

CredoSense User Resources

User Manual

SELF-LOGGING SOIL MOISTURE SENSOR SYSTEM

Please use this Manual for best user's experience

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CreDock Firmware Version: 1.4.8

CSL-SM2 Firmware Version: 1.1.0

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Disclaimer

Self-logging Soil Moisture Sensor System is designed only to monitor volumetric water content of soil; they do not monitor the quality of the accompanying products, goods, or commodities. Similarly, the CSL Reader (CreDock) assists Loggers with monitoring volumetric water content and temperature of the soil, but does not monitor Self-logging Soil Moisture Sensor Systems' quality.

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Colophon

This User Manual was typeset using the [KOMA-Script](#) and [L^AT_EX](#) using the [kaobook](#) class. The source code of kaobook is available at: <https://github.com/fmarotta/kaobook>.

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We dedicate this resource to the people who keep on trying when there appeared to be no hope at all and working hard to make our world a better place.

CredoSense – Resilient, Accurate, Affordable

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The CS-SL-SM comprised of two parts: a Logger (CSL-SM2) and a Soil Moisture Sensor (CS-SM2). The CS-SM2 uses capacitive technology to determine the volumetric water content (VWC) stored in a soil profile at a very affordable price. The sensors are made of industry-grade materials, ensuring their usability in industrial (e.g., agriculture) and research applications. CS-SM2 sensors are calibrated with utmost care and tested for a wide range of soils worldwide.

1.1 What this manual is about?

This document has been written as a User Manual and knowledge-base resource¹ for the Self-logging Soil Moisture Sensor. The CS-SL-SM is a logging ecosystem comprising of Logger(s), CreDock (reader/programmer), CredoWare (software to handle communication between Loggers and CredoWare). We have provided a detailed description of these products in CSL-Series Loggers Manual (downloadable from [CredoSense Website](#)). We also have demonstrated how Self-logging Soil Moisture Sensor System should be used to get the best user experience. Upon careful reading of this manual, a user should be able to:

- ▶ Connect the Logger to a computer.
- ▶ Configure/program the Logger using the CreDock.
- ▶ Retrieve recorded data on a computer.
- ▶ Generate summary reports, graphs, and do some basic analyses of the recorded data.

1.2 Areas of application

Self-logging Soil Moisture Sensor System (CS-SL-SM) have been designed to suit a wide array of applications as follows:

- ▶ Irrigation scheduling
- ▶ Watershed characterization
- ▶ Greenhouse management
- ▶ Water balance studies
- ▶ Plant disease forecasting
- ▶ Soil respiration
- ▶ Hydrology
- ▶ Soil health monitoring

Please [contact us](#) for assistance with a particular application. CredoSense also builds customized Loggers to suit user-specific needs.

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1: We have provided details information on working principles, calibration, and important scientific references related to the micro-climatic variables our loggers measures. We believe in quality data and hope that this will help our users to take educated measurements of their variables of interest.

1.3 Update software and get used to the Self-logging Ecosystem

Before using CredoWare, please make sure the latest version (different for Mac and Windows) is installed on the computer. Details on how to find CredoWare version number and update it are presented in CSL-Series Logger Manual (downloadable from [CredoSense Website](#)). If a feature described in the Manual is missing, CredoWare is using an older version of the software. The latest version of the CredoWare can be downloaded from [CredoSense Website](#).

The user is expected to be familiar with using a computer and the Windows/Mac OS/Linux operating system.

Self-logging Soil Moisture Sensor System (CS-SL-SM) is a unique product of CredoSense as it is the only product of its kind available in the market. It is developed based on the requirements of many end-users. This chapter highlights some key features of the CS-SL-SM.

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2.1 Key features

- ▶ Operating temperature: -40 to 50 °C
- ▶ Excitation voltage: 3.3 V DC
- ▶ Sensor length: 50 mm
- ▶ Cable length: 1 meter (default, but can be to varying length)
- ▶ Accuracy: $\pm 2.5\%$ typical with most soils (soil solution EC < 10 dS/m). Soil-specific calibration can enhance the accuracy up to $\sim 2\%$
- ▶ VWC range: 0% to saturation
- ▶ Uses high frequency (>70 MHz) to minimize soil salinity and textural effects
- ▶ Temperature-compensated measurements ensure high accuracy
- ▶ Small-footprint and wear-free sensor design engineered to last long.
- ▶ Self-logging System uses less wire and better preserves the overall integrity of the data compared to a general logger system.
- ▶ Soil moisture sensor has a larger sensing zone that can measure volumetric water content of a larger sample size at once
- ▶ Small footprint ensures low disturbance to the system
- ▶ Consumes less power than traditional data logger, making it well-suited for remote applications
- ▶ During sensor networking, it reduces the wiring hassle in the field

2.2 Unique features

In a traditional sensor-data logger setup, multiple sensors are connected to the data logger. If the logger fails, all sensor fails and the user loses the whole data. Unlike a traditional setup, the CS-SL-SM is a unique concept that reduces the chances of data loss due to disturbance and other factors causing a data logger to fail (e.g., power failure).

