



701255

MET ONE 6000P Series Particle Counter

USER MANUAL

October 2010, Edition 2



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Section 1 Specifications

Specifications are subject to change without notice.

Instrument	
Light source	Long Life Laser™ diode
Weight	4.62 kg (10.2 lb)
Dimensions (W x D x H)	17.15 cm x 11.43 cm x 31.75 cm (6.75 in. x 4.5 in. x 12.5 in.) (Figure 1 on page 4)
Enclosure	304 Stainless steel
Status indicator	Multi-colored LED for normal status, count alarm, count alert, sensor failure, flow failure or communication failure
Power requirements	24 VDC $\pm$ 10% 50W Max, or optional 100 to 240 VAC, 50-60 Hz, 0.4A Max
Operating temperature	10 to 32 °C (50 to 90 °F)
Storage temperature	–40 to 70 °C (–40 to 158 °F)
Operating humidity	Maximum relative humidity 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C
Altitude	2000M (max)
Storage humidity	5 to 98% relative humidity, non-condensing
Port sizes	Model 6000P: barb fitting for ¼" ID inlet tubing, 3/8" ID outlet tubing. Optional 3/8" ID inlet fitting.
Signal output options	Analog 4–20 mA
	Ethernet with ModbusTCP protocol
Data storage	1000 samples/records
Sampling	
Number of size channels	Standard: 2 Optional: 4
Flow rate	Model 6000P: 1.0 cfm (28.3 Lpm) $\pm$ 5%
Sensitivity	Model 6000P: 0.5 μ m at 1.0 cfm (28.3 Lpm)
Range	Model 6000P: 0.5 μ m to 10.0 μ m at 1.0 cfm (28.3 Lpm)
Counting efficiency	Model 6000P: 50% $\pm$ 20% at 0.5 μ m and 100% $\pm$ 10% for sizes at least 1.5 times, or larger than the smallest channel size (fully complies to JIS and ISO 21501-4)
Coincidence loss	Model 6000P: 5% at 14,000,000 particles/m ³ (400,000 particles/ft ³)
False count rate	One or less in five minutes
Operating location	Indoor use only
Pump type	Air Vacuum, rated for continuous use
Product CE compliant	Contact manufacturer for details.

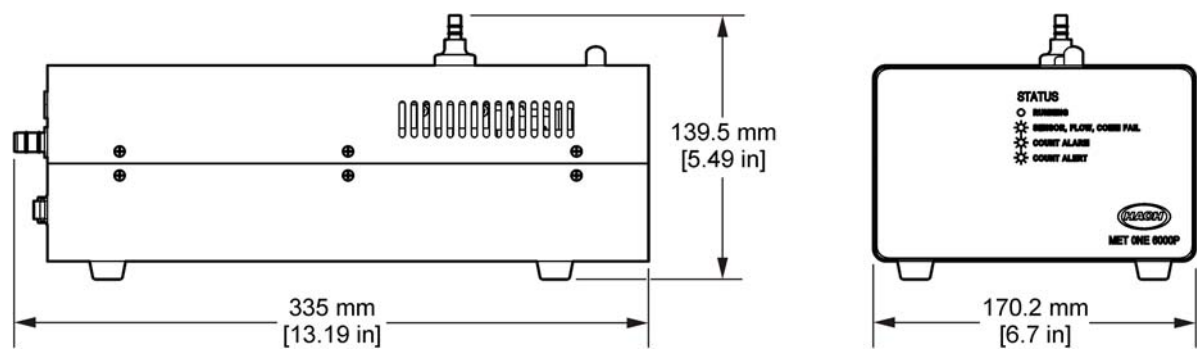


Figure 1 MET ONE 6000P dimensions

Section 2 General information

The contents of this manual are thought to be accurate. The manufacturer is not liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual, even if advised of the possibility of such damages. In the interest of continued product development, the manufacturer reserves the right to make improvements in this manual and the products it describes at any time, without notice or obligation.

Revised editions are found on the manufacturer's web site.

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 ensure 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 may result in minor or moderate injury.

***Important Note:** Information that requires special emphasis.*

General information

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.

	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: 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.
	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates the need for protective eye wear.
	This symbol indicates that a laser device is used in the equipment.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicates that care must be taken to prevent damage to the equipment.
	This symbol identifies the location of a fuse or current limiting device.

2.1.3 Class 1 Laser Product

	This symbol indicates that the instrument contains a Class 1 Laser Product.
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This Class 1 Laser product complies with 21 CFR Chapter 1, subchapter J. It is evaluated and tested in accordance with EN 61010-1, Safety Requirements for Electrical Equipment for Measurement and Control and Laboratory Use and IEC/EN 60825-1, Safety of Laser Products. FDA accession number: 9022243-029.

2.2 General product information

Figure 2 shows a diagram of the MET ONE 6000P particle counter. The remote airborne particle counters use a laser diode light source and collection optics for particle detection. The air quality of a clean room can be monitored by placing multiple particle counters at specific locations in the room.

The MET ONE 6000P particle counter has four main components—the sensor, counting electronics, communication electronics, and vacuum pump. Room air is pulled through the particle counter by the vacuum pump. The sensor detects the particles that enter the counter. The counting electronics store the count data. The data is transferred to the central monitoring software through the communication electronics and relevant communication protocols.

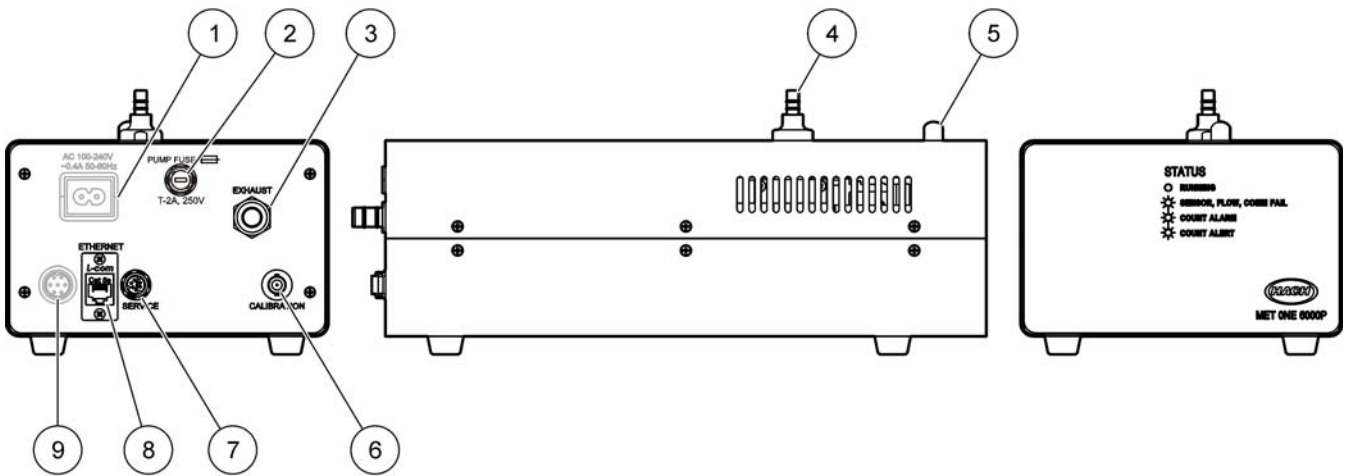


Figure 2 Overview of Met One 6000P particle counter

1	AC power input (optional)	6	Calibration Port
2	Fuse holder	7	Service Port and Remote Indicator Light Connector
3	Barbed exhaust tubing connector	8	Ethernet Port
4	Barbed intake tubing connector nozzle	9	DC power input (optional) and 4~20mA Analog output (optional)
5	Built in diagnostic indicator LED		

2.3 Status LED indicator description

The particle counter has a multi-color LED indicator (Figure 2) that indicates the status of the system. The colors indicate normal, alarm, alert or failure (refer to Table 1). The limits that activate the indicator can be changed using the central monitoring software or the setup utility (section 4.1.2 on page 17).

Table 1 LED indicator description

LED color	Indication	System status
Green	Blinking (3 second)	Normal operation sampling
	Steady	Normal operation not sampling
Red	Solid or blinking	Count alarm
Blue	Steady	Sensor failure
Blue	Flashing	Communication failure

Table 1 LED indicator description

LED color	Indication	System status
Blue	One short flash, one long flash	Flow failure

Important Note: A yellow LED can be activated from the central monitoring software to flash for count alert. If not activated by the software, the yellow LED will only turn on during startup initialization.

2.4 Theory of operation

The sensor in the MET ONE 6000P air particle counter contains a laser diode light source that illuminates an area called the view volume with intense light. Particles in the sample pass through the view volume and scatter the laser light, which is then collected through the collection optics and focused onto a photodiode. The intensity of scattered light varies depending on the size of the particle. The photodiode detects and converts the light signal to electrical pulses, the magnitude of which is proportional to the particle size. The information processed by the on-board controller electronics are then communicated to the central monitoring system through the communication electronics.

