

Introduction

SEVEN Soil Monitoring System measures the soiling due to environmental factors and which causes energy loss.

PV Soiling = Energy Loss

The Soil Monitoring system, which is suitable for both large areas and roof projects, informs the user of production losses due to soiling. Thus, if the sensor reads 10% as soiling ratio, this means that the energy loss in the PV system 10% as well.

SEVEN Manual Soiling Monitoring System consists of two irradiance sensors and an HMI-PLC display. The irradiance values received from the irradiance sensors are displayed on HMI-PLC and the PLC calculates the soiling ratio, according to IEC61724-1 standard. One of the sensor is cleaned periodically and the other one is cleaned with the panels at the same time. The sensors measure the irradiance values in W/m². The measured data is transmitted to the HMI-PLC via RS485 communication. The software calculates the difference between these data and gives the soiling ratio of the PV plant as per IEC61724-1 (Annex C) Standard. The Investors can check the soiling ratio and prevent the power loss by cleaning the panels on time they choose.

MANUAL SOILING MONITORING SYSTEM

EQUIPMENT SPECIFICATIONS



Sensor Box

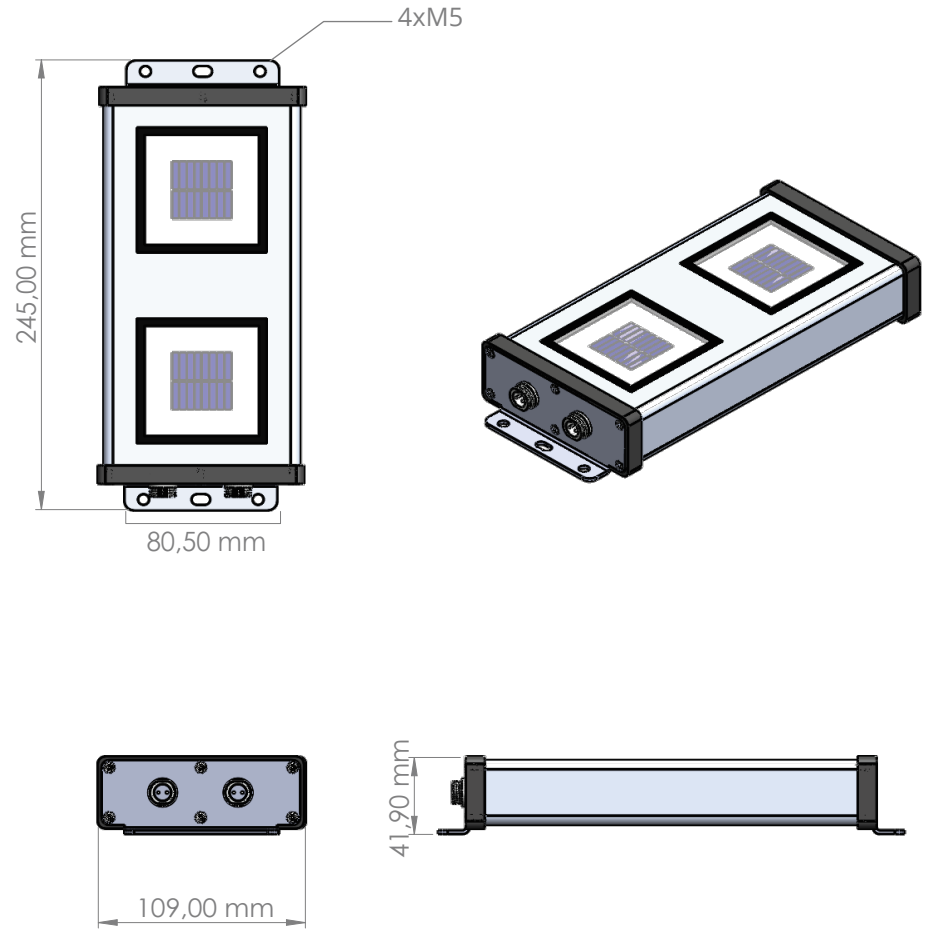
It consists of two solar cells in a UV-protected aluminum housing with an output connector and a ventilation plug, measures the irradiance values. The clean sensor must be cleaned periodically the other sensor must be cleaned with the panels at the same time.



