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701094

MET ONE 227 Particle Counter

USER MANUAL

May 2008, Edition 6



EXCELLENCE IN PROCESS ANALYTICS

701094

MET ONE 227 Particle Detector

USER MANUAL

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Section 1 Specifications

Specifications are subject to change without notice.

| General | |
|-------------------------|--|
| Dimension (W x H x L) | 101.60 mm x 58.42 mm x 165.10 mm (4.0" x 2.3" x 6.5") |
| Weight | 1 kg (2.13 lb) |
| Maximum count displayed | 9,999,999 |
| Sample flow rate | 0.1 cfm |
| Number of size ranges | 2 (second size range can be selected at the front panel) |
| Particle size ranges | MET ONE 227A—0.5 micron and larger (channel 1); 0.7 micron, 1 micron, 3 micron or 5 micron (channel 2) |
| | MET ONE 227B—0.3 micron and larger (channel 1); 0.5 micron, 1 micron, 3 micron or 5 micron (channel 2) |
| Coincidence error | Less than 5% at 2,000,000 particles/cubic foot |
| Power | +5 W, +10 V (approximately) (+6 V with battery pack) |
| Light source | Laser diode |
| Sample/hold times | 1 second to 24 hours |
| Count alarms | 1 to 9,999,999 counts |
| Data storage | 200 samples, rotating buffer |
| Count cycles | Up to 100 in Auto or Average mode |
| Locations | Up to 250 (number appears on the printout) |
| Output | RS232C/RS485 for computer |
| Pump type | Carbon vane, 0.1 cfm |
| Recharging time | Up to 90% in 10 hours, 100% in 12 hours |
| Battery type | Rechargeable NiMH, 3500 mAH |
| Operating time | 8 hours, typical |
| Environment | |
| Operating temperature | 12 to 29 °C (55 to 84 °F) |
| Operating humidity | 10 to 85% relative humidity, non-condensing |
| Storage temperature | -40 to 71 °C (-40 to 160 °F) |
| Storage humidity | Up to 98% relative humidity, non-condensing |

Section 2 General Information

2.1 Safety information

Read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To make sure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION








Indicates a potentially hazardous situation that can result in minor or moderate injury.

Important Note: *Indicates a situation which, if not avoided, can cause damage to the instrument. Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol, if noted on the instrument, will be included with a danger or caution statement in the manual.

| | |
|---|---|
|  | This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information. |
|  | Electrical equipment marked with this symbol cannot be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. Note: <i>To return for recycling, contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories and all auxiliary items for proper disposal.</i> |
|  | This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists. |
|  | This symbol, if noted on the product, indicates the need for protective eye wear. |
|  | This symbol, when noted on the product, identifies the location of a fuse or current limiting device. |
|  | This symbol indicates a laser device is used in the equipment. |
|  | This symbol, when noted on the product, indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment. |

2.1.3 Laser safety information

This particle counter contains a laser-based sensor that is a Class 1 product (as defined by 21 CFR, Subchapter J, of the Health and Safety Act of 1968) when used under normal operation and maintenance. The manual contains no procedures for service of internal parts within this unit. Only factory-authorized personnel must perform the service.

The particle counter has been evaluated and tested in accordance with EN 61010-1:1993, "Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use" and IEC 825-1:1993, "Safety of Laser Products".

2.1.4 Battery safety information

WARNING

An explosion can occur if the internal battery is replaced incorrectly.

Figure 1 shows the label that appears on the battery for the safety of the user.

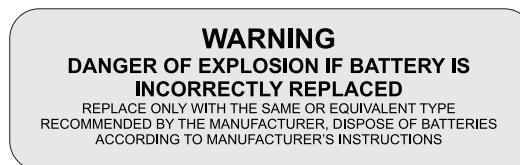


Figure 1 Battery safety label

2.1.5 Electrostatic discharge (ESD) considerations

Important Note: To minimize hazards and ESD risks, maintenance procedures not requiring power to the analyzer should be performed with power removed.

Delicate internal electronic components can be damaged by static electricity, resulting in degraded instrument performance or eventual failure.

The manufacturer recommends the user to take the following steps to prevent ESD damage to the instrument:

- Before the user touches any instrument electronic components (such as printed circuit cards and the components on them) discharge static electricity. This can be accomplished by touching an earth-grounded metal surface such as the chassis of an instrument or a metal conduit or pipe.
- To reduce static build-up, avoid excessive movement. Transport static-sensitive components in anti-static containers or packaging.
- To discharge static electricity and keep it discharged, wear a wrist strap connected by a wire to earth ground.
- Handle all static-sensitive components in a static-safe area. If possible, use anti-static floor pads and work bench pads.

2.2 General product information

The MET ONE 227 particle counter is a battery operated, laser based particle counter that is used in a walk-around sampling routine. The MET ONE 227 particle counter stores up to 200 records with a different location label for each sample. The data records may later be printed or downloaded to a computer for analysis. The MET ONE 227 particle counter is used in environments where the particulate contamination does not exceed two million particles per cubic foot of air, such as clean-rooms, medical instrument assemblies, computer rooms and downstream of air filter installations in HVAC systems. The Concentration mode in the MET ONE 227 particle counter is used to take a brief sample and estimate the probable cleanliness in areas with unknown particulate levels. This is based on built-in calculations performed in the microprocessor of the MET ONE 227 particle counter. Long term use of the MET ONE 227 particle counter in uncontrolled environments such as open air office spaces or outdoor air will require frequent sensor maintenance.

The MET ONE 227 particle counter operates at a flow rate of 0.1 cubic foot per minute (cfm). The flow rate is required to set the sampling parameters. For instance, the MET ONE 227 particle counter takes 10 minutes to sample 1 cubic foot of air. To obtain the counts per cubic foot, multiply the results of a 1-minute sample by ten. All counts are reported as cumulative counts; that is, all the reported 0.3 micron particles are 0.3 micron and larger in size.

2.3 Theory of operation

The MET ONE 227A/B particle counter is a combination of a sensor, pump and electronics (refer to [Figure 2 on page 10](#)) that includes full particle counter features. Both variants use the same sensor, pump, CPU and display electronics. The MET ONE 227A particle counter is calibrated with channel 1 sensitivity of 0.5 micron and the MET ONE 227B particle counter is calibrated with a channel 1 sensitivity of 0.3 micron. Both operate at a flow rate of 0.1 cfm.

The sample passes through a laser beam in the sensor, where the particles scatter the laser light. The sample then passes through a pump and a filter to trap particles in the counter rather than return them to the environment. The flashes of scattered light are converted to electronic pulses directly proportional to the amount of scatter, which creates a correlation to the particle size. The electronic pulses are counted and stored in channel bins in a data record. A data record also includes the date and time from the CPU clock and snapshots of the environmental conditions, if the Relative Humidity/Temperature (RH/T) probe is attached.

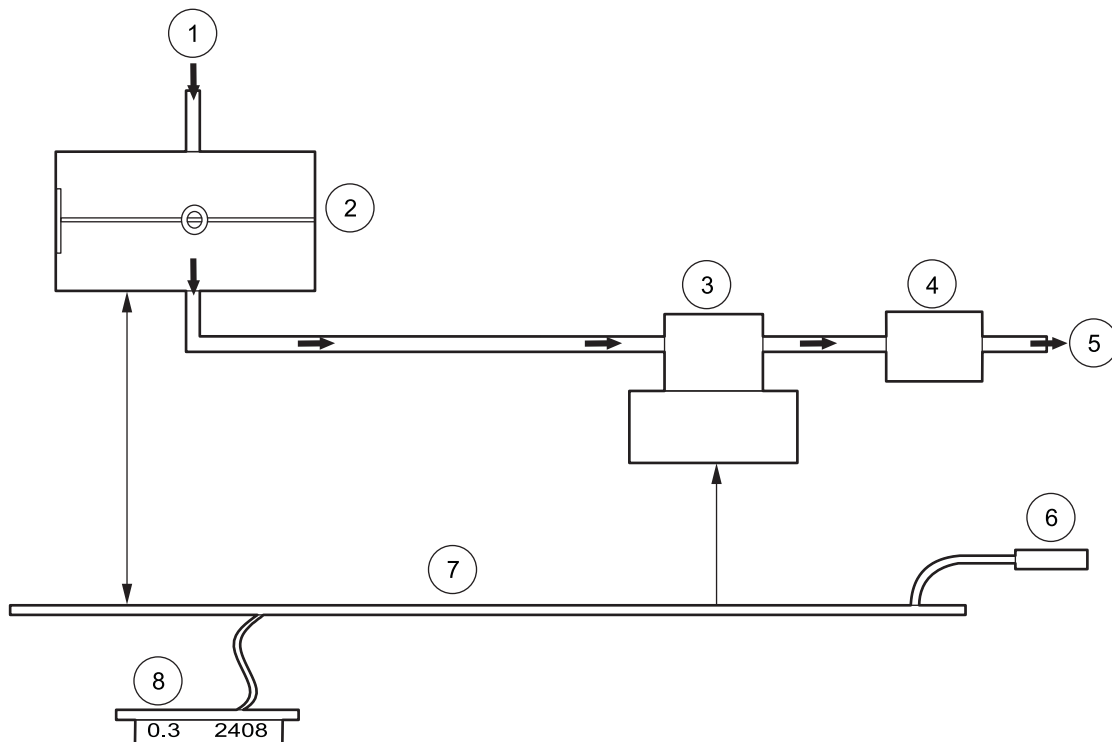


Figure 2 Theory of operation

| | |
|----------------|-----------------------|
| 1 Sample inlet | 5 Sample exhaust |
| 2 Sensor | 6 Serial data out |
| 3 Pump | 7 Control electronics |
| 4 Filter | 8 Display |

Section 3 Installation

DANGER

Only qualified personnel should conduct the tasks described in this section of the manual.

This section describes the setup of the MET ONE 227 particle counter and connections to the equipment. If necessary, contact the Technical Support department with questions regarding the compatibility or suitability of this product for a specific application.

3.1 Unpack the instrument

Remove the components from the shipping container and inspect for damage. Verify that all the items listed in [Figure 3](#) are included. If any items are missing or damaged, contact the manufacturer or sales representative.

Retain the original packaging materials. Use the original packaging material to store or ship the instrument to protect against damage during storage or transportation.

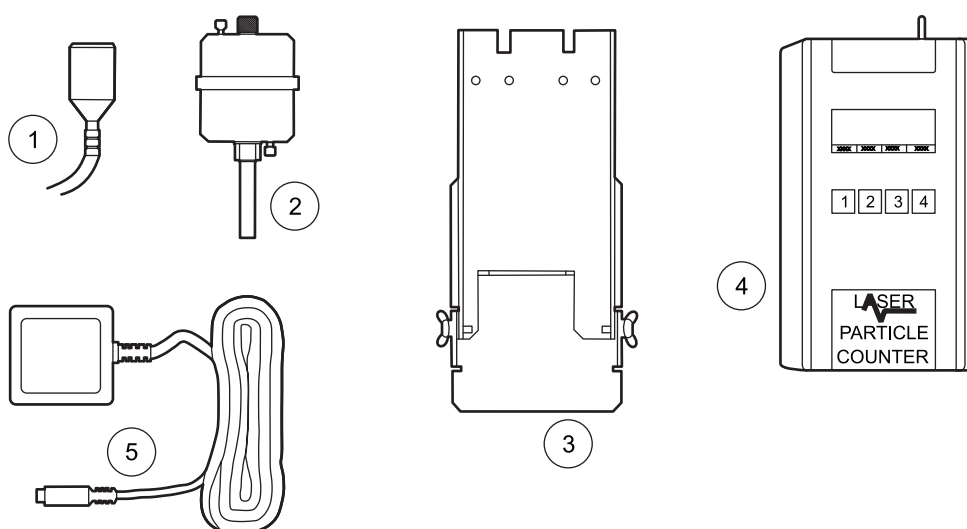


Figure 3 List of packaged items

| | | | |
|---|--|---|--|
| 1 | Isokinetic probe (Catalog No. 2080613) | 4 | MET ONE 227 particle counter |
| 2 | Purge filter (Catalog No. 2080442) | 5 | AC adapter—115 VAC (Catalog No. 770007), 230VAC (Catalog No. 770012), 100 VAC (Catalog No. 770009) |
| 3 | Charging stand (Catalog No. 2080469) | | |

3.2 Installation guidelines for the MET ONE 227 particle counter

The MET ONE 227 particle counter is ready to use when shipped and is configured in a default mode (refer to [section 4.2 on page 15](#)).

