PEWA
Messtechnik GmbH

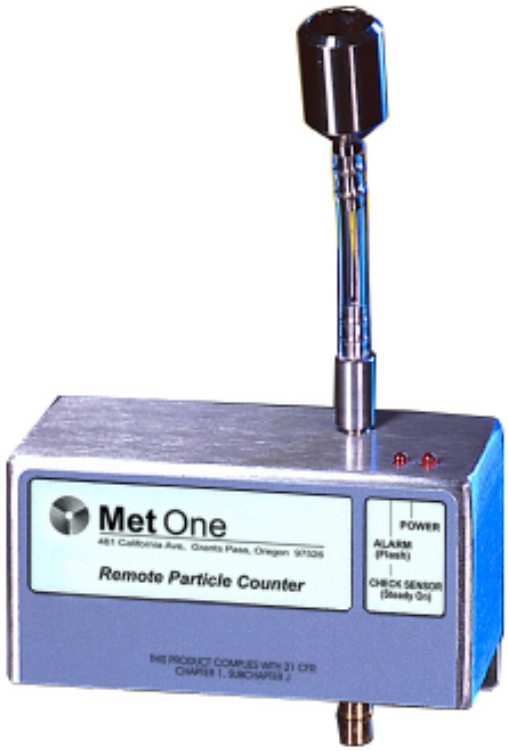
Weidenweg 21
58239 Schwerte

Tel.: 02304-96109-0
Fax: 02304-96109-88
E-Mail: info@pewa.de
Homepage : www.pewa .de

Model R4903/ R4905/R4915 Remote Airborne Particle Counter

Operating Guide

Met One



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FAX ..... (541) 479-3057

Phone..... (541) 479-1248

Online..... www.particle.com

Major revisions of this manual will be indicated by a new revision level. Minor corrections or additions may be made at any time without changing the revision level. Changes made to this manual causing the new revision are documented under "Manual Backdating" at the back of this manual.

Published September, 1995.

Note

Shipping the sensor out of the U.S.A. may require an export license. Contact the factory for more information.

Manual PN 701130

REV	DESCR./ E.O. NUMBER	DATE
A	initial release	9/95
B	ECO 8303	11/01

Contents

Safety

Safety Considerations

Warnings and cautions are used throughout this manual. Familiarize yourself with the meaning of a warning and a caution before operating the particle sensor. A warning appears before the procedure or step to which it applies. A caution appears in the narrow column and next to the step to which it applies. Take extreme care when doing any procedures preceded by or containing a warning.

WARNING

A WARNING indicates a hazard for you. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or possibly death. A WARNING appears directly above the step to which it applies. Do not proceed beyond a WARNING until the indicated conditions are fully understood and met.

CAUTION

A CAUTION indicates a hazard for the particle counter. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to the counter. A CAUTION appears in the column to the left or right of the step to which it applies. Do not proceed beyond a CAUTION symbol until the indicated conditions are fully understood and met.

Note

A Note highlights an important operating procedure or other important information not involving safety of equipment or personnel.

Additional safety information is contained in the "Particle Counters For Air" manual.

Safety

There are several classifications of Warnings defined as follows:

Laser — pertaining to exposure to visible or invisible laser radiation
Electrostatic — pertaining to electrostatic discharge

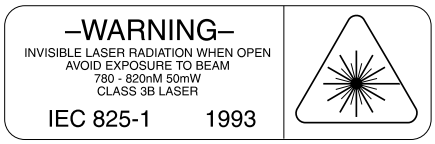
Laser Safety Information

This product 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. Service procedures on the sensor can result in exposure to invisible radiation. Service should be performed only by factory-authorized personnel.

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".

