OPERATION MANUAL

C-12

Portable Carbon Monitor
C-12-9805
Rev A

Met One
Instruments

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Met One Instruments, Inc. is now part of the Acoem international group of companies.

Met One Instruments has been designing and manufacturing class-leading meteorological, ambient air sensing, and air quality monitoring instrumentation since its inception in 1989. Its line of robust industrial-grade meteorological equipment, air particulate monitoring equipment, and indoor air quality monitoring systems have set the standard for the industry. Headquartered in Grants Pass, OR, Met One Instruments, Inc. is fueled by a dedicated expert team who is diligently working to advance the technology required to ensure continued improvements in human and environmental health now and for generations to come.

Acoem is committed to helping organizations and public authorities find the right balance between progress and preservation — safeguarding businesses and assets and maximizing opportunities while conserving the planet's resources. Headquartered in Limonest, France, Acoem delivers unrivaled inter-operable AI-powered sensors and ecosystems that empower our customers to make enlightened decisions based on accurate and timely information.

In 2021, Acoem acquired Met One Instruments, marking a pivotal moment when two industry leaders in the air quality monitoring sectors converged — creating a single, stronger and more future-focused provider of holistic environmental monitoring solutions. Now, **Met One Instruments Powered by Acoem** has opened new possibilities through an extensive offering of class leading, multi-parameter environmental monitoring and industrial reliability solutions. These integrated measurement systems, technologies, and services deliver comprehensive solutions for a range of applications, including environmental research, regulatory compliance, and industrial safety and hygiene.

For more information about **Met One Instruments Powered by Acoem**, please visit: **metone.com**

For more information about **Acoem**, please visit: **acoem.com**

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1. INTRODUCTION

1.1 About this Manual

This document is organized with the most important information grouped together for easy reference by the user. All C-12 owners and operators should read and understand the sections on assembly, deployment, setup, menu hierarchy and field calibrations. Other sections that provide in-depth information on subjects such as theory, diagnostics, accessories, and alternate settings provide valuable information which should be consulted as needed.

This manual is periodically revised for maximum accuracy and to incorporate new features or updates. User feedback is welcome. An electronic version of this manual is available at https://metone.com/support-documents/.

1.2 Technical Service

This manual is structured to provide the required information for setup, operation, testing, maintaining, and troubleshooting the C-12. Should you still require support after consulting the documentation, we encourage you to contact one of our expert Technical Service representatives during normal business hours of 7:00 a.m. to 4:00 p.m. Pacific Time, Monday through Friday. In addition, technical information and service bulletins are posted on our website.

Contact Information:	Tel: +1 541 471 7111	Address:	Met One Instruments
	Fax: +1 541 471 7116		1600 NW Washington Blvd
	Web: www.metone.com		Grants Pass, OR 97526
	Email: service.moi@acoem.com		U.S.A.

1.2.1 Return Authorization

Met One Instruments requires that a Return Authorization (RA) form be completed and sent to the Met One Service department for approval, before sending instruments back for factory service.

Please contact the Met One Service Department to obtain a Return Authorization (RA) number. This allows us to track and schedule service work and to expedite customer service.

> NOTE: Please have the instrument serial number available when contacting the manufacturer. On most models manufactured by Met One Instruments, it will be located on a silver product label on the unit, and also printed on the calibration certificate. The serial number will begin with a letter and be followed by a unique four or five-digit number such as A12345.

Domestic Customers: Visit the service tab at ***www.metone.com*** or email service.moi@acoem.com for the return authorization form and instructions.

International Customers: Email the Service department (service.moi@acoem.com) for Return Authorization instructions.

1.3 Unpacking the C-12

Please refer to Section 4, Page 19 for a list of standard accessories delivered with the C-12.

NOTE: Please keep all the special shipping materials (box, foam packing, etc.) used to ship the C-12. They should be re-used when the C-12 is transported (changing site locations, returning to the factory, etc.). Contact Met One Instruments to purchase replacement packing materials if necessary.

1.3.1 Shipping Damage

If any damage to the shipment is present before unpacking, **a claim must be filed with the commercial carrier immediately**. Follow any special unpacking instructions provided by the carrier when all items are carefully removed from the containers and each component inspected. It is recommended to document and photograph all damaged packages and items before, during, and after unpacking them. Contact Met One Instruments to arrange for any replacement items needed.

1. Carefully unpack items from the box.

2. Inspect all components for damage.

3. Compare all components to the packing list to ensure all items have been shipped.

4. After unpacking all components/subassemblies, take photos of each part with labels still attached and confirm they match all components/sub-assemblies listed on the packing list.

From the list provided below, check that all mandatory, standard equipment and optional accessories have been included.

1.3.2 Packing Materials Replacement

Met One Instruments recommends keeping the special shipping box and foam packing material the C-12 was shipped in as they could be re-used when the instrument is transported to another site or returned to the factory.

If the original packing materials are disposed of or lost, replacement packing materials can be purchased through the Met One service department via email.

1.4 About the C-12 Portable Carbon Monitor

The Met One Instruments, Inc. model C-12 Portable Carbon Monitor is a two-wavelength (370 nm and 880 nm) black carbon monitor. It automatically measures and records optical transmission across filter media onto which particulate matter has been deposited. The industry standard wavelength of 880 nm is used to determine the concentration of black carbon "BC". Data from the 370 nm and 880 nm channels may be used for source apportionment. Source apportionment allows one to determine how much of the measured carbon originates from combustion of fossil fuel or from biomass. Measurement results are sent to a customized web page dashboard where data can be viewed and downloaded.

Figure 1-1 The C-12

Ambient air is drawn into the instrument at a controlled flow rate through a heated inlet section and then through special glass fiber filter tape, capturing ambient particulate matter. Optical transmission is measured through the filter tape allowing BC mass concentrations to be calculated. The filter tape will advance when sufficient particulate matter has been deposited on the tape to cause the attenuation of the selected channel to exceed a factory recommended level.
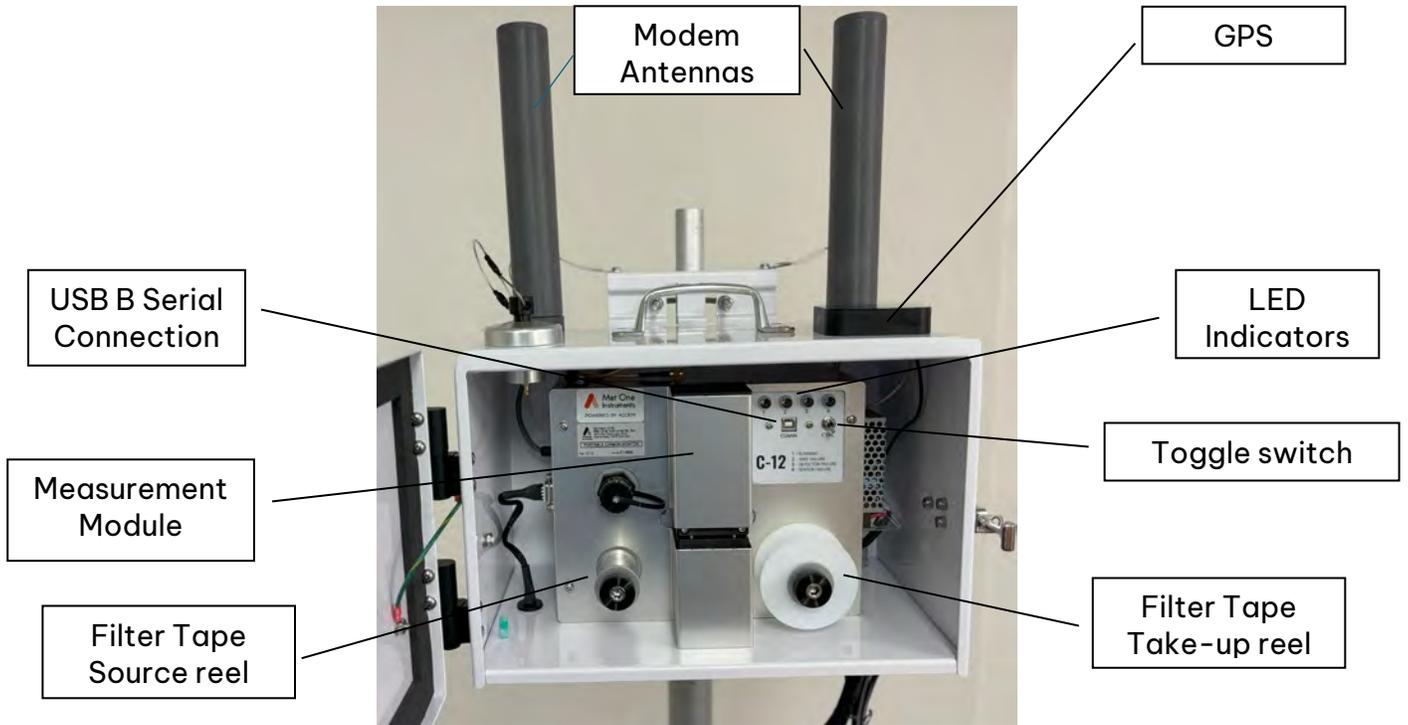
Figure 1-2 C-12 Internal View
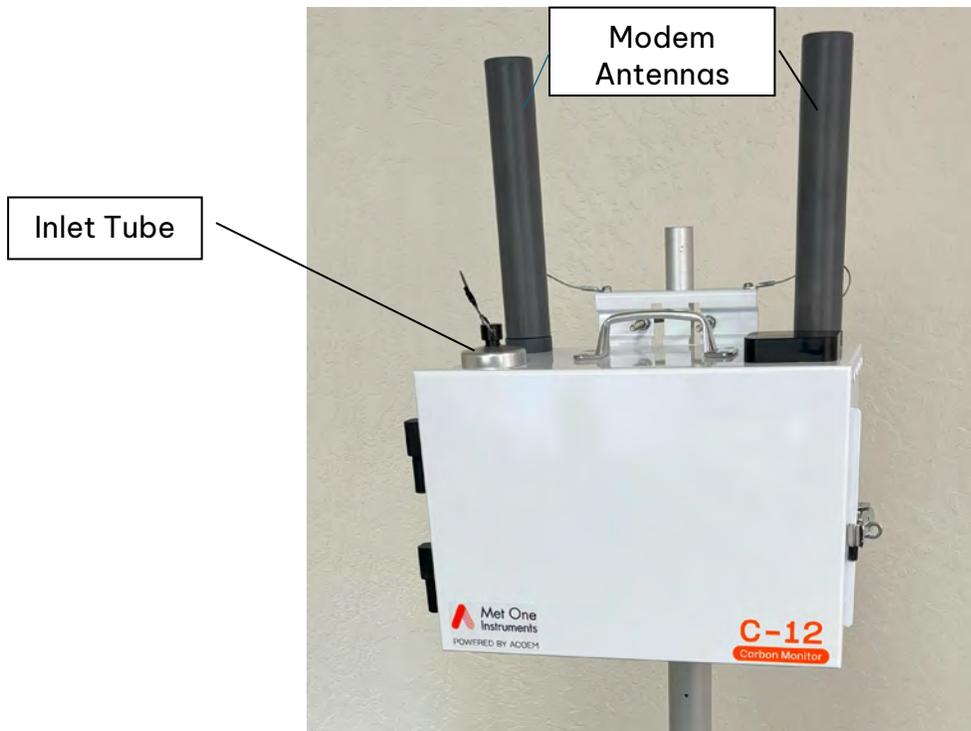
Figure 1-3 C-12 External View

1.5 C-12 Variants

1.5.1   C-12 Base unit - RS-232, AC Power supply, no cellular modem, no solar power supply, 2 wavelengths, one for black carbon, and one for brown carbon (Source apportionment)

1.5.2   C-12 CELLULAR – RS-232, AC Power, Cellular modem and SIM card slot for the customer to provide their own SIM card and data plan. Users will have to program in their own APN (Access Point Name) using the USB port for their data plan which will be provided by their carrier (see Section 2).