HMI-PLC Display

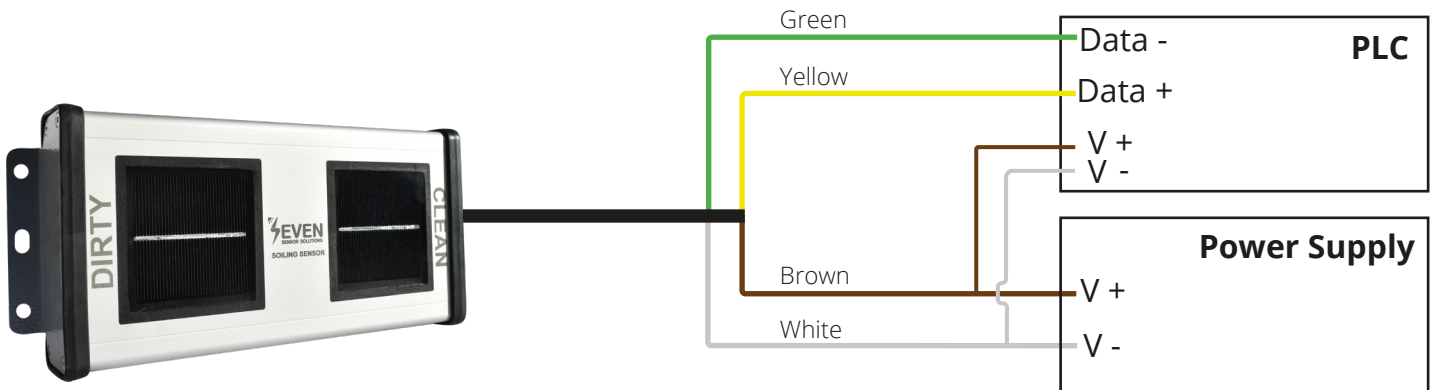
It includes PLC and HMI for monitoring and recording the Soiling Ratio as per IEC61724-1. The displayed value will be the daily average soiling ratio. This device must be mounted in a way that it won't be effected by precipitation and sun.

TECHNICAL DRAWINGS



MANUAL SOILING MONITORING SYSTEM

WIRING DIAGRAM



TECHNICAL SPECIFICATIONS

General Information	
Soiling Ratio	0%... 100% as per IEC61724 Standard Measured once a day
Display Device	HMI-PLC Display (55 mm x 96 mm)
Kullanım Yöntemi	Manual
Resolution	%1
Recording and Display	Excel/PDF/Graphic
Irradiance Sensor Calibration	IEC 6904-2:2020
Sensor Box	UV resistant, advanced weatherproof box
Dimensions and Weight	244 mm x 108 mm x 42 mm (W x L x H), approximately 450g
Power Supply	24V
Operating Temperature	0 / +50°C
Other	
Warranty	2 years limited warranty against manufacturer defects.

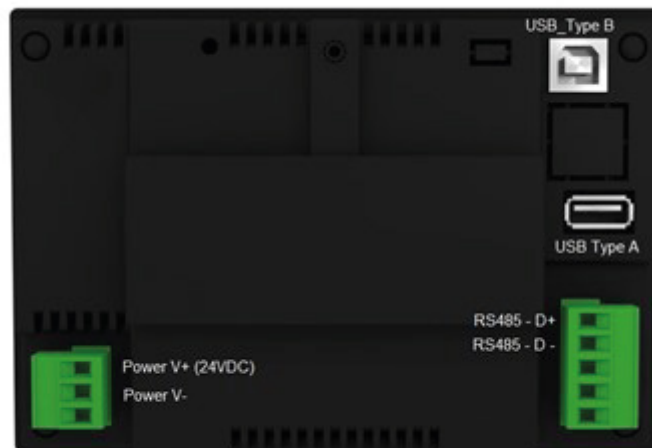
TEST&CALIBRATION

The soil monitoring system is tested before delivery. Both irradiance sensors are calibrated under class AAA sun simulator as per IEC60904-2 by using a calibrated reference cell from ISFH Germany. Each sensor is tested under natural sunlight by using calibrated reference cell from Fraunhofer ISE, Germany. Recommended periodic calibration is at least 3 years from the installation of the sensor

COMMUNICATION & INSTALLATION

The communication between the two irradiance sensors and the PLC is done through a Modbus RTU protocol, so that the data collected goes directly from the sensors to the PLC.