3.1 Self-logging Ecosystem (CS-SL-SM)

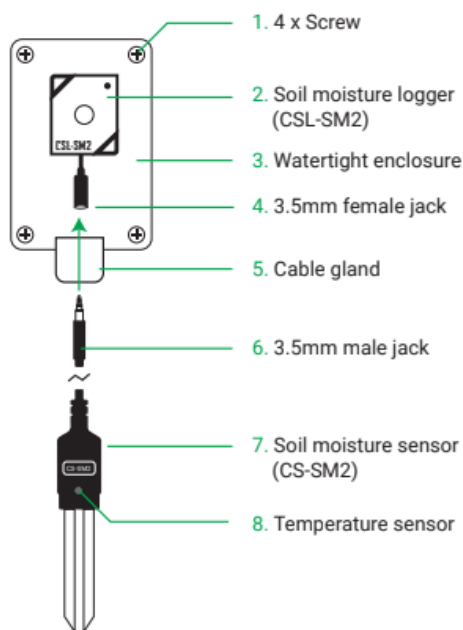


Figure 3.1: Components of a Self-logging Soil Moisture Sensor System

Figure 3.1 shows various components of a Self-logging Soil Moisture Sensor System. Components are designated by a number, which will frequently be used in this step-by-step guide.

3.2 Configuring the Logger (CSL-SM2)

Configure the CSL-SM2 Logger using a CreDock (the reader for CSL-Series Logger, available to purchase separately) via CredoWare— a software freely available from our website. Install the CredoWare, open it and connect the CreDock to the computer using a USB cable provided with CreDock, connect the Logger to the CreDock (Figure 3.2). Once the Logger is connected to the CreDock, the following window will appear in CredoWare (Figure 3.3). To configure the Logger, users can specify logging interval, set a start/stop option, and alarm.

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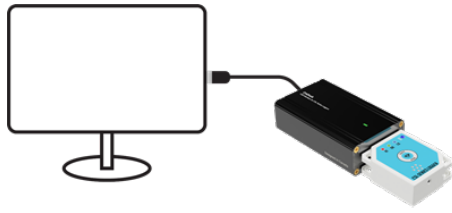


Figure 3.2: Components of a self-logging soil moisture measurement system

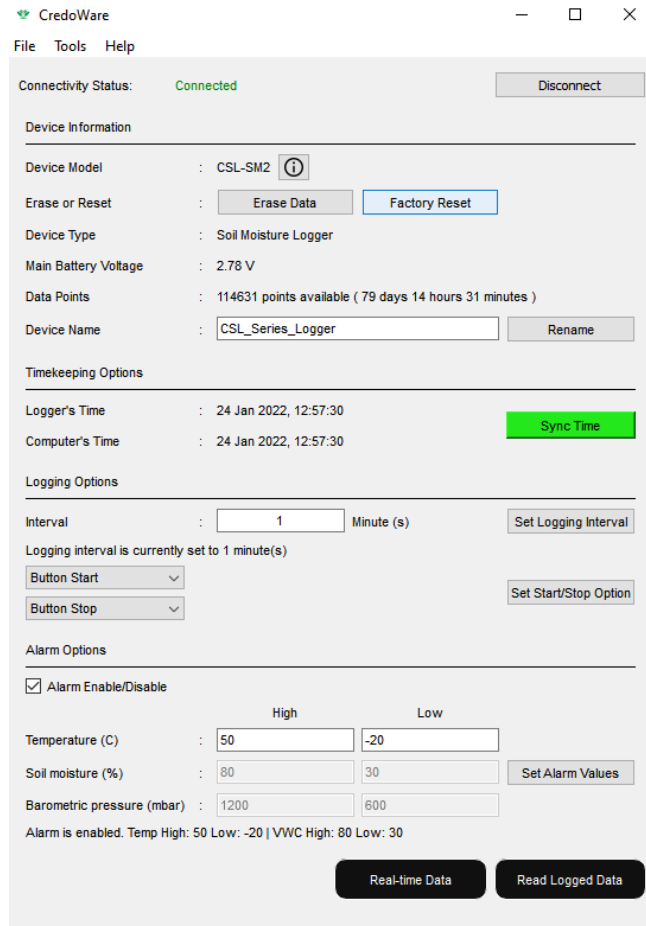


Figure 3.3: CredoWare User Interface

3.3 Preparing CSL-SL-SM for connection

Unscrew (1) the protective box (3) and loosen the cable gland (5). Now, insert the 3.5mm male jack (6) inside the protective box through the cable gland.

[NOTE: The user may find foam and silica gel inside the waterproof box as shown in Figure 3.4. The foam is used to better place the CSL-SM2 within the casing and the silica gel to absorb the internal moisture of the protective box.]



Figure 3.4: Self-logging System is placed in a protective box

3.4 Connecting the Logger (CSL-SM2) to the Soil Moisture Sensor (CS-SM2)

Place the CSL-SM2 inside the protective box (3). Connect the 3.5mm female jack (4) to the 3.5mm male jack (6) of the CS-SM2. Tighten the cable gland (5), place a small silica gel bag inside the protective box, and screw the protective box keeping the CSL-SM2 inside.