1.6 Safety Warnings

Optical Warnings: The C-12 monitor employs LED light sources in the near IR (880 nm) and in the near UV (370 nm). Both wavelengths are outside the range of normal vision and could present a potential invisible ocular exposure hazard. The near infrared light source is a 7 mW IR LED emitting at 880 nm. The UV light source is a 15 mW LED emitting at 370 nm. Appropriate precautions should be taken.

A protective housing with this warning symbol fully encapsulates the light source and optics system during normal operation. Whenever the optical module is disassembled for service, the power cord must be disconnected to prevent accidental exposure to IR radiation.

Electrical Warnings: The C-12 is a 12 V DC powered system. However, there are hazardous live voltages located inside the instrument as it is equipped with an internal power supply module with a 100-240 V AC, 50/60 Hz input range, and a 12 V DC, 2.1 A output. C-12 units configured for solar use do not have an AC/DC power supply installed. C-12 instruments configured for solar power must use a solar power system with a regulated 12 V DC output using a DC/DC converter. The C-12 instrument is housed in a weather-proof case for deployment outdoors.

NOTE: ONLY use the designated power supplies provided by Met One Instruments.

1.7 C-12 Specifications

Table 1-1 C-12 Specifications

PARAMETER	SPECIFICATION
Measurement Principle:	Optical absorption wavelengths: 880 nm (near infrared) 370 nm (ultraviolet)
Measurement Range:	0.01 µg/m^3 to 100 µg/m^3 BC
Data Resolution	0.1 ng/m^3
LLD:	≤ 70 ng/m^3 with 1 minute sample time
Measurement Interval:	15 minutes, 15 one-minute samples sent to the cloud
Sample Rate:	1.0 LPM
Filter Tape:	Proprietary treated glass fiber
Operating Temperature:	–20 to +50°C
Internal Data Storage:	75 Days, (108,134 records)
Data Retrieval:	Cell Modem, USB, RS-232
Data Retrieval Software	Comet™ Software or Terminal Emulator
Serial Interface:	USB, RS-232
User Interface:	4 LEDs and toggle switch
Mounting Options:	Pole mount and optional tripod
Unit Dimensions:	Base Unit: 15.75 in (40 cm) width x 16.5 in (41.9 cm) height x 9 in (22.9 cm) depth Cell Unit: 15.75 in (40 cm) width x 19.5 in (49.5 cm) height x 9 in (22.9 cm) depth
Power Supply:	100-240 V AC, 50/60 Hz input range, and a 12 V DC, 2.1 A
Power Consumption:	10 W
Unit Weight:	14.375 lbs. (6.52 kg)

Specifications may be subject to change without notice.

See C-12 datasheet for latest published specs.

2. CELLULAR NETWORK CONNECTIVITY

1. Contact your cellular provider and choose an M2M (Machine to Machine) data plan (minimum of 100 MB/month). Choose the "Dynamic IP" option. A Silicon Labs CP210x USB driver must be installed on the host computer before connecting it to the C-12 USB Type B port. Note: Before using the USB Type B port, ensure nothing is connected to the RS-232 port on the bottom panel. Driver download weblink: https://metone.com/software/

2. Some cellular carriers may require an IMEI Number. The IMEI number is located on the C-12 CELLULAR Web Address Data sheet, which is provided in the large yellow envelope with the system and is unique to each unit. When the IMEI number is required the micro-SIM card must be kept with its mated unit.

3. A SIM card is required and can be purchased from a local store or via mail. The SIM card must be a 1.8V/ 3V SIM holder for micro-SIM card (3FF). This is being used in an LTE Cat 4 Embedded Modem with 3G fallback via a SIM Card extender that accepts the micro-SIM card (3FF).   Modem make/model: MTSMC-L4G1.R1A

4. Make sure you get the complete APN (Access Point Name) from your provider. This must be programmed into your device via the USB Type B serial interface port located on the front panel of the instrument using a terminal emulator (e.g. HyperTerminal, Putty, etc.).

5. Power on the instrument. Launch a terminal emulator program (e.g. HyperTerminal, Putty, etc.). By default, the USB RS-232 port communication protocol is: 115200 Baud, 8 data bit, no parity, one stop bit, and no flow control. The terminal program baud rate must match the C-12 baud setting. Once connected, the terminal connection window should now be open. Rapidly press the Enter key three times. The window should respond with an asterisk (*) indicating that the program has established communication with the C-12.

6. We recommend programming the APN into the system prior to actually installing the SIM card into the front panel. Send the APN command followed by a space, followed by the given APN exactly as it is provided from your carrier. Example: APN iot.aer.net

7. Power off the instrument. Remove the dust cap to access the SIM card slot. Install the SIM card into the SIM card slot on the front panel of the C-12, orienting the SIM card as shown in Fig. 2-1. Press the card all the way into the slot per Fig. 2-2 (you will feel a spring engage during this step). Once the card is fully engaged it will lock into the fully engaged position in Fig. 2-3 below. If the SIM card is not installed correctly, the modem will not work.

Figure 2-1
Orienting SIM Card

Figure 2-2
Pressing SIM Card

Figure 2-3
Fully Engaged SIM Card

3. SITE SELECTION and POSITIONING CRITERIA

Use the following criteria when choosing a sampling location for the C-12. Always consider safety, security, and the suitability of the sampling environment before deploying the unit.

3.1 Site Selection Requirements

Due to the C-12's portability and simple, weatherproof design, site selection requirements are minimal. The most important sample site requirement is a 100 to 240 V AC standard wall outlet using the basic system configuration.

For C-12 units with the internal cell modem option, sufficient cellular data coverage is required for proper data output to the cloud.

For solar-powered versions, it is critical to maximize exposure to sun.

3.2 Power Options

The C-12 versatility allows for a range of power options to accommodate most sample sites. This section describes the different types of power options compatible with the C-12.

3.2.1 Electrical Grounding

An external grounding cable (Part # 9035) is provided for connecting the unit to Earth ground.

3.2.2 AC Power Options (Standard Power Supply)

The C-12 uses an internal AC/DC power supply which can be supplied with 100 - 240 V AC, 50 or 60 Hz input power. The sampler is rated at 10 Watts maximum continuous power with the sample pump running. The power supply provides a 12 V DC, 2.1A output.

For outdoor use, the sample site needs to be equipped with a standard weatherproof outdoor AC power outlet.

In areas where electrical interferences or outages may occur, the instrument can be used with an uninterruptible power supply (UPS). The supply must be rated for the electrical load and must be appropriately configured for an outdoor application. Consult a qualified electrical contractor.

3.2.3   DC Power Options

All DC power options, including solar power options, must be regulated for a 12 V output to the C-12. Without properly regulated input power, the C-12 can sustain catastrophic damage to its internal electrical components.

3.3 Mounting Options

The C-12 is a weatherproof carbon monitor designed to be mounted on the EX-905 tripod, to a wall, or on a vertical post for outdoor deployment. It may also be installed indoors on a bench or some form of outdoor enclosure that allows the C-12 inlet to be exposed in the intended sampling environment.

3.4 Inlet Spacing requirements

Position the inlet to ensure it is not impeded from sampling the surrounding air.

4. C-12 Components

The C-12 is supplied with the following standard accessories listed below. Optional accessories are also listed below the standard accessories.

Standard Accessories

- ☐ TSP Inlet (**9441**)
- ☐ Inlet Tube (**83799**)
- ☐ USB Cable, A-B male (**500784**)
- ☐ Serial Cable (**83245**)
- ☐ Span Check Membrane (**83011**)
- ☐ Filter Tape, two rolls **(83599)**
- ☐ Operation manual **(C-12-9805)**
- ☐ C-12 Quick Start Guide **(C-12-9806)**
- ☐ Leak Test Assembly **(80356)**
- ☐ Grounding Cable **(9035)**
- ☐ U-Bolt Kit **(9104-1)**
- ☐ Software Placard **(82984)**

Optional Accessories

The following optional accessories may be purchased separately:

- ☐ Tripod (**EX-905**)
- ☐ Flow Meter (**Swift 6.0**)
- ☐ Rubber Nozzle Sealing Tool (**80206**)

5. Assembly and Deployment

The C-12 is designed for easy setup and deployment. This allows it to be used for either permanent long-term sampling at a fixed site or for portable audit sampling for temporary applications. The following sections describe how to assemble and mount the various components that make up the C-12 system in its standard configuration.

5.1 Mounting Options Setup

5.1.1 EX-905 Tripod

The Met One EX-905 aluminum tripod is the recommended mounting solution for the C-12. This optional mounting accessory provides a sturdy and portable platform.

The EX-905 is **NOT** included as a standard accessory to lower the overall cost for users who may not require it.

5.1.1.1 EX-905 Tripod Setup

The Met One EX-905 aluminum tripod is the recommended mounting option for the C-12 in most outdoor applications. To deploy the tripod, follow the instructions below.

- **Tripod Leg Deployment**
  1. Withdraw the three stainless steel detent pins from the tripod mast base by pulling on the rings attached to the three pins.
  2. Flip the tripod so the mast is in the upward position, this will allow the legs to pivot down into the leg slots.
  3. Line up the holes in the leg supports with the detent pin holes in the mast base slots.
  4. Insert each pin into the aligned holes until the detent ball is visible from the other side, securing the legs in the open position. Make sure the assembled tripod is rigid and stable.

Securing the EX-905 Tripod Legs:

> WARNING: It is very important to secure the tripod to the sample site floor to protect the instrument from damage and minimize personal injury in case of unstable or windy conditions.