The pulses are counted and measured by electronics on a circuit board containing counting operations circuitry. Comparators are used to measure pulse height and sort the signals into channels according to size. Counting circuits count the pulses in each channel. The results indicate the particle counts for each size channel.

Calculations, if required by the operator, are performed and the data is available to the I/O circuits for the facility monitoring system software through suitable communication protocol or for peripheral devices. The firmware that controls counter operations is stored in flash memory.

Additional circuitry provides device controls for the sample flow and external accessories. Power regulation and distribution circuits control the proper levels and internal application of DC voltages.

Isokinetic sampling probes

The isokinetic sampling probe is designed for accurate sampling in laminar flow environments. The velocity of air in the probe is close to that of a typical vertical or horizontal laminar flow environment such as a clean room or clean hood. The probe will match the vertical (or horizontal) flow speed of the air in order to collect representative samples of the cleanroom laminar flow for the particle counter. Refer to [Figure 3](#) for a comparison of sampling with and without the isokinetic probe.

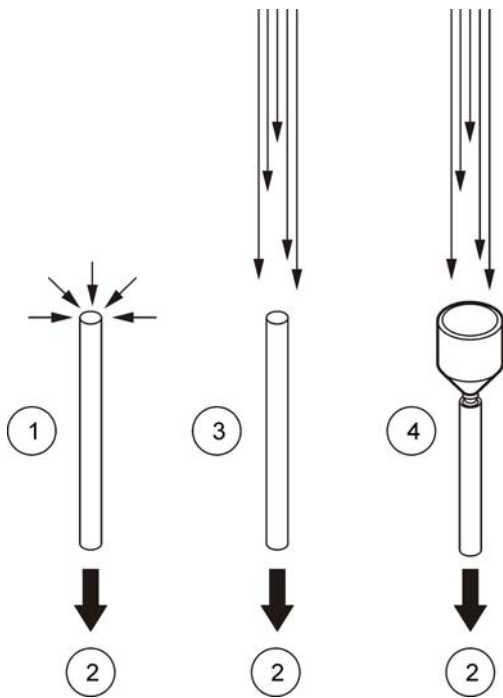


Figure 3 Isokinetic probe function

1	No probe in non-laminar air flow	3	No probe in laminar air flow—particles are missed
2	To particle counter	4	Isokinetic probe in laminar air flow—most accurate

Section 3 Installation

Important Note: Approved personnel only must install or commission the equipment.

3.1 Component list

Compare each item to the items in the shipment (Figure 4). Keep the packaging materials to use when the counter is sent to the factory for calibration. If an item is missing or damaged, contact the manufacturer (Section 8 on page 31).

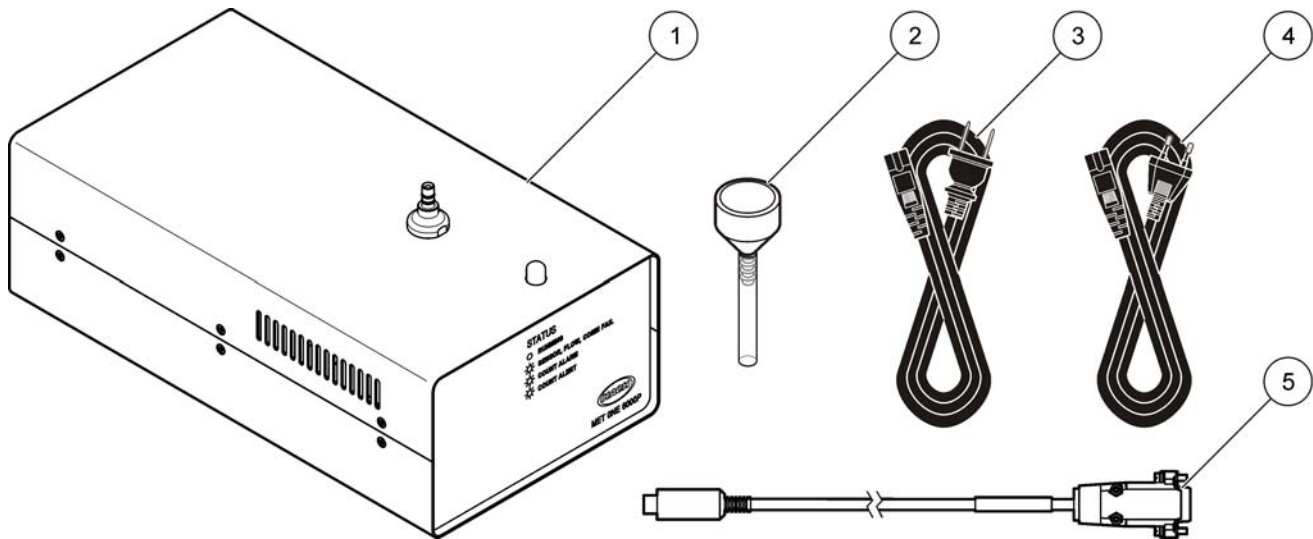


Figure 4 Instrument components¹

1	MET ONE 6000P particle counter	4	230 VAC EU power cord (AC Units)
2	Iso-kinetic probe with tube	5	Configuration cable
3	110 VAC power cord (AC units)		

¹ Not shown: user manual, purge filter, setup utility disc, 7-pin DC power/Analog connector

3.2 Installation overview

To install the particle counter, install the cables for power and communication.

3.3 Installation guidelines

Important Note: *This counter is not waterproof or resistant to VHP. All disinfecting processes require a light wipe with minimal fluid contact to the instrument. Make sure the power is unplugged prior to performance of these procedures.*

Refer to the following general guidelines during installation.

- The MET ONE 6000P is not designed to be installed in areas where frequent washdown occurs. When possible, mount the instrument directly below the sample point. Otherwise, keep the airflow in a constant downward direction.
- Make sure that the temperature in the installation area is not more than the specified temperature for the particle counter ([Specifications on page 3](#)). A high temperature decreases the life of the electronic components and laser.
- Keep the distance between the particle counter and the sampling point to a minimum. Make sure that the distance is not more than 3 m (10 ft).
- Make sure that the tubing does not bend and restrict the air flow ([section 3.3.1 on page 12](#)).
- Follow the sampling guidelines to prevent sampling errors ([3.3.2.2 on page 14](#)).

3.3.1 Tubing installation

Use hooks or cable ties to hold the tubing and prevent a bend in the tubing. A bend in the tubing can restrict the air flow and cause the following problems:

- A restriction on the sampling side can cause particles to collect on the inside of the tubing. The particles will not be counted. The collected particles can release at random, which will cause spikes in the count level.
- A restriction on the exhaust side will cause the vacuum to fall below specified levels and put a load on the pump, possibly causing premature wear and failure. The low vacuum can cause a flow alarm and low particle count.

Prerequisites:

- Sample tubing—Hytrel® Bevaline or equivalent
- Exhaust tubing—Tygon or equivalent
- Tubing hooks or cable ties

Installation procedure:

Complete the following steps to install the intake or exhaust tubing.

1. Cut the intake (sample) tubing to connect the counter to the sample probe. Keep the tube length to a minimum. Make sure that the length is not more than 6 m (20 ft) as this could affect the flow rate of the pump.

Note: *A tube length that is longer than 3 meters can cause a loss of particles > 1 µm. If a longer length is necessary, compare the results between a portable particle counter and the remote 6000P.*

2. Put a cover on the tube ends to make sure that unwanted material does not go in the tubes during installation.
3. Support the tubing with hooks or cable ties at intervals that are not more than 4 feet apart. Make sure that the tubing has a minimum bend radius of 4-inches ([Figure 5](#)).

4. Connect the intake tubing to the fitting on the top of the particle counter. Connect the other end of the tubing to the isokinetic probe.
5. Connect the exhaust tubing to the fitting on the back of the counter.