Before the operation of the MET ONE 227 particle counter, make sure that the following guidelines are complied to:

- Remove the red sensor inlet cap and attach the isokinetic probe prior to sampling (refer to [section 3.3.1 on page 12](#)).
- If the RH/T probe is used, attach it before the MET ONE 227 particle counter is turned on (refer to [section 3.3.5 on page 13](#)).

3.3 Mechanical installation

3.3.1 Install the isokinetic probe

The isokinetic probe (refer to [Figure 4 on page 12](#), item 2) is used in the laminar air flow for a flow rate of up to 100 feet per minute.

To install the isokinetic probe:

1. Remove the red sensor inlet cap from the MET ONE 227 particle counter.

Note: To minimize contamination, the isokinetic probe is protected with a cap on the opening that should remain in place till the probe is used.

2. Attach the isokinetic probe to the sensor inlet so that the open end faces the direction of the air stream.

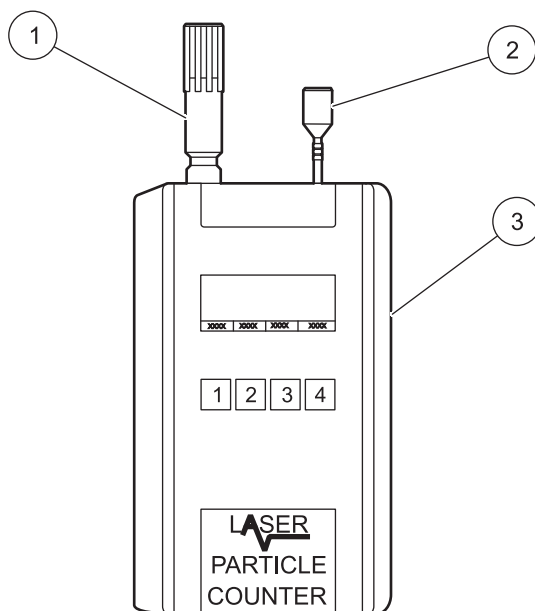


Figure 4 Installation of the isokinetic and relative humidity/temperature probe

| | | | |
|---|-------------------------------------|---|------------------------------|
| 1 | Relative humidity/temperature probe | 3 | MET ONE 227 particle counter |
| 2 | Isokinetic probe | | |

3.3.2 Install the purge filter

The purge filter (refer to [Figure 3 on page 11](#), item 2) is used for the maintenance of the MET ONE 227 particle counter. The filter prevents the contamination of the sensor and purges the sensor of accumulated internal particles.

To install the purge filter:

1. Remove the red sensor inlet cap or the isokinetic probe from the MET ONE 227 particle counter.
2. Attach the purge filter to the sensor inlet.

3.3.3 Install the charging stand

The charging stand (refer to [Figure 3 on page 11](#), item 3) is used to hold the MET ONE 227 particle counter during recharge or when sampling from a stationary position.

To install the charging stand:

1. Install the charging stand on any stable surface.
2. Place the MET ONE 227 particle counter on the charging stand.

3.3.4 Connect the AC adapter

WARNING

An explosion can occur if the internal battery is replaced incorrectly.

The AC adapter (refer to [Figure 3 on page 11](#), item 5) is used to charge the internal battery and use the MET ONE 227 particle counter with a standard 115 VAC outlet.

To connect the AC adapter:

1. Turn off power to the MET ONE 227 particle counter.
2. Attach the AC adapter to the power input jack (refer to [Figure 5 on page 13](#)) on the bottom of the MET ONE 227 particle counter.

3.3.5 Install the RH/T probe

To install the RH/T probe:

1. Locate the connector for the RH/T probe (refer to [Figure 4 on page 12](#), item 1) on top of the MET ONE 227 particle counter.
2. Attach the RH/T probe to the inlet so that the open end faces the direction of the air stream.

3.4 Connections and adjustments

The power and serial I/O connectors and the power switch are at the bottom of the counter. The brightness of the display may be adjusted for optimum performance in various ambient light conditions as shown in [Figure 5](#).

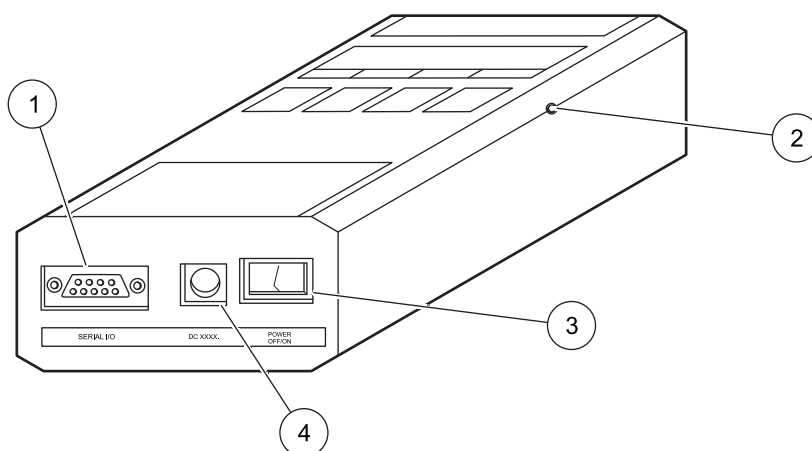


Figure 5 Connections and adjustments

| | | | |
|---|-------------------------------|---|------------------|
| 1 | Serial I/O connection | 3 | Power switch |
| 2 | Display brightness adjustment | 4 | Power connection |

Section 4 Operation

4.1 Power up

Use the power switch at the bottom of the counter to turn on the MET ONE 227 particle counter (refer to [Figure 5 on page 13](#), item 3). When first turned on, the counter will display the main screen ([Figure 6 on page 16](#)). The MET ONE 227 particle counter exhibits various counting modes. The factory default setting for the counting mode will be the Manual mode.

4.2 Factory default settings

[Table 1](#) lists the default parameters that are programmed at the factory. Refer to [Section 4 on page 15](#) for a detailed explanation of the terms and instructions required for programming parameters.

Table 1 Default parameter settings

| Parameter | Setting |
|-------------------------|---|
| Location number | 000 |
| Count mode | Manual (the counter will take one sample and stop counting) |
| Alarm limits | 0 (no particle count level alarms will be registered) |
| Channel 2 particle size | 0.7 micron in 227A; 0.5 micron in 227B |
| Volume | Liters (applies to Concentration mode only) |
| Temperature | °C (only if RH/T probe is attached). |
| RS232 mode | Normal |
| Baud rate | 9600 |
| Sample time | 1 minute (length of sample period) |
| Hold time | 1 second (hold time between samples in Automatic mode) |
| Program mode | Unlocked (allows user programming). |

4.3 Manual mode

In the Manual mode, the MET ONE 227 particle counter takes one sample of programmed length (default is one minute) and stops. This operation is based on the factory default settings described in [Table 1 on page 13](#).

To initiate a 1-minute count cycle:

1. Press 1 on the front panel (refer to [Figure 6](#)). The pump will begin to operate. The count cycle status will change from “Stop” to “Wait” for two seconds while the pump reaches maximum speed.

The count cycle status (refer to [Figure 6](#), item 2) will change to “Run” during the 1-minute sample and return to “Stop” at the end of the count cycle. The MET ONE 227 particle counter draws 0.1 cubic foot of air through the instrument. Multiply the results by ten to calculate the particle counts per cubic foot.

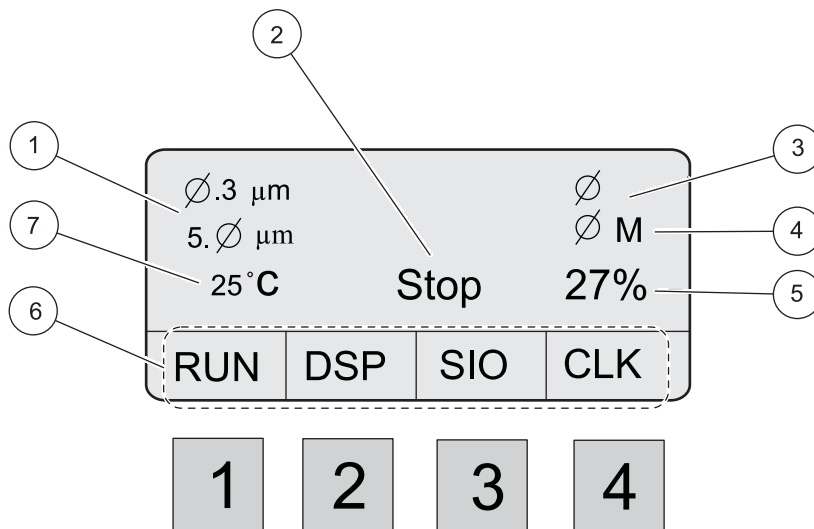


Figure 6 LCD display

| | | | |
|---|--|---|-------------------|
| 1 | Channel 1 and channel 2 sizes (MET ONE 227B) | 5 | Relative humidity |
| 2 | Count cycle status | 6 | Keypad functions |
| 3 | Channel 1 and channel 2 count results | 7 | Temperature |
| 4 | Counting mode | | |

4.4 Automatic mode

The Automatic mode is used to program sampling parameters. The Automatic mode covers the typical programming requirements for the common functions associated with the MET ONE 227 particle counter. [Table 2 on page 17](#) describes all the common functions of the MET ONE 227 particle counter. The MET ONE 227 particle counter need not be programmed in a sequential order and any parameter may be programmed at any time without affecting the others.

[Figure 7 on page 17](#) shows an example of a program sampling pattern where a MET ONE 227 particle counter is used to verify the cleanliness of a large room, dividing the space into eight sections for a comprehensive measurement.

