

CO2-Sense

**CO2 1% or 30%, Temperature
& %RH, Diffusion Data Loggers**



Models Covered

ESCM-18
ESCM-19
ESCM-209
ESCM-210
ESCM-08-CC

ESCM-16
ESCM-17



edaphic scientific

environmental research & monitoring equipment

Save meter information for future reference

Model Number: _____

Serial Number: _____

Purchase Date: _____

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Welcome

Thank you for purchasing our meter. Please take some time to read through this manual in order to become familiar with the meter. Also, please pay special attention to the important safeguards shown on the next page.

Important Safeguards

To reduce the risk of fire, electrical shock and/or injury to persons, basic safety precautions should always be followed when using electrical appliances, including the following:

1. **READ ALL INSTRUCTIONS BEFORE USING THIS METER.**
2. **INSTALL GasLab® SOFTWARE BEFORE CONNECTING METER TO A COMPUTER.**
3. Charge rechargeable meters for at least 5-8 hours before use.
4. The rechargeable data loggers contain a lithium polymer (Li-Ion) battery. Do not expose to extreme heat or cold.
5. The Li-Ion battery is not user-replaceable. Please do not attempt to open the meter and replace the battery.
6. Do not use rechargeable AA batteries.
7. For models using AA batteries, do not store the meter with the AA Alkaline batteries installed to prevent the potential for battery leakage.
8. Use only the supplied 5/6VDC international wall power supply adapter. Precisely 5/6V must be applied to the meter. Other voltages can cause permanent damage.
9. The meter is not designed for outdoor use.
10. Do not allow the meter to be exposed to water.
11. Do not operate the meter with the enclosure opened.
12. Do not operate the meter if it is malfunctioning.
13. Use of this device in environments above 95% humidity may cause irreparable damage to the components.

**SAVE THESE
INSTRUCTIONS**

Package Contents

Please verify that your package contains the following items before using the meter:

All meters:

- (1) Meter
- (1) 5/6VDC international power supply
- (1) 6-foot USB Cable
- (1) Calibration Certificate Tag
- (1) User's Manual



**Picture 1: ESCM-16 or
ESCM-17**



**Picture 2: ESCM-18,
ESCM-18-CC, ESCM-19
ESCM-209 or ESCM-210**

Optional Accessories

A Hydrophobic Vent Filter Kit may be purchased separately. These filters are ideal for high-humidity environments to allow air flow while keeping humidity out. Long-lasting, use anywhere humidity is very high (> 95%). Order part number ESCM-172.

Software Capabilities

Our GasLab® software will allow users to:

- Manage and download logs
- Configure Sensor
- Adjust logging intervals
- Calibrate the meter
- Automatic data logging when meter is powered ON
- Data logging session status displayed on LCD screen
- Collect data real-time

Please visit:

<http://www.co2meter.com/pages/downloads> for your free download of our GasLab® software. Please note GasLab® must be installed prior to connecting the meter/sensor to your computer.



Powering the Meter

All data loggers come with an international power adapter and they are also battery-powered. Some meters are powered by an internal rechargeable Li-Ion battery and others by dry cell non-rechargeable alkaline AA batteries (not included), depending on the model of the meter. The table below shows detailed information about the battery used by each available model.

| Model No. | LCD | Battery Type | Capacity(mAh) | Qty. |
|------------|-----|---------------------|---------------|------|
| ESCM-16 | Yes | Dry AA Cell* | 1,800-2,600 | 4 |
| ESCM-17 | Yes | Dry AA Cell* | 1,800-2,600 | 4 |
| ESCM-18-CC | No | Dry AA Cell* | 1,800-2,600 | 4 |
| ESCM-18 | No | Rechargeable Li-Ion | 2,200 | 1 |
| ESCM-19 | No | Rechargeable Li-Ion | 2,200 | 1 |
| ESCM-209 | No | Rechargeable Li-Ion | 6,000 | 1 |
| ESCM-210 | No | Rechargeable Li-Ion | 6,000 | 1 |

*Batteries not included. Duracell brand recommended.