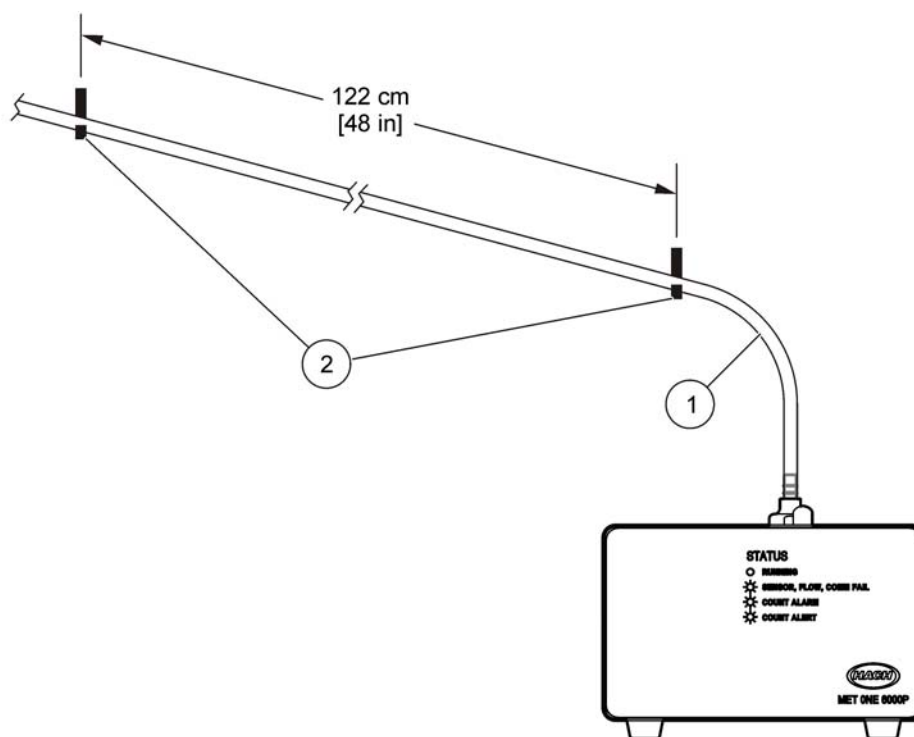


Figure 5 Tubing installation guidelines

1 Bend radius—minimum of 102 mm (4 in.)	2 Tubing supports—4 feet maximum between supports
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3.3.2 Sample probe installation

The sample probe must be installed correctly to prevent contamination of the counter and to get a representative sample of the area.

3.3.2.1 Sample probe kits

The following optional kits are available for installing the sampling probe. Refer to [Figure 6](#) and [Replacement parts and accessories on page 29](#) for order information.

- Direct mount—the probe is installed on a short piece of tubing directly on top of the Barbed Intake tubing connector nozzle on the counter. Use this probe when the particle counter can be located where the sample is collected. Use the direct mount probe to keep particle loss to a minimum.
- T-type wall bracket—the probe is installed in a wall bracket. The tubing is cut to connect the probe to the counter.
- Vertical wall mount—the probe is connected to a stainless steel tube and bracket. Use this probe for installation on equipment with stainless steel tubing. The probe can be located where the sample is collected.

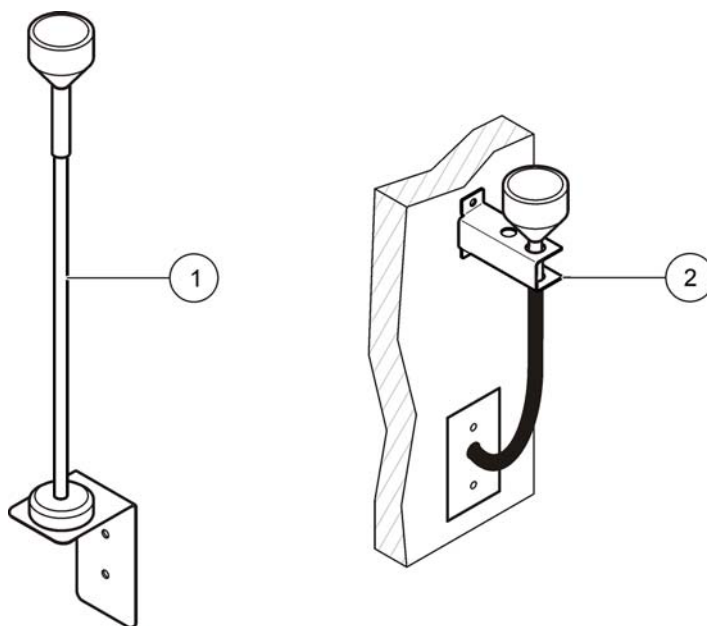


Figure 6 Probe mount options

1 Vertical wall mount	2 T-type wall bracket
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3.3.2.2 Sample probe guidelines

The position of an isokinetic probe is very important for count accuracy. Refer to the sampling guidelines and [Figure 3 on page 9](#) before installation.

Sampling guidelines

- Keep the sample probe a minimum of 12 inches from loose materials, dust, liquids and sprays.
- Keep the sample probe a minimum of 12 inches from potential contamination sources such as an instrument exhaust fan.
- Laminar flow—install at least 1 sample probe per 25 sq. ft. of surface area.
- Turbulent flow—install at least 2 sample probes per clean room.
- Position the sampling probe to face the direction of flow (refer to [Figure 3 on page 9](#)).
- Powders will contaminate the sensor and cause incorrect results or a counter failure.
- Liquids will contaminate the internal optics of the sensor and change the calibration of the counter. Liquids can be suspended in air in the form of oil droplets.
- The vapors from drying adhesives or other chemicals can permanently coat the sensor optics or other internal parts.
- All types of smoke will contaminate the sensor.
- Vapors that contain corrosives will quickly cause permanent damage to the optics or electronics of the counter.

3.4 Wiring safety information

When making any wiring connection to the instrument, obey the warnings and notes that follow. Obey all warnings and notes in the installation sections. For more safety information refer to [section 2.1 on page 5](#).

Important Note: Position the equipment so the disconnect device is easily accessed and operated.

Important Note: Always remove power to the instrument before an electrical connection is made.

Electrostatic discharge (ESD) considerations

To keep hazards and ESD risks to a minimum, remove power to the instrument when a maintenance procedure does not require power.

Internal electronic components can be damaged by static electricity. This damage can cause degraded instrument performance or instrument failure.

To prevent ESD damage to the instrument, complete the following steps:

- Before touching an electronic component, discharge static electricity from the body. Touch an earth-grounded metal surface such as the chassis of an instrument or a metal conduit or pipe.
- To keep static build-up to a minimum, avoid excessive movement. Transport static-sensitive components in anti-static containers or packaging.
- To discharge static electricity from the body 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.

3.5 Electrical installation

Refer to the following sections for the communication option that is used:

- Ethernet ([section 3.5.4 on page 15](#))
- Analog ([section 3.5.5 on page 16](#))

3.5.1 Wire preparation

Properly prepare each wire by removing the insulation on the wires by ¼ inch.

3.5.2 DC power requirements

The DC configuration requires an external power source that can supply 24 VDC to supply power to the instrument.

3.5.3 AC power requirements

The AC configuration requires use of the AC power cord supplied with the instrument.

3.5.4 Ethernet wiring

Ethernet standard 10Base-T or 100Base-T can be used. However, the facility wiring must be appropriate for the speed of the network to prevent intermittent problems from occurring. For particle counter installations, Ethernet standard 10Base-T is sufficient to transmit data and is more forgiving of installation errors.

- Length—100 meters maximum single wire length (repeaters can be used to increase the distance)
- Repeaters—4 maximum
- Connector type—RJ-45 (standard Ethernet wiring convention T-568B)

3.5.5 Analog wiring

Counters with the analog output feature send a 4-20 mA signal that is proportional to the number of counts in a given sampling time (refer to [Figure 7](#) and [Table 2](#)). A data acquisition system receives the signal. The maximum number of counts that correspond to the 20 mA signal is set using the setup utility program.

An analog instrument can have only 2 channel sizes. If the power is set to off, then all channels send an output that is < 2 mA. The channel output is < 2 mA if there is a sensor-calibration failure or flow failure and the instrument has a flow monitor installed.

Any signal excursion below 4 mA (zero count point) will result in a negative number in the data acquisition system which is an immediate indicator of a problem with the signal from the particle counter. Most 4-20 mA systems require an external loop supply. The Met One 6000P produces the loop power internally. This is true for both the AC and the DC versions. However, there must be a common reference (ground) between the instrument and the data acquisition system (pin 4 of the 7-pin connector).

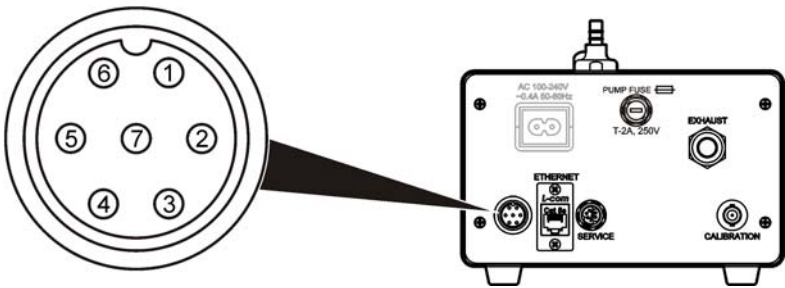


Figure 7 Unit Main DC power input and 4-20ma analog output

Table 2 Unit Main DC power input and 4-20ma analog output

Pin	Description
1	Channel 1
2	Channel 2
3	Not used
4	Power return/common ground reference
5	Not used
6	Not used
7	Unit Main Power-24 VDC

Section 4 Operation

Each particle counter must be configured before operation for parameters such as sample time and count alarm thresholds.