When the legs are deployed and secured, position the tripod on a level surface. The tripod feet have holes in them so the tripod can be anchored to the sample site floor. Heavy duty bolts, screws, or heavy tent pegs are good options, depending on the surface the tripod is being secured to.
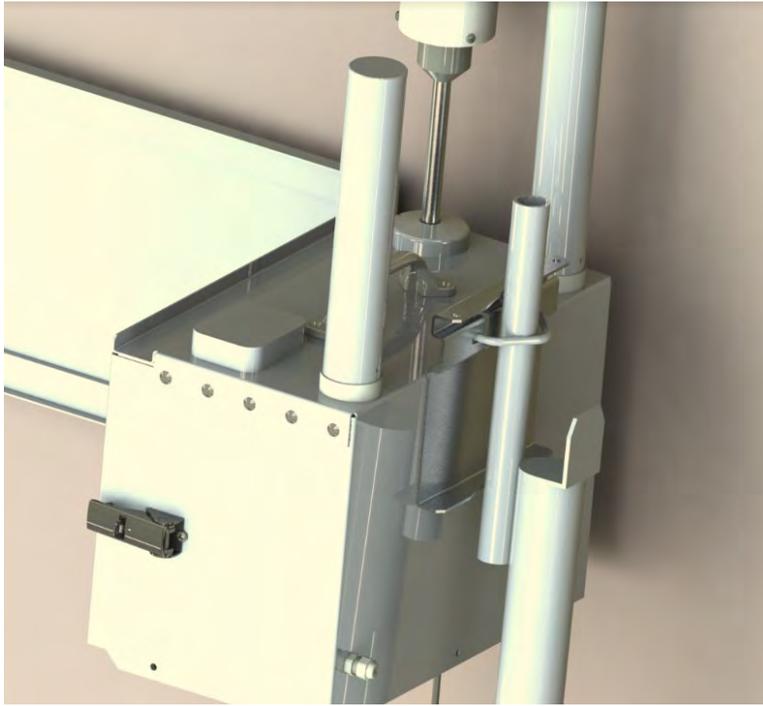
Figure 5-1 EX-905 Mounting

5.2 Pole Mounting

The method and hardware for pole mounting is the same as for mounting the C-12 on the mast of the EX-905.

5.3 Benchtop Mounting

The C-12 can be installed on a level bench-top or a shelf. The instrument should be placed on a rubber mat or some other form of anti-slip material on top of the mounting surface and below the instrument. This is to minimize the chance of movement or slippage during operation.

5.4 C-12 Assembly

5.4.1   Inlet Assembly

Insert the inlet tube: Pull out the lanyard connected fitting from the inlet mount in the top of the C-12 and insert the inlet tube. Connect the TSP Inlet to the inlet tube: Slide the TSP inlet onto the top of the inlet tube. Be certain the TSP inlet is fully seated onto the inlet tube.

5.4.2   Antenna Assembly and Installation

Remove the shipping covers from the antenna mounts at the top of the instrument. Thread on the cell antennas (finger tight only - do not overtighten). Mount the gray antenna cover tubes and press into place over the O-ring seals, line up the screw holes and install the thumbscrew to secure it in place (thumbscrew is attached to the C-12 enclosure via a lanyard).

5.4.3 Filter Tape Installation

The C-12 carbon monitor uses treated glass fiber filter tape rolls, available from Met One Instruments under part number 83599. It is essential that this tape be used in the C-12 in order to maintain proper instrument calibration and consistent data.

A roll of filter tape is expected to last anywhere between 2 and 12 months, depending on the sampling conditions.

Filter Tape-Loading: Filter tape loading is caused by sample particulates building up on the filter tape. The C-12 is designed to automatically move the filter tape to a clean spot when the maximum loading is reached.

Filter Tape installation steps:
1. Apply power to turn the instrument ON. When power is applied, the C-12 will start the automatic sampling routine. When the measurement module is OPEN, remove power.
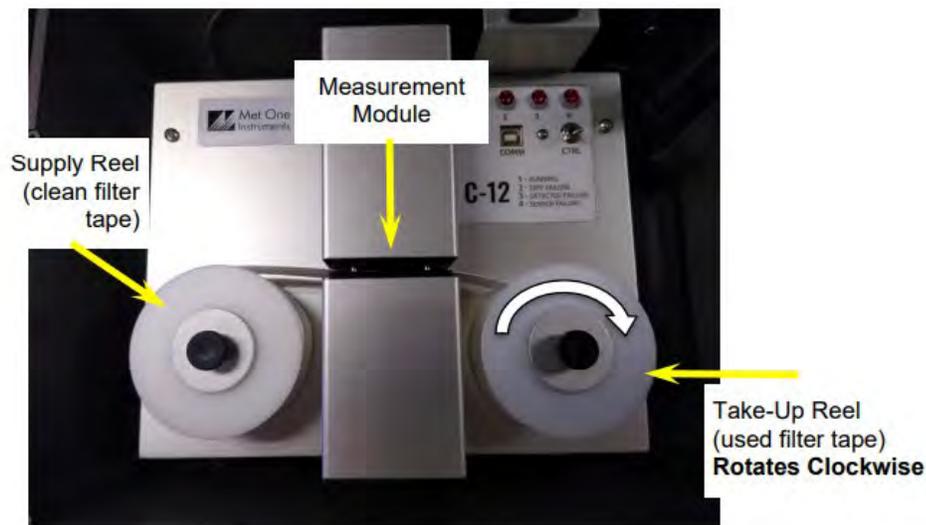
Figure 5-2 C-12 Filter Tape Routing

2. Loosen and remove the two black tape reel knobs.
3. Install the new filter tape roll onto the left (supply) reel, with the tape coming off the right side of the roll. Route the tape exactly as shown in the photo above. It should go through the slot in the measurement module and then to the take-up reel on the right side of the instrument. During this step, install the retainer screw for the take-up spool, but don't tighten it fully. Fasten the loose end of the tape to the right edge of an empty spool installed on the take-up reel with cellophane tape. After the tape is fastened to the empty spool, hold the tape so it doesn't slip and rotate the take-up spool at least 1 full turn and tighten the retainer thumb screw.
4. The tape should now be correctly installed and tensioned. If there is slack in the tape, gently rotate the supply reel counterclockwise to tension it. The tape is fragile, so don't apply too much tension.

6. C-12 USER INTERFACE and OPERATIONS

The C-12 has a simple user interface composed of four LED lights, a toggle switch (CTRL), and a USB type B serial port (COMM). The LED lights indicate the status of the instrument. The toggle switch controls instrument operations.

Figure 6-1 LED and Toggle Switch Interface

6.1 "CTRL" Toggle Switch Quick Guide

Table 6-1 below describes how to start and stop sampling and move tape with the toggle switch.

Table 6-1 Toggle Control Switch Definitions

Action	Description
Start Sampling	Toggle up and hold for >five (5) seconds. This will start sampling and LED 1 will turn ON. Release the toggle switch when LED 1 is ON.
	Note: LED 2 will turn on first after 2 seconds then turn off. Continue to toggle up until LED 1 lights up.
Stop Sampling	Toggle up and hold for >five (5) seconds. This will stop sampling and LED 1 will turn OFF. Release the toggle switch when LED 1 is OFF.
	The unit will automatically start sampling after 30 minutes of inactivity.
Initiate Tape Movement	**This action can only be done when the unit is not Sampling.**
	Toggle up and hold for >two (2) seconds. When LED 2 turns ON release the toggle switch. The tape move process will begin.

6.2 Status-LED Interface

Table 6-2 describes light sequence indicating the Instrument Status.

Table 6-2 Status-LED Definitions

LED	OFF	ON	DESCRIPTION
1	Not sampling	Sampling	N/A
2	Transport OK	Failure	Nozzle, Tape Break failure
3	Detector OK	Failure	Detector failure
4	Sensors OK	Failure	Flow, LED T, DET T, AT, or FT out of range

6.3 Power-Up, Start and Stop Sampling

When 12 V DC power is applied to the unit, the C-12 will boot up and immediately begin sampling. After powering up and starting sampling, the C-12 takes 1 to 3 hours to warm up and equilibrate before optimal measurement stability is achieved.

The C-12 carbon monitor is factory configured with an array of default settings that are appropriate for most sampling requirements. The operator may consider changing some of these settings depending on specific requirements.

6.3.1 Starting Initial Sample Operations

To start a sample when the unit is stopped, hold the toggle switch up for at least 5 seconds until the green Sampling LED turns on. The transport LED will briefly turn on after 2 seconds. Continue to hold the toggle switch up until Sampling LED turns on.

6.3.2 Stopping and Resuming Sample Operations

To stop a sample, hold the toggle switch up for at least 5 seconds until the Sampling LED turns off.

After 30 minutes of inactivity, the unit will automatically resume sampling.

6.4 Remote Connection User Interface and Menu System

The C-12 does not have a physical screen. A remote user interface is available by USB Cable or RS-232 Cable from the unit to a PC or laptop with Met One Instruments Comet

software. Create a new C-12 black carbon product with a serial connection baud rate of 115200 within the Comet software. Refer to the Comet software manual for detailed instructions. The remote interface allows the user to perform maintenance on the unit. Figure 6-2 illustrates the remote user interface.
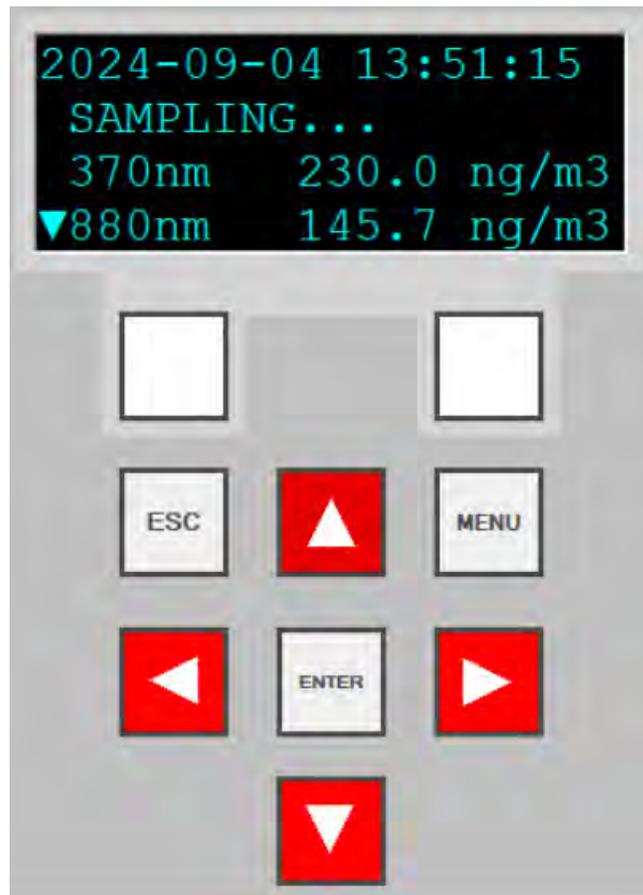
Figure 6-2 C-12 Remote User Interface

The C-12 remote user interface software consists of a display and a dynamic keypad. The two white keys under the display are called "softkeys" or "hotkeys". These are dynamic keys which change in response to a menu option displayed directly above them on the bottom row of the display. The function of these keys depends on which menu is shown on the display.

The four arrow (cursor) keys are used to scroll up, down, left, and right, to navigate in the menu system, and to select items or change fields on the screen. The arrow keys are also often used to change parameters or increment/decrement values in the menu system.