HMI - PLC DISPLAY DESCRIPTION



Power V+/V- (24VDC): The port where the power supply is connected. The operator panel operates at 24V. The white and brown wires of the sensor are the power connections. The adapter that supplies the power to the operator panel can also supply the power to the soiling sensor with parallel connection.

RS485 D+/D-: The COM port to where the data wires of the sensor are connected. The operator panel is programmed by this COM port. The green wire from the sensor must be connected to (D+) and yellow wire to (D-).

USB Type-B: It is used to upload the soiling sensor software or for the system updates of EMKO by using Proop Builder Program.

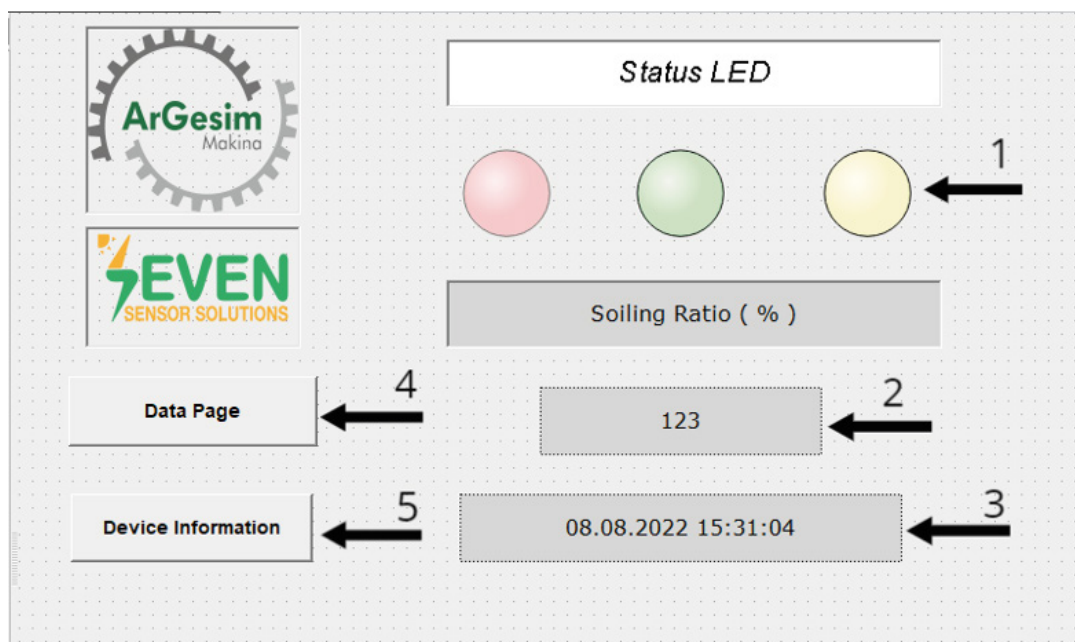
USB Type-A: The USB flash drive can be connected to this port. It is used to download the calculated data.

HMI - PLC DISPLAY USAGE

- Home Page
- Data Recording Page
- Device Information

A. Home Page

The calculated soiling ratio is displayed on this page. The other pages are accessible via this page.



1) Status LED :

- Red LED** : The soiling sensor and the operator panel are unable to communicate.
- Green LED** : The calculation and communication are done correctly.
- Yellow LED** : There is undefined data in the calculation time.

