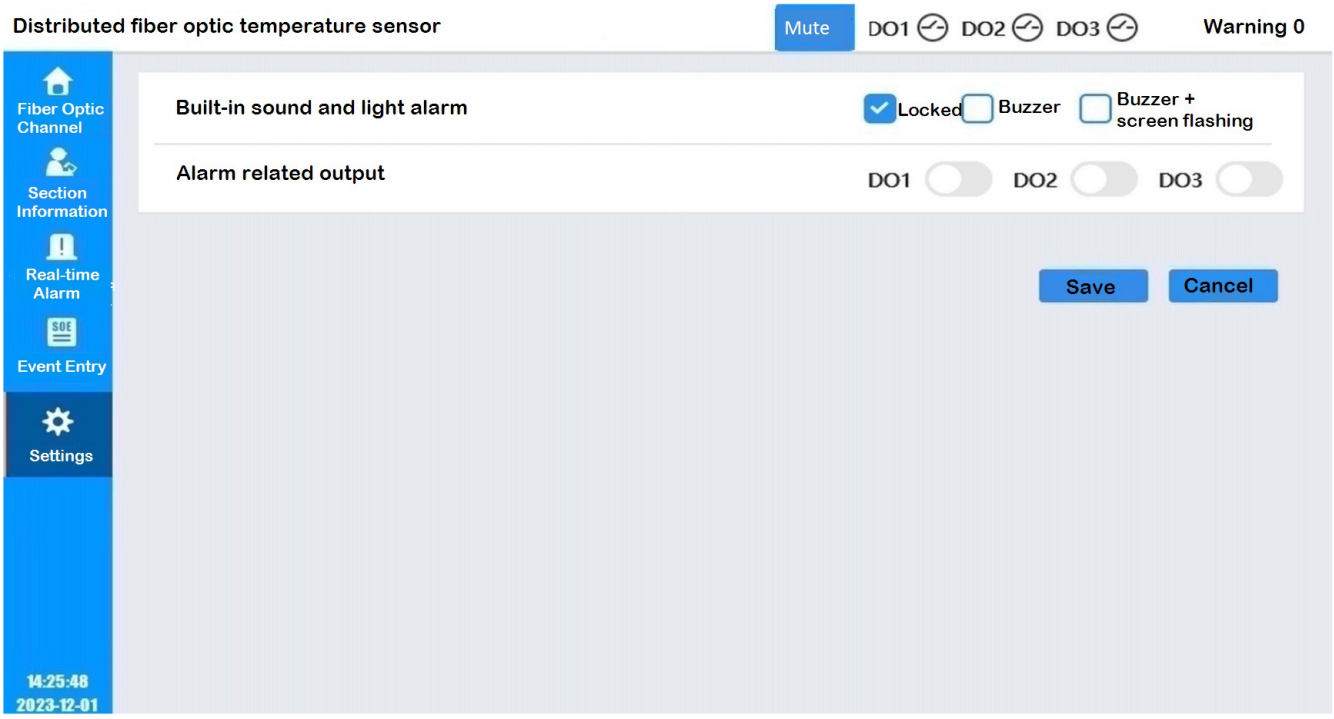


Figure 6.5.18 Sound and Light Alarm Output Setting Interface.

Local IP: Set the IP address of the local computer.

Figure 6.5.19 IP Address Settings Screen

Password: Set a password for this device.

