SEVEN
SENSOR SOLUTIONS



3S-2IS

Dual Orientation
Irradiance Sensor

USER MANUAL

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Waste Disposal



This symbol indicates that the product is subject to European Union regulations on separate waste disposal. This applies to both the product itself and any accessories bearing the same symbol. Such products must not be disposed of as unsorted household waste.

Note: *SEVEN reserves the right to make changes to this document without prior notice.*

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1. Introduction

The Dual Orientation Irradiance Sensor is part of the SEVEN meteorological sensor range, which includes professional, smart measurement sensors featuring a digital interface, developed for environmental and industrial applications such as dual-orientation photovoltaic (PV) plants.

The sensor is specially designed for the requirements of PV plant monitoring systems, based on the IEC 61724 and IEC 60904 standards, so that an accurate Performance Ratio (PR) can be calculated at dual-orientation PV plants.

With the external sensors that can be connected to the Dual Orientation Irradiance Sensor, module & ambient temperature and wind speed data can also be measured. All measured data is transmitted to data loggers and receiving systems via the Modbus RTU protocol over the RS485 serial communication interface.



Figure 1 - Dual Orientation Irradiance Sensor

2. Dual Orientation Irradiance Sensor Model Selection

The Dual Orientation Irradiance Sensor is offered with different order configurations according to the connectable external sensor options. Customers can determine the sensor types they need, follow the diagram below and select the sensor model most suitable for their application.

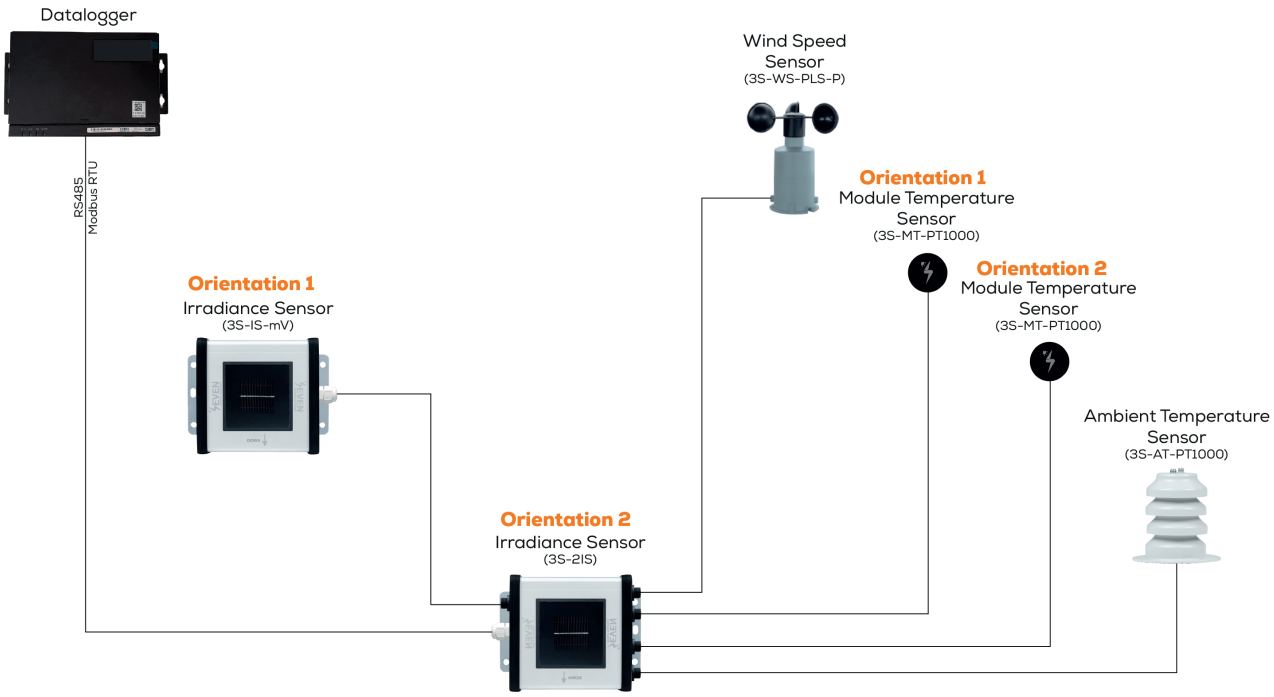


Diagram 1 – 3S-2IS Model Selection

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3. Dual Orientation Irradiance Sensor Installation

It is recommended that the products be tested before installation to make sure that all system components work correctly. A general flow diagram of the main steps to follow during the installation process is given below.