The MENU key is used to enter the main menu. The ESC key is used to escape or exit out of a screen or menu. The ENTER key enters parameters in a selected field or selects an item in a list.

This section describes the C-12 remote user interface system, and describes the functions of the main menu options, including how to view data and errors.

6.4.1 Main Sampling Screens

The C-12 main sampling/operation screens are shown in Figure 6-3. The current date and time are always fixed at the top line of the display in these screens. The up/down arrow keys can be used to scroll to additional viewable parameters.

Figure 6-3 Main Sampling Screen Order

The definitions of the fields shown in Figure 6-3 are as follows:

Parameter	Description
370nm	Previous sample period result of the UV particulate concentration. (nanograms per cubic meter, ng/m^3)
880nm	Previous sample period result of the black carbon concentration. (nanograms per cubic meter, ng/m^3)
FLOW	Previous sample period result of the actual sample flow rate (through the sample filter). (Liters per minute, L/min.)
BT	Previous sample period result of the temperature of the inside of the C-12 enclosure. (degrees Celsius)
BP	Previous sample period result of the real-time ambient barometric pressure. (mmHg)

Table 6-3 Main Display Parameter Descriptions

6.4.2 Menu Hierarchy and Navigation

The C-12 menu structure is outlined in the following table:

Main Menu	Sub Menu Options	Overview
Sampling Screen	No sub menu	Displays date, time, operational mode, carbon concentration, flow rate, and internal conditions.
Start/Stop Sample	No sub menu	Start and stop sampling operations
Load Tape	No sub menu	Install the filter tape, verify tape movement.
View Alarm Log	No sub menu	View alarms
Setup Menu	Clock Sample Memory	Set the date and time Configure set Location Clear stored data and alarm logs

Calibrate Menu	Calibrate Flow	Calibrate sample flow rate or restore default settings
	Calibrate Audit	Verify the attenuation calibration
Test Menu	Self-Test	Verify tape movement, flow and optical system operation
	Tape Test	Verify tape movement
	Leak Test	Check the flow system for leaks
Advanced Menu	Calibrate Menu	Test LED Setpoint
	Test Menu	Test LED operation
About	No sub menu	View the current model, serial, and firmware revision numbers

Table 6-4 C-12 Menu Hierarchy

Menu selections and instructions are detailed in the following sections of this operating manual as assigned in the Main Menu column of Table 6-4 above.

Field editing in the C-12 is slightly different from the methods used in some of the other similar Met One Instruments, Inc. products.

The flashing cursor ■ is moved to the field to be changed with the ▼▲ keys. Once the desired field is highlighted, the ENTER key must be pressed to open it for editing.

A ▼ symbol will appear next to open fields where a pick list is available and the ▼▲ arrow keys can then be used to cycle through the available choices. Once the preferred option is highlighted, press the ENTER key again to select it and lock the field. To return to the previous menu, press ESC.

If a numeric field is open for editing, the cursor will be positioned at the leftmost digit. Use the ◄► keys to move the cursor to the digit to be modified and then use the ▼▲ keys to increment/decrement the value. Once all the digits have been set to the required value, press the ENTER key again to lock the field. To return to the previous menu, press ESC.

Use the ESC key to cancel any edit that may be in progress. The ESC and MENU keys are used to exit the current menu and return to the previous menu level. If the Main Menu is currently selected, the monitor will exit to the Main Sampling Screen.

6.5 Start or Stop Sample

This screen is used to begin or end the C-12 sampling operations. It will be labeled on the main menu as either START SAMPLE or STOP SAMPLE. The label indicates the action that can be taken when entering this screen. Once selected, press the START or STOP softkey (shown in the START mode in Figure 6-4) to begin or end sampling.

Figure 6-4 The Start Sample Screen

If the START softkey is pressed, the monitor will advance to a fresh spot of filter tape, turn on the pump, and display WAIT TOP-OF-MIN in the status field. Then the status field will change to "SAMPLING..." It will take two full minutes before BC concentrations will appear.
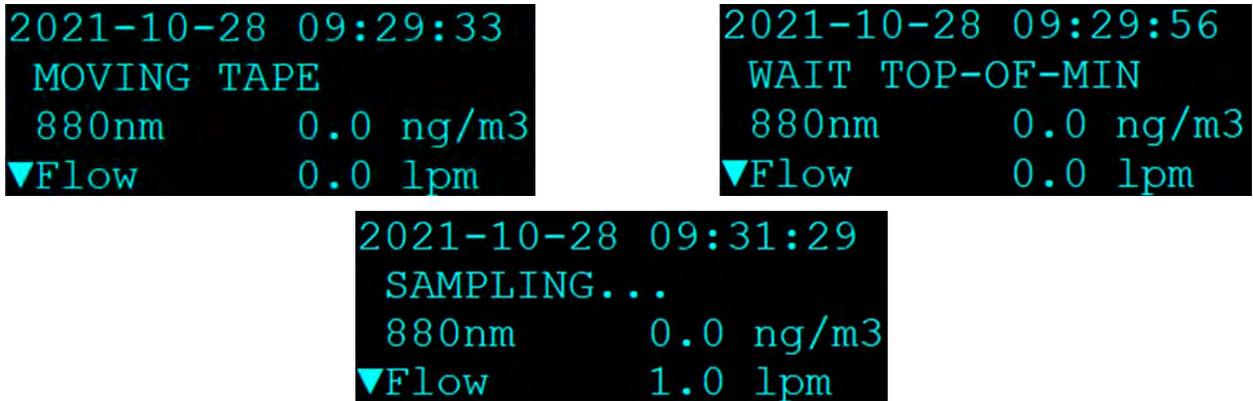
Figure 6-5 C-12 Startup Screens

To stop sampling, press either the ESC or MENU button while on the main screen. This will exit the main screen and enter the main menu. Place the flashing cursor next to the STOP SAMPLE option at the top of the menu and press the ENTER key. The C-12 will ask the user to confirm if the sample should be stopped. If confirmed, the C-12 will stop running and return to the main menu.

To resume sampling after the unit has been stopped for any reason, return to the main menu. The top option of the menu will now read START SAMPLE. Place the cursor on this option and press the ENTER key. The C-12 will ask the user to confirm if the sample should be started. If confirmed, the C-12 will begin the startup sequence and return to the Sampling Screen.

The Start/Stop Measurement screen can also be accessed by pressing the ENTER key from the main menu.

Figure 6-6 C-12 Stop/Start Sample Screens

6.6 Load Tape Screen

This screen enables operation of the Measurement Module assembly and tape spools. Use the OPEN softkey to lower the bottom of the measurement module and open the tape path. When opened, the OPEN softkey will read as CLOSE, indicating that when pressed, the key will close the measurement module assembly. Use the MOVE button to advance the tape one sample space. If the measurement module is closed when the MOVE key is pressed, the C-12 will automatically open it and then advance the tape. See **Section 5.4.3** for instructions on loading the filter tape.


Figure 6-7 The Load Tape Screen

6.7 View Alarm Log Screen

This screen is used to view time-stamped alarm events with the most recent alarm displayed first. To view earlier alarms, use the arrow keys to navigate through the list. The ◄ and ▲ keys will scroll to the previous alarm in the list (earlier time stamps) and the ► and ▼ keys will scroll to the next alarm (later time stamps). This information is also reported in the Alarm File (see **Section 8.3.1**).
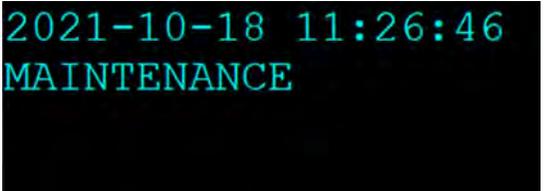
Figure 6-8 The View Alarm Log Screen

6.8 Setup Menu

The C-12 setup menu contains the settings and configuration parameters used by the instrument. The factory default values will be correct for most applications but can be reviewed and altered to suit the specific needs of the local monitoring program, as needed. The settings will not be lost if the unit is unplugged or powered down.

Use the ▲▼ keys to select the desired sub-menu and press the ENTER key to enter. The SETUP menu is shown below:

Figure 6-9 The C-12 Setup Menu

6.8.1 Clock Setup Screen

The CLOCK setup screen is used to change the instrument date and time.

Press the ENTER key to open the fields for editing. Once open, use the arrow keys to set the desired date and time and then press the ENTER key again to lock the field. Press the SET softkey to set the clock and exit out to the SETUP menu screen. It is recommended to exit the menu system to the main sampling screen and verify that the date and time are correct.

Figure 6-10 The C-12 Clock Setup Screen

The Time Zone setting is used to configure the CCS Modem. Enter your time zone offset from UTC, the time at zero degrees longitude. A list of UTC time offsets can be found here:

https://en.wikipedia.org/wiki/List_of_UTC_time_offsets .

6.8.2 Sample Setup Screen

The SAMPLE setup screen allows users to set the Location ID of the unit.

The location ID is a simple ID number that will appear in the data files. When using multiple monitors, it can be used as a Unit ID number to indicate a data collection location independent of serial number. The range is 001 to 999.

Figure 6-11 The Sample Setup Menu

6.8.3 Memory Setup Screen – Clearing the Memory

The MEMORY setup screen is used to clear/erase files in the C-12 memory. CAUTION: This menu function will permanently delete the selected files from the instrument memory!
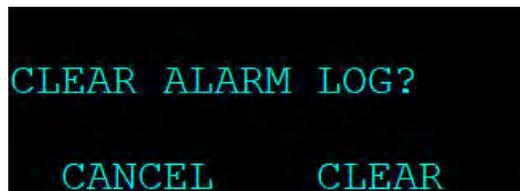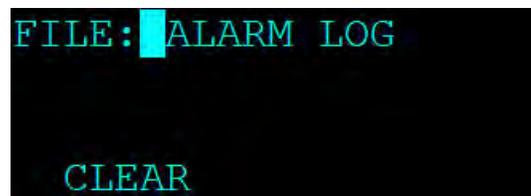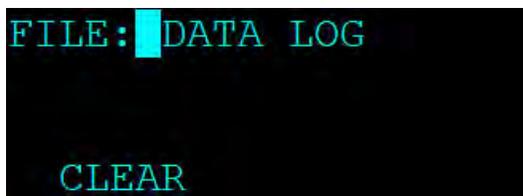

Figure 6-12 The C-12 Clear Memory Menus

The FILE value can be set to the DATA LOG, ALARM LOG, or ALL LOGS. Pressing the CLEAR softkey will cause the confirmation screen to appear before the selected files are cleared as shown in Figure 6-12.

6.9 Calibrate Menu

The C-12 CALIBRATE menu provides access to a system of calibration menus which allow the operator to audit or calibrate various system parameters for optimal performance.
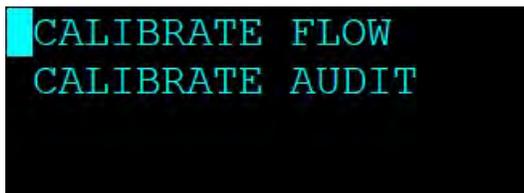
Figure 6-13 The C-12 Calibrate Menu

6.9.1 Calibrate Flow Screens

The CALIBRATE FLOW screen is used for field audits and calibrations of the sample flow measurement of the C-12.