IMPORTANT: METERS USING DRY AA CELLS: USE NON-RECHARGEABLE ALKALINE BATTERIES ONLY. DO NOT STORE THE METER WITH THE BATTERIES INSTALLED TO PREVENT THE POTENTIAL FOR BATTERY LEAKAGE.

Li-Ion Battery Life vs Logging Interval

In operation, the Li-Ion powered data loggers draw less than 0.7 mA continuously and ~400 mA for 2.5 seconds during each measurement. Each has a logging capacity of 5,400 time-stamped measurements.

This allows us the following calculation to determine both battery life (endurance in the field) and the time to fill the logging memory:

$$\text{AVERAGE DRAW (mA)} = \frac{0.7 (T-2.5) + 1,000}{T}$$

Where T = the measurement interval in seconds. The .7 (T-2.5) gives us the current total current draw for one cycle of standby because we draw .7 mA for the entire interval except the 2.5 seconds of actual measurement. Then we add the measurement cycle during draw of ~400 mA for 2.5s (2.5 * 400 = 1,000). And finally we divide by T to get the overall average draw.

For example, the average draw for a 30 second interval:

$$\text{AVERAGE DRAW (mA)} = \frac{0.7 (30-2.5) + 1,000}{30} = 33.9 \text{ mA}$$

To get the Estimated Battery Life (EBL), we divide the battery capacity by the average draw. In the case of a 2,200mA battery, this would be:

$$\text{ESTIMATED BATTERY LIFE} = 2,200 / 33.9 = 64.9 \text{ HOURS}$$

To determine the Time to Fill Memory (TTFM), we use a different calculation:

$$\text{TTFM} = \text{SAMPLING INTERVAL} * 5,400 \text{ DATA LOGS} / 3,600$$

For example, taking a sample every 30 seconds would mean:

$$\begin{aligned} \text{TTFM} &= 32 * 5,400 / 3,600 \\ \text{TTFM} &= 48 \text{ HOURS} \end{aligned}$$

Of course, TTFM must be less than EBL. This means that in most cases, you can completely fill the memory with data logs more than once between charges.

Battery Life

Data loggers using AA dry cell alkaline batteries can run continuously for up to 8 hours, regardless of logging interval selected.

The battery life for data loggers using a rechargeable Li-Ion battery depends on the selected logging interval. Table below shows the estimated battery life (EBL) and the time to fill the internal memory (TTF) based on some typical logging intervals.

| Logging Interval (T) | Avg. Draw* (D) | Estimated Battery Life* (EBL) | | Time to Fill Memory* (TTF) |
|----------------------|----------------|-------------------------------|----------|----------------------------|
| | | 2,200mAh | 6,000mAh | |
| 30 sec. | 33.9 mA | 65 hrs. | 177 hrs. | 45 hrs. |
| 60 sec. | 17.3 mA | 127 hrs. | 347 hrs. | 90 hrs. |

| | | | | |
|------------|--------|------------|------------|------------|
| 300 sec. | 4.0 mA | 550 hrs. | 1,500 hrs. | 450 hrs. |
| 670 sec. | 2.2 mA | 1,005 hrs. | 2,740 hrs. | 1,005 hrs. |
| 1,800 sec. | 1.3 mA | 1,754 hrs. | 4,782 hrs. | 2,700 hrs. |
| 3,600 sec. | < 1 mA | 2,251 hrs. | 6,139 hrs. | 5,400 hrs. |

*Contact us if you need to calculate D, EBL, or TTF for other logging intervals (T).

As shown in the table above, in order to completely fill the internal memory at logging intervals equal to approximately 670 seconds or longer, a high capacity (6,000mAh) Li-Ion battery will be required if meter is not connected to power adapter, assuming meter is fairly new and battery was fully charged initially.