4.1 Configure the particle counter

A setup utility program is used to configure parameters that are stored in the particle counter. When power is applied, the counter will look for a new configuration. If a new configuration is not found, the previously saved configuration will be used.

4.1.1 Configuration setup

Each particle counter must be connected to a PC for configuration.

Prerequisites

- Service port cable, 8-pin DIN to 9-pin serial connector ([Section 7 on page 29](#))
- MET ONE 6000P setup utility program—requires PC with Windows® 2000 Professional or Windows® XP Professional

Setup

1. Make sure that Microsoft .Net Framework is installed on the PC. If not installed, open the dotnetfx.exe file on the utility program CD to install the application.

***Note:** The user must be logged on to the PC as an Administrator.*

2. Copy and paste the SetupUtility.exe file from the utility program CD to the PC.
3. Connect the particle counter to the PC.
4. Start the utility program to configure the instrument ([section 4.1.2 on page 17](#)).

4.1.2 Utility program operation

Complete the following steps to configure the particle counter.

1. Open the SetupUtility.exe file. The utility program will open (refer to [Figure 8](#)).
2. Find the **Port** field. If necessary, change the COM port to match the port on the PC that the particle counter is connected to. Click **READ INSTRUMENT**. The utility will read the data that is stored in the instrument.
3. Make sure that the data in the **Instrument Information** section is accurate. This section shows the instrument model number, communication option, firmware version and communication address (if applicable).
4. Change the parameters in the **General** section as is necessary. Refer to the parameter descriptions that follow:
 - **Count Mode** (for Modbus or FXB only)—set to differential or cumulative. The default count mode is set as cumulative.
 - **System Date/Time**—enter the current date (YYYY/MM/DD) and time (HH:MM:SS, 24-hour format).
 - **Sample Timing: Sample**—the length of time that data is collected for each sample. The default sample time is one minute (00:01:00).
 - **Sample Timing: Hold**—the length of time that data collection is stopped between samples. Use the Hold time to stop data collection during maintenance procedures. The default Hold time is 0 (00:00:00).
 - **Count Alarms**—set the number of counts for each size channel that will trigger a count alarm.

- **Sample Mode**—set to Auto.
 - **Flow Units**—set to CFM (cubic feet per minute) or LPM (liters per minute).
5. The **Diagnostics** section can be used to make sure that the wiring to an external light stack is correct. Set the **Indicator LED** to flash or not flash for one of the colors. Look for the LED on the light stack to illuminate or flash to make sure that the wiring is correct.

Note: It is not possible to save the diagnostic settings and they have no effect on the instrument operation. For a description of the LED indicators, refer to [section 2.3 on page 7](#).
 6. Change the settings for the communication protocol that is used:
 - **Analog**—set the count value for each channel that corresponds to the 4-20 mA output signal (default = 1000). Refer to [Figure 9](#).
 - **Ethernet**—refer to [section 4.2.1 on page 19](#).
 7. Click **SAVE SETTINGS** to save the settings in the instrument.

Met One Setup Utility V2.0.0.2 Copyright © Hach Company 2007-2010

Local Setup LAN Setup Data Display

Service Port Based Setup

Instrument Information

Model: 6003
Module Option: Ethernet
Firmware Version: 210
Serial: 2010082088
Sensor Flow Measurement: Yes

Diagnostics

Indicator LED ☐ Flash

☐ Yellow ☐ Blue ☐ Red ☐ Green

Ethernet

MAC: 00 : 0E : 1C : 00 : FE : EF

☐ DHCP/PIPA Config. Port: 16000

IP Address: 169.254.1.50 Subnet Mask: 255.255.0.0

Server Port: 502

Client Port: 502

Gateway: 169.254.1.19 Remote Server IP: 169.254.1.3

Ethernet Protocol: Modbus

General

Count Mode: ☒ Cumulative ☐ Differential

System Date/Time: 2010-08-20 08:44:22

Sample Timing: Sample: 00:00:10 Hold: 00:00:00

Comm Timeout: 60

Count Cycles: 0

Slave Address/Location ID: 1

Location Name: Loc 1

☐ Remote LCD

Default Settings

Count Alarms

CH1: 0
CH2: 0
CH3: 0
CH4: 0

Sample Mode

☒ Auto ☐ Manual

Flow Units

☐ CFM ☒ LPM

Analog

Full Scale: CH1: 1000, CH2: 1000, CH3: 1000, CH4: 1000

Output State: ☒ Normal ☐ Zero ☐ Span

Read Instrument

Save Settings

Port: Open COM1

Connected

Update Firmware

Quit

Figure 8 Setup utility program

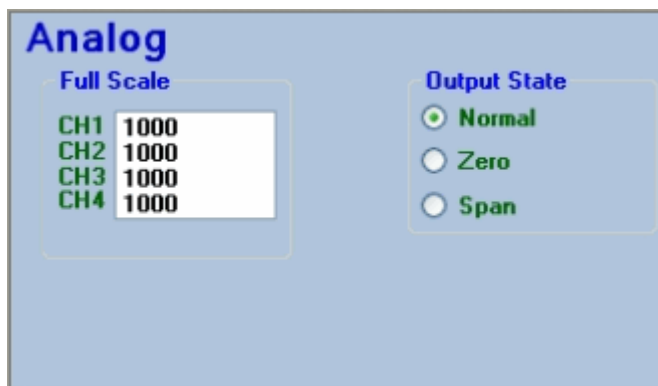


Figure 9 Channel count values

4.2 Particle counter communication

Each MET ONE 6000P particle counter is assembled with the following communications format:

- Ethernet with ModbusTCP protocol ([section 4.2.1 on page 19](#))
- Analog output (optional) ([section 4.2.2 on page 21](#))

4.2.1 Ethernet with ModbusTCP protocol

Important Note: The network should be set up by a network professional. After the network is set up, the counter can be configured through the network (operational) settings.

Refer to [Figure 10](#) and [Table 3](#) for a description of the fields for Ethernet configuration.

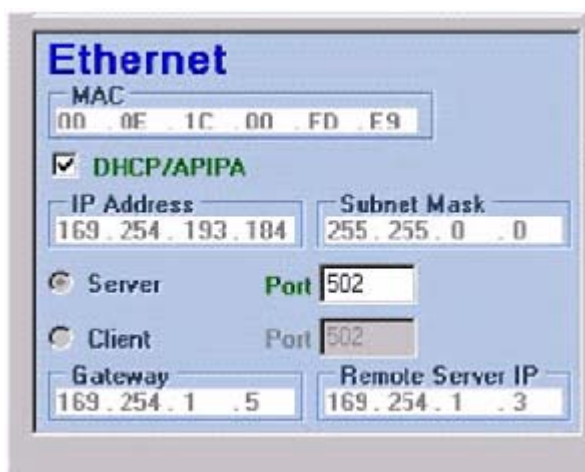


Figure 10 Ethernet section of utility program

Table 3 Ethernet field description

Field	Description	Default
MAC	Media access control: unique permanent hardware address (read-only)	Read-only
DHCP/APIPA	Enables or disables static or dynamic IP addressing by connection to a DHCP server. When enabled, the counter will get an IP address and subnet mask automatically on power up. If a DHCP server is not available, the counter will use APIPA for an IP address and subnet mask. APIPA IP address range: 169.254.0.0 to 169.254.255.255; subnet mask: 255.255.0.0 (Class B network).	Disabled
IP Address	For static IP addresses, each LAN-based instrument must have a unique IP address. Range: 169.254.0.0 to 169.254.255.255 (e.g. 169.254.180.43).	169.254.1.2
Subnet Mask	Instruments of the same type that communicate with a single software package such as FMS use the same subnet mask. Range: 0 to 255, integer only.	255.255.0.0
Server Port	ModbusTCP server listen port. Range: 0 to 65535, integer only.	502
Client Port	Not available	Disabled
Gateway	Router or access point to another network	169.254.1.5
Remote Server IP	Not available	Disabled

4.2.1.1 LAN setup

For configuration through a network, only the LAN settings can be changed. All other settings must be changed through local setup by direct connection to the service port on the counter or through a ModbusTCP connection.

1. In the utility program, select **LAN SETUP**. The LAN Based Setup window will be shown ([Figure 11](#)). The software will search for LAN instruments.
2. If LAN instruments are found, the instruments will be listed as shown in [Figure 11](#). Select an instrument to show the LAN Instrument Settings.
3. Change the instrument settings if necessary. Refer to [Figure 10](#) and [Table 3](#) for a description of the settings. When configured as necessary, click **SAVE SETTINGS**.
4. Click the Port field drop down arrow and select TCP/IP.

A ModbusTCP connection can be made where all the Modbus registers are available. The user can then access all configuration options in the Modbus register map (refer to [Appendix A on page 35](#)).