In Figure 6-14, the first screen allows for verifying and then setting the zero-flow condition, if needed. The second screen is used for verification and calibration of the actual sample flow rate. Press the CONTINUE button on the zero flow screen to advance to the sample flow rate screen.
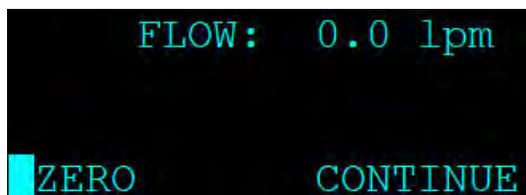
Figure 6-14 C-12 Calibrate Flow Screens

The SET POINT field is the target flow rate the monitor should be maintaining. The FLOW field indicates the current flow rate being measured by the internal flow sensor. The STANDARD field is where the value from the traceable flow standard is entered, if necessary. See **Section 7.6.1.2** for details on using this screen for performing periodic flow audits and calibrations.

6.9.2 Calibrate Audit Screens

The CALIBRATE AUDIT series of screens is used to verify the optical measurement system of the C-12 monitor. A neutral density filter calibration tool is used in conjunction with these screens to perform the calibration audit. See **Section 7.6.2** for full details on using these screens and verifying the monitor's calibration.

6.10 Test Menu Screen

The C-12 TEST menu allows the operator to perform various diagnostic tests, both for troubleshooting and verification of proper system operation.

Use the ▲▼ keys to select the desired sub-menu and press the ENTER key to enter. The TEST menu is shown below:

Figure 6-15 C-12 Sample Screen

6.10.1 Self-Test Screen

The SELF TEST screen is used to activate an automatic test of most of the C-12 subsystems to verify that the instrument is in operational condition.

Once the test is initiated, the instrument will test for properly loaded filter tape and test the function of all tape control hardware. The pump, flow sensor, LED light sources and detectors are also tested, and any detected failures are shown on the display.

Upon entering the screen, the start option will appear as shown in Figure 6-16. Press the START softkey to begin the sequence. The tape and flow detectors are tested first as shown in Figure 6-17.
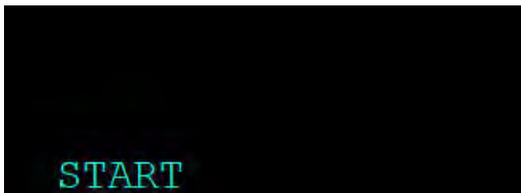
Figure 6-16 The Self Test Start Screen
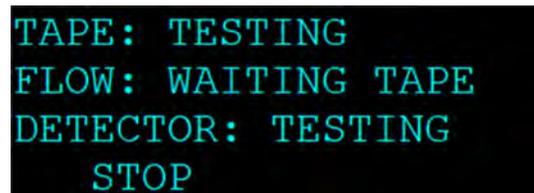
Figure 6-17 Tape and Detector Testing
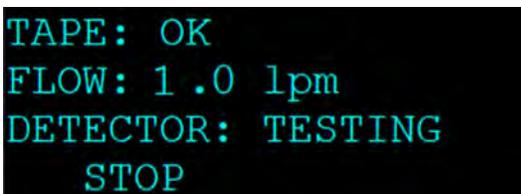
Figure 6-18 Flow Testing
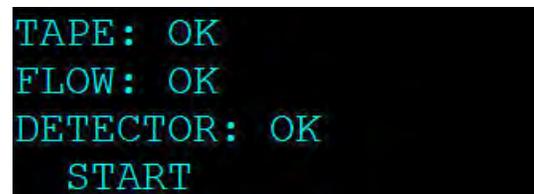
Figure 6-19 Self Test Complete

After about 25 seconds, the pumps should turn on and the flow tests should commence. After the pump has been running for about a minute, the flow rate should be stable as shown in the FLOW field (see Figure 6-18). The test should take about another minute from that point to complete. The results will be displayed and the option to run the test again will be provided (see Figure 6-19). Press the ESC key to return to the Test menu.

6.10.2   Tape Test Screen

The TAPE TEST menu is used to manually advance the filter tape to spool up the end of a new roll of tape, or to test the tape motor and encoder. Press the MOVE softkey to advance the tape. The amount of travel, as measured by the encoder, is displayed in the TRAVEL field. Figure 6-20 shows a typical tape movement result.
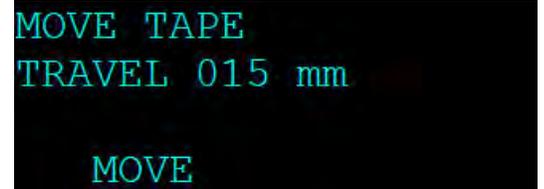
Figure 6-20 The Tape Test Screen

Each time the MOVE softkey is pressed, the displayed travel distance is reset to 000 mm before moving the tape and the new result is displayed.

6.10.3   Leak Test Screen

See **Section 7.5** for a detailed explanation of the LEAK TEST screen and its use.

6.11 Advanced Menu

The ADVANCED menu provides access to advanced setup, calibration, and test features. Settings are configured for most sampling environments and will only need to be accessed in special situations. Attempting to enter this menu displays the warning message shown in Figure 6-21.

Figure 6-21 The Advanced Menu Warning

Figure 6-22 Advanced Menu Screen

6.11.1   Calibrate Menu Screen

The CALIBRATE MENU screen allows the operator to select the LED SET POINT Screen to adjust the nominal operating current for the BC LED. This should only be used if a detector or LED board is replaced. Select the 880 ON softkey to turn on the 880 nm LED.
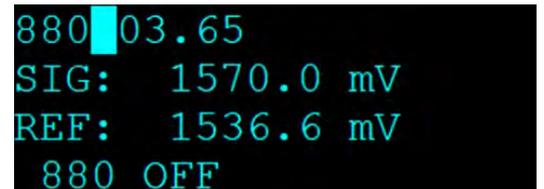
Figure 6-23 – LED SET POINT Screen

6.11.2 Test Menu Screen

The TEST menu allows the operator to select the LAMP TEST Screen to review the detector voltage. Press the 880nm ON softkey to turn on the LED and check the detector voltage.
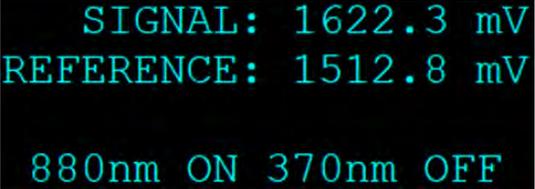
Figure 6-24 – LAMP TEST Screen

6.12 About Screen

This screen is used to view the C-12 firmware part numbers and revision levels. The instrument's serial number is displayed on the third line as shown in Figure 6-25.

Figure 6-25 The About Screen

7. MAINTENANCE and TROUBLESHOOTING

This section provides information about routine maintenance of the C-12, and for performing more detailed diagnostic tests if a problem is encountered. The instrument generates an error in the data log if a failure or other problem is detected. Many times, there is a simple solution. Persistent errors often signify a failure that will require investigation.

7.1 Suggested Periodic Maintenance Intervals

Table 7-1 shows periods for routine maintenance items as recommended by Met One Instruments. Note that some of these items will need to be performed more often or less often depending on local conditions. Local monitoring program administrators may need to review these items and establish SOPs appropriate for local applications.

Table 7-1 Periodic Maintenance Schedule

Maintenance Item	Minimum Period	Manual Section
Replace filter tape	As Required (2-12 Months Typical)	**7.4**
Flow audit	1 Months	**7.6.1.1**
Span check	3 Months	**7.6.2**
Leak test	3 Months	**7.5**
Flow full calibration	3 Months	**7.6.1.2**
Replace main pump	As Required	Contact qualified service technician
Factory service	As Required	Contact qualified service technician

7.2 C-12 Error and Alarm Event Descriptions

The C-12 contains a system of error and alarm codes that are used to alert the operator to problems with the unit. The errors are stored in the digital alarm log with the time and type of the error. Corresponding alarm codes are stored in the data array.

The Alarm field is reported in data files by a numeric code. If multiple alarms are generated for a single data record, the reported alarm value is the sum of the alarm codes. The general alarm events are described in Table 7-2. Certain alarm events may not be posted to the data array if an alarm condition terminates operation before the end of a sample. Please consult the Alarm Log for more detailed information when an error is encountered.

Table 7-2 Alarm/Error Code Causes and Solutions

Code	Description	Causes	Solutions
0	No Alarm	System fully functional	N/A
1	Power Failure	Caused by a power cycle or a microprocessor reset.	Power off/on event logged. Ensure unit is provided with stable power
2	N/A		
4	Tape Move Failure	Tape roll exhausted Tape break Tape loose, not turning encoder Encoder wheel turns, but not measuring tape movement	Install new roll of tape Re-attach tape (Section 5) Tighten tape (Section 5) Optical encoder fault. Contact MOI service department for assistance
8	Maintenance	Stop for maintenance during normal operation. Operation terminated because of an error condition.	"Stop Sample" logged. Not an error condition. See additional error messages in the Alarm log to determine cause.
16	Flow Failure	Failure when the flow is 10% out of regulation for more than one minute, or when the flow is 5% out of regulation for more than five minutes. 1. Inlet hose kinked or other blockage on inlet 2. Bad pump 3. Bad flow sensor	1. Straighten hose or remove blockage, clean TSP inlet. 2. Replace pump* 3. Replace flow sensor* * Contact MOI service department for assistance.
32	Automatic Tape Advance	The tape was advanced because of tape loading.	Automatic tape advance logged. Not an error condition.
64	Detector Failure	Mis-installed tape Blocked Reference or Sample port Light leak Hardware Failure	Verify tape is installed correctly (Section 5) Clear obstructions in the ports below the tape (Contact Met One Instruments service department for assistance) Contact qualified service technician

Code	Description	Causes	Solutions
128	N/A		
256	Sensor Range	A sensor is outside its designated limits. Check Alarm log for abbreviation BT, BP, FLOW, LED T, or DET T.	1. If BT, replace internal temperature sensor. 2. If FLOW, LED T, DET T contact qualified service technician
512	Nozzle Move Failure	Set when nozzle failed to move up or down.	1. Lift motor not turning: Verify connection in nozzle motor cable. 2. Lift motor turning, lift bearing not moving: Lift bearing slipping on shaft, or shaft broken. Refer to qualified service technician "UP" and/or "DOWN" optical sensor not functioning. Refer to qualified service technician
1024	N/A		
2048	Calibration Audit	A user Calibration Audit was being performed.	Calibration Audit activity logged. Not an error condition.
4096	N/A		
65536	Tape Move	System advances the filter tape.	Tape advance logged. Not an error condition.