2) **Soiling Ratio (%)** : This ratio value is updated once a day after 3pm

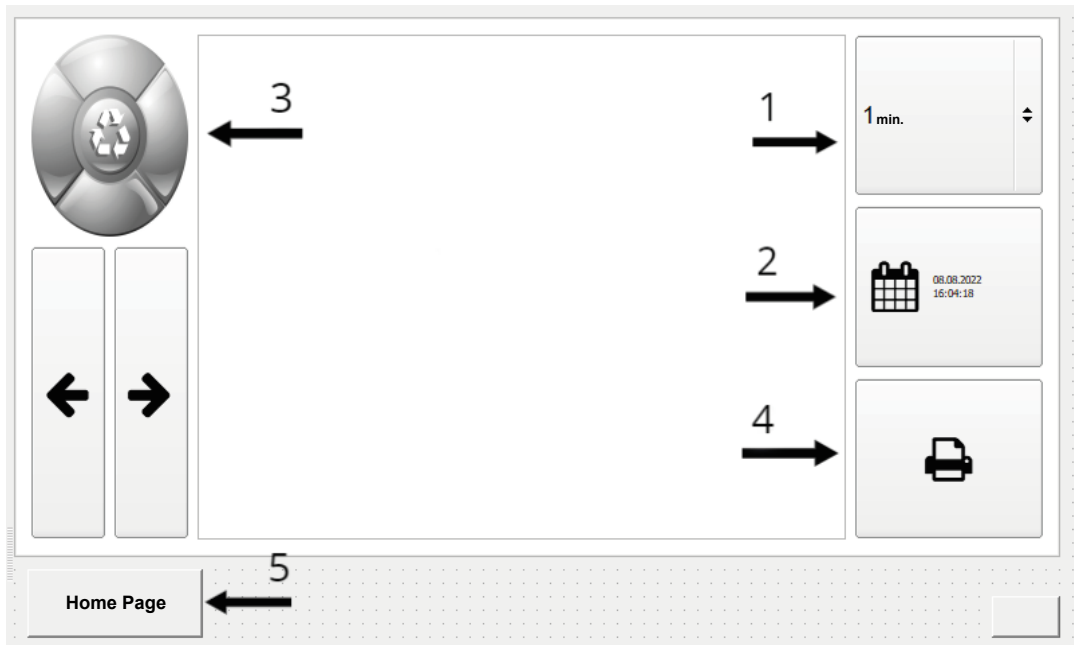
3) System Data and Time

4) **Data Recording Page**: Acces to the data recording page.

5) **Device Information**

B. Data Recording Page

The system records the soiling ratio once an hour. The user can display the records and download them to a USB flash drive.



1) Display Time: Determine the duration of the data to be displayed in the table.

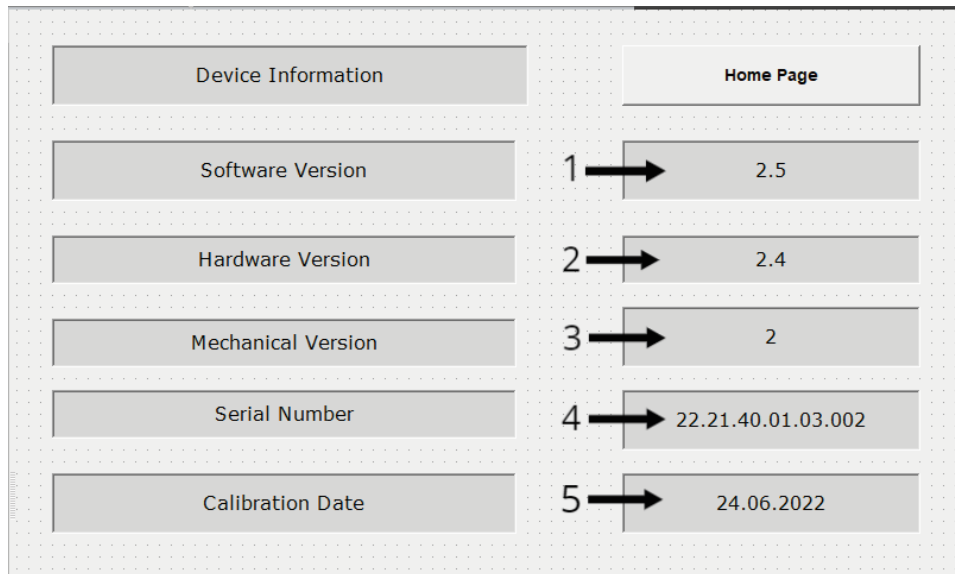
2) Data Table Start Time: Set the start time. The recording data is shown from the start time until the display time.