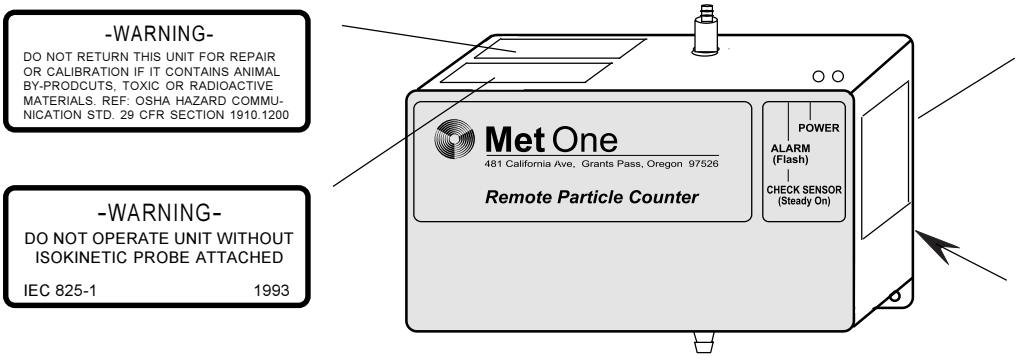
WARNING

The use of controls, adjustments, or performance of procedures other than those specified within this manual may result in exposure to invisible (infrared) radiation that can quickly cause blindness.

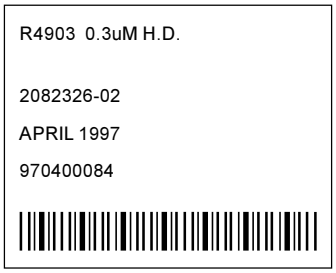


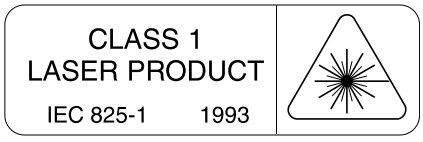
(Located inside on sensor mounting plate)

Several labels are attached to the unit for your awareness. Reproductions of the labels are shown below:



Sample of Identification Label:





(Located on rear panel of unit)

Additional safety information is contained in "Particle Counters For Air" manual you also received. For further technical assistance, contact our Technical Support Department at the location shown on the back cover of this manual or e-mail us at *www.pacsciinst.com*.

Safety

Electrostatic Safety Information

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all service or maintenance work should be done at a static-safe work station. A static-safe work station 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 buildup of static charge

WARNING

Using a wrist strap without an isolation resistor will increase the severity of an electrical shock.

Introduction

This operating guide introduces you to the remote airborne-particle counter. Also included in this guide are instructions for inspecting, using, and maintaining the counter. Any changes of counter operation due to design changes are covered at the back of this guide.

The remote counter is manufactured in three standard configurations. The Model 4903 counts particles in the 0.3µ size range and 0.5µ size range at 0.1 cfm flowrate. Model 4905 counts particles in the 0.5µ size range and 5.0µ size range at 0.1 cfm flowrate. Model 4915 counts particles in the 0.5µ size range and 5.0µ size range at 1.0 cfm flowrate. All three units can be used for remote counter applications in class 10 or better cleanrooms requiring low zero counts.

Figure 1. The Remote Airborne-Particle Counter

The remote counter uses a laser diode light source and collection optics for particle detection. Particles scatter light from the light source. The collection optics collect and focus the light onto a photo diode that converts the bursts of light into electrical pulses. The pulse height is a measure of particle size. Pulses are counted and their amplitude is measured for particle sizing.

All counters use the industry-standard 4-20 mA interface. Loop current is driven by voltages between 15 and 30 vdc. The sensors use an RS-485 serial interface for programming count and hold times, alarm level, alarm delay, and scaling for the 4-20 mA output. This programming data is retained through power off and on cycles.

Introduction

Accessories

You can order several accessories to tailor the remote counter to your needs. These accessories can be ordered from the factory during the week from 8:00 a.m. to 4:00 p.m. PST. See back cover of this manual for address and telephone number.

Switching Power Supply—for operating up to 16 counters (6 vdc, 5 A).

Loop Power Supply—provides 24 Vdc for current loop supply from a 12 to 30 vdc input (may not be required if switching power supply is capable; see text for more details)

Power Adapter (part of wall plate)—provides 6 Vdc PCBA voltage (plugs in-line with cable to counter; one required for each counter).

RS232-to-RS485 Converter—for computer RS232 interface.

Wall Plate—provides quick-disconnect to signals and vacuum.