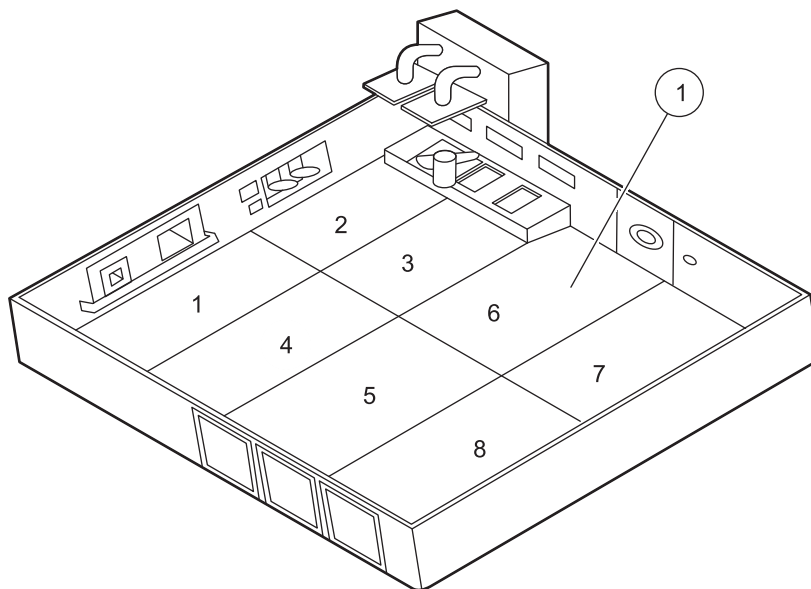


Figure 7 Example of a sampling pattern

1 Sections of a large room (1–8)

Table 2 MET ONE 227 particle counter function descriptions

| Function | Description |
|--------------------------------------|---|
| Stop | Count cycle status when the count cycles are complete. |
| Wait | Count cycle status for 2-second pause to allow the pump to come up to speed before starting first count cycle. |
| Run | Count cycle status during a particle count cycle. |
| Hold | Count cycle status during the pause between count cycles. |
| Location Num | Location number (0 to 250) can be set for a sample location as well as for an addressing number established for the counter (computer control). |
| Count Mode = Manual (M) | Counts for one count cycle; then turns pump off. Counter remains on. |
| Count Mode = Auto (A) | Repeats count cycles until all the cycles programmed are completed. |
| Count Mode = Average (Av) | Gives the average, minimum and maximum count for a specified number of count cycles. |
| Count Mode = Concentration (CF or L) | Approximates count per cubic foot of air (CF) or count/liter of air (L). Also changes temperature readout from °F to °C. |
| Period | Time (1 to 10 seconds) selected for count approximation when in Concentration mode. |
| Count Mode = Beep (B) | One beep after channel 1 and channel 2 count limit is reached and each step multiple thereafter. Counter counts until stopped. |
| Num Cycles | Number of count cycles (1 to 100 or INF) in Auto (A) and Average (Av) modes. If INF (Infinity) is selected, the counter will continue the count cycles until stopped. |
| Ch 1 Lim | Count limit of channel 1 when an audible alarm begins. |
| Ch 2 Lim | Count limit of channel 2 when an audible alarm begins. |
| Ch 2 Size | Minimum size threshold of particles counted in second size channel. Also, second size channel can be selected while in this function. |
| Volume = | Changes particle count readout when in Concentration mode from counts/liter to counts/cubic foot |

Operation

Table 2 MET ONE 227 particle counter function descriptions (continued)

| Function | Description |
|--------------------------------------|---|
| Temp = | Changes temperature readout from °F to °C. |
| RS232 Mode = Print a Record | When the printer is connected, results are printed at the end of each count cycle. |
| RS232 Mode = Print Buffer | When the printer is connected, the printer prints count data for all count cycles stored in buffer. |
| RS232 Mode = Normal | Printer is disabled; RS232 (computer control) is enabled. |
| Buffer Cnt | Number of count cycles presently stored in the buffer. |
| Baud Rate | Select from 300, 1200, 2400 or 9600. |
| Date | Present date |
| Time | Present time of day (24-hour clock format) |
| Period | Sample time for each count cycle (up to 24 hours) |
| Hold | Time between count cycles (up to 24 hours) |
| Program Mode Is Unlocked (or Locked) | The counter can be locked so that the program settings cannot be changed. |
| <Sensor Fail!> | When flashing, indicates a sensor problem. |
| <Count Alarm!> | When flashing and beeping, indicates that the programmed count alarm limit has been exceeded. |
| <Low Battery!> | When flashing, indicates battery needs recharging. |
| (Program Mode) | Indicates that the user has entered the mode for changing parameters or limits of the display, serial I/O or clock functions. |
| RUN | Begins the count cycle. |
| STOP | Stops the count cycle before completion; data is not saved. |
| DSP | Top menu name (Display) for all display parameters. |
| SIO | Top menu item (Serial Input/Output) for all serial interface parameters. |
| CLK | Top menu name (Clock) for all clock parameters. |
| PROG | Allows user to change parameters or limits. |
| NXT | Moves to the next function within the top menu. |
| BAK | Moves to the previous function within the top menu. |
| RET | Returns to the main screen. |
| INC | Either moves to the next mode selection or increments (increases) the number settings. |
| DEC | Either moves to the previous mode selection or decrements (decreases) the number settings. |
| → | Advances to the next set of digits to be changed. |
| ZERO | Sets buffer count to zero (clears buffer of all count cycle data). |

4.4.1 Unlock the program mode

To program the MET ONE 227 particle counter, unlock the Program mode.

Note: The Program mode is unlocked at the factory by default.

To unlock the Program mode:

1. Press 4 (CLK) on the main screen.
2. Press 3 (BAK) to display the Program mode status screen (refer to [Figure 8](#)).
3. Press 1 (PROG) to enter the Program mode.
4. Press 2 (INC) to unlock the Program mode.
5. Press 4 (RET) to return to the main screen.

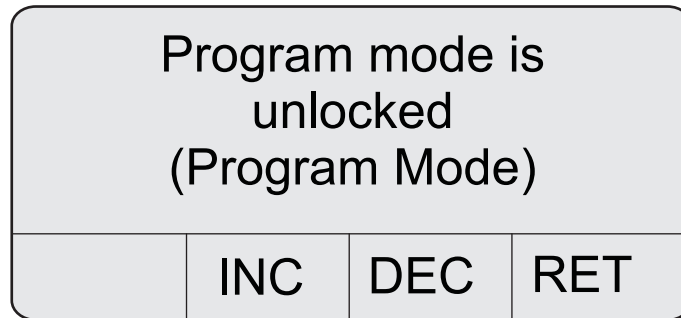


Figure 8 Program mode status screen

4.4.2 Set display (DSP) functions

4.4.2.1 Location number

To set the location number:

1. Press 2 (DSP) on the main screen. The Location Number screen is displayed (refer to [Figure 9](#)).
2. Press 1 (PROG) to enter the Program mode.
3. Press 2 (INC) to set the Location Number to 001.
4. Press 4 (RET) to return to the main screen.

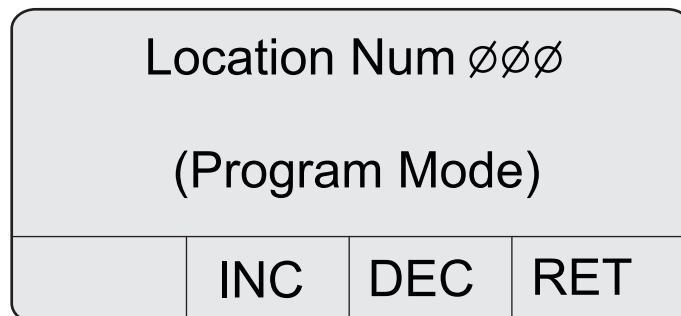


Figure 9 Location number screen

4.4.2.2 Count mode

To set the count mode:

1. Press **2 (DSP)** on the main screen.
2. Press **2 (NXT)** to display the Count mode screen.
3. Press **1 (PROG)** to enter the Program mode.
4. Press **2 (INC)** or **3 (DEC)** to select the Automatic count mode (refer to [Figure 10](#)). Auto (A) repeats count cycles until all the count cycles programmed are complete.

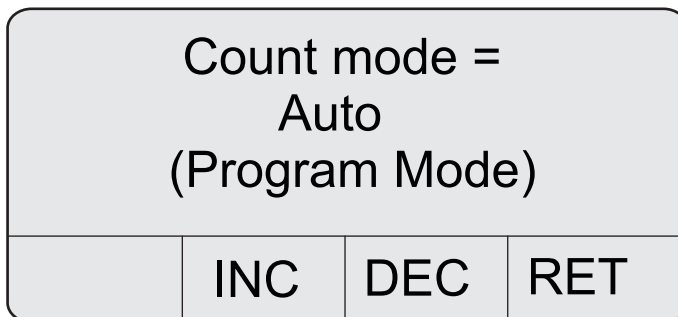


Figure 10 Automatic count mode screen

5. Press **4 (RET)**. The Num Cycles screen is displayed in the Program mode (refer to [Figure 11](#)).

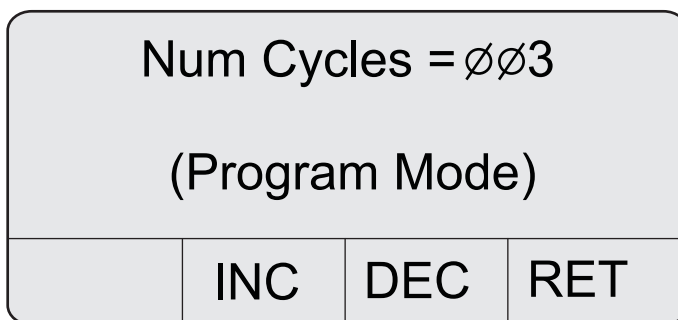


Figure 11 Num cycles screen

6. Press **2 (INC)** and **3 (DEC)** to select three count cycles. If infinity (INF) is selected, the MET ONE 227 particle counter will continue to count cycles until manually stopped.
7. Press **4 (RET)** to save the settings and return to the main screen.

4.4.3 Set serial input/output (SIO) functions

4.4.3.1 Clear the memory buffer

Clear the memory buffer to remove data records that were stored previously.

To clear the memory buffer:

1. Press **3 (SIO)** on the main screen.
2. Press **2 (NXT)** to display the Buffer Count screen (refer to [Figure 12](#)).
3. Press **1 (ZERO)** to clear the contents of the buffer.

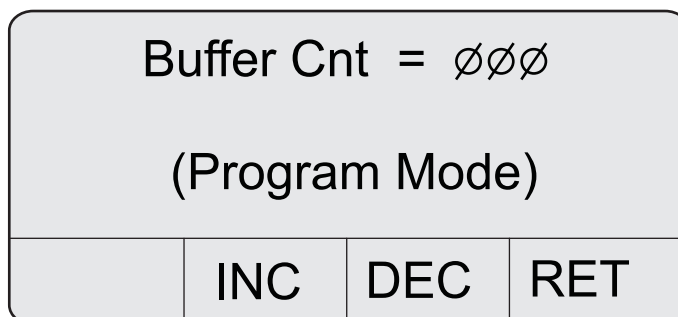


Figure 12 Buffer count screen

4.4.4 Set clock (CLK) functions

4.4.4.1 Set the date and time

To set the date and time:

1. Press **4 (CLK)** on the main screen. The Date and Time screen is displayed (refer to [Figure 13](#)).
2. Press **1 (PROG)** to enter the Program mode.
3. Press **1 (→)** to move the cursor along the digits.
4. Press **2 (INC)** and **3 (DEC)** to set the current date and time. The date and time will appear on the data record for each sample.
5. Press **4 (RET)** to save the settings and return to the main screen.

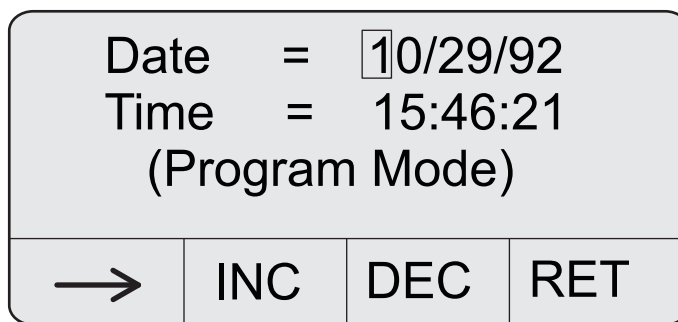


Figure 13 Date and time screen

4.4.4.2 Set sample period and hold times

To set the sample Period and Hold times:

1. Press 4 (CLK) on the main screen.
2. Press 2 (NXT) to display the Period and Hold screen (refer to [Figure 14](#)).
3. Press 1 (PROG) to enter the Program mode.
4. Press 1 (→) to move the cursor along the digits.
5. Press 2 (INC) and 3 (DEC) to set the Period time to 1 minute and the Hold time to 1 second as shown.
6. Press 4 (RET) to save the settings and return to the main screen.