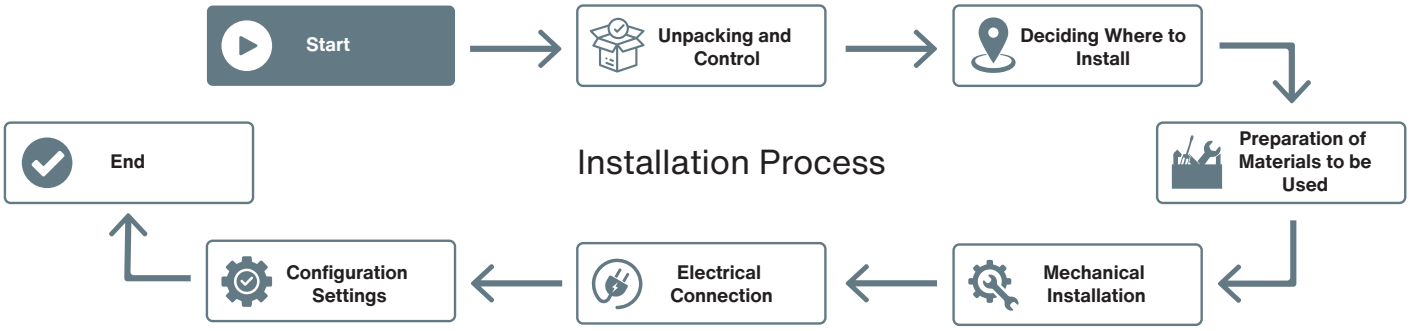


Diagram 2 – Installation Process

3.1. Unpacking and Control

When you receive the product, check carefully that the package contents are complete. If any component is missing, damaged or defective, contact SEVEN Sensor Solutions.
The package contents of the other external products that can be added to the system can be checked in the user manual of the relevant sensor.

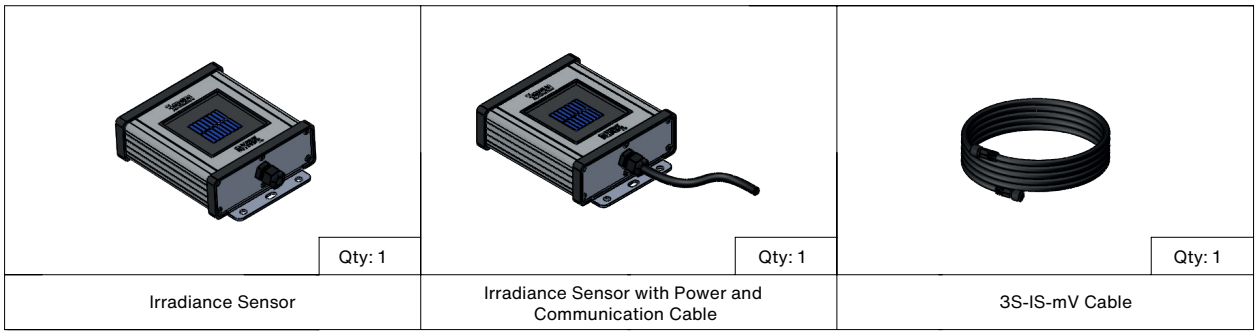


Figure 2 – Package Contents

3.2. Field Requirements and Considerations

Each site has its own environmental conditions and installation challenges. Therefore, the installation method of the product may vary depending on the site conditions.

Before starting the installation, the location where the product will be placed must be determined carefully. The Irradiance Sensors, Temperature Sensors and Wind Speed Sensor can be affected by surrounding obstacles, shading sources and local topography.

The Irradiance Sensor must be positioned at a distance of at least 10 times the height of any obstacle or shading source. In addition, the sensor must be placed at a point away from dark-colored, highly reflective or heat-absorbing surfaces.