Programming Kit—provides for setting program parameters in counter

Specifications

Sensitivity:

4903	0.3 micron (50%) @ 0.1cfm; 0.32 micron (100%) @ 0.1cfm
4905	0.5 micron (50%) @ 0.1cfm; 0.75 micron (100%) @ 0.1cfm
4915	0.5 micron (50%) @ 1.0 cfm; 0.75 micron (100%) @ 1.0cfm

(Note: percentage given is counting efficiency)

Flow Control	critical orifice requires 18" Hg vacuum
Light Source	laser diode
Coincidence Loss	5% at 2,000,000 particles per cubic foot
Zero Count	not more than one count in 20 minutes
Inlet Pressure	ambient to 0.1" Hg vacuum
Indicators	power and count alarm/calibration LEDs
Power	6 Vdc (±10%) at < 250 mA (internal PCBA)
	24 Vdc (±10%) at < 250 mA (loop supply)
Weight	10.7 ounces (0.30 kg.)
Port Sizes	1/8 inch ID inlet (all)
	1/4 inch ID outlet (all)
Environment:	
-Operating	55 to 105°F (12 to 41°C)
	20 to 95% relative, non-condensing
-Storage	-40 to 160°F (-40 to 70°C) up to 98% relative, non-condensing

Getting Started

Dimensions

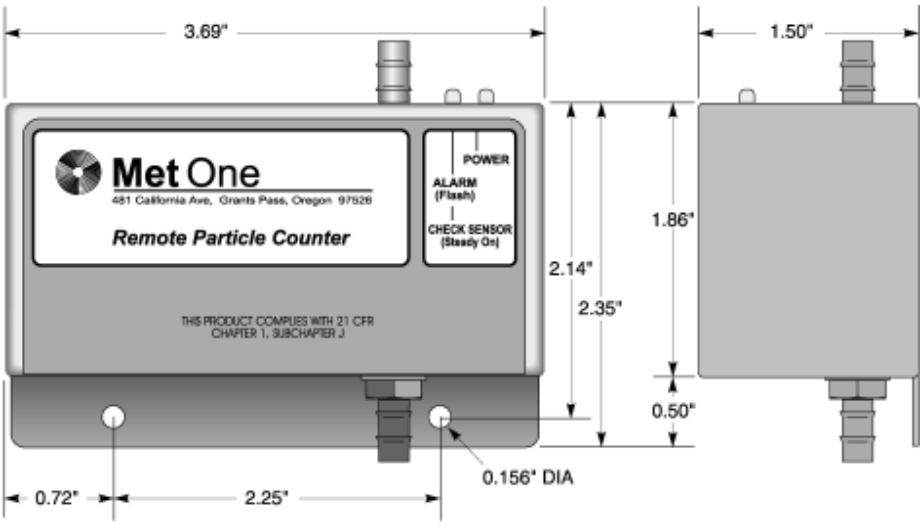


Figure 2. Overall Unit Dimensions

Unpacking and Initial Inspection

The remote counter is thoroughly inspected and tested at the factory and is ready for use upon receipt. When received, inspect the shipping carton for damage. If the carton is damaged, notify the carrier and save the carton for carrier inspection. Inspect the counter for broken parts, scratches, dents, or other damage.

If the carton is not damaged, keep for reshipment. For example, you may want to reuse the carton when you return the counter for the annual factory calibration.

Shipping Instructions

Should it become necessary to return the remote counter to the factory for any reason, be sure to contact Customer Service and obtain a Return Authorization number. Reference this number on all shipping documentation and purchase orders. After receipt of the return number, follow the shipping instructions provided below.

1. Use the original container or carton and packing materials whenever possible.
2. If the original container and packing materials are not available, wrap the unit in “bubble pack” plastic; surround with shock-absorbent material and place in a double-wall carton.
3. Seal container or carton securely. Mark “Fragile” and enter Return Authorization number in any unmarked corner.
4. Return to the address shown on the back cover of this manual.

Operation

Note

When the unit is first powered up, the Cal/Alarm LED will also come on. This is normal. After one minute the Cal/Alarm LED will turn off and the count cycle will begin.

20 mA output = full scale particle counts, 4 mA output = zero particle counts, and zero mA output = sensor calibration failure.

Interpreting Indicators

Both front-panel indicators have a specific meaning when illuminated. The figure below shows location of the indicators and gives a brief description of their meaning.