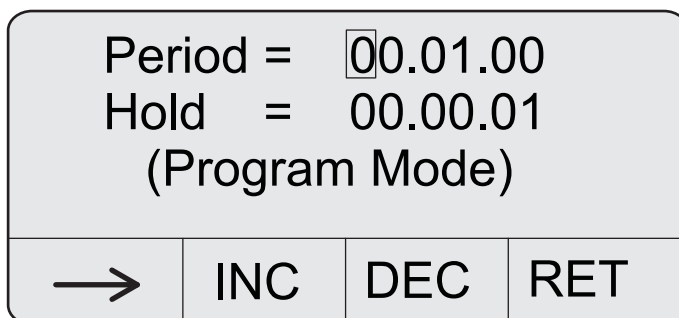


Figure 14 Period and hold screen

Once all the parameters are set, begin to sample the room. One possible sampling pattern is as follows:

1. Take the counter to the center of the first area to be tested.
2. Place or hold the counter about 4 feet off the floor. Make sure that the opening of the isokinetic probe faces directly into the laminar flow.
3. Press 1 (RUN) to initiate counting. The display shows three 1-minute samples being taken, separated by a 1-second hold time. When the three 1-minute samples are complete, the MET ONE 227 particle counter will stop the count.
4. Move the MET ONE 227 particle counter to the next location that needs to be sampled. If required, reprogram the Location Number to reflect the movements in the room.
5. When sampling is complete, print or download the count results. Analyze the results to verify the condition of the room.

Note: The preceding steps may be modified to create a sampling pattern that fits specific needs.

4.5 Average mode

In the Average mode, the MET ONE 227 particle counter counts for the number of sample periods programmed and then stops. The results displayed for both the channels are the average results of all the cycles. The minimum and maximum number of counts in all cycles are also displayed.

To program the MET ONE 227 particle counter for Average mode:

1. Press **2 (DSP)** on the main screen.
2. Press **2 (NXT)** to display the Count mode screen (refer to [Figure 15](#)).

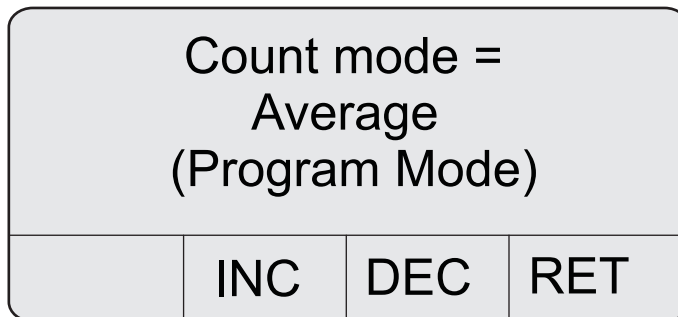


Figure 15 Count mode screen

3. Press **1 (PROG)** to enter the Program mode.
4. Press **2 (INC)** or **3 (DEC)** to select the Average mode.
5. Press **4 (RET)**. The Num Cycles screen is displayed in the Program mode (refer to [Figure 16](#)).

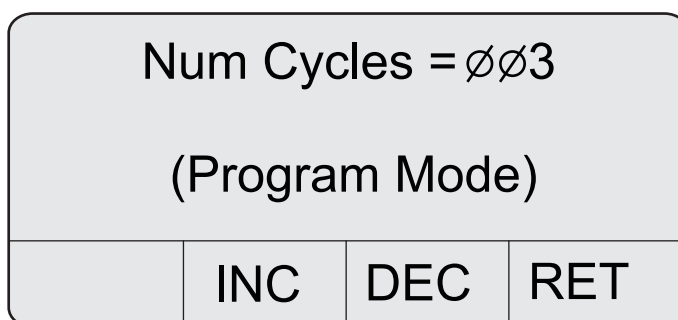


Figure 16 Num cycles screen in program mode

6. Press **2 (INC)** or **3 (DEC)** to select the required period.
7. Press **4 (RET)** to save the settings and return to the main screen.
8. Press **1 (RUN)** to begin the count cycle. The count status display will display "Wait" while the pump comes up to speed, then display "RUN" when the MET ONE 227 particle counter takes a sample. The MET ONE 227 particle counter will display "Hold" for the programmed Hold time between samples. When the programmed number of count cycles is complete, the MET ONE 227 particle counter will stop sampling and display the Completed Samples screen (refer to [Figure 17 on page 24](#)). Press **1, 2** or **3** to view the average, minimum and maximum counts respectively.
9. Press **4 (RET)** to return to the main screen.



Figure 17 Completed samples screen

4.6 Concentration mode

The Concentration mode in the MET ONE 227 particle counter can be used to take a quick snapshot of airborne particulate contamination levels, but cannot be used as a substitute for full sampling. The Concentration mode is appropriate for areas where the particulate levels are unknown and may exceed the operating limits of the MET ONE 227 particle counter. When the Concentration mode is used, no data records are stored in the memory buffer.

In the Concentration mode, the MET ONE 227 particle counter begins sampling and estimates the counts per cubic foot or per liter based on a programmable period of time. The MET ONE 227 particle counter updates the calculation results on the display at 1-second intervals. The programmable period sets the size of a 'calculation window' in seconds, which is moved each second to incorporate the sample data for the next second. The sample data for the oldest second of the previous period is then discarded.

The MET ONE 227 particle counter calculates the concentration based on a 3-second window that moves every one second (refer to Figure 18). The MET ONE 227 particle counter uses a 10-second period to calculate the concentration based on a 10-second window that moves every one second.

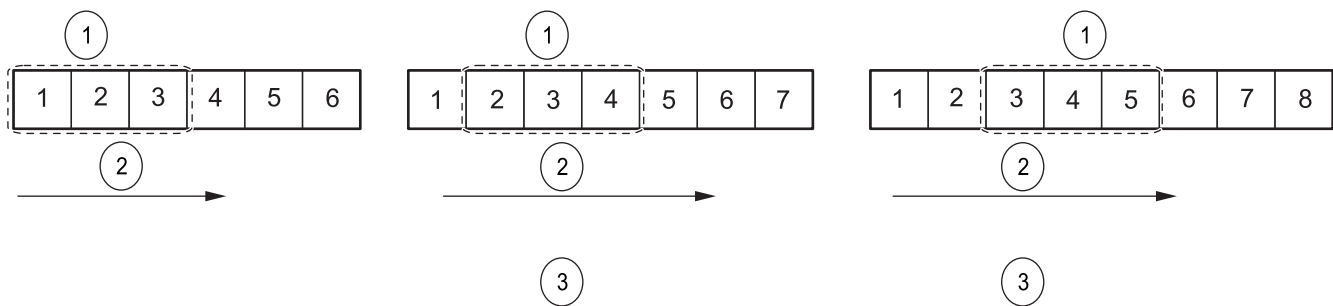


Figure 18 Concentration mode (3-second period)

| | | | |
|---|-----------------|---|----------------------------------|
| 1 | 3-second period | 3 | Recalculation and display update |
| 2 | Seconds | | |

A 10-second period is more likely to give a good representation of the actual concentration because it covers a longer period. Longer periods allows high particulate levels to contaminate the sensor (refer to [Figure 19](#)). Use a shorter period for unknown environments.

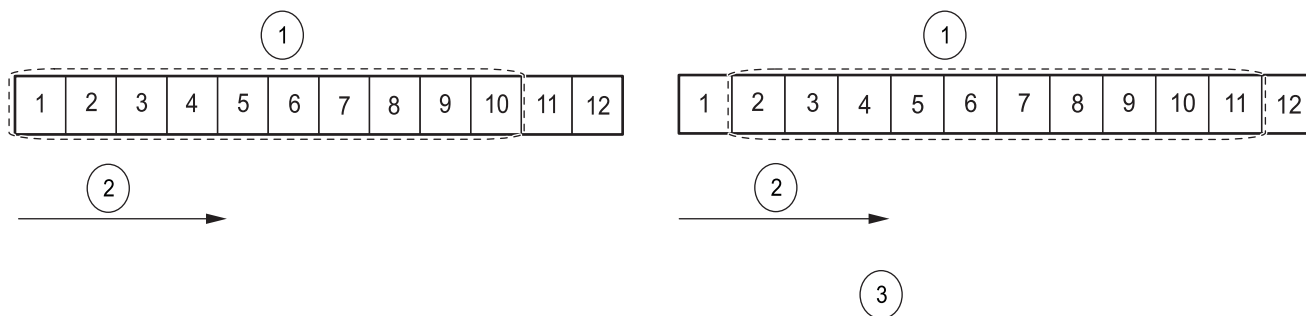


Figure 19 Concentration mode (10-second period)

| | | | |
|---|------------------|---|----------------------------------|
| 1 | 10-second period | 3 | Recalculation and display update |
| 2 | Seconds | 4 | |

To program the MET ONE 227 particle counter for the Concentration mode:

1. Press **2 (DSP)** on the main screen.
2. Press **2 (NXT)** to display the Count mode screen (refer to [Figure 20](#)).

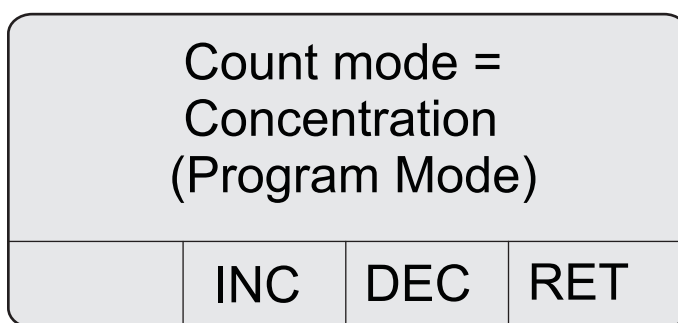


Figure 20 Count mode screen

3. Press **1 (PROG)** to enter the Program mode.
4. Press **2 (INC)** or **3 (DEC)** to select the Concentration mode.
5. Press **4 (RET)** to display the Period screen in the Program mode (refer to [Figure 21 on page 26](#)).

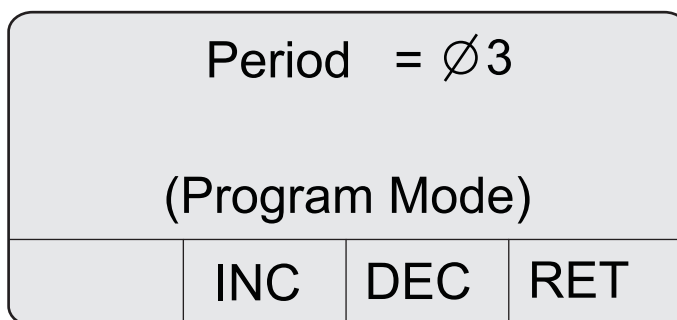


Figure 21 Period screen

6. Press **2 (INC)** and **3 (DEC)** to select the required period.
7. Press **4 (RET)** to save the settings and return to the main screen.
8. Press **2 (DSP)** and then press **2 (NXT)** four times to display the Volume screen (refer to [Figure 22](#)).

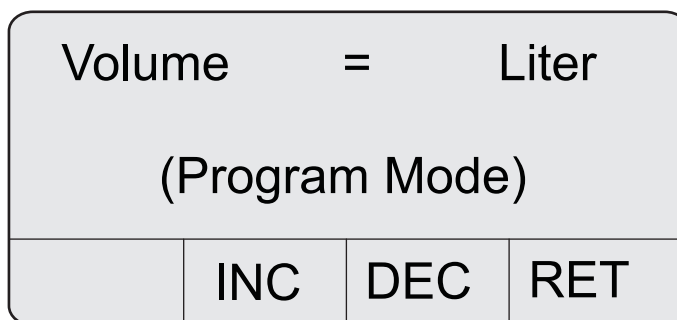


Figure 22 Volume screen

9. Press **1 (PROG)** to enter the Program mode.
10. Press **2 (INC)** and **3 (DEC)** to select the unit of volume.
11. Press **4 (RET)** to save the settings and return to the main screen.
12. Press **1 (RUN)** to begin the count cycle. The count status display will display "Wait" while the pump comes up to speed. The count status display then displays "RUN" while the counter takes a sample. In the Concentration mode, counting continues until **1 (STOP)** is pressed.