Detector Alarm Events: The detector alarm events are detailed in Table 7-3. Any detector failure event will stop machine operation, force a tape advance, and then attempt to resume normal sampling. Detector *warnings* will be logged but will not interrupt operation. The IR and UV detector range is 0.0 to 2500 mV. The limits are as follows:

Saturation Limit = 2450 mV   Detector Limit = 100 mV   Zero Limit = 5 mV

Table 7-3 Detector Alarm Causes

Description	Causes
LED Failure	While an LED is ON, the signal and reference detector readings are below the Detector Limit.
Signal Detector Failure	While the LED 1 is ON, the signal detector reading is below the Detector Limit and reference detector reading is above the Detector Limit.
Reference Detector Failure	While the LED 1 is ON, the signal detector reading is above the Detector Limit and reference detector reading is below the Detector Limit.
Signal Zero Warning	When the signal zero is above the Zero Limit.
Reference Zero Warning	When the reference zero is above the Zero Limit.
Signal Saturation Failure	When any LED Signal reading is above the Saturation Limit.
Reference Saturation Failure	When any LED Reference reading is above the Saturation Limit.

Sensor Outside Range Alarm Events: This alarm occurs if one of the sensor parameters registers a value outside of its measurement range, indicating a possible sensor failure. It is intended to filter out and catch full scale readings which can occur from the ambient sensors.

Table 7-4 Set Point Ranges

Sensor	Minimum	Maximum
Flow	-3.0 LPM	11.0 LPM
LED Temperature	-21.0° C	110.0° C
DET Temperature	-21.0° C	110.0° C
BT Sensor	-40.0° C	60.0° C
BP Sensor	304 mbar	1090.6 mbar

7.3 Basic Problems and Solutions

The following table contains information on some of the more common C-12 problems that may be encountered, and some steps to identify and remedy the problems. Met One Instruments welcomes user suggestions for new items to include in this section of future manual revisions.

Problem:	The instrument doesn't appear to be turning on or starting.
Cause/Solution:	- Make sure the power supply and power cord are properly connected to a good electrical outlet. - If the instrument is ON, the hum of the internal pump should be audible. - The C-12 should start sampling within 1 minute after power-up. - After using the STOP SAMPLE function, sampling will resume after 30 minutes.

Problem:	Flow failures or low flow.
Cause/Solution:	- Make sure that the tape is properly advancing the dirty spots. See Section 6.10.2 - DEFAULT the flow sensor calibrations and re-calibrate the flow. If corrupted flow calibration parameters are entered into the flow calibration, it may appear that the flow system is not working. See Section 7.6.1. - Verify the BT and BP sensor function. Failed sensors will affect the flow. - The sample pump itself will eventually wear out and need to be replaced. It should last at least two years under normal conditions. Check the other possibilities first. See Section **9** for replacement parts.

Problem:	Leak check failures
Cause/Solution:	- There is always a small amount of leakage at the filter tape interface. - Make sure the upper and lower nozzles are completely clean. - The filter tape can be replaced with a Rubber Nozzle Sealing Tool (part number 80206) positioned under the nozzle. This will eliminate the tape as the leak point to help isolate the leak source.

Problem:	Optical system alarms and failures
Cause/Solution:	• A Detector Failure will occur if no filter tape is installed in the measurement module. • Detector Failure will occur if an LED has failed, if either the Reference or Signal Detectors have failed or if there is a ZERO failure (high background). First, ensure tape is properly installed.

Problem:	Data download timestamp does not match webpage data
Cause/Solution:	• Check that the time zone offset is properly set in the clock setup screen. Refer to Section 6.8.1.

Problem:	Calibration Audit failures
Cause/Solution:	• A Calibration Audit Failure can occur if the filter tape is moved during the Calibration Audit procedure. Care should be exercised to not move or damage the tape when performing the calibration audit. • A Calibration Audit Failure can occur if the Span Check Membrane (83011) is inserted incorrectly. The Membrane should be fully seated and the open holes on the LEFT. • A Calibration Audit Failure can occur if the ND filter membrane in the 83011 span check membrane is damaged. A replacement 83011 span check membrane can be purchased from the Met One Instruments Service Department.

7.4 Filter Tape Replacement

1. Use the toggle switch to open the measurement module, if not already open (see Section 6).

2. Loosen and remove the two tape reel knobs.

3. Remove the used tape and spools from the tape reels.

4. Install the new filter tape roll onto the left (supply) reel, with the tape coming off the <u>right</u> side of the roll. Route the tape exactly as shown in Figure 5-2. It should go through the slot in the measurement module and then to the take-up reel on the right side of the instrument. Fasten the loose end of the tape to the <u>right edge</u> of an empty spool installed on the take-up reel, with cellophane tape.

5. Align the filter tape and take up the slack by turning the left (supply) reel counterclockwise.

6. Hold the toggle switch up for about 2 seconds until the Transport LED turns on, then release the toggle switch to initiate a tape move. Verify that the tape spools correctly. Repeat this tape advance sequence until the take up spool rotates at least one full turn.

7.5 Flow System Leak Check

NOTE: Leak check must be performed with the tape installed.

The tape interface nozzles in the optical measurement module should be checked and cleaned on a routine basis, in order to prevent flow leaks at the filter tape interface. This requires removing the filter tape. With the measurement module open, the parts can be inspected and cleaned with a cotton-tipped applicator if needed. Be sure to replace the tape prior to beginning the leak check.

The C-12 contains an easy to maintain flow system. To perform a leak test, use the Slow-release tool, Part # 80356, and the corresponding operation guide.

Press the PUMP ON softkey. This will turn on the pump at a fixed control point while the slow-release tool is in place. The FLOW value should be 0.5 LPM or less for the leak test to be considered passing.

```
LEAK TEST
   FLOW:  0.0 lpm


PUMP ON
```
```
>>>>> WARNING <<<<<
   SLOWLY RELEASE
      VACUUM
               EXIT
```
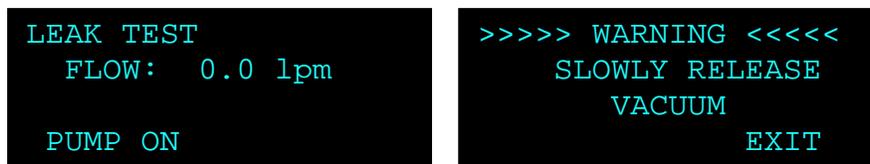
Figure 7-1 The C-12 Leak Test Menu

Once complete, press the PUMP OFF key to turn off the pump. **Slowly release the vacuum** in the system by following the instructions in Section 3 of the 80356 Operation guide **_before_**

exiting this screen. The warning screen shown in Figure 7-1 will be displayed when exiting the Leak Test screen. Exiting the Leak Test screen before releasing the vacuum will cause the vacuum to be released rapidly. This can damage the tape and suck debris into the sample chamber which may require returning the monitor to the factory for service. Reconnect the TSP cap to the inlet sample tube and resume sampling operations.

7.6 Field Calibration Procedures

General description for calibration procedures and reason for calibration.

7.6.1 Flow Audit and Calibration

The C-12 has a system of calibration menus which allow the operator to audit or calibrate various system parameters for optimal performance. It is recommended that airflow control parameters be audited monthly and calibrated quarterly during continuous operation. The exact frequency may vary depending on local conditions and the data validation requirements established by the sampling program administrator.
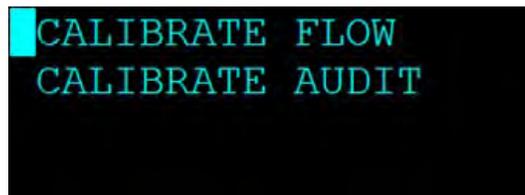

Figure 7-2 The C-12 Calibrate Menu

The CALIBRATE MENU option is in the main C-12 menu. The CALIBRATE MENU is described below:

7.6.1.1 Flow Audits

To audit any of the flow parameters, enter the corresponding calibration menu and allow the reading to stabilize. Verify the value is correct and matches the flow standard. Record the results and press ESC to exit to the Calibration menu.

7.6.1.2 Flow Sensor Calibration

The CALIBRATE FLOW screen is used for field audits or calibrations of the sample flow measurement of the C-12. The leak status must be checked before performing any flow calibrations.

Flow calibrations require a traceable flow audit calibration device. The Met One Instruments, Inc. Swift 6.0 and similar particulate sampler flow calibrators work well. Attach the flow meter to the C-12 sample inlet. The nominal flow rate for the C-12 is 1 LPM. Flow calibration devices should be selected accordingly.

```
         FLOW: 0.00 lpm                    SET POINT:   1.00 lpm
                                                FLOW:   1.00 lpm
                                            STANDARD:   1.00
    ZERO         CONTINUE                   DEFAULT   CALIBRATE
```

Figure 7-3 The C-12 Flow Calibration Screens

All flow values are in Q_a actual volumetric conditions.

The screen will first display the zero-flow mode with the pump OFF. The measured flow will be displayed at the top of the screen.

Press the ZERO softkey to zero the flow sensor. Then press CONTINUE to proceed to the main flow calibration screen and automatically turn the pump ON.

The SET POINT parameter is the target flow rate that the C-12 will attempt to maintain. The FLOW parameter is the current flow reading from the C-12 flow sensor. The instrument should automatically regulate to 1 LPM within a few moments.

The DEFAULT softkey may be pressed to clear out all previous field calibrations and restore the factory defaults for the sensor if difficulties are encountered.

The STANDARD field is where the correct flow value from the traceable flow meter should be entered if the flow does not match within ± 5% of the traceable standard. To correct the FLOW reading, enter the value shown on the reference meter in the STANDARD field and then press the CALIBRATE softkey. The FLOW value should change to match the STANDARD value when the CALIBRATE softkey is pressed. The monitor will then attempt to regulate the FLOW value to match the SET POINT.

Audit-Only Flow Checks: see **Section 7.6.1.1**. No flow calibrations are changed if the ZERO and CALIBRATE softkeys are not pressed.

7.6.2 The CALIBRATE AUDIT Menu – Performing Optical Span Tests

The CALIBRATE AUDIT menu is used to perform the optical span calibration verification test on the instrument using a neutral density filter. This will introduce a known and consistent amount of optical attenuation into the measurement system. The 83011 Span Check Membrane tool will be required to perform this test.

Note: No changes to the instrument calibration are made with this process. This is a span check only.

Press the MENU key. Highlight the CALIBRATE MENU item and select the ENTER key. Scroll to the CALIBRATE AUDIT option and select the ENTER key again.