3) Refresh the Table: The table must be updated to display the recording data after setting the start time and the display time.

4) Download the Data: Upload the displayed data to a USB flash drive.

5) Home Page : Return to the first page.

C. Device Information



1) Software Version: There are two softwares in the system. Therefore they are displayed as X.Y

- i) **X** : The version of the Macro Software in the operator panel.
- ii) **Y** : The soiling sensor software version.

2) Hardware Version : There are two hardware in the system. Therefore they are displayed as X.Y

- i) **X** : The hardware version of the operator panel. Hardware versions vary according to the 4.7" and 5" screen sizes of the operator panel.
- ii) **Y** : The soiling sensor hardware version.

3) Mechanical Version

4) Serial Number : Serial number of the soiling sensor includes the production year, the product serial number (AA.BB.CC.DD.FF.EEEE)

(AA.BB.CC.DD.FF.EEEE)

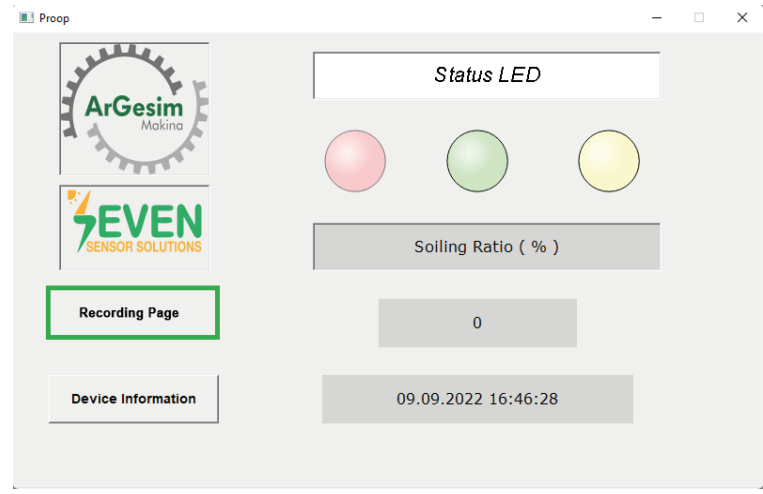
- i) **AA** : Production Year.
- ii) **BB** : Product Code.
- iii) **CC** : Cell Serial Number.
- iv) **DD** : Board Serial Number.
- v) **FF** : Box Serial Number.
- vi) **EEEE** : Product Serial Number.

MANUAL SOILING MONITORING SYSTEM

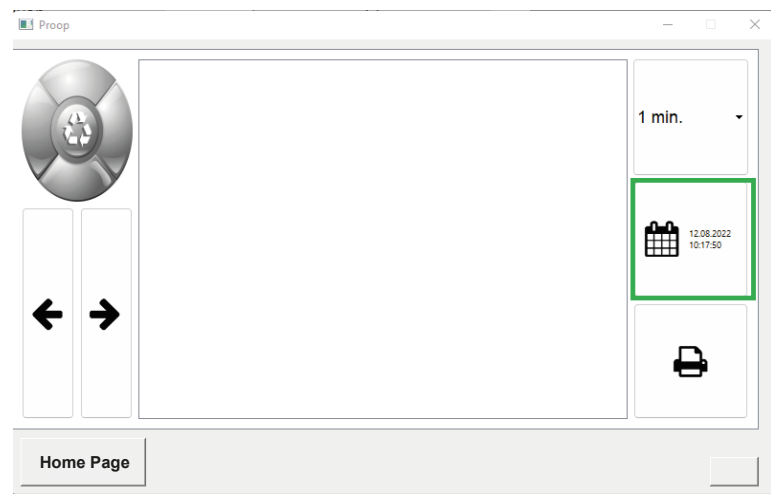
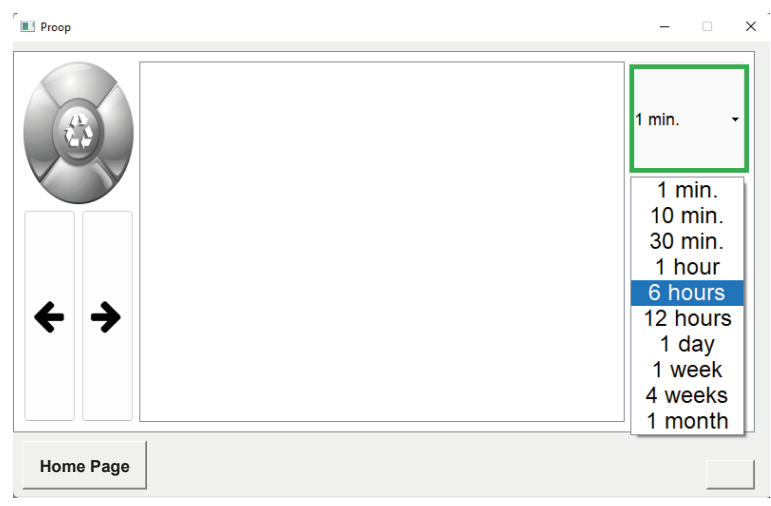
D. Download the Data to a USB Flash Drive