4.7 Beep mode

In the Beep mode, a single audible sound beeps once, every time a count alarm limit is reached and then once more for every multiple of the count limit. For example, if the limit is set at 1,000 particles, the beep will sound at 1,000, 2,000, 3,000 and so on. There are two size channels displayed at once and the MET ONE 227 particle counter beeps when either particle size range limit is reached. Set a limit for only one size range of interest and set the remaining range to zero, which generates no alarm. The Beep mode limits and count alarm limits are the same.

To program the MET ONE 227 particle counter for the Beep mode:

1. Press **2 (DSP)** on the main screen.
2. Press **2 (NXT)** to display the Count mode screen (refer to [Figure 23](#)).

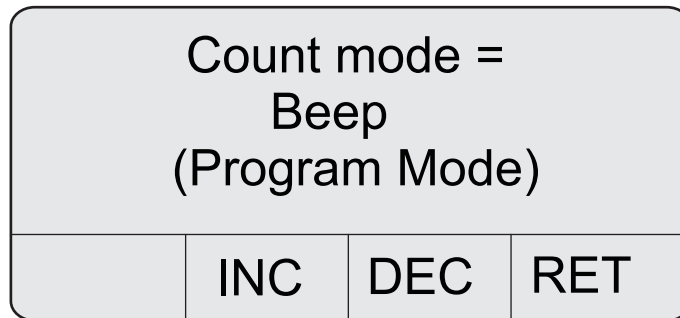


Figure 23 Count mode

3. Press **1 (PROG)** to enter the Program mode.
4. Press **2 (INC)** or **3 (DEC)** to select the Beep mode.
5. Press **4 (RET)** to return to the main screen.
6. Press **2 (DSP)** on the main screen and then press **2 (NXT)** twice to display the Alarm Limits screen (refer to [Figure 24](#)).
7. Press **1 (PROG)** to enter the Program mode.
8. Press **1 (→)** to move the cursor along the digits.
9. Press **2 (INC)** or **3 (DEC)** to set the alarm limits for the required settings time to 1 minute and the Hold time to 1 second (refer to [Figure 24](#)).

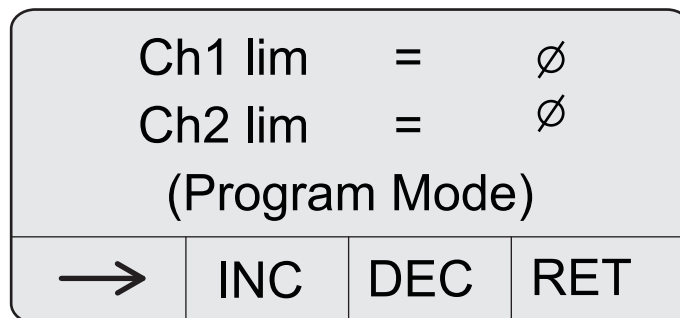


Figure 24 Set the alarm limit and hold time

10. Press **4 (RET)** to save the settings and return to the main screen.
11. Press **1 (RUN)** to begin the count cycle. The count status display will display "Wait" while the pump comes up to speed. The count status display will then display "RUN" while the counter is taking a sample. In the beep mode, counting continues until **1 (STOP)** is pressed.

4.8 Program the temperature probe

The MET ONE 227 particle counter displays the temperature readings of the optional environmental probe in degree Celsius (°C) or degrees Fahrenheit (°F).

To program the temperature display:

1. Press **2 (DSP)** on the main screen and then repeatedly press **2 (NXT)** to display the Temperature screen (refer to [Figure 25](#)).

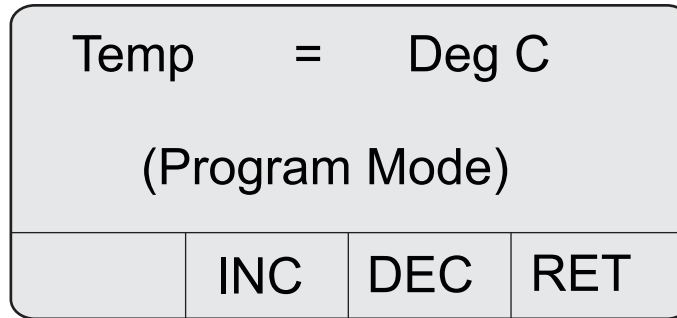


Figure 25 Temperature screen

2. Press **1 (PROG)** to enter the Program mode.
3. Press **2 (INC)** or **3 (DEC)** to select the Beep mode.
4. Press **4 (RET)** to return to the main screen.

Section 5 Maintenance

DANGER

Only qualified personnel should conduct the tasks described in this section of the manual.

DANGER

Electrocution hazard. Always disconnect the power to the instrument before making any electrical connections.

WARNING

Harmful radiation exposure. Do not use the controls or adjustments or performance of procedures other than those specified.

CAUTION

Electrostatic discharge (ESD) can damage or destroy electronic components. All work inside the particle counter should be done at a static-safe workstation.

5.1 Maintenance guidelines

A static-safe workstation can be created by doing the following:

- Use a grounded conductive table mat and resistor-isolated wrist-strap combination.
- Earth-ground all test instruments to prevent a build-up of static discharge.

Important Note: *The laser diode in this device is extremely sensitive to static charges and out-of-tolerance voltage variations.*

Important Note: *Never connect or disconnect the sensor cable from the counter when the counter is on.*

5.2 Clean the sensor

To clean the sensor:

1. Remove the four screws (two on each side) from the MET ONE 227 particle counter.
2. Remove the two screws from the bracket on the top end of the MET ONE 227 particle counter.
3. Open the two halves of the unit apart. Pull the back of the unit slightly downward to enable the sensor inlet to have an opening at the top of the counter.
4. Remove the four nylon screws that hold the sensor to the case.
5. Disconnect the tubing from the sensor.
6. Disconnect the sensor cable from the sensor circuit board.
7. Insert two #2-56 machine screws into the two threaded holes in the reflector. Use these screws as a handle to remove the reflector with a pulling and twisting motion.
8. Clean the reflector and photo detector with cotton swabs dipped in a small amount of reagent grade Acetone. Wipe the optical surfaces with a dry swab. Blow the dust out of the interior surfaces with clean dry air.
9. Perform steps 1 to 8 in the reverse order to assemble the MET ONE 227 particle counter.

Section 6 Troubleshooting

6.1 Common problems

Table 3 Troubleshooting procedures

| Message displayed on the LCD | Description | Cause/User action |
|------------------------------|---|---|
| <Low Battery!> | Indicates that the battery needs to be recharged. | <ol style="list-style-type: none">1 Turn off the counter and attach the AC adapter/charger to the power input jack at the bottom of the counter.2 Place the counter on the charging stand or on any stable surface and allow it to charge for 10 to 12 hours. |
| <Sensor Fail!> | Indicates that the internal particle sensor is no longer operating within acceptable limits. Any count data taken during this alarm condition is disregarded as inaccurate. | <p>The primary cause of this condition is sensor contamination. When this alarm occurs:</p> <ol style="list-style-type: none">1 Purge the sensor by attaching the purge filter that is supplied with the counter to the sensor inlet on top of the counter.2 Place the counter on the stand and attach the AC adapter/charger to the power connection on the bottom of the counter.3 Set the counter to Automatic mode and the number of cycles to infinite (INF).4 Press RUN and observe the particle count display. If the count totals are high but descending, allow the counter to operate continuously for an extended period of time until the counts stabilize at or near zero. If the <Sensor Fail!> alarm persists or if the counts do not reach zero after an extended period of time, clean the sensor (refer to section 5.2 on page 29). |
| <Count Alarm!> | Indicates that the particle counts have exceeded the programmed limits, but does not indicate a failure in the counter. | Make sure that the alarm limits are set to an appropriate level for the environment being monitored. |

6.2 Reset the counter

If for any reason the MET ONE 227 particle counter begins to perform out of character (for example, incorrect date and time), clear the counter memory and start the microprocessor again.

To reset the counter:

1. Disconnect any printer and serial cables. Turn the power off.
2. Hold down **1** and **2** while turning the power on. Release the keys when the MET ONE 227 particle counter beeps once. The Default mode screen is displayed (refer to [Figure 26 on page 32](#)).

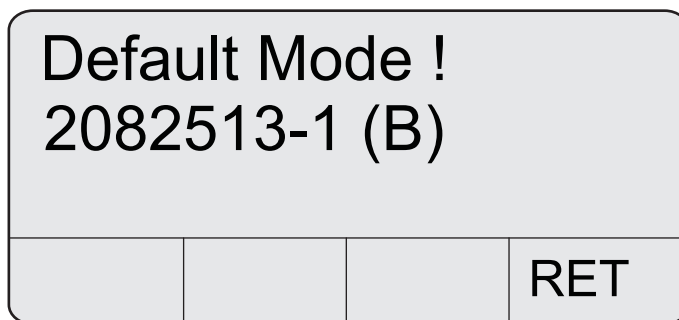


Figure 26 Default mode screen

3. Press **4 (RET)** to return to the main screen.
4. Program the date and time and any other function that may have been set to original default values.

6.3 Troubleshoot the pump

If the vacuum pump does not operate or exhibits any questionable symptoms such as unusual sound or vibration, it may be removed for maintenance to restore it to optimum operation.

6.3.1 Disassemble and clean the pump

Prerequisites:

- 1.27 mm or 1.5 mm Allen wrench

To disassemble and clean the pump:

1. Open the counter as described in steps 1 to 3 of [section 5.2 on page 29](#).
2. Remove the pump from the chassis clip.

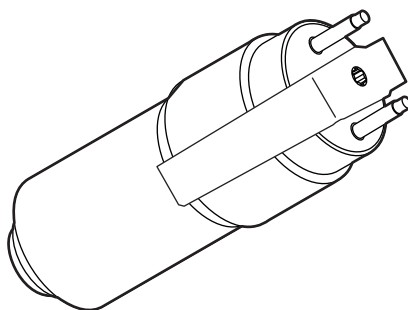


Figure 27 Pump

3. Unplug the pump electrical connection.
4. Disconnect the tubing from the pump.

Note: Make note of the tubing that is attached to the Vacuum (V) fitting and the Pressure (P) fitting. This information is required for the assembly of the pump.