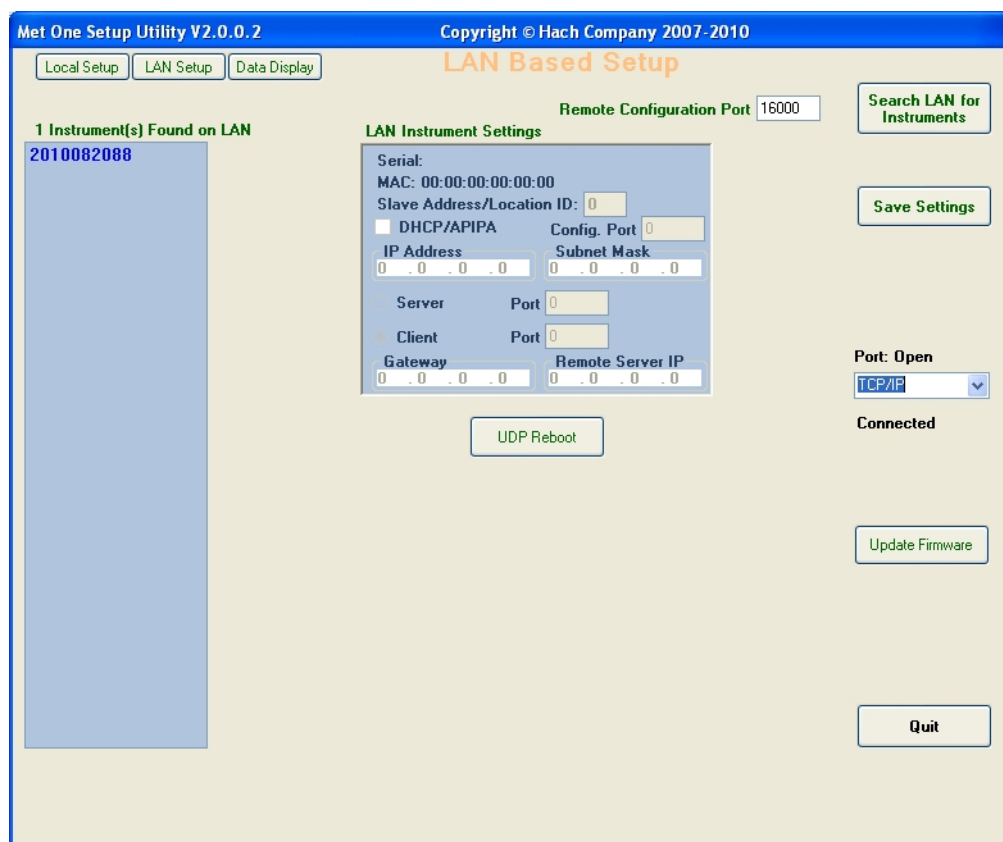


Figure 11 LAN setup for Ethernet units

Error messages

If an error message such as “Invalid IP setting” is shown, refer to [Table 3](#) to find the values that can be used. Enter a value in the range for the setting.

4.2.2 Analog output

The analog unit sends a 4–20 mA signal that is proportional to the number of particles that are counted in a given sampling time. A data acquisition system installed by the user and connected to an output channel of the analog unit receives the signal. The 4–20 mA output current is scaled for a range between zero and a maximum count set by the user ([Figure 12](#)).

For test and setup purposes, the setup utility can create set signal outputs. The output options and corresponding output results are given in [Table 4](#).

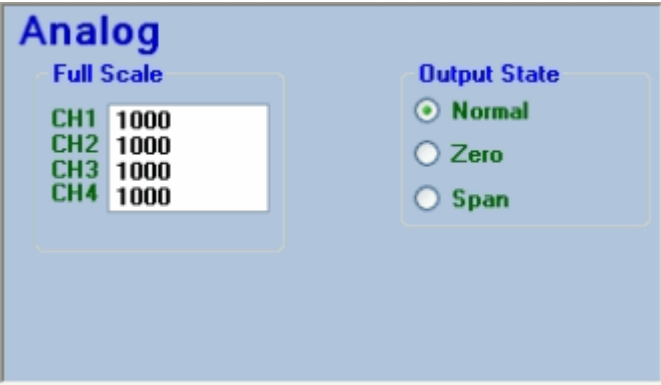


Figure 12 Channel count values

Table 4 Set signal outputs

Signal Output Option	Output Current
Zero	4 mA
Span	20 mA
Normal	Regular operation

4.2.3 Testing analog output

Use a set of load resistors with 0.1% accuracy and at least ¼ watt capability. Typically values of 100, 250 or 500 ohms are used.

For 100 ohms:

- a. 4 mA output will create a 0.4 volt output +/- 0.01 volts
- b. 20 mA output will create a 2.0 volt output +/- 0.01 volts
- c. A fault condition for FLOW or SENSOR/CAL will cause a value close to 0 volts

For 250 ohms:

- a. 4 mA output will create a 1 volt output +/- 0.01 volts
- b. 20 mA output will create a 5 volt output +/- 0.01 volts
- c. A fault condition for FLOW or SENSOR/CAL will cause a value close to 0 volts

For 500 ohms:

- a. 4 mA output will create a 2 volt output +/- 0.01 volts
- b. 20 mA output will create a 10 volt output +/- 0.01 volts
- c. A fault condition for FLOW or SENSOR/CAL will cause a value close to 0 volts

4.3 Firmware update

Use the utility program to update the instrument with a new version of firmware.

Important notes:

- Power loss during a firmware update can cause serious problems with the instrument. Refer to [Firmware update error on page 24](#).

- LAN firmware updates require bootloader V1.3 or greater. If bootloader V1.3 is not already installed (LAN firmware update fails), the bootloader must be updated to V1.3 using the Service Port. After the bootloader is installed, the application firmware can be uploaded via LAN.
- A TCP/IP connection is not necessary for the LAN update. Just make sure there is a connection to the LAN and that the counter is selected in the instrument list on the LAN setup tab.

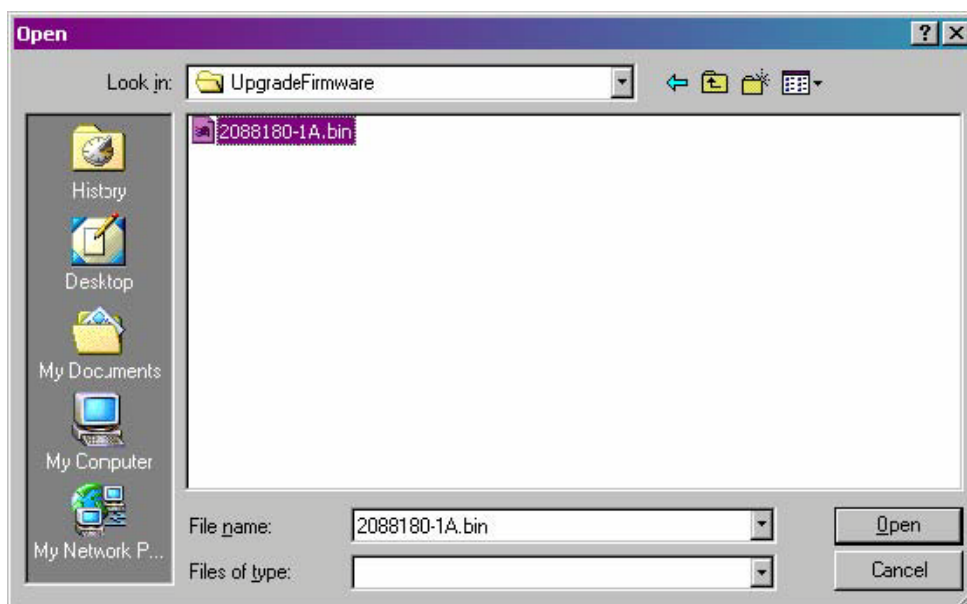
To install the firmware on the particle counter, complete the steps that follow.

1. Open the 6000P Setup Utility program.

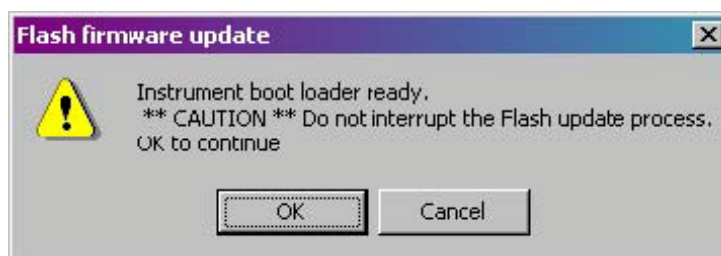
Note: Verify the Firmware Version shown in the Instrument Information section of the Setup Utility is Version 2.11 or newer. Also verify that the Setup Utility is version 2.0.0.4 or newer. Consult the factory for other versions.