3.5 Placing the Soil Moisture Sensor in the soil

Take a thin spatula (to minimize air gaps around the sensor) and make a pocket in the soil vertically as shown in the Figure 3.5. Gently place the soil moisture sensor (CS-SM2) inside the soil pocket and push the adjacent soil to fill gaps around the sensor. Bury the CS-SM2 up to the temperature sensor (8) as shown in the Figure 3.5.

For optimal performance, do not place the sensor near (within a few cm) a large magnet/metal object.

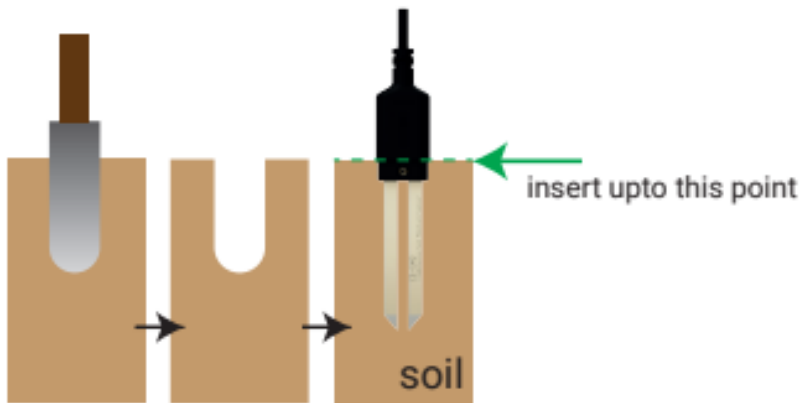


Figure 3.5: Placing Soil Moisture Sensor (CS-SM2) into the soil

3.6 Downloading data from the Logger (CSL-SM2)

Connect the CSL-SM2 Logger to a computer (Figure 3.2) and open CredoWare. The CredoWare user interface will show Logger status Connected (Figure 3.3).

To download data from the Logger to the computer, the user needs to click on the 'Read Logged Data' icon at the bottom right corner of the CredoWare User Interface. The following window will appear (Figure 3.6) where the user can graphically visualize logged data. These data can be downloaded to a computer by clicking on the 'Save Data' icon on the bottom right corner of the window. A saving window will appear as shown in Figure 3.7. The user can select a specific directory to save the logged data. After saving the data, a confirmation window will pop-up (Figure 3.8). The data will be saved in .csv format on the users' computer.

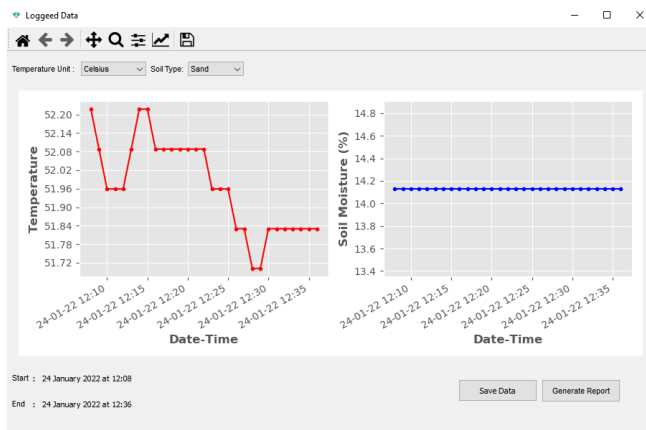


Figure 3.6: Showing logged data window

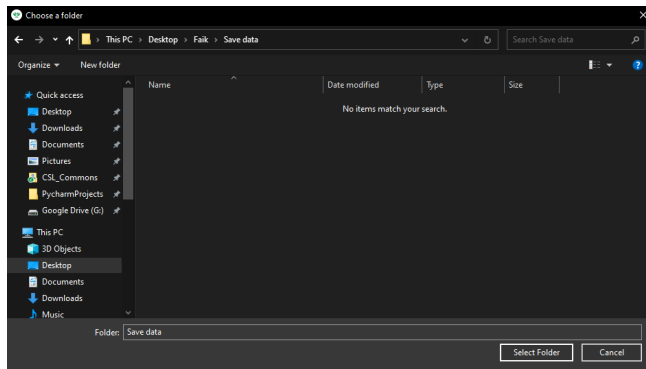


Figure 3.7: Saving logged data

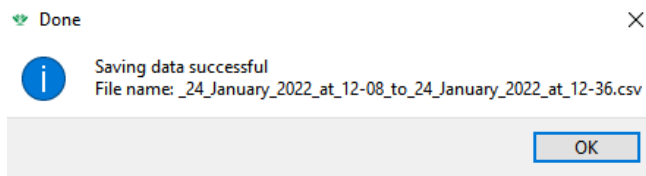


Figure 3.8: Data saving completed

The saved *.csv data can be used for further analysis and processing.