IMPORTANT: DOWNLOAD THE DATA LOGS REGULARLY TO PREVENT POSSIBLE DATA LOSS. ONCE THE MEMORY IS FULL, PREVIOUSLY LOGGED DATA WILL BE OVERWRITTEN.

NOTE: The AA battery-powered Meter (ESCM-18-CC) will have an estimated battery life similar to that of its 2,200mAh Li-Ion battery-powered counterpart (ESCM-18).

Charging the Meter

Meters powered by rechargeable Li-Ion batteries can be charged using the supplied universal power adapter or a USB port on a powered computer. Li-Ion batteries will be fully charge in 5-8 hours and will lose about 8% of their charging capacity per every year of use at 25°C.

Product Overview

This data logger is designed to measure carbon dioxide (CO₂), percent of relative humidity (%RH), and temperature through diffusion sampling. It stores collected data to its internal memory to be retrieved at a later time for analysis. When combined with our GasLab® software, you can also see real-time data on your computer's screen.

Scientific devices such as this data logger require the user to have an intimate knowledge of the meter, its operation, the required software, and the meter specifications prior to use. We highly recommends reading this user's manual before operating the device, especially the *Important Safeguards* section on page 4.

Theory of Operation

The CO₂ sensor inside this meter uses NDIR (non-dispersive infrared) technology to sense, as a function of transmitted light, the concentration of CO₂ in the air. It has been factory calibrated to operate within the specified range and precision.

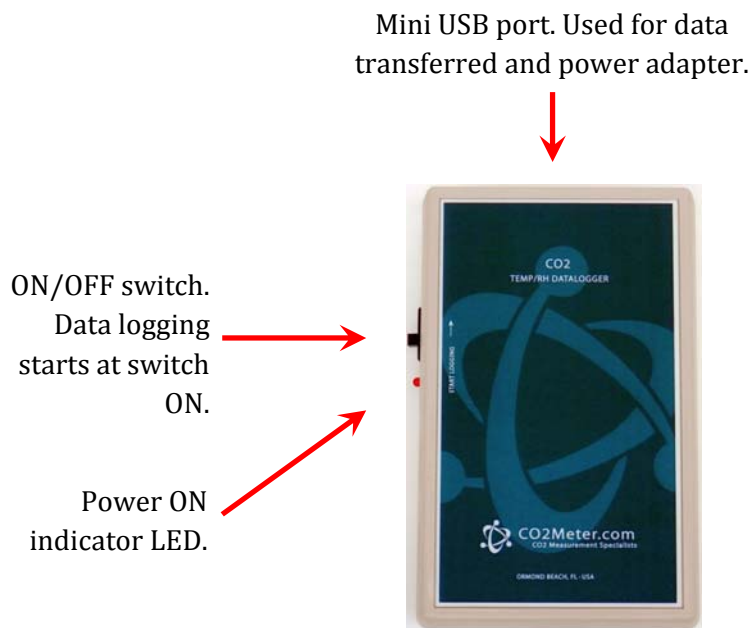


Figure 1: Data logger models: ESCM-18, ESCM-18-CC, ESCM-19, ESCM-209, and ESCM-210