Note: Firmware updates can be done using either the service port or over a LAN connection. When using a LAN, establish TCP/IP, then:

2. Click **UPDATE FIRMWARE**. A window will open for file selection.



3. Select the file that contains the firmware update information and click **OPEN**. A window will open to indicate that the instrument is ready to receive the update.



4. Click **OK**. The instrument update will start. The update status will show below the **UPDATE FIRMWARE** button. The green LED on the counter will flash to indicate update activity. A confirmation message will be shown when the update is complete.

Firmware update error

If an error message is shown during the update, make sure that the instrument has power and that the instrument is connected to the correct port on the PC.



Power failure during update

If a power failure occurred during the update, complete the following procedure.

1. Complete steps [1](#) to [3](#) in [section 4.3](#).
2. When the message "Waiting for instrument reply" is shown, remove and connect the terminal connector on the counter. The instrument power must be applied within 30 seconds of opening the firmware file.

If the update fails again, the instrument must be sent to the factory for repair.

Section 5 Maintenance

Important Note: Only qualified personnel should perform the tasks described in this section of the manual. Do not disassemble the particle counter for maintenance. If the internal components require cleaning, contact the manufacturer.

5.1 Maintenance schedule

Complete the maintenance tasks according to the schedule in [Table 5](#) to keep the particle counter operating efficiently. The maintenance tasks are described in the following sections.

Table 5 Maintenance schedule

Maintenance task	As needed	6 months	Annually
Calibrate			X
Clean instrument	X		
Inspect sample tubing		X	
Purge	X		
Wipe down	X		

5.2 Cleaning the instrument



Caution: Remove power to the instrument before cleaning.

Important Note: Never touch the particle counter directly with liquid or VHP stream. When liquid solutions enter the counter flow path or electronics they damage the sensor. Do not allow disinfecting chemical vapor to enter the counter enclosure and come in contact with the counter electronics. For disinfecting purposes, use a wipe-down procedure.

5.2.1 Wipe down

Wipe the external surface with a soft cloth lightly moistened with isopropyl alcohol (IPA). The isokinetic probes can be autoclaved for cleaning.

5.2.2 Zero counting

Zero counting is a process for removing contaminants such as particles, lint, or dust from the inside of the counter. Zero counting uses a near-absolute filter to block any external particles from entering the counter. Over time, particles are removed from the inlet tube and other internal areas and counted. When the count reaches zero, the counter is considered clean.

Prerequisites:

- Standard purge filter assembly (refer to [Replacement parts and accessories on page 29](#)).

Procedure:

Perform zero counting as follows:

1. Attach a standard purge filter assembly to the sensor inlet tube.
2. Start the count cycle and run for at least 30 minutes.
3. Start sampling data in 5-minute intervals and continue until the count reaches zero.
4. When the count is zero and no alarms are on, the counter is functioning correctly. If the count does not reach zero after nine or ten 5-minute sampling periods, purge the sensor overnight.

5.2.3 Purging

Purging is an extension of zero counting ([section 5.2.2](#)), running as long as is necessary to achieve zero count results, often for 24 hours. Purging is usually done before a test to make sure there is a proper baseline reference for the counter.

1. Cut off approximately one inch of the inlet tubing so that any stretched or scored section is removed for a good seal.
2. Attach a standard purge filter assembly to the sensor inlet tube.
3. Allow the counter to operate for 24 hours. If a zero count is not reached after 24 hours, inspect the sample tubing for contamination and change if necessary.
4. Allow the instrument to run for 15 minutes with the purge filter assembly attached. Take a 5 minute sample and record the results. A passing condition is 0-1 count in the 5 minute sample. Repeat for 3 cycles as needed. If the instrument does not pass this purge process, please contact the Technical support team for assistance.

For further help, contact an authorized service center.

5.3 Tubing replacement

Replace the inlet tubing (from the counter to the isokinetic probe) regularly to avoid organic growth or inorganic particle contamination on the tube walls. Such contamination may result in false high particle counts. Tubing of typical FMS installations in life science and pharmaceutical manufacturing cleanrooms are recommended for replacement once every year.

5.4 Calibration

The MET ONE 6000P particle counter must be returned to the service center for calibration ([section 8.1 on page 31](#)). On-site service and calibration is available through a service contract or on demand. The manufacturer also offers service contracts for routine calibration needs. Please contact your sales representative for available service contract options.

To remove the instrument from the clean room for calibration/repair services:

1. Unplug the connectors to disconnect the wiring.
2. Disconnect the inlet and exhaust tubing from the unit.

5.5 Fuse Replacement

Important Note: Disconnect power to the instrument before changing the fuse.

1. Locate the fuse holder located on the rear panel (refer to [Figure 2 on page 7](#)).
2. With a flat head screwdriver, push the fuse holder cap in to the fuse holder.
3. With pressure applied to the cap, turn the screw driver counterclockwise.
4. Remove the old fuse and put a new T-2A, 250V fuse in place.
5. With the screw driver, push the fuse holder cap in to the fuse holder.
6. With pressure applied to the cap, turn the screw driver clockwise to secure the cap.

Section 6 Troubleshooting

6.1 Troubleshooting table

Use [Table 6](#) for help with problems that may occur with the system.

Table 6 Troubleshooting table

Problem	Possible causes	Solution
Communication failure	Incorrect wiring	Examine the system for loose or incorrect connections
	Unit not configured	Configure the counter using the setup utility program
Flow failure	Cap placed on inlet probe during wash down not removed.	Remove cap from probe
	Kink in tubing	Examine both sample and vacuum tubing for bends that may restrict the air flow
	Leak	Examine the vacuum line and fittings for leaks in the system
	Vacuum pump failure	Repair the vacuum pump
High count alarm	High counts in room	Troubleshoot the process to determine the source of the counts
	Probe placed near source of contamination	Reposition probe
	Potential sensor contamination	1 Use a portable counter to confirm the counts from the remote counter. 2 If the count is similar, the problem is with the process and not the counter. If the count is lower, use a zero count filter to clean the internal components. 3 If the count is still high, contact the nearest service center for repair.
Sensor failure	Contamination	Purge the counter using the zero count filter (section 5.2.3 on page 26)

Section 7 Replacement parts and accessories

7.1 Parts and accessories

Description	Catalog Number
4 size channel option	2088601-15
AC power cordset, 115V	VP623501
AC power cordset, 230V	VP623500
Bracket, to mount external LED light stack with isokinetic probe	2088480
Bracket, wall, for external LED light stack	2088482
Bracket, wall, type T, for isokinetic probe	2082644-3
Cable, for external stainless steel LED light stack, 4 m with connector	460-400-7004
Cable, service port	2088379-01
DC input and/or Analog input connector	410-400-1507
Filter, zero counting, 1 cfm ¼ in. tube	203813-3
Fuse, T-2A 250V	590815
Inlet nozzle, ⅜"	2088594
Light stack, stainless steel, external LED	2088396-01
Probe, extended—vertical wall mount, 1.0 cfm, 12"	2080999-3
Probe, extended—vertical wall mount, 1.0 cfm, 16"	2080999-4
Probe, extended—vertical wall mount with bracket for indicator light stack, 1.0 cfm, 12"	2080999-9
Probe, extended—vertical wall mount with bracket for indicator light stack, 1.0 cfm, 16"	2080999-10
Probe, isokinetic 1.0 cfm, 1/4"	2082646-2
Probe, isokinetic 1.0 cfm, ⅜"	2084148-02
Tubing, ¼-inch ID	960200
Tubing, ⅜-inch ID	960380

8.1 Return procedures

The MET ONE 6000P series Particle Counter has a one-year calibration cycle. Each of the MET ONE 6000P models must be returned to an authorized service center for calibration after one year of the date of calibration, listed on the decal on the back of the models. However, on-site service is available for many locations and should be the preferred calibration solution. Please check with your Hach representative if on-site calibration service option is available for your facility location.

To return the MET ONE 6000P series Particle Counters for repair or calibration, first obtain a returned material authorization number (RA#). The RA# number is necessary for any instrument that requires repair or calibration by an authorized service center. Include the RA# number on the shipping label when the instrument is returned.

For the most up-to-date RA# process information, including copies of all required forms, call Hach at 800.866.7889 or +1 541.472.6500.

If you have a service contract, contact your Hach service representative. To return an instrument for credit, please contact the local sales representative.

8.2 Technical support

Technical Support Engineers are available to provide advice and recommendations for applications, product operation, measurement specifications, hardware and software, factory and customer site training.

Please provide name, company, phone number, fax number, model number, serial number and comment or question.