When entering the CALIBRATE AUDIT menu, the Measurement Module should be in the OPEN position. If it is not, or if the state is unknown, press the MOVE button (see Figure 7-4) to open the measurement module and advance the tape one position.
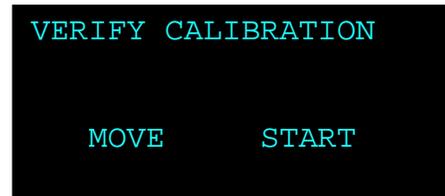

Figure 7-4 Entering the CALIBRATE AUDIT Menu

Press the START button to advance to the Zero measurement. Verify the filter tape is installed and press the CONTINUE softkey. The measurement module will close, and the zero measurement will begin as shown in Figure 7-5.
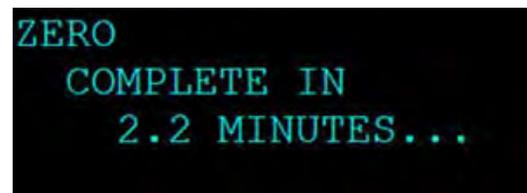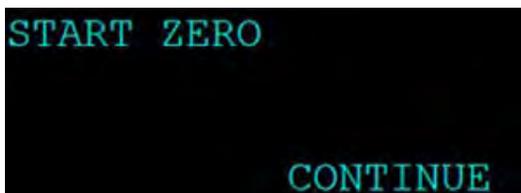

Figure 7-5 Performing the Zero Test

Once the zero test is complete, the span test must be performed using the 83011 Span Check Membrane. The measurement module will open, and the screen will display instructions to insert the ND Filter as shown in Figure 7-6.

Hold the 83011 Span Check Membrane so that the label is UP (filter element is on the right-hand side) and insert it above the tape. Be certain it is fully inserted and seated squarely against the pins at the front of the measurement module.

CAUTION: Be very careful not to move the tape as this will affect the measurement!

Figure 7-6 The Span Test Start Screen
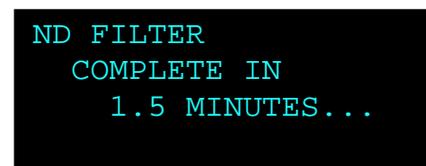

Figure 7-7 The Span Test in Progress Screen

```
CALIBRATION RESULTS
BC: 2006.3 ng
UV: 1037.9 ng
              CONTINUE
```

Figure 7-8 The Span Test Completed Screen

7.7 Flash Firmware Upgrades

The C-12 has the capability for flash firmware upgrades. This allows the field operator to reprogram or update the instrument operating system through the front panel USB port using the Firmware Update Utility program. A Met One Instruments technician may supply the firmware update files by email if a bug fix is released, or if additional features are added to the firmware program.

Ensure that the power source to the C-12 and the computer will not be interrupted during the update process! This may cause the firmware to become inoperative. If this happens the unit will have to be returned to the factory. Make sure the USB cable connection does not come loose during the update.

The following must be performed to update the firmware:

1. It is advisable to download and save the data log and alarm log from the instrument before proceeding. Note: The firmware update process does not clear the instrument memory.

2. A PC or laptop with a USB port must be available and the USB drivers for the C-12 installed. Install the Firmware Update Utility program onto the computer by following the prompts after following the e-mail link to the Met One FTP site.

3. Connect the instrument USB serial port to the computer.

4. Run the Firmware Update Utility. From the computer "Start" menu, go to: Programs/Met One/c-12/C-12 Master Program Installer (or similar directory). The program may prompt to press ENTER to begin the update.

5. A "Done!" message will be displayed at the end of the update process. Execution time is approximately five to fifteen minutes.

8. VIEWING AND DOWNLOADING DATA

8.1 View and Download Cloud Data

> **NOTE: This section is only applicable for instruments with the optional modem package.**

Met One offers two options for viewing the data from a C-12 system: an internet-based Cloud interface and Comet Software, a windows application. This section will cover the Cloud Interface. See **Section 8.2** on how to use Comet Software.

The C-12 uses a cloud service for storing and viewing data. After the C-12 collects the data, it connects to the internet and designated secure Cloud site via its internal cell modem. Once connected it will push the data to the cloud site. Users may then go to their dashboard and view their data in gauge, chart, and tabular formats (hosted by Grovestreams).
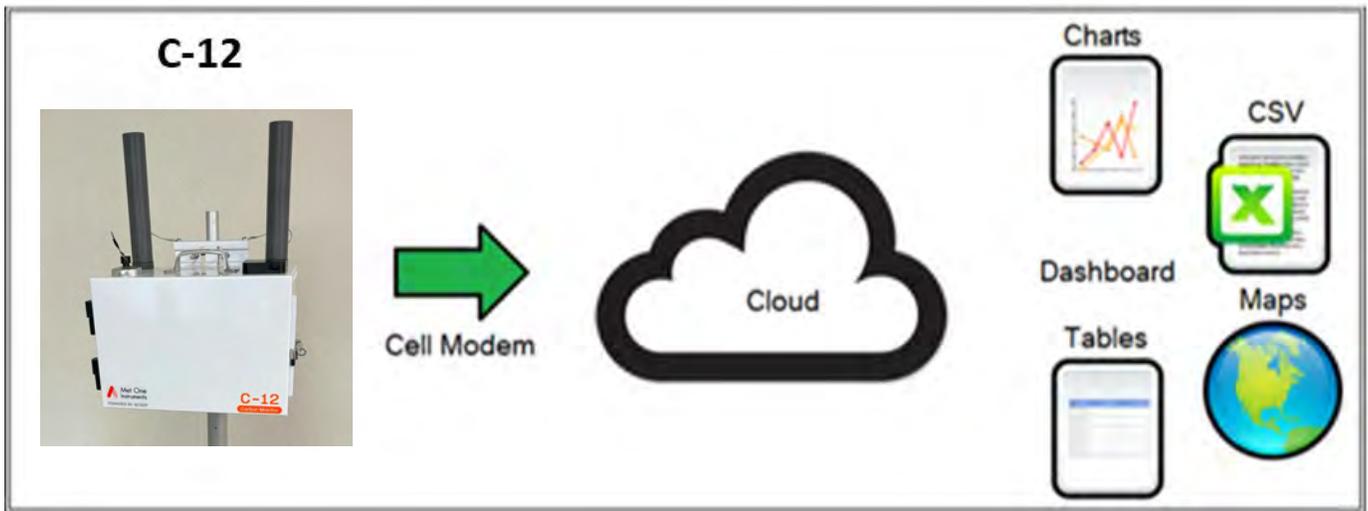

Figure 8-1 C-12 Data Transfer to the Cloud

Each customer will be sent a private Grovestreams weblink to a custom dashboard in which users can view, chart, and download/export their data.
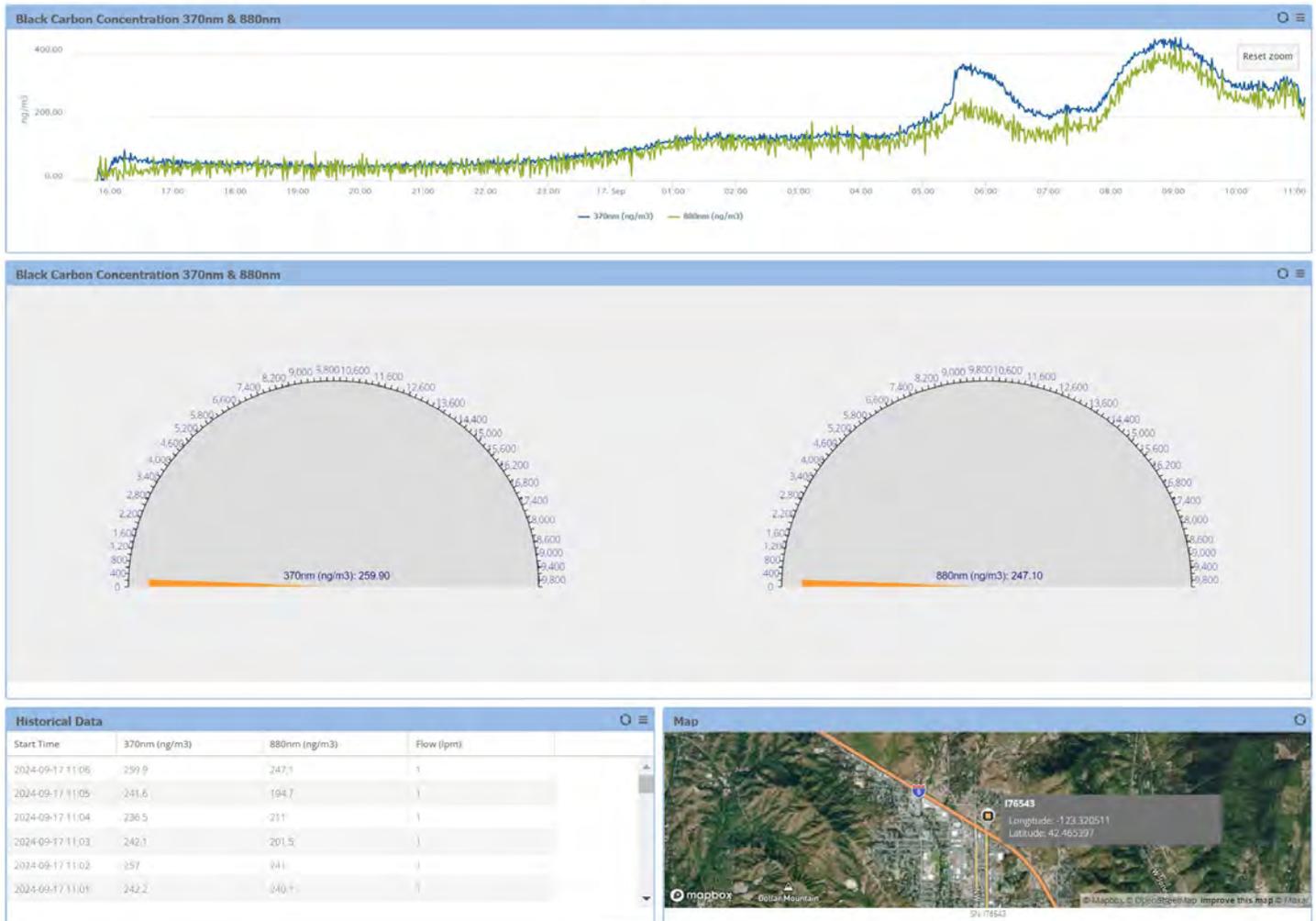
Below is an example dashboard setup:

Figure 8-2 C-12 Website Data Dashboard

8.1.1 Cloud Data Storage

The cloud site stores 2 years of data. When the storage is full, the oldest records are over-written. Met One recommends using the Comet utility program to routinely download data and store the data on a local computer or network. Comet automatically creates a time-stamped comma separated CSV data file when data is downloaded. The CSV file can be found in the My Documents folder. The C-12 unit itself holds 75 days of data records in case of a cloud modem failure.

8.2 Comet Software

The C-12 is compatible with a free copy of the Comet™ program. Comet is a simple, Windows-based, communications terminal program developed by Met One Instruments, Inc. Comet allows the user to connect to the cloud and download the data, as described in Section 8.2.2.

The Comet User Manual is available on the metone.com website. Install the program onto the computer you will be using and review the manual for more operational details.

A link to the Comet software is available at https://metone.com/software/.

Comet is a communications terminal program which can retrieve data from the C-12 using a direct local connection or a remote connection via an IP address or a variety of modem options.