5. Use a 1.27 mm or 1.5 mm hex key (Allen) wrench to loosen the set screw in the bracket on top of the pump.

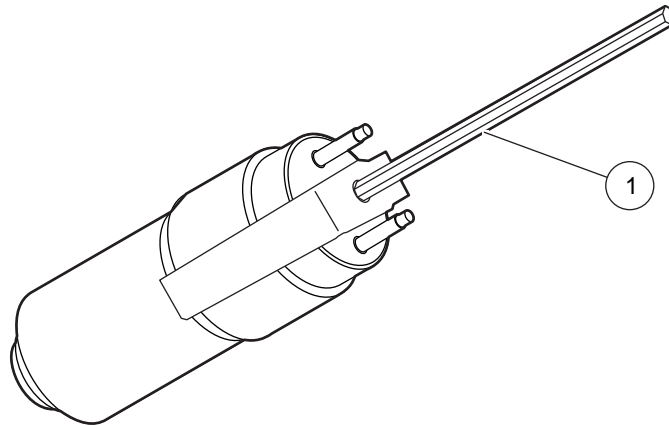


Figure 28 Loosening of the set screw

| |
|------------------|
| 1 Hex key wrench |
|------------------|

6. Push the bracket to one side and remove it from the pump (refer to [Figure 29](#)).

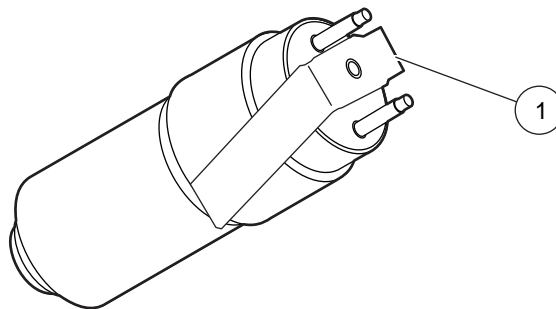


Figure 29 Removal of the bracket

| |
|-----------|
| 1 Bracket |
|-----------|

7. Remove the top of the pump (refer to [Figure 30](#)) and locate the locator pin.

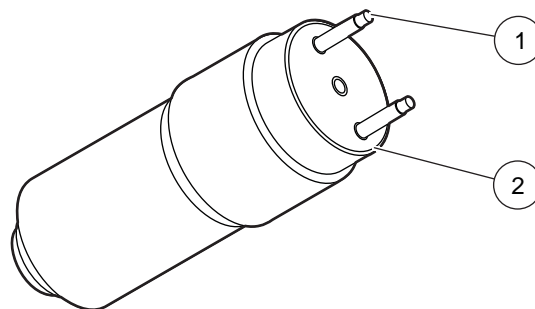


Figure 30 Removal of the top of the pump

| |
|---------------|
| 1 Locator pin |
|---------------|

| |
|-------------------|
| 2 Top of the pump |
|-------------------|

8. Remove the pump body (refer to [Figure 31](#)).

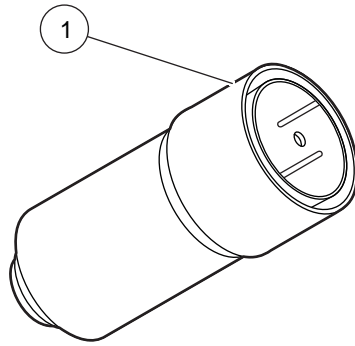


Figure 31 Removal of the pump body

| |
|-------------|
| 1 Pump body |
|-------------|

9. Remove the carbon vanes (refer to [Figure 32 on page 34](#) and [Figure 33 on page 34](#)) and make sure that the rotor turns freely.

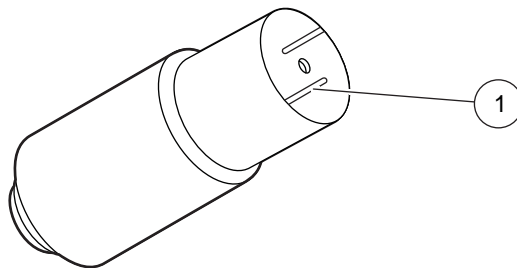


Figure 32 Removal of carbon vanes

| |
|---------------|
| 1 Carbon vane |
|---------------|

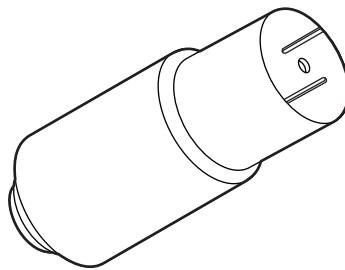


Figure 33 After removal of carbon vanes

10. Perform steps 1 to 9 in the reverse order to assemble the pump into the counter.

6.3.2 Optimize the pump

To optimize the pump:

1. After the assembly of the pump, loosen the set screw plug in the bracket. Connect the set screw plug to the MET ONE 227 particle counter.
2. Turn on power to the MET ONE 227 particle counter.
3. Press **1 (RUN)** to initiate a count cycle and turn on the pump.
4. Hold the pump motor still.
5. Rotate the entire pump head in a 180° arc (refer to [Figure 34](#)).

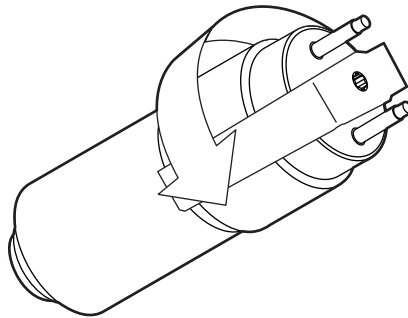


Figure 34 Rotation of the pump head

6. As the pump head is rotated listen for the point where the Revolutions per Minute (RPMs) are the greatest.
7. Keep the pump head steady and tighten the set screw.

Section 7 Replacement Parts and Accessories

7.1 Accessories

| Description | Quantity | Catalog no. |
|------------------|----------|--|
| Isokinetic probe | 1 | 2080613 |
| Purge filter | 1 | 2080442 |
| AC adapter | 1 | 770007 (115 VAC) 770012 (230 VAC) 770009 (100 VAC) |
| Charging stand | 1 | 2080469 |

7.2 Optional accessories

RH/T probe

The RH/T probe is attached to the connector on top of the MET ONE 227 particle counter. The probe monitors the relative humidity (10 to 90%) and temperature (5 to 122 °F or -15 to 50 °C). The MET ONE 227 particle counter displays and stores the readings in the internal particle count data record. Refer to [section 3.3.5 on page 13](#) for installation instructions.

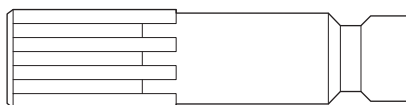


Figure 35 RH/T probe (2080825)

High-pressure diffuser

The high-pressure diffuser is connected to the sensor inlet tubing of the MET ONE 227 particle counter. The diffuser permits the direct sampling of pressurized air at pressures that range from 30 to 150 psi.



Figure 36 High-pressure diffuser (2080372-6)

RS485 converter

The RS485 converter converts data from the RS232 to RS485 format for longer serial networking to a computer. Consult Technical Support for installation.

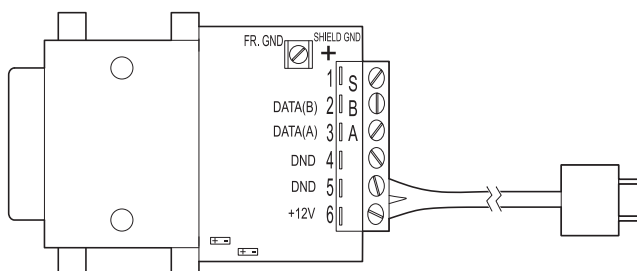


Figure 37 RS485 converter (2082383-2)

PortAll software

The PortAll software is used to transfer count data from the buffer of the counter and to display the data on the computer in a spreadsheet format. The software performs calculations as per the FS 209E and ISO 14644 standards. The software includes an adapter for use with a standard 9-pin serial cable. Refer to [Appendix B on page 47](#) for additional information.

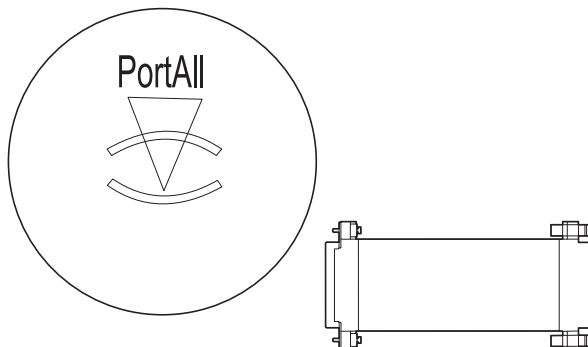


Figure 38 PortAll software (2084045)

Carrying case

The carrying case protects the particle counter during shipment and storage.

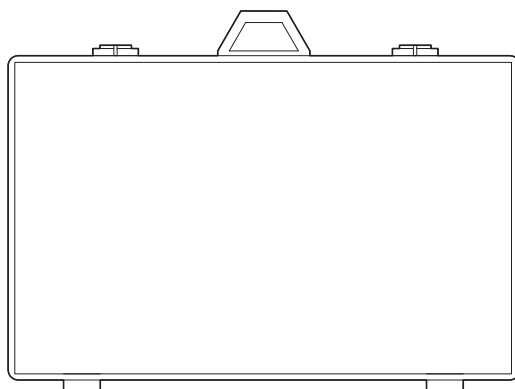


Figure 39 Carrying case (2080878)

Section 8 Service Contact Information

U.S.A. customers

By Telephone:

(541) 472-6500

6:30 a.m. to 5:00 p.m. PST

Monday through Friday

By Fax:

(541) 474-7414

By Mail:

Hach Ultra

481 California Avenue

Grants Pass, Oregon 97526

Email:

TechSupportGP@hachultra.com

Website:

www.hachultra.com

International customers

By Telephone:

41 22 594 64 00

By Fax:

41 22 594 64 99

By Mail:

Hach Ultra

Service Department

6, route de Compois, C.P. 212,

CH-1222 Vézenaz, Geneva, Switzerland

Website:

www.hachultra.com

Information required

- Your name
- Your phone number
- Your company name
- Your fax number
- Model number
- Serial number
- Comment or question

Section 9 Limited Warranty

Hach Ultra warrants this instrument to be free of defects in materials and workmanship for a period of one year from the shipping date. If any instrument covered under this warranty proves defective during this period, Hach Ultra will, at its option either repair the defective part without charge for extra parts and labor or provide an equivalent replacement in exchange for the defective product.

If any diode covered under this warranty proves defective during this period, Hach Ultra will, at its option, either repair the defective diode without charge for parts and labor or provide an equivalent replacement in exchange for the defective product.

To obtain service under this warranty, the customer must notify the nearest Hach Ultra service support center on or before the expiration of the warranty period and follow their instructions for return of the defective instrument. The customer is responsible for all costs associated with packaging and transporting the defective unit to the service support center and must prepay all shipping charges. Hach Ultra will pay for return shipping if the shipment is to a location within the same country as the service support center.

This warranty shall not apply to any defect, failure or damage caused by improper use or maintenance or by inadequate maintenance or care. This warranty shall not apply to damage resulting from attempts by personnel other than Hach Ultra representatives or factory authorized and trained personnel, to install, repair or service the instrument; to damage resulting from improper use or connection to incompatible equipment; or to instruments that have been modified or integrated with other products when the effect of such modification or integration materially increases the time or difficulty of servicing the instrument.

THIS WARRANTY IS GIVEN BY HACH ULTRA ANALYTICS WITH RESPECT TO THIS INSTRUMENT IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED. HACH ULTRA ANALYTICS AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR NON-CONTRACTUAL PURPOSE. HACH ULTRA ANALYTICS' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. HACH ULTRA ANALYTICS AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES EVEN IF HACH ULTRA ANALYTICS OR ITS VENDORS HAS BEEN GIVEN ADVANCED NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

DECLARATION of CONFORMITY

We,
Pacific Scientific Instruments
481 California Avenue
Grants Pass, Oregon 97526

declare under sole responsibility that the

Particle Counter, Model 227, part number 2082611

conforms to Directive 89/336/EEC for Electromagnetic Compatibility and Directive 73/23/EEC for Low Voltage. Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities:

EN 61326:1998, Class A / EN 500081-1:1992 Emissions:

EN 55011 :1991 Class A Radiated
EN 55011 :1991 Class A Conducted

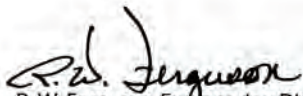
EN 61326:1998 / EN 50082-1:1997 Immunity:

EN 61000-4-2 Electrostatic Discharge
EN 61000-4-3 Electromagnetic Field
EN 61000-4-4 Electrical Fast Transient
EN 61000-4-5 Surge Test Common and Differential mode
EN 61000-4-6 3 Volt Modulated Interfering Signal
EN 61000-4-8 Susceptible Magnetic Fields
EN 61000-4-11 Voltage Interruption Test

EN 61010-1:1993 Amendment 1 & 2, Safety Requirement for Electrical Equipment for Measurement, Control and Laboratory Use

EN 60825-1:1993 Safety of Laser Products, Equipment Classification, Requirements and User's Guide.