Call +1 541.472.6500
Toll Free 800.866.7889 (US/CA)
Fax +1 (541) 472-6180
6:00 AM to 4:30 PM Pacific Time
Monday through Friday
Email: TechSupportGP@hachultra.com

Section 9 Limited warranty

Hach warrants this instrument to be free of defects in materials and workmanship for a period of two (2) years from the shipping date. If any instrument covered under this warranty proves defective during this period, Hach will, at its option, either repair the defective product without charge for parts and labor, or provide an equivalent replacement in exchange for the defective product.

Hach warrants the Long Life Laser™ diode to be free of defects in materials and workmanship for a period of three (3) years from the shipping date. If any diode covered under this warranty proves defective during this period, Hach 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 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 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 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 WITH RESPECT TO THIS INSTRUMENT IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED. HACH AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR NON-CONTRACTUAL PURPOSE. HACH RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. HACH AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES EVEN IF HACH OR ITS VENDORS HAS BEEN GIVEN ADVANCED NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

Appendix A Modbus register maps

Important Note: The Modbus register tables in this section may become updated. Contact Hach for updated tables.

This section describes the Modbus registers that are used to communicate with Met One 6000 series particle counters. These registers are applicable to units that have RS485 serial output with Modbus RTU protocol or Ethernet output with ModbusTCP protocol. Detailed descriptions of the Modbus registers are available from the manufacturer.

- Each register is 16-bits wide (2 bytes). Some values use more than one sequential register (e.g., model number = 20 bytes, which is 10 registers long).
- Access codes **R/W/P** = read/write/protected.

A.1 Identity information

The identity block contains basic information about the instrument (refer to [Table 7](#)). These registers can only be configured at the factory and by qualified service personnel.

Table 7 Modbus register for identity information

Address	Register description	Access	Size (bytes)	Data format
0–14	Manufacturer ID ¹	R/P	30	Printable ASCII (0x20–0x7E)
15–24	Model number ¹	R/P	20	Printable ASCII (0x20–0x7E)
25–29	Serial number ¹	R/P	10	Printable ASCII (0x20–0x7E)
30–33	Sensor ID ¹	R/P	8	Printable ASCII (0x20–0x7E)
34	Last calibration date—year	R/P	2	YY (0–9999)
35	Last calibration date—month, day	R/P	2	MD (1–12, 1–31)
36	Calibration due date—year	R/P	2	YY (0–9999)
37	Calibration due date—month/day	R/P	2	MD (1–12, 1–31)
38	Firmware version (counter) ^{2, 3}	R	2	100 = V1.00
39	Hardware version ²	R	2	100 = V1.00
40	Reserved		2	
41–99	Expansion			

¹ Each 16-bit register contains two 8-bit characters. For example, 0x3838, 0x3031 and 0x0000 for model number = "8801" (upper byte of first address = 0x38, which is ASCII '8', and lower byte = 0x38, which is ASCII '8'). A register byte value of 0x00 or word value of 0x0000 indicates the end of the value.

² The version is for the particle counter and not the Ethernet.

³ If the value is 1–26, then the value represents legacy firmware revision A–Z (e.g. a value of 3 represents revision C). A decimal value of 101 indicates firmware version 1.01.

A.2 Counter configuration

The configuration data block (Table 8) has parameters that directly affect the sampling characteristics of the instrument. If a sample is active, any modifications to these registers will restart the current sample.

Table 8 Configuration information

Address	Register description	Access	Size (bytes)	Data format
100	Modbus slave address	R/W	2	1–247 (0 = broadcast)
101–102	Reserved			
103	Sample mode	R/W	2	1 = auto, 2 = manual
104	Sample control	R/W	2	1 = run, 2 = stop
105	Sample cycles	R/W	2	1–100, 0 = infinite
106	Sample period—hours	R/W	2	H (0–23)
107	Sample period—minutes and seconds	R/W	2	MS (0–59:0–59)
108	Hold period—hours	R/W	2	H (0–23)
109	Hold period—minutes and seconds	R/W	2	MS (0–59:0–59)
110	Delay period—hours	R/W	2	H (0–23)
111	Delay period—minutes and seconds	R/W	2	MS (0–59:0–59)
112	UTC—year	R/W	2	YYYY (2000–2105)
113	UTC—month and day	R/W	2	MD (1–12, 1–31)
114	UTC—hour	R/W	2	H (0–23)
115	UTC—minute and second	R/W	2	MS (0–59, 0–59)
116–119	Reserved			
120	Active mode	R/W	2	1 = active, 2 = inactive
121–126	Reserved			
127	Location name	R/W	32	Double byte characters (16)
143	Concentration mode	R/W	2	0 = counts, 1 = counts/ft ³ , 2 = counts/L, 3 = counts/m ³
144	Count mode	R/W	2	0 = cumulative, 1 = differential
145	Flow units	R/W	2	0 = Lpm, 1 = cfm
146	Communication timeout—seconds	R/W	2	12 hour maximum 1–43200 seconds, 0 to disable
147	Protocol selection for RS485/RS232	R/W	2	FX (0), Modbus (1), 4800 Emul (2), FXB1
148	Channel 2 pulse out selection	R/W	2	Count channel 2, 3 and 4
149	Light/LED indicator flash	R/W	2	0 = steady, 1 = flashing
150	Red light/LED indicator	R/W	2	0 = off, 1 = on
151	Green light/LED indicator	R/W	2	0 = off, 1 = on
152	Yellow light/LED indicator	R/W	2	0 = off, 1 = on
153	Blue light/LED indicator	R/W	2	0 = off, 1 = on
154	Analog channel 1 full scale	R/W	4	0–4,294,967,295
156	Analog channel 2 full scale	R/W	4	0–4,294,967,295
158	Analog channel 3 full scale	R/W	4	0–4,294,967,295
160	Analog channel 4 full scale	R/W	4	0–4,294,967,295
162	Remote LCD	R/W	2	0 = disable, 1 = enable
163	Protocol selection for Ethernet/WiFi	R/W	2	FX(0), Modbus (1), 4800 Emul (2), FXB1 (3)

Table 8 Configuration information (continued)

Address	Register description	Access	Size (bytes)	Data format
165	Internal Pump	R/W	2	0 = not installed (default), 1 = installed
166–199	Expansion			

A.3 Data label

[Table 9](#) provides a register for sample and analog data labels.

Table 9 Count bin data labels

Address	Register description	Access	Size (bytes)	Data format
200	Size 1 label	R/P	4	0.001–999 microns
202	Size 2 label	R/P	4	0.001–999 microns
204	Size 3 label	R/P	4	0.001–999 microns
206	Size 4 label	R/P	4	0.001–999 microns
208–231	Reserved			
232	Analog input 1 label	R	4	CAL
234	Analog input 2 label	R	4	TMP
236	Analog input 3 label	R	4	RH
238	Analog input 4 label	R	4	FLO
240–251	Reserved			
252–299	Expansion			

A.4 Sample data

Sample data records ([Table 10](#)) are updated at each polled interval regardless of the sample and hold times in the configuration registers. If real-time data is not required, use the buffered records (address 500+).

Table 10 Sample data

Address	Register description	Access	Size (bytes)	Notes
300	Sample UTC timestamp—year	R	2	YYYY (2000–9999)
301	Sample UTC timestamp—month/day	R	2	MD (1–12, 1–31)
302	Sample UTC timestamp—hour	R	2	H (0–23)
303	Sample UTC timestamp—minute/second	R	2	MS (0–59, 0–59)
304	Sample period—hours	R	2	H (0–23)
305	Sample period—minutes/seconds	R	2	MS (0–59, 0–59)
306	Modbus address	R	2	Integer (1–247)
307–308	Sample volume	R	4	
309	Sample status. Refer to Table 11 .	R	2	Bit wise mapped
310	Reserved			
311	Size 1 counts	R	4	0–4,294,967,295
313	Size 2 counts	R	4	0–4,294,967,295
315	Size 3 counts	R	4	0–4,294,967,295
317	Size 4 counts	R	4	0–4,294,967,295
319–342	Reserved			
343	Analog channel 1 (CAL)	R	2	mV

Table 10 Sample data (continued)

Address	Register description	Access	Size (bytes)	Notes
344	Analog channel 2 (temperature)	R	2	0.1 °C external probe only
345	Analog channel 5 (relative humidity)	R	2	0.1% RH external probe only
346	Analog channel 6 (flow)	R	2	100 = 0.100 cfm; 1000 = 1.000 cfm
347–352	Reserved			
353	Location name	R	32	Double byte characters (16)
385–399	Expansion			

Sample alarm status

Registers 309 and 509, sample status and buffered sample status, contain the sample alarm status (refer to [Table 11](#) for an example). These alarms are bit-wise mapped.

Table 11 Register 309 sample alarm status

Address	Status
0	Calibration
1	Flow
2	Temperature
3	Relative humidity
4	Air velocity
5	System alarm
6	Count alarm
7	Reserved
8	Channel 1 count alarm
9	Channel 2 count alarm
10	Channel 3 count alarm
11	Channel 4 count alarm
12–15	Reserved

A.5 Buffered sample data

[Table 12](#) shows the offline buffered sample record access control.