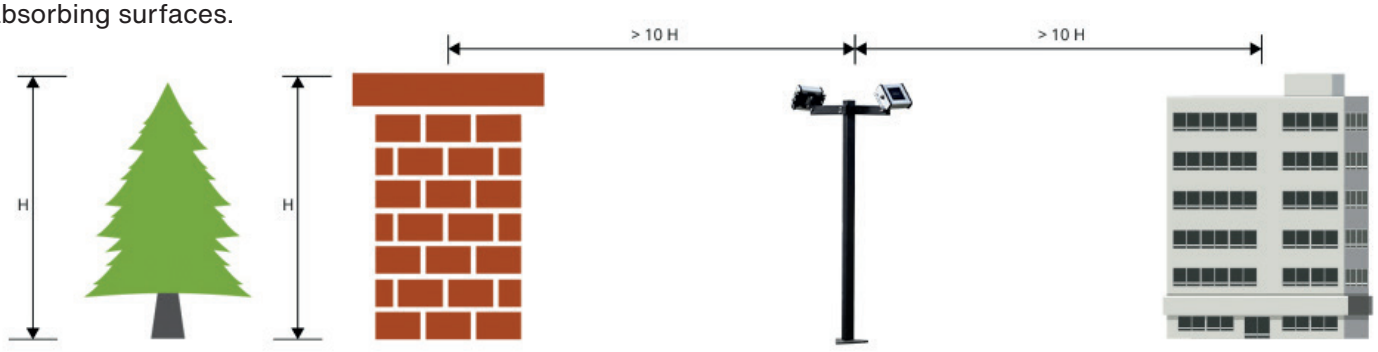


Figure 3 - Installation Site Selection

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If the Dual Orientation Irradiance Sensor set is mounted on a roof, the sensor should be placed where it is exposed to the wind and airflow as much as possible. In addition, placing the sensor near any heat source such as chimneys or ventilation should be avoided.

The Irradiance Sensor must be in the same orientation and at the same tilt as the solar panels. It must be positioned in the same plane as the solar panels or in a higher plane.

Note: *To make the maintenance and cleaning of the Irradiance Sensor easier, especially in rooftop projects, the Dual Orientation Irradiance Sensor set should be mounted in an easily accessible location.*

The Wind Speed Sensor must be mounted at a height of 2 meters above the ground. For rooftop projects, this height can be 1 meter. There must be no obstacle nearby that could affect the airflow and wind speed.

The Module Temperature Sensor must be mounted at the exact centre of the solar panel. The sensor position should be chosen at the centre of the cell closest to the exact centre of the module and outside the boundaries between the cells.

3.3. Preparation of Materials to Be Used in Installation

The main mounting materials required during installation are provided by SEVEN. The user only needs to have the hand tools and personal protective equipment listed below ready before installation.

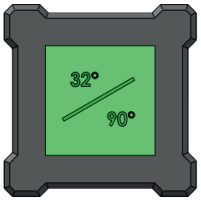
Materials			
			
Gloves	Tape Measure	Spirit Level	Digital Compass
 Qty: 8			 Qty: 8
M5 Bolt	M5 Allen Key	M5 Wrench	M5 Nut

Figure 4 – Materials Used in Installation

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3.4. Installation

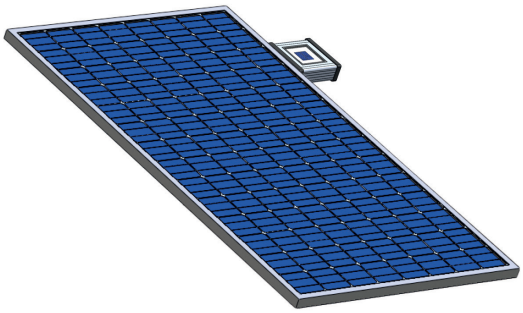
The Dual Orientation Irradiance Sensor can be installed in two ways:

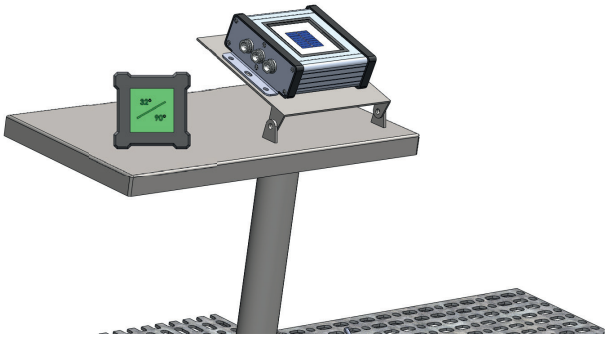
1. Installation on the Mounting Structure: If the customer has purchased a mounting structure, the below link should be followed for installation.
https://www.sevensensor.com/files/d/en/3S-MS_Mounting-Structure_User-Manual.pdf

2. Installation Without the Mounting Structure: If the customer has not purchased a mounting structure, section 3.4.1 should be followed.

3.4.1. Irradiance Sensor Installation

Follow the steps below for each Irradiance Sensor in the Dual Orientation Irradiance Sensor.





1st Step
The position of the Irradiance Sensor must be adjusted using a spirit level. The tilt angle must be the same as the solar panels. The Irradiance Sensor must be placed so that the arrow (↓) points downward.

2nd Step
Four M5 screws must be used to fix the Irradiance Sensor.

3rd Step
The Irradiance Sensor must be fixed to the relevant mounting area using a drill.

Note: Do not overlook the position of the arrow (↓)!
There are ventilation holes on the box. If the arrow (↓) is overlooked and these holes end up positioned on the top of the box, water can get inside the box and damage the electronic board.

Note: *Using sensors with an IP54 protection rating in tracker systems may pose a risk in terms of sealing. This is because the range of motion angles that tracker systems perform during operation can affect the sealing performance. Using IP54 may not be a problem in systems that move at small angles; however, the sealing risk may increase in systems that move at large angles. For this reason, the choice of protection rating should be evaluated by the user in line with the application conditions and site requirements, and the IP class should be decided accordingly. You must state your protection-rating preference to the SEVEN Sales Team in your order.*

3.4.2. External Sensors

A module temperature, ambient temperature and wind speed sensor can be connected to the Dual Orientation Irradiance Sensor. For the installation of the external sensors you have selected, follow the user manual of the relevant external sensor.

- **Module Temperature Sensor Installation Instruction:**
https://www.sevensensor.com/files/d/en/3S-MT-PT1000_Module-Temperature-Sensor_User-Manual.pdf

- **Ambient Temperature Sensor Installation Instruction:**
https://www.sevensensor.com/files/d/en/3S-AT-PT1000_Ambient-Temperature-Sensor_User-Manual.pdf

- **Wind Speed Sensor Installation Instruction:**
https://www.sevensensor.com/files/d/en/3S-WS_Wind-Speed-Sensor_User-Manual.pdf

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4. Maintenance and Repair

The Dual Orientation Irradiance Sensor does not require maintenance or spare-part replacement under normal operating conditions. However, to maintain measurement accuracy and sustain performance in line with the standards, the glass surface of the solar cell must be cleaned periodically. The glass surface can be cleaned gently with a soft cloth and soapy water.

According to the IEC 61724-1:2021 standard, the monitoring system should be inspected at least once a year, and preferably at more frequent intervals. During these periodic inspections, check the tightness of the fasteners, the condition of the cables, and whether there is any damage, loosening, deterioration or disconnection to the sensor and electrical enclosures.

In addition, conditions such as soiling or displacement of the optical sensors, signs of moisture or pests in the enclosures, loose cable connections, detachment of the temperature sensors from the surface and brittleness of the connections should be inspected regularly. If any issue that could affect measurement performance is detected, the necessary corrective actions must be taken.

Note: *We recommend using a thread-locking fluid for the fasteners.*

5. Calibration and Recalibration

5.1. Calibration

SEVEN delivers all irradiance sensors together with their calibration certificates. Each irradiance sensor is calibrated under a Class AAA sun simulator in accordance with the IEC 60904-2 and IEC 60904-4 standards, using a reference cell calibrated by the Institute for Solar Energy Research (ISFH) in Germany.