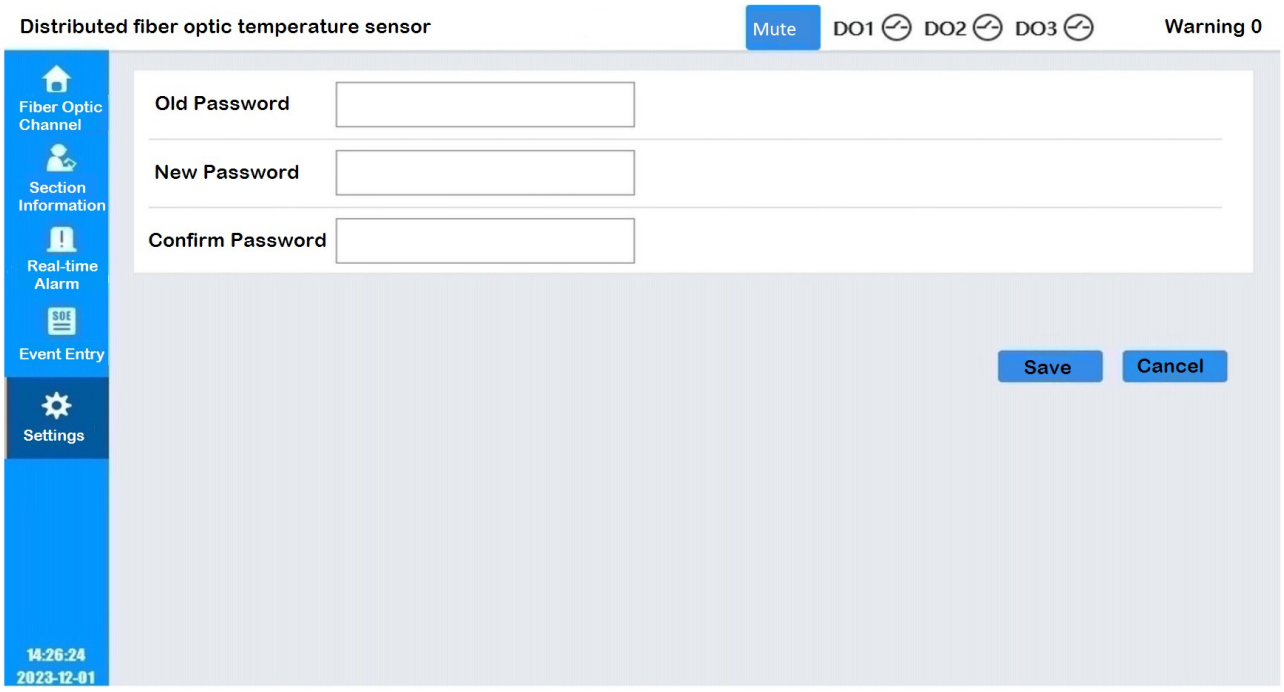


Figure 6.5.20 Password Setup Screen

About this device: Displays the version date, contact phone number, and other information.

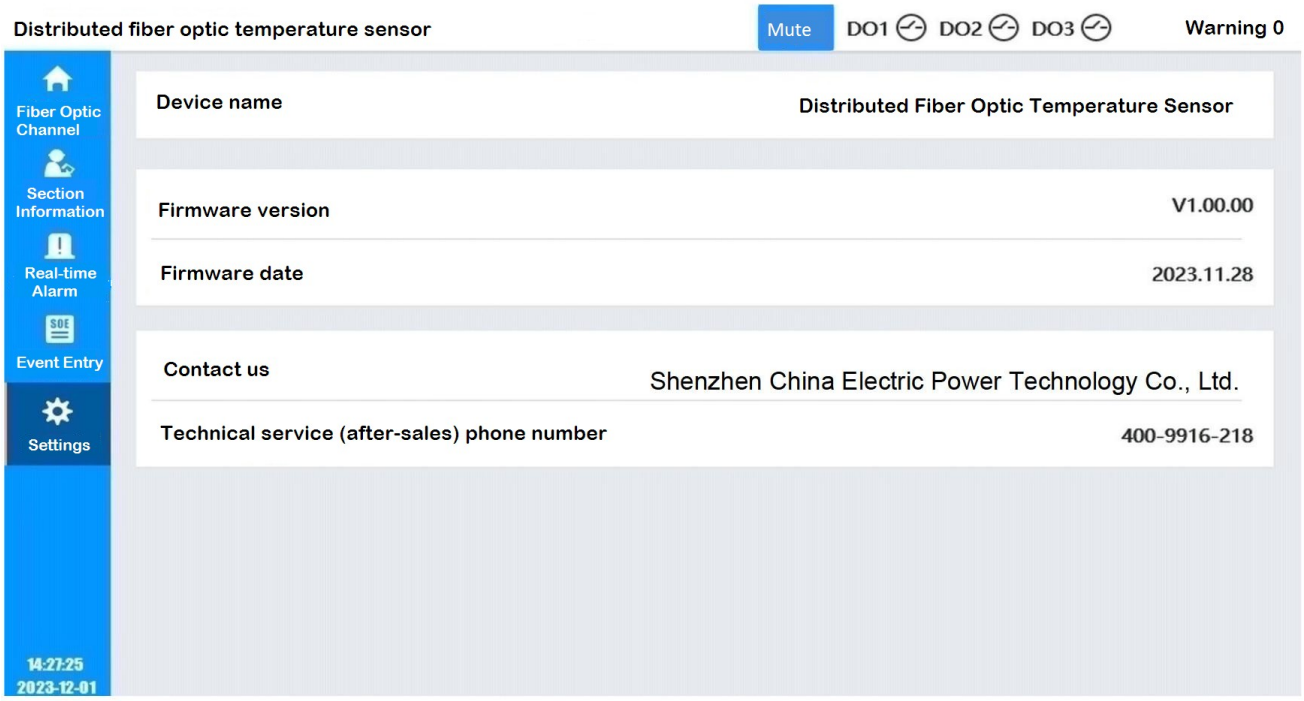


Figure 6.5.21 Local Settings Screen

7. Quality Assurance (QA)

7.1 Warranty Limitations

The warranty does not cover the following cases:

• Damage caused by improper installation, use, and storage of the equipment.

• Inappropriate operating conditions and applications that exceed the requirements specified for this equipment.

• Repair of the device by an organization or person not authorized by the company.

• Expiration of the free warranty period for the device.

Selectric

ELECTRICAL EQUIPMENT

DESIGNED FOR MAXIMUM RELIABILITY

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