The recorded data can be downloaded in the form of PDF or Excel Table to a USB flash drive.

- Plug in a USB flash drive into the USB port on the back of the HMI-PLC display
- Go to Data Recording Page.

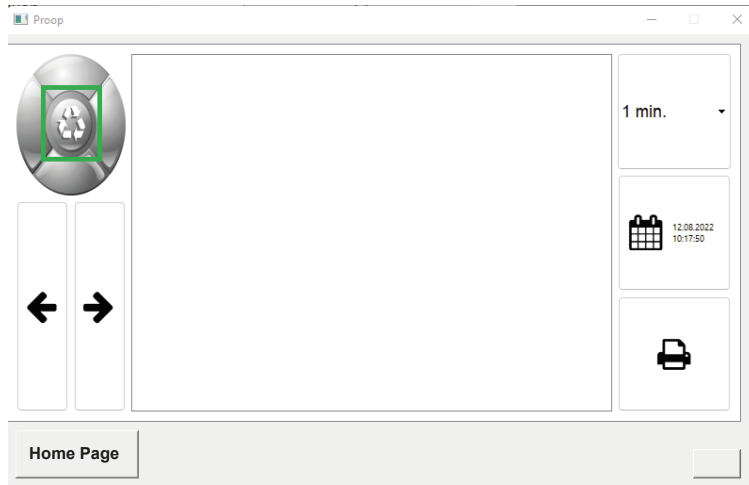



- Set the time interval & start time

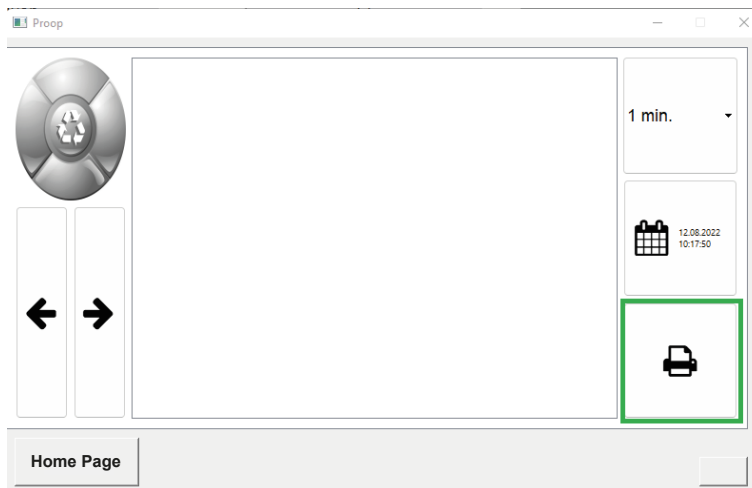


MANUAL SOILING MONITORING SYSTEM

- Refresh the page to list the data in the table.



- Click on  icon after the data has been listed.



- Click on forms options, PDF or CSV (Excel Table) that appears on the screen.