As noted in Section 2, a Silicon Labs CP210x Driver for the USB connection must be installed before connecting to the USB Type B port. If Section 2 has been completed, then the driver has been successfully loaded.

8.2.1   Comet Installation

Download the Comet software onto a PC and run the Windows Installer Package. Follow the on-screen instructions until Comet is successfully installed, then run it from the Programs directory. Create a new station for the C-12 and use it to retrieve the data from the monitor.

8.2.2   Setting up a Cloud Station

The first time the Comet program is opened it prompts the user to create a new station for your Cloud site. If Comet does not prompt you, go to the top left menu and select Add New Station to create a new station.

Select the Cloud Device Product Type and click next. Refer to **Figure 8-3**.
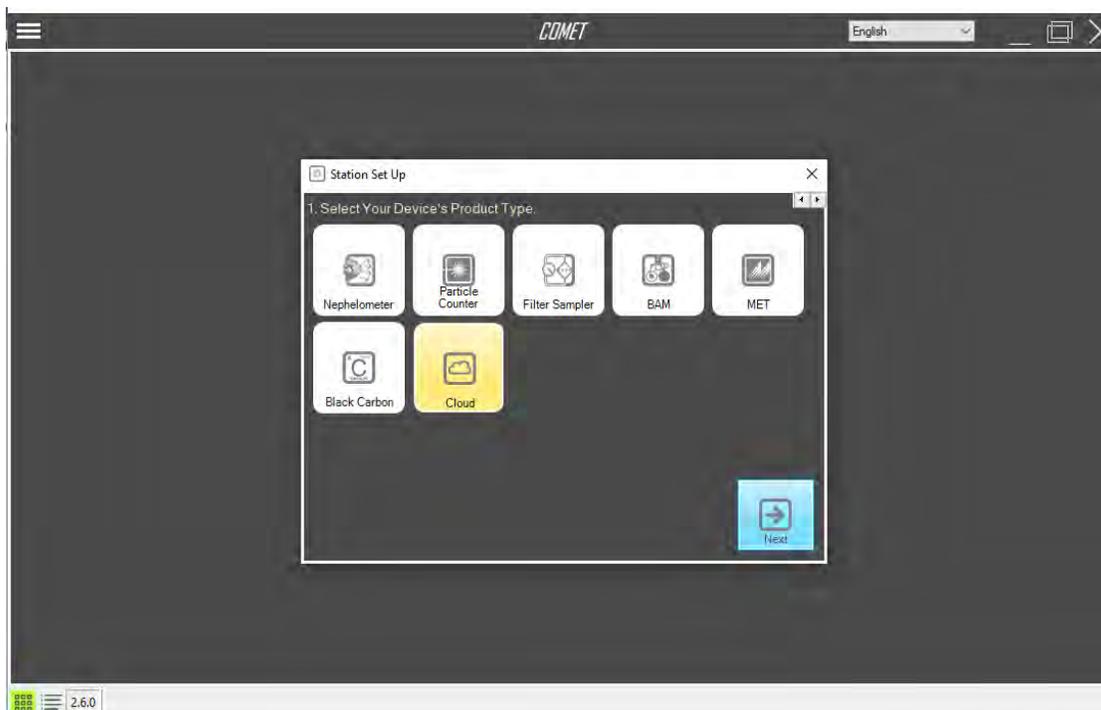

Figure 8-3 Comet Station Setup

Select the Met One Cloud Product Type and click next.

Figure 8-4 Comet Product Type Screen

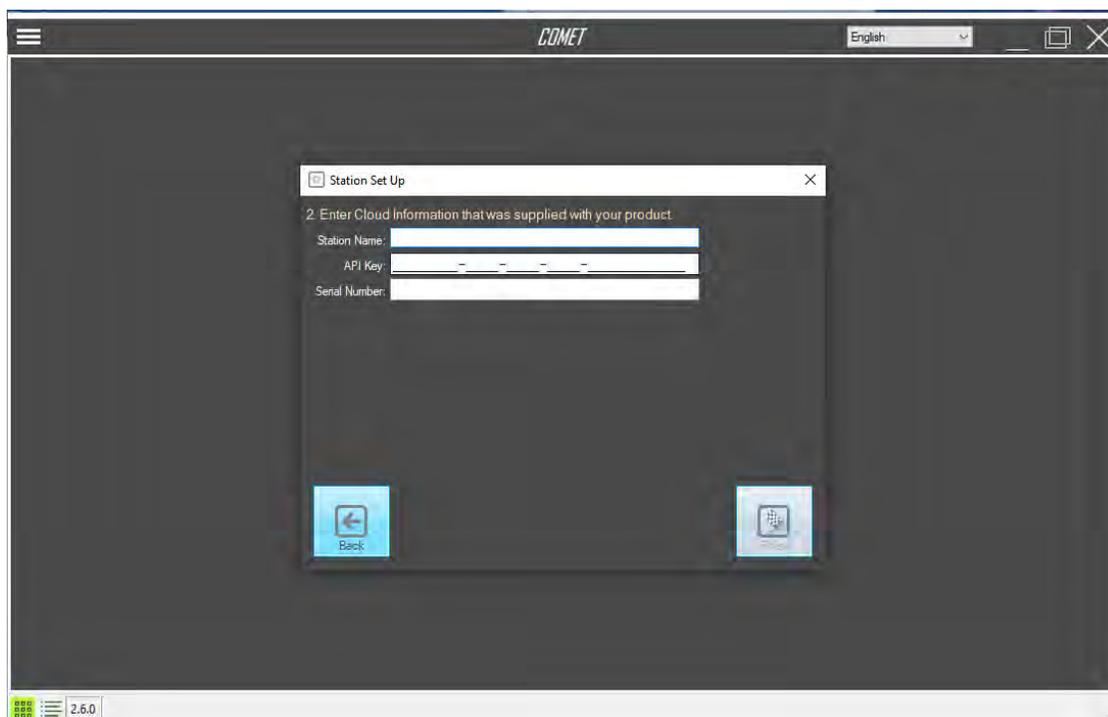Enter a Station ID, API key, and Serial Number for the C-12.

Figure 8-5 Comet Cloud Information Screen

Note: Customers will receive an API on the provided configuration sheet; a digital copy can be obtained from the Met One Instruments Service department.

Press the Retrieve button to open the Retrieve Data menu screen. When prompted, enter a data range and press OK to download your station's data from the cloud.

Figure 8-6 Comet Retrieve Data Screen

Comet will connect to the cloud site and download the device's data. Users can use the data tab and chart tab to view the data. When Comet downloads the data, a CSV file is created in the user's My Documents folder.

8.3 Downloading Data

This section describes the methods used to retrieve data from the C-12 carbon monitor. The unit has a single serial data output which can be routed through the USB serial converter port. This is used for all data transfer and may be used with a local computer and Comet software. It also has an RS-232 port on the bottom of the chassis for the same function.

The default serial settings are as follows:

Baud Rate: 115,200

Data Bits: 8

Parity: None

Stop Bits: 1

Flow Control: None

8.3.1 C-12 Data Outputs and Data Examples

The SETTINGS File:

The settings file contains most of the setup menu parameters for the C-12. This file should be reviewed periodically to ensure that no settings have been incorrectly changed. It also serves as a good data validation record. An example of a C-12 settings text file is shown in Figure 8-7.

The settings file also contains encrypted Factory Settings at the end of the Settings file report.

```
C-12 Settings Report
2021-12-02 14:34:47

      Firmware, 83533, R1.0.0.10
 Serial Number, I98765
      Location, 1
 Sample Period, 1 MIN
Cloud Output Type, CELL

  Name, Offset,  Slope
  Flow,  0.000,  1.000

Factory Settings
```

DQogICAgICBQYXNzd29yZCwgMA0KICAgICAgICAgIEJhdWQsIDExNTIwMA0KICAg
IFRpbWUgU3RhbXAsIEVORElORw0KICAgICAgIElTZXR0bGUsIDENCiAgICAgIElB
dmVyYWdlLCA5DQogICAgICBDLUZhY3RvciwgMi42MTANCiAgICAgICAgVVYgQWJz
LCAxOC4yMzM2DQogICAgICAgIEJDIEFicywgNy43NzAwDQogICBCVViBLLUZhY3Rv
ciwgMS4wMDANCiAgIEJDIEstRmFjdG9yLCAxLjAwMA0KICAgICBCVViBBBZXJvIEss
IDEuMDAwDQogICAgIEJDIEFlcm8gSywgMS4wMDANCjM3MG5tIEstRmFjdG9yLCAx
LjAwMA0KODgwbm0gSy1GYWN0b3IsIDEuMDAwDQozNzBubSBLLUxvYWRpbmcsIDAu
NzEwDQo4ODBubSBLLUxvYWRpbmcsIDEuMTcwDQogICAggQm94IFAtR2FpbiwgMTAu
MDAwDQogICAggQm94IEktR2FpbiwgMC41MDANCiAgICAgRlQgUC1HYWluLCAwLj4
MDANCiAgICAgRlQgSS1HYWluLCAwLjUwMA0KICAgICAgRlQgSS1HYWluLCBGVCBQV00sIDEwLj4
DQogICBGbG93IFAtR2FpbiwgMTUwMDANCiAgICAgRZsb3cgSS1HYWluLCA1MDAwDQog
IDM3MG5tIFNldCBQdCwgOS40OA0KICA4ODBubSBTZXQgUHQsIDMuNzUNCiAgICAg
U2F0IExpbWl0LCAyNDUwDQogICAgIERldCBMaW1pdCwgMTAwDQogICAggWmVybyBM
aW1pdCwgNQ0KICAgIGVGFwZSBQZXJpb2QsIEFVVE8NCiAgICAgVGFwZSBTcG90LCAx
DQogICBMb2FkIEVuYWJsZSwgT04NCiAgICBMb2FkIEexdmVsLCAzMA0KICAggTG9h
ZCBDYXJib24sIDg4MG5tDQpJbnRlcnZhbCBPdXRwdXQsIE9GRg0KQ2xvdWQgUmF0
ZSBMaW1pdCwgMTAgTUlODQogIE5hbWUsIE9mZnNldCwgIFNsb3BlDQogICAgIQlQs
ICAwLjAwMA0KICAgIEJQLCAgMC4wMDACj==

Figure 8-7 Settings File

9. ACCESSORIES and PARTS

The following parts are available from Met One Instruments for maintenance, replacement, service, and upgrades. If unsure about a part, please contact the technical service department. Some of these parts may require technical skills or special instructions before use or installation.

Table 9-1 Spare Parts and Accessories

Description	Part Number	Image
Filter Tape Roll (includes 2 rolls)	83599	
Span Check Membrane	83011	
Cap, Vinyl, 1/2" I.D. x 1/2" Long, Black	770025	
TSP Inlet	9441	
Optional Tripod	EX-905	
Leak Check Tool	80356	
Rubber Nozzle Sealing Tool	80206	
USB Cable	500784	
Serial Cable	83245	