5.2. Recalibration

According to the IEC 61724-1 standard, the recalibration of irradiance sensors should be planned so as to minimize any interruptions that may occur during the monitoring process and to keep the risk of sensor failure to a minimum.
The effective methods that can be applied for this purpose are given below:
- Replacing the installed sensors with new or recalibrated sensors,
- Recalibrating the sensors in the field where suitable conditions can be met,
- Using a spare sensor to ensure uninterrupted operation of the monitoring system while the laboratory calibration process is ongoing.

According to the IEC 61724-1 standard, irradiance sensors used in Class A monitoring systems must be recalibrated every 2 years, or at intervals in line with the manufacturer's recommendations if a shorter period is recommended by the manufacturer. In Class B monitoring systems, the recalibration of irradiance sensors must be carried out according to the manufacturer's recommendations.

6. Connections

The supply voltage of the Dual Orientation Irradiance Sensor is in the range of 12–30 V DC. It is recommended to operate the sensor with a 24 V DC supply voltage.

The communication and power cables must be routed separately from AC/DC power cables to reduce the risk of electromagnetic interference.

Note: *The installation and electrical connections of SEVEN sensors must be carried out by a qualified electrician.*

6.1. Cable Connection

The external sensors are designed on a plug-and-play principle. The sensor connection box has waterproof and UV-resistant connectors. Since each external sensor has a different pin configuration, it is not possible to make an incorrect connection. The minimum bending diameter of the cables is 35 mm.

Connector Information for External Sensors	
Wind Speed Sensor	3-Pin Connector
Module Temperature Sensor	5-Pin Connector
Ambient Temperature Sensor	6-Pin Connector

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The Dual Orientation Irradiance Sensor has an electrically isolated, half-duplex, 3-wire RS485 interface for configuration, communication and firmware update.

Wire Assignment for Power and Communication	
Data (+)	Green
Data (-)	Yellow
Power (+)	Brown
Power (-)	White
Signal Ground	Pink / Red
Protective Earth	Black

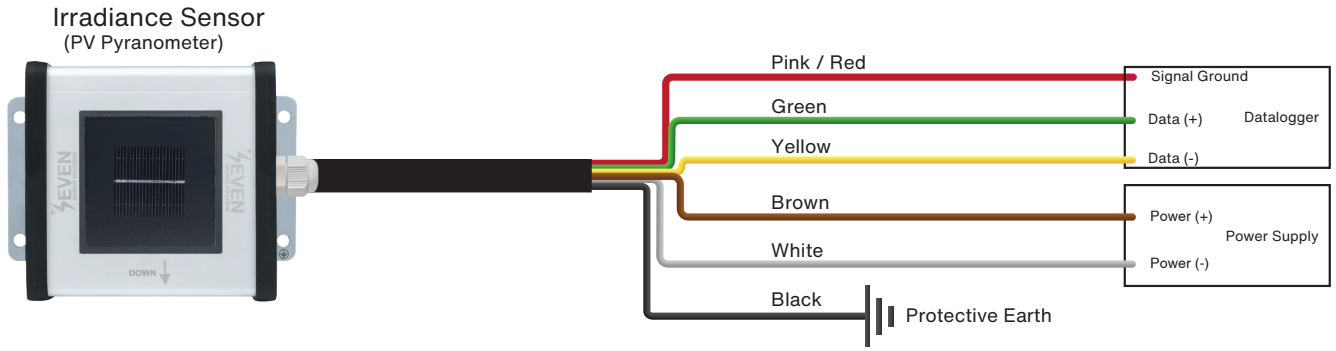


Diagram 3 – Cable Connection Diagram

6.2. Grounding of the Dual Orientation Irradiance Sensor

To protect the Irradiance Sensors in the Dual Orientation Irradiance Sensor (to which the power and communication cable is connected) from electrical noise (EMI) and to ensure measurement accuracy, the sensor must be properly grounded. Grounding must be carried out at two complementary points: via the communication cable and via the sensor housing.

There is a special grounding point marked with a grounding symbol (⏚) on the mounting bracket of the Irradiance Sensor box. If the sensor is to be mounted directly on a surface, grounding must be provided by screwing at this point. If a mounting structure is used, the sensor must again be connected to the structure at this grounding point, and the mounting structure must be integrated into the facility's protective earthing (PE) system. The black Earth GND wire in the communication cable must be connected to the grounding bus on the panel where the power supply is located. All grounding operations must be carried out by qualified site technical personnel using appropriate equipment and methods.