Pacific Scientific Instruments
July 6, 2000
(Place and date of issue)


R. W. Ferguson-Engineering Director
(Name/signature of authorized person)

Appendix A Computer Interface Operations

A.1 Data analysis for ISO 14644

The primary reason for a computer interface with the MET ONE 227 particle counter is to download the count data for analysis.

ISO 14644 is the governing standard for clean-rooms. The MET ONE 227 particle counter cannot perform the calculations internally. Use the PortAll® software package offered by the manufacturer along with the MET ONE 227 particle counter to download data from the counter. Perform all the necessary functions to make sure that there is compliance to the ISO standard. Refer to [Appendix B on page 47](#) for instructions to setup and operate the MET ONE 227 particle counter with the PortAll software.

A.1.1 Computer communications

The MET ONE 227 particle counter has been setup for RS232 and Rs485 serial data communications capabilities:

- RS232 serial interface circuitry—Provides asynchronous communications between the counter and computer.
- RS485 serial network circuitry—Provides asynchronous communications between up to 64 counters and a controlling computer.

A terminal program such as Windows HyperTerminal® is used to perform the basic communication. The MET ONE particle counter uses a special serial cable (Catalog No. 2082197-1) available from the manufacturer. The pin configuration of the cable is shown in [Figure 40](#). The backshell of the cable must be modified to fit the recessed connector on the MET ONE 227 particle counter.

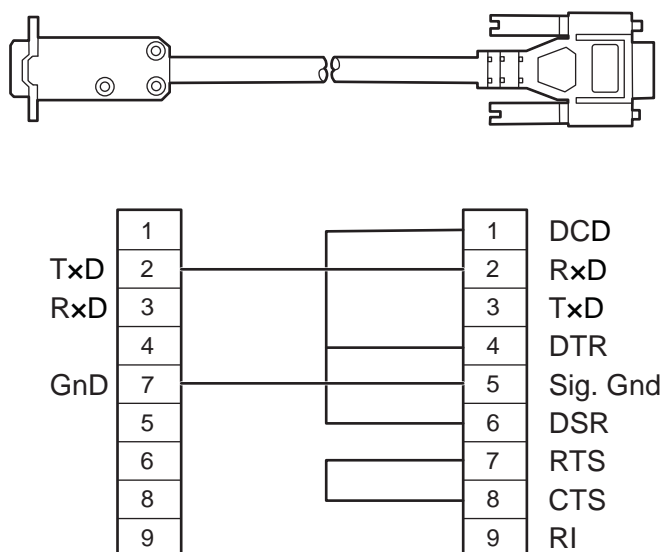


Figure 40 Serial interface pinout

A.1.1.1 Communication protocol

The counter has the following fixed parity and protocol:

- Eight (8) data bits
- One (1) stop bit
- No parity

Table 4 describes the ASCII commands that are supported by the MET ONE 227 particle counter.

Table 4 ASCII commands supported by the counter

| ASCII command | Description |
|---|---|
| "a" Auto: | When the "a" command is used, the counter is placed in the Auto mode. |
| "b" Manual: | When the "b" command is used, the counter is placed in the Manual mode. |
| "c" Start Counting (computer controlled): | The counter will begin counting without waiting for an even second boundary (quick start). Counting will continue until stopped by the computer. The computer must control the count cycle. |
| "d" Start Counting (counter controlled): | The counter will begin counting and control the count cycle based on the counter's setting for period. |
| "e" Stop Counting: | The counter will immediately stop counting without waiting for an even second boundary. |
| "C" Clear Buffer: | The rotating buffer will be erased. |
| "D" Send Number of Records: | The counter will send the number of records in the rotating buffer. |
| "E" Send EPROM Revision: | The counter will send the EPROM number and revision level. |
| "M" Mode Request: | The counter will send the present mode. If counting, a "C" will be sent. If holding, a "H" will be sent. If stopped, an "S" will be sent. |
| "T" Identify Model: | The counter will send a 4-character model number (for example, 227A). |
| "A" Send Record: | The next record in the rotating buffer will be sent. When the rotating buffer is empty, a "#" will be sent. Each record is erased from the buffer as it is sent. If no count cycles have been completed since the counter was turned on, then a "#" will be sent. The record cannot be sent until the current count cycle is complete. |
| "R" Resend Record: | The last record sent will be sent again. Records sent prior to the last record have been permanently erased. |
| "h" Standby Mode: | The counter will enter a mode that turns off the air pump and shuts down the sensor to conserve power and reduce equipment wear. |
| "g" Active Mode: | The counter will enter a mode that prepares it for counting. The air pump will turn on to purge the air path. |
| "l" Local Mode: | The counter will be set to offline (for factory test purposes). |
| "U" Universal Select: | The counter will respond to all commands after receiving this command, regardless of which select code is programmed into the counter until a counter select command is received (functions only when one counter is connected at a time). Any counter select command (128 through 191) will disable the Universal Select command. Enable this command again by turning off power to the unit and then turning it on. |
| "128-191" Counter Select: | The counter will respond to all subsequent commands when a number is sent that matches the select code, that is, sending a number between 128 (corresponding to LOC 0) and 191 (corresponding to LOC 63) that does not equal the select code of the counter. The counter is deselected or made unresponsive to computer commands by selecting another counter. |

A.1.1.2 Data record format

Each counter can send a record of the data available. The data record is a string of ASCII characters where the position in the string identifies the meaning of the character. The length of the string changes with the amount of data points available from the counter. Each data point is preceded by a 3-character tag that identifies the type of data that follows in the next six data characters. Figure 41 shows an example of the serial communications format of a two-channel particle counter. CRLF is the carriage return and line feed command.

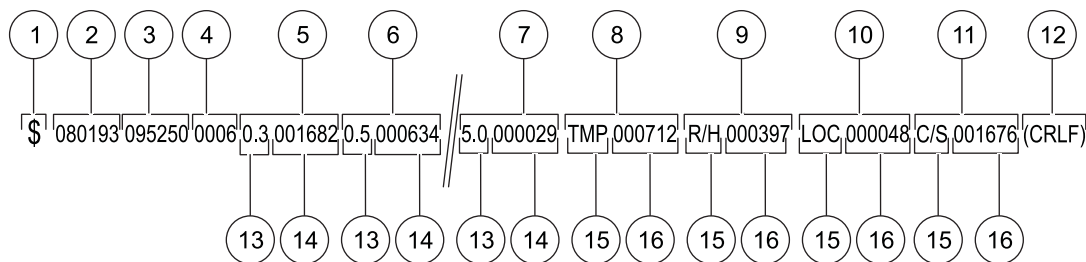


Figure 41 Serial communications format example

| | | | |
|---|-------------|----|-------------------|
| 1 | Status | 9 | Relative humidity |
| 2 | Date | 10 | Location |
| 3 | Time | 11 | Checksum |
| 4 | Period | 12 | End message |
| 5 | Channel 1 | 13 | Size |
| 6 | Channel 2 | 14 | Count |
| 7 | Channel 6 | 15 | Tag |
| 8 | Temperature | 16 | Value |

Appendix B PortAll Software

The clean-room classification standards FS 209E and ISO 14644-1 require specific particle count measurements and calculations to verify the cleanliness level of a clean-room or clean area. The PortAll software can use the measurement data from the MET ONE 227 particle counter to generate clean-room verification results automatically.

B.1 Connections

Note: The PortAll software is provided with an adapter that can be used use with a standard 9-pin to 9-pin serial cable instead of a special cable that is required for a serial interface.

In order to communicate with a computer, set the RS232 mode below the SIO menu to Normal (printer disabled). Make sure that the location number is set between 0 and 31 (refer to Figure 42). This enables the PortAll software to recognize the MET ONE 227 particle counter. After any communication with the computer, the keypad of the MET ONE 227 particle counter is disabled until the power is cycled off and on.

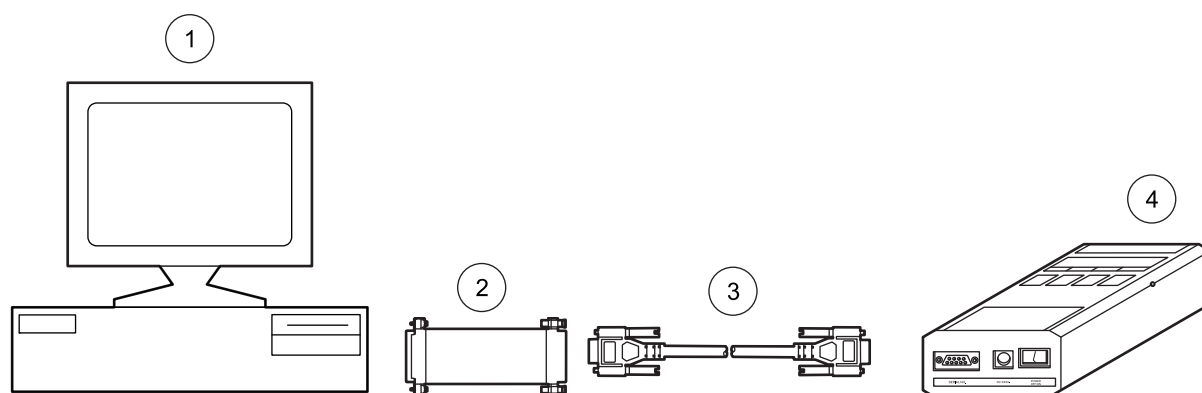


Figure 42 MET ONE 227 particle counter connections

| | | | |
|---|-----------------|---|------------------------------|
| 1 | Computer | 3 | Standard 9-pin serial cable |
| 2 | PortAll adapter | 4 | MET ONE 227 particle counter |

B.2 Operation

Perform the following procedures to make sure that an accurate classification result is obtained from the PortAll software.

- The data returned from the particle counter contains a location number for each sample. Use the front panel instrument controls to change the location number each time the instrument is moved to a new location.

Note: The PortAll software relies on the location number as an accurate indicator of the number of sample locations and number of samples per location.

- Set the sample time to obtain the required sample volume at each location (Sample Time x Instrument Flow Rate = Sample Volume). The PortAll software does not have access to the instrument flow rate and has no way to verify that the sample volume complies with standard requirements. It is necessary to set up the MET ONE 227 particle counter as follows:

- Sample period to one minute (0.1 cubic ft) and select Normalize Data (counts x 10) in PortAll

OR

- Sample period to 10 minutes (1.0 cubic ft) and do not select Normalize Data in PortAll

-
- The total count data returned from the particle counter must be normalized to counts per unit volume to obtain a correct classification. The PortAll software will automatically normalize (counts x 10) the count data. Refer to the online User's Guide for instructions to set up this feature. The data normalization settings for a particular instrument are saved based on the instrument address. For most instruments, the sample location (LOC) value is also the serial port address. Make sure that the instrument address is reset after collecting samples in the clean-room and before connecting the instrument to the PortAll software. Otherwise, the count values will not be automatically normalized.

Note: Make sure that the address value does not exceed 31. PortAll will not recognize an instrument whose address is outside the range of 0 to 31.

- For ISO 14644-1—PortAll stores the ISO classification limits internally in a table as counts per cubic meter. To obtain accurate classifications, the data in the spreadsheet must be normalized to counts per cubic meter.
- For FS209E—PortAll stores the FS 209E classification limits as counts per cubic foot. To obtain accurate classifications, the data in the spreadsheet must be normalized to counts per cubic foot.
- Clear the instrument memory before beginning a sampling sequence to classify a clean-room or clean area. The PortAll spreadsheet of the instrument memory will then contain only relevant samples to select for the classification calculations.

Note: For full PortAll documentation, refer to the PortAll CD.

Appendix C DPU-414 Printer

C.1 Printer setup

The Model DPU-414 printer (refer to [Figure 43 on page 49](#)) is an accessory of the MET ONE 227 particle counter.

DIP switch settings for the DPU-414 printer are made in the internal firmware of the printer with the use of the front panel buttons of the printer.