Table 12 Buffered sample record control

Address	Register description	Access	Size (bytes)	Data format
400	Number of buffered sample records	R	2	0–1000
401	Retrieve buffered record Table 13	W	2	1
402	Buffered record ready	R	2	1 = record available
403	Erase buffer	W	2	1 = start
404–498	Expansion			
499	Auto download	R/W	2	0 = Disable, 1 = Enable

A.6 Buffered record block

The buffered record block ([Table 13](#)) gives a remote application the ability to access data that is stored in the instrument. The block is continuously updated with new sample data.

Table 13 Buffered record

Address	Register description	Access	Size (bytes)	Data format
500	Buffered UTC timestamp—year	R	2	YYYY (2000–9999)
501	Buffered UTC timestamp—month/day	R	2	MD (1–12, 1–31)
502	Buffered UTC timestamp—hour	R	2	H (0–23)
503	Buffered UTC timestamp—minute/second	R	2	MS (0–59, 0–59)
504	Buffered sample period—hours	R	2	H (0–23)
505	Buffered sample period—minutes/seconds	R	2	MS (0–59, 0–59)
506	Buffered Modbus address	R	2	Integer (1–247)
507–508	Buffered sample volume	R	4	
509	Buffered sample status ¹	R	4	Bitmap
511	Buffered size 1 counts	R	4	0–4,294,967,29
513	Buffered size 2 counts	R	4	0–4,294,967,295
515	Buffered size 3 counts	R	4	0–4,294,967,295
517	Buffered size 4 counts	R	4	0–4,294,967,295
519–542	Reserved			
543	Buffered analog channel 1(CAL)	R	2	mV
544	Buffered analog channel 4 (external temp)	R	2	0.1°C external probe only
545	Buffered analog channel 5 (RH)	R	2	0.1% RH external probe only
546	Buffered analog channel 6 (flow)	R	2	100 = 0.100 cfm, 1000 = 1.000 cfm
547–552	Reserved			
553	Location name	R	32	Double byte characters (16)
585–599	Expansion			

¹ Contains sample alarm status. Refer to [Table 11 on page 38](#).

A.7 Sample mode parameters

The sample mode parameters register ([Table 14](#)) defines basic counting characteristics of a sample. Any updates to these registers will restart any active sample sequences.

Table 14 Sample mode parameters

Address	Register description	Access	Size (bytes)	Data format
600	Number of count bins	R	2	1–4
601–616	Reserved			
617	Count bin 1 limit	R/W	4	0–4,294,967,295
619	Count bin 2 limit	R/W	4	0–4,294,967,295
621	Count bin 3 limit	R/W	4	0–4,294,967,295
623	Count bin 4 limit	R/W	4	0–4,294,967,295
625–653	Reserved			
654	ADC multiplier	R/P	2	Factory calibration only
655	DAC multiplier 1	R/P	2	Factory calibration only
656	DAC multiplier 2	R/P	2	Factory calibration only
657	DAC offset 1	R/P	2	Factory calibration only
658	DAC offset 2	R/P	2	Factory calibration only
659	DAC offset 3	R/P	2	Factory calibration only
660	DAC offset 4	R/P	2	Factory calibration only
661	Flow offset	R/P	2	Factory calibration only
662	ADC offset	R/P	2	Factory calibration only
664	ADAC Multiplier	P	2	Factory calibration only
665	ADAC Offset	P	2	Factory calibration only
666	Unused R		2	Factory calibration only
667	ADAC Output Mode	R/W	2	0-5, 0 = normal (default)
668–699	Expansion			

A.8 Diagnostic data

[Table 15](#) shows the Diagnostics data register that is updated at a 30 second (default) rate or at the conclusion of any Test mode diagnostics.

Table 15 Diagnostics data record

Address	Register description	Access	Size (bytes)	Data format
700–705	Reserved			
706	+5 VDC	R	2	mV
707	+3.3 VDC	R	2	mV
708	+5 VA	R	2	mV
709–714	Reserved			
715	Laser calibration	R	2	mV
716	Laser current	R	2	mA
717–723	Reserved			
724	Error condition ¹	R	2	System specific (e.g. sensor error)
725–749	Expansion			

¹ Set bits indicate a failure.

A.9 Sensor calibration information

The sensor calibration information register is used for instruments that can electronically adjust the calibration circuitry or algorithm. The sensor information can be read from a plug and play sensor or can be loaded at the factory or by qualified field personnel.

Table 16 Sensor calibration information

Address	Register description	Access	Size (bytes)	Data format
900–903	Reserved			
904–943	Sensor calibration curve sizes	R/P	80	Size (20 points maximum) format: XXX.XXX
944–983	Sensor calibration curve voltages	R/P	80	mV (20 points maximum) format: XXXX.XX
984–985	Reserved			
986	Nominal flow	R/P	2	Range: 1–10000, 1 = 0.01cfm
987–996	Reserved			
997	Sensor type	R/P	2	1 = liquid, 2 = air
998–1089	Reserved			
1090	Sensor flow measurement present	R/P	2	0 = not present, 1 = present
1091–1099	Expansion			

A.10 Miscellaneous functions

[Table 17](#) shows the register blocks to perform a specialized action, such as resetting the instrument (hardware reset) and saving all instrument configuration parameters to non-volatile EEPROM memory.

Table 17 Miscellaneous functions

Address	Register description	Access	Size (bytes)	Data format
1100	Set Write access password	W	2	
1101	Module reset	W	2	1 = reset
1102	Reserved			
1103	Save all settings	W	2	1 = save
1104	Default settings	W	2	1 = default
1105–1199	Expansion			

A.11 Application-specific information

[Table 18](#) shows application specific register blocks.

Table 18 Application specific

Address	Register description	Access	Size (bytes)	Data format
1200	Run status	R	2	0=Delay, 1=Start, 2= Stop, 3=Count, 4=Hold
1201–1259	Reserved			
1260–1299	Expansion			

A.12 Ethernet configuration

[Table 19](#) shows the register blocks for counters that have an Ethernet module. These settings will take affect when the settings have been saved and when the counter has been reset (refer to registers [1101](#) and [1103](#) in [section A.10](#))

Table 19 Ethernet configuration

Address	Register Description	Access	Size (bytes)	Notes
1300	Ethernet MAC address	R	6 bytes	00-0E-1C-XX-XX-XX = default
1303	DCHP enabled	R/W	2 bytes	0 = disabled, 1 = enabled
1304	IP address	R/W	4 bytes	169.254.1.2 = default
1306	Subnet mask	R/W	4 bytes	255.255.0.0 (class B)
1308	Gateway	R/W	4 bytes	169.254.1.5 = default
1310	Modbus server port	R/W	2 bytes	502 = default
1311	Server	R/W	2 bytes	Not active—server: 1 (default), client: 0
1312	Remote Modbus server port (client port)	R/W	2 bytes	Not active—reserved for client apps.
1313	Remote Modbus server IP address	R/W	4 bytes	Not active—reserved for client apps.
1315–1399	Expansion			

A.13 Last sample data

Table 20 shows the register block mirrors of the real-time and buffered data register blocks with different data. This block is updated with the most recent data at the end of each sample. Data remains available until the next sample. The update interval is based on the sample and hold time programmed into the configuration registers ([Table 8 Configuration information on page 36](#)).

Table 20 Last sample data

Address	Register Description	Access	Size (bytes)	Notes
1500	Sample UTC timestamp—year	R	2	YYYY (2000–9999)
1501	Sample UTC timestamp—month/day	R	2	MD (1–12, 1–31)
1502	Sample UTC timestamp—hour	R	2	H (0–23)
1503	Sample UTC timestamp—minute/second	R	2	MS (0–59, 0–59)
1504	Sample period—hours	R	2	H (0–23)
1505	Sample period—minutes/seconds	R	2	MS (0–59, 0–59)
1506	Modbus address	R	2	Integer (1–247)
1507–1508	Sample volume	R	4	
1509	Sample status	R	2	Bitmap
1510	Reserved			
1511	Size 1 counts	R	4	0–4,294,967,295
1513	Size 2 counts	R	4	0–4,294,967,295
1515	Size 3 counts	R	4	0–4,294,967,295
1517	Size 4 counts	R	4	0–4,294,967,295
1519–1542	Reserved			
1543	Analog channel 1 (Flow)	R	2	mV
1544	Analog channel 2 (Temperature)	R	2	0.1 °C external probe only
1545	Analog channel 3 (Relative humidity)	R	2	0.1% RH external probe only
1546	Analog channel 4	R	2	
1547	Analog channel 5 (CAL)	R	2	mV
1548–1552	Reserved			
1553	Location name	R	32	Double byte characters (16)
1585–1599	Expansion			

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