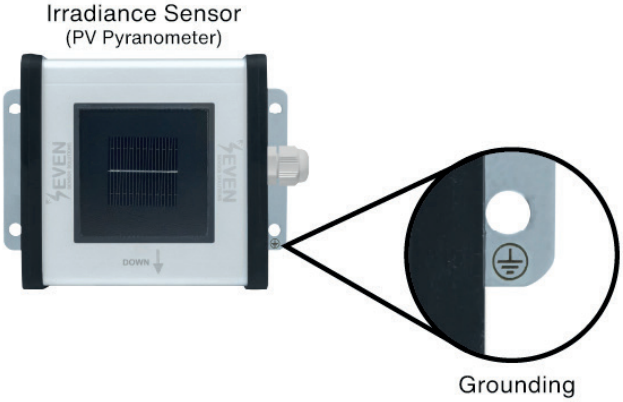


Figure 5 – Grounding Connection Point

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7. Communication

When the Dual Orientation Irradiance Sensor is correctly installed and connected, the sensor starts taking measurements automatically. The following points should be noted:

- A measurement test must be performed on the Dual Orientation Irradiance Sensor using the 3S-2IS Configuration Tool, and its proper operation in the field must be verified.
- If multiple Modbus devices are operated on the same network, a unique device ID must be assigned to each device.

7.1. 3S-2IS Configuration Tool

The 3S-2IS Configuration Tool is a software tool used to test communication on the Dual Orientation Irradiance Sensor and set the Modbus parameters.

For configuration and testing, a Windows® PC, a serial bus interface set as a serial COM port, the 3S-2IS Configuration Tool software and a USB-to-RS485 converter are required.

Follow the instructions in the 3S-2IS Configuration Tool User Manual:
https://www.sevensensor.com/files/d/en/3S-2IS_Dual-Orientation-Irradiance-Sensor_GUI.pdf

7.2. Modbus Map

A standard input register map has been created for SEVEN Sensor Modbus devices. The following register addresses can be read individually or as a block.

3S-2IS MODBUS INPUT REGISTER MAP					
ID-Dec	ID-Hex	Register	Data Type	Measurement Range	Resolution
30000	0x00	Irradiance 1	uint16_t	0...1600 W/m²	0,1 W/m²
30001	0x01	Irradiance 2	uint16_t	0...1600 W/m²	0,1 W/m²
30012	0x0C	Total Effective Irradiance	uint16_t	0...1600 W/m²	0,1 W/m²
30006	0x06	Temperature Compensated Irradiance 1	uint16_t	0...1600 W/m²	0,1 W/m²
30007	0x07	Temperature Compensated Irradiance 2	uint16_t	0...1600 W/m²	0,1 W/m²
30015	0x0F	Internal Temperature 1	int16_t	-40...+85 °C	0,1°C
30016	0x10	Internal Temperature 2	int16_t	-40 ...+85 °C	0,1°C
30022	0x16	Module Temperature 1	int16_t	-40 ...+85 °C	0,1°C
30023	0x17	Module Temperature 2	int16_t	-40 ...+85 °C	0,1°C
30021	0x15	Total Effective Module Temperature	int16_t	-40 ...+85 °C	0,1°C
30029	0x1D	Ambient Temperature	int16_t	-40 ...+85 °C	0,1°C
30053	0x35	Wind Speed	uint16_t	0...60 m/s	0,1 m/s

Note: *The table above lists the addresses that need to be monitored by the user for Dual Orientation Irradiance Sensor software version 6.1. For Modbus and SunSpec addresses belonging to other software versions, the software features of these addresses, or if you have a different software version, you can access the detailed Modbus map from the link below.*
https://www.sevensensor.com/download

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8. Contact Details

Please feel free to contact us if you face any difficulties during installation or configuration.

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Website: www.sevensensor.com

Technical Support Portal: https://www.sevensensor.com/support

Through the portal, you can create and follow your support requests, view our responses, and check the status of your requests.

For easier access and to receive notifications regarding your support requests, you can also download our Meetlys application:

- iPhone / iPad: Meetlys – App Store
- Android: Meetlys – Google Play
- Windows: Meetlys – Microsoft Store

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