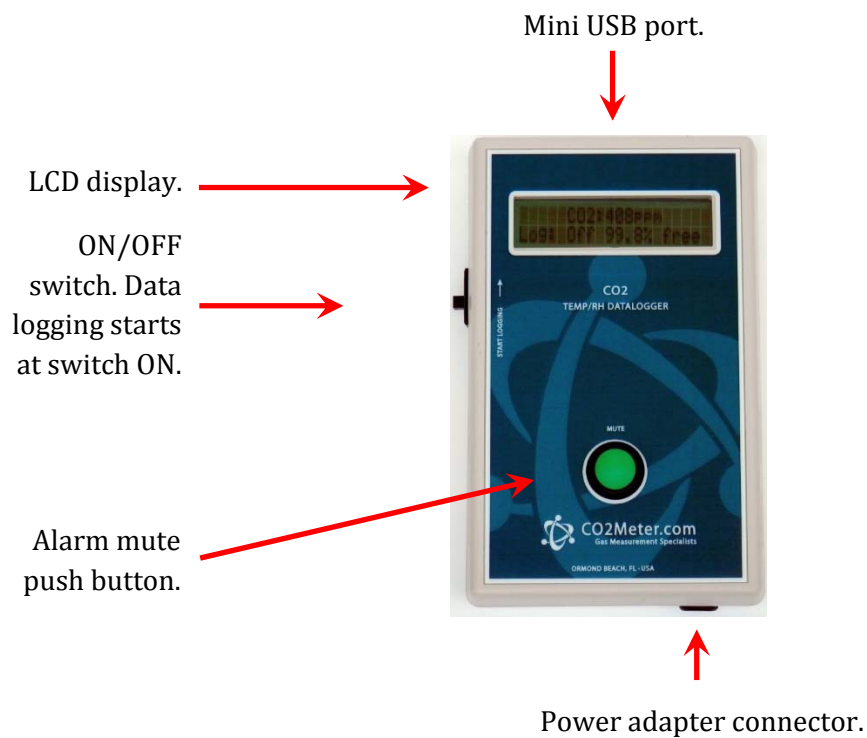


Figure 1: Data logger models: ESCM-16 and ESCM-17 (with display and audible alarm)

Operation Guide

Make sure you read through these instructions thoroughly before using the meter. This guide will help you become more familiar with the meter in order to be as productive as possible in a short period of time. Please read the Important Safeguards on page 4 before continuing.

IMPORTANT: Follow these instructions to ensure proper set up:

1. Start by downloading the GasLab® Software to your computer as shown on page **Error! Bookmark not defined.**
2. Power the meter using batteries or the included international power adapter.

NOTE: connecting the included USB cable to a port in a computer will not supply the appropriate power.

3. Turn *ON* the meter.
4. If the meter has a LCD (ESCM-16 and ESCM-17), wait until the display changes colors to visually confirm it has reset successfully after connecting it to a USB port on a computer.

Connecting Meters

The first time the meter is connected to your computer, the operating system will install the necessary USB drivers as shown in **Figure 2**. This process could take a few minutes.

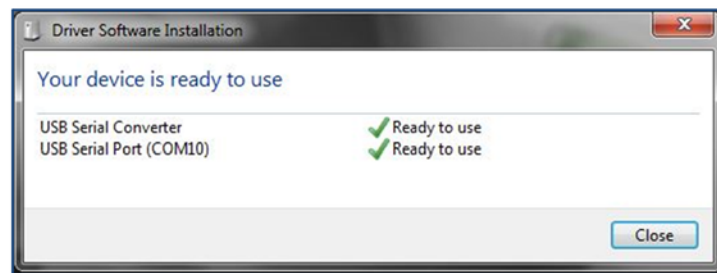


Figure 2: USB Driver Installation.

Setting the Meter

1. Ensure the data logging switch is in the ON position.
2. Connect the meter to the computer using the included USB cable.
3. Launch the GasLab® software.
4. Connect the meter/sensor to your computer

NOTE: The meter must be started at least 1 minute prior to use and data logging to allow the CO2 sensor enough time to warm-up and calibrate.

After connecting the meter to a computer and setting it, the GasLab® software will allow you to perform the following main functions:

- **Collect Real-time** – data being recorded is displayed on graph.
- **Manage and Download Logs** – provide options to manage data logs saved in the meter.

- **Configure Sensor** – provide options to setup the sensor inside the meter and data logging options, among other features.

NOTE: A separate data file will be created each time the meter is powered ON (starts logging).

Logging Data

Once the GasLab® software has been installed and the meter is connected to the computer, you can gather data in a variety of ways. Depending on the type of meter, data can be collected in real time, data logs can be downloaded from the meter's memory (if equipped), and saved to the computer, and data can be reviewed on the meter's LCD display (if equipped).