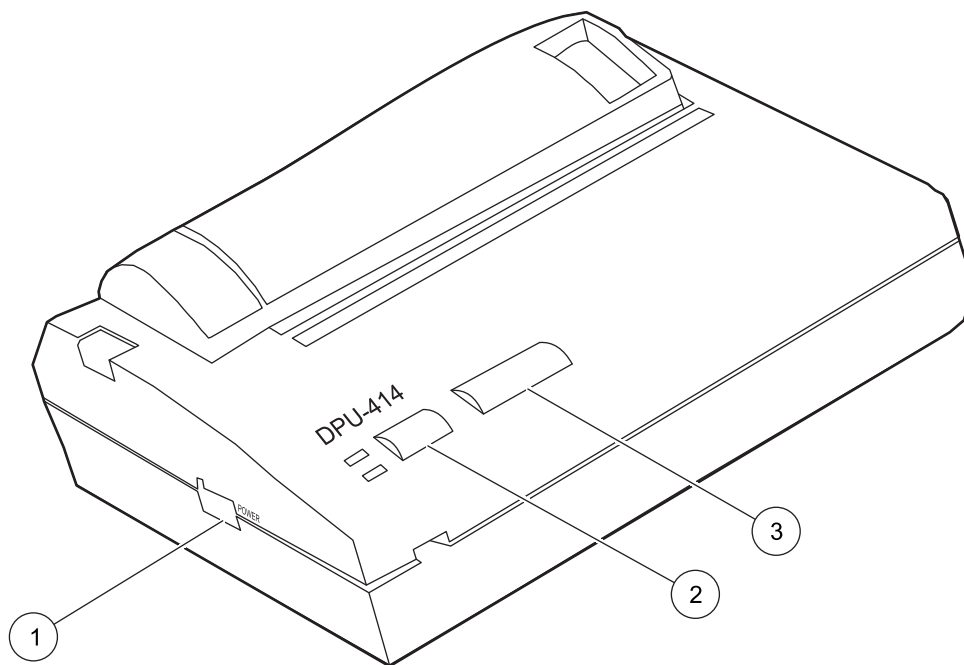


Figure 43 Model DPU-414 printer

| | | | |
|---|---------------|---|-------------|
| 1 | Power switch | 3 | FEED button |
| 2 | ONLINE button | | |

To set up the printer:

1. Turn the power switch off. Press and hold the **ONLINE** button.
2. Turn on the power switch.
3. When the printer begins to print the current DIP switch settings, release the **ONLINE** button. The current settings will be printed and the printer will be in the DIP switch setting mode. If the DIP switch settings match the settings in [Table 5 on page 50](#), no changes are necessary.
4. Press the **FEED** button to exit the DIP switch setting mode. If changes are necessary, proceed to step 5.
5. Press the **ONLINE** button to begin the programming of DIP SW-1 settings. The printer will print "Dip SW-1" and open the first switch position.
6. Press the **FEED** button to set the first DIP switch position off. The printer will print "1 (OFF) : Input = Serial" and open the next switch position.
7. Press the **ONLINE** button to set the second DIP switch position on. The printer will print "2 (ON) : Printing speed = High" and open the next DIP switch position.
8. Continue to program the remaining positions as above using the **ONLINE** button to turn on the switches and the **FEED** button to turn off the switches.

Table 5 DIP switch settings

| Dip switch 1 | | |
|---------------------|-------|-----------------------------|
| 1 | (OFF) | : Input = Serial |
| 2 | (ON) | : Printing Speed = High |
| 3 | (ON) | : Auto Loading = On |
| 4 | (ON) | : Auto LF = On |
| 5 | (ON) | : Setting Command = Enable |
| 6 | (ON) | : Printing |
| 7 | (ON) | : Density |
| 8 | (ON) | : = 72 % |
| Dip switch 2 | | |
| 1 | (ON) | : Printing Columns = 40 |
| 2 | (ON) | : User Font Back-up = ON |
| 3 | (ON) | : Character Select = Normal |
| 4 | (ON) | : Zero = Normal |
| 5 | (ON) | : International |
| 6 | (ON) | : Character |
| 7 | (ON) | : Set |
| 8 | (OFF) | : = U.S.A |
| Dip switch 3 | | |
| 1 | (ON) | : Data Length = 8 bits |
| 2 | (ON) | : Parity Setting = No |
| 3 | (ON) | : Parity Condition = Odd |
| 4 | (ON) | : Busy Control = H/W Busy |
| 5 | (OFF) | : Baud |
| 6 | (ON) | : Rate |
| 7 | (ON) | : Select |
| 8 | (ON) | : = 9600 |

When all the SW-1 settings are complete, the printer prompts the user to select **CONTINUE** by pressing the **ONLINE** button or **WRITE** by pressing the **FEED** button. If SW-2 and SW-3 settings are correct, select **WRITE** to exit the programming routine and save the settings. If SW-2 settings are correct, but SW-3 settings need to be changed, SW-2 settings must be programmed first in order to access SW-3 settings. If the SW-3 settings are modified, the printer will automatically exit the DIP-SW programming mode after the last position is set and print "DIP SW setting complete!!". Make sure that the printer is online when the programming is complete.

C.2 Counter setup for the printer

Connect the printer cable to the MET ONE 227 particle counter. The printer interface settings are located below the SIO functions menu on the main screen of the MET ONE 227 particle counter because the data is transmitted serially from the MET ONE 227 particle counter in an RS232 format.

To select the required RS232 mode:

1. Press **3 (SIO)** on the main screen to display the RS232 mode screen.
2. Press **2 (NXT)** twice to display the Baud Rate screen (refer to [Figure 44](#)).

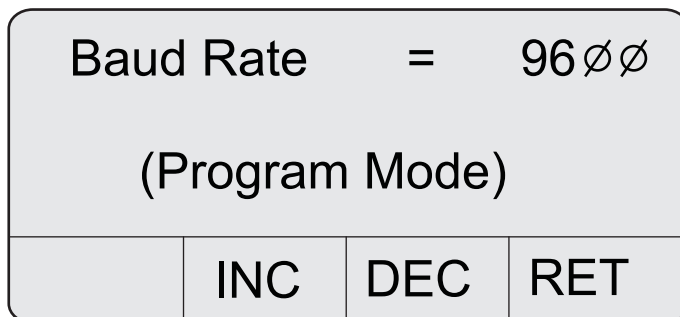


Figure 44 Baud rate screen

3. Press **1 (PROG)** to enter the Program mode.
4. Press **2 (INC)** or **3 (DEC)** to select the required RS232 mode.
5. Press to return to the main screen.

There are three RS232 modes to select from:

- Normal mode—Disables the printer function
- Print A Record—Prints the particle count results after completion of each count cycle
- Print The Buffer—Prints all the count cycles contained in the rotating buffer. Data is removed from the rotating buffer during printing in Print The Buffer mode. Press **4 (RET)** to start the print if Print The Buffer mode is selected.

To change the RS232 mode:

1. Press **3 (SIO)** on the main screen to display the RS232 mode screen (refer to [Figure 45](#)).

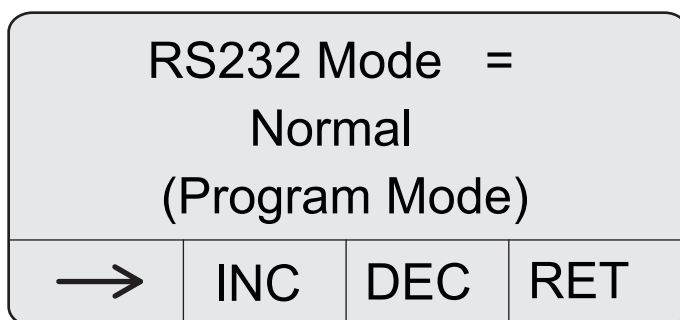


Figure 45 RS232 mode screen

2. Press 1 (PROG) to enter the Program mode.
3. Press 2 (INC) or 3 (DEC) to select the required RS232 mode.
4. Press 4 (RET) to return to the main screen.

C.3 Interpret the printout

The printer will print the following:

- The particle size ranges and total counts for both the particle size ranges
- Environmental probe values if an external probe is connected to the counter
- Date, time, period and location
- The type of alarm that has occurred if there is an alarm during a sample run

Figure 46 shows a typical Print The Buffer printout.

| PRINTING 002 RECORD(S) | | | |
|--------------------------------------|-------------|---------------|----------|
| DATA WILL BE REMOVED FROM THE BUFFER | | | |
| ***** | COUNT ALARM | | ***** |
| DATE = | 8/04/00 | TIME = | 09:45:39 |
| PERIOD = | 00:01:00 | LOCATION NUM. | 1 |
| 0.3um = | 71045 | 5.0um = | 74 |
| ***** | COUNT ALARM | | ***** |
| DATE = | 8/04/00 | TIME = | 09:46:49 |
| PERIOD = | 00:01:00 | LOCATION NUM. | 2 |
| 0.3um = | 83158 | 5.0um = | 41 |

Figure 46 Data record printout

Figure 47 shows a printout when the count mode is set to Average, where the minimum, maximum and average count for both sizes are provided.

| PRINTING 002 RECORD(S) | | | |
|--------------------------------------|----------|---------|----------|
| DATA WILL BE REMOVED FROM THE BUFFER | | | |
| DATE = | 8/04/00 | TIME = | 09:45:39 |
| PERIOD = | 00:01:00 | LOC 0 | CYCS. 5 |
| TEMP = | 27 C | RH = | 39 % |
| SIZE | MINIMUM | MAXIMUM | AVERAGE |
| 0.3um | 69045 | 71693 | 70474 |
| 5.0um | 25 | 43 | 34 |
| DATE = | 8/04/00 | TIME = | 09:46:49 |
| PERIOD = | 00:01:00 | LOC 0 | CYCS. 5 |
| TEMP = | 26 C | RH = | 38 % |
| SIZE | MINIMUM | MAXIMUM | AVERAGE |
| 0.3um | 69045 | 71693 | 70474 |
| 5.0um | 25 | 43 | 34 |

Figure 47 Average mode data record printout

| | | | |
|---|----|--|--------------------------------|
| A | | | |
| accessories, included | 37 | | |
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| default settings, factory | 15 | | |
| display functions, setup | 19 | | |
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| H | | | |
| hazard information | 7 | | |
| L | | | |
| laser safety | 8 | | |
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| printout, interpretation | 52 | | |
| product information, general | 9 | | |
| program mode, unlock | 19 | | |
| protocol, communication | 44 | | |
| pump, disassembly | 32 | | |
| pump, maintenance | 32 | | |
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| S | | | |
| Safety information | 7 | | |
| sensor, cleaning | 29 | | |
| serial input/output functions, setup | 21 | | |
| setup, instrument | 11 | | |
| specifications, environment | 5 | | |
| specifications, general | 5 | | |
| T | | | |
| troubleshooting procedures | 31 | | |
| U | | | |
| Unpack, instrument | 11 | | |



Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. *Note: For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment for proper disposal.* Important document. Retain with product records.

GERMAN Elektrogeräte, die mit diesem Symbol gekennzeichnet sind, dürfen in Europa nach dem 12. August 2005 nicht mehr über die öffentliche Abfallentsorgung entsorgt werden. In Übereinstimmung mit lokalen und nationalen europäischen Bestimmungen (EU-Richtlinie 2002/96/EC), müssen Benutzer von Elektrogeräten in Europa ab diesem Zeitpunkt alte bzw. zu verschrottende Geräte zur Entsorgung kostenfrei an den Hersteller zurückgeben. *Hinweis: Bitte wenden Sie sich an den Hersteller bzw. an den Händler, von dem Sie das Gerät bezogen haben, um Informationen zur Rückgabe des Altgeräts zur ordnungsgemäßen Entsorgung zu erhalten.* Wichtige Informationen. Bitte zusammen mit den Produktinformationen aufbewahren.

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