For each logging session

1. Turn the meter ON.
2. The meter must be started at least 1 minute prior to deployment and data logging to allow the CO2 sensor time to warm-up and calibrate.
3. Set the logging interval (min 30 sec) as desired and commence logging.
4. When data logging is completed, turn the meter OFF.

Setting the Logging Interval

To change the default settings, connect the meter to a computer using the included USB cable then follow the procedure below.

1. Open GasLab® and select desired meter/sensor from the **NOTE:** Refer to the GasLab® User's Manual for more information.
2. Please reference the included GasLab® manual for detailed instruction on using the software.

NOTE: Refer to the GasLab® User's Manual for complete instructions.

Display and Alarm (ESCM-16, ESCM-17 only)

This data logging meter includes a built-in audible (80dB) alarm and an LCD (Liquid Crystal Display) back-lit display that provides visual indication of the current CO2 level by changing color to green, yellow or red, depending on CO2 level ranges selected. The display will change colors depending on the actual CO2 level readings by setting the "Green", "Yellow", and "Red" ranges. The alarm is set per LEED levels by default but can be programmed to other standards such as OSHA levels using the GasLab® software. The new alarm level will be maintained in the meter's memory.

During operation, when the meter is turned on, and when the high concentration CO2 level programmed is reached, an 80dB alarm will sound. The alarm can be muted for 30 seconds by pressing the button on the front of the meter. This feature can be programmed for user preference.

Calibration

The CO2 sensor, in IAQ applications only, uses an algorithm called Automatic Background Calibration (ABC) to ensure maximum accuracy by continuously adjusting the zero-point. The ABC algorithm allows the CO2 sensor to dynamically shift its CO2 reading by a constant. It works via storing the lowest CO2 sample taken over the ABC Period and assuming that this low value is equal to a known value (the target value). It then adjusts the output of the CO2 reading by the delta between these values. This algorithm does not affect the linearization of the output signal. For example, by default ABC is enabled with an ABC Period of 180 hours, a target value of 400ppm, and a maximum delta of 30ppm. This operates under the principle that ambient, outdoor air is at 400ppm.

The sensor will keep track of the lowest CO2 reading recorded over a period of 180 hours and then adjust the zero point, up to 30ppm at a time, towards that value.

To ensure maximum accuracy it is recommended to install the device in an environment that will routinely see this low value.

In addition, this meter can be exposed to fresh air for a few minutes between uses to verify calibration by making sure the readings are close to 400 ppm, or can be manually calibrated using the GasLab® software.

NOTE: Refer to the GasLab® User's Manual for complete instructions.

Meter Specifications

| | | |
|----------------------------------|----------------------------|--|
| Measuring Principle: | CO2 | Non-dispersive infrared (NDIR) sensor |
| Measuring Range: | | |
| | 1% CO2 models | 0-10,000 ppm |
| | 30% CO2 models | 0-300,000 ppm (0-30% vol.) |
| Repeatability: | | |
| | 1% CO2 models | ±20 ppm, ±1% measured value |
| | 30% CO2 models | ±0.1%, ±2% of measured value |
| Accuracy: | | |
| | 1% CO2 models | ±30ppm, ±3% measured value |
| | 30% CO2 models | ±0.2%, ±3% of measured value |
| CO2 Sensor Ratings: | | |
| | Life Expectancy | >15 years |
| | Warm-up Time | <1 min (instant measurements) |
| Temperature Sensor: | Range | -40 to 120°C |
| | Repeatability | ±0.1°C |
| | Accuracy | ±0.5°C |
| Relative Humidity Sensor: | | |
| | Range | 0-100% |
| | Repeatability | ±0.1% |
| | Accuracy | ±3% |
| Dimensions: | | (mm) inches |
| | L x W x D | (146.1)5.75 x (91.4)3.60 x (32.7)1.30 |
| Data Logging: | Data Points | 15,000 (ESCM-16,-17) 5,400 (ESCM-18,-18-CC,-19, -209,-210) |
| | Programmable Interval Data | Date, time, CO2, %RH, temp. |
| Power: | Input Voltage | 5VDC (use only supplied adapter) |
| | Power Consumption | 500 mA (while charging) |
| | Charging Time | 5-8 hrs. (approximately) |
| | Battery Type/Capacity | 4xAA (ESCM-16,-17,-18-CC) Li-Ion/2,200mA (ESCM-18,-19) Li-Ion/6,000mA (ESCM-209,-210) 2- |
| | Li-Ion Battery Lifetime | 3 years depending on cycles |

Troubleshooting Guide

| Symptom / Issue | Possible Cause | Resolution |
|---|--|--|
| Meter is not recognized by computer | The meter's batteries might be depleted. | Replace the batteries or connect meter to the included power supply and power meter ON. |
| All log time stamps start in the year 2000 | The real-time clock was not synced. | Connect the meter to the computer with data logging off. The time will synchronize in GasLab@ . |
| No logs are present on the meter after data logging | The meter was disconnected while logs were being downloaded. | Connect the meter to the computer and download logs again. |
| The display is Blue or showing Sensor Missing | The meter's EEPROM has been corrupted. Battery or power supply issues. | Please email our technical support for further assistance. |
| CO2 Readings are inaccurate | ABC is adjusting the zero point. | Turn off ABC or ensure the unit is exposed to 400ppm air while data logging. |
| | Batteries are low. | Replace AA battery cells or connect meter to power supply if rechargeable Li-Ion battery. |
| | The meter was disturbed mechanically. Meter may need calibration. | Perform a calibration or send the meter to CO2 Meter for professional calibration and recertification. |

Support

The quickest way to obtain technical support is via email. Please send all support inquiries to info@edaphic.com.au

Please include a clear, concise definition of the problem and any relevant troubleshooting information or steps taken so far, so we can duplicate the problem and quickly respond to your inquiry.

Warranty

This meter comes with a 1YEAR (warranty period) limited manufacturer's warranty, starting from the date the meter was shipped to the buyer.

During this period of time, Edaphic Scientific warrants our products to be free from defects in materials and workmanship when used for their intended purpose and agrees to fix or replace (at our discretion) any part or product that fails under normal use. To take advantage of this warranty, the product must be returned to Edaphic Scientific at your expense. If, after examination, we determine the product is defective, we will repair or replace it at no additional cost to you.

This warranty does not cover any products that have been subjected to misuse, neglect, accident, modifications or repairs by you or by a third party. No employee or reseller of Edaphic Scientific's products may alter this warranty verbally or in writing.

Use of this device in environments above 95% humidity may cause irreparable damage to the components and is not warranted.

Liability

All liability under this agreement shall be limited to the actual cost of the product paid to Edaphic Scientific. In no event shall Edaphic Scientific be liable for any incidental or consequential damages, lost profits, loss of time, lost sales or loss or damage to data, injury to person or personal property or any other indirect damages as the result of use of our products.

Returns

If the product fails under normal use during the warranty period, a RMA (Return Material Authorization) number must be obtained from Edaphic Scientific. After the item is received Edaphic Scientific will repair or replace the item at our discretion.

To obtain a RMA number, email: info@edaphic.com.au When requesting a RMA please provide reason for return.

If the product fails under normal use in the first 10 days of ownership, at our discretion we will email you a postage-paid UPS label to return the product at our expense.

If we determine that the product failed because of improper use (water damage, dropping, tampering, electrical damage etc.), or if it is beyond the warranty date, we will inform you of the cost to fix or replace the product.

Contact Us

We are here to help!

For information or technical support, please contact us.

info@edaphic.com.au

PO Box 1843, Port Macquarie, NSW 2444

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