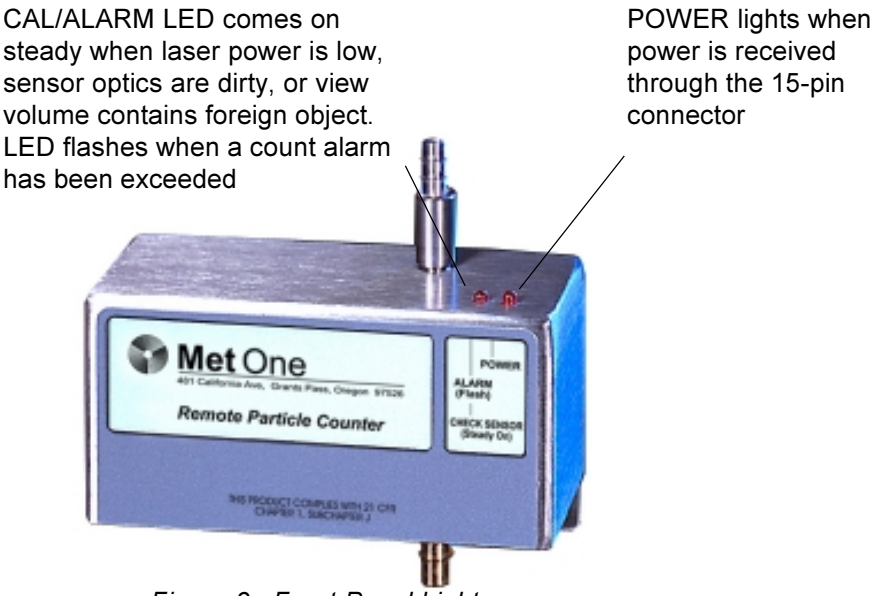


Figure 3. Front Panel Lights

Changing Operating Configuration

The firmware of the remote counters allows parameters to be entered after power is turned on. Once the setup is entered, it is retained in non-volatile memory. On each subsequent power up, the remote counter will look for a new set up and if the set up dialog is not opened in the first one minute after power is applied, the previously saved setup will be used. The current set up will be kept if a set up dialog is not opened.

The counter programming interface is RS-485 and requires a programming module to connect to the RS-232 port of a computer. A programming module consists of a converter kit, a power module, and two cables and is available from the factory for this purpose.

Change the internal setup program in remote counters as follows:

1. Connect programming kit, computer, and a remote counter as shown in figure 4.
2. Apply power to the computer then verify the following computer settings: 9600 baud, no parity, eight data bits, one stop bit.
3. Turn power switch on programming module to ON. You will have 60 seconds after the power is turned on to access the change menu for configuration of the remote counter.
4. To change the operating configuration, send the ASCII command “LOAD <Enter>” to the counter using a serial communications

Note

The word "load" is case sensitive, that is, all letters in the word must be either all lower or all upper case characters.

software package (e.g. Procomm or Windows "Terminal"). The load menu format of a typical configuration may appear on your computer's monitor as follows:

```
Enter Command(Sp) Data(Ret)

P Per. (HH:MM:SS)..... 000030
H Hold (HH:MM:SS)..... 000012
A Alarm (XXXXXX)...... 000100
S Suppress (01-09).... 01
L Location (00-63)..... 00
1 Ch.1 FS (XXXXXX).... 000500
2 Ch.2 FS (XXXXXX).... 000100
Q Quit
COMMAND ? Q
Program EEPROM (Y/N) ? N
```

} (see note to right)

} (see note to right)

where (Sp) is the keyboard space bar, (Ret) is the Enter key, and Suppress is the number of consecutive times the alarm limit must be exceeded before an alarm lamp, etc. is triggered.

5. To change the operating configuration, type the letter of the parameter that you wish to change followed by a space. Then enter desired configuration data, ending with <Enter>. For example, to change the "hold" time to 20 seconds, you should type: “H<space>00:00:20<Enter>”.
6. End the sequence by typing “Q”, and answer “Y” when asked “Program EEPROM (Y/N)?”. All of the configuration information will be saved in the EEPROM. Two beeps will be heard when the EEPROM has finished reprogramming.
7. Repeat steps 1 through 6 above for remaining remote counters.

Operation

Note

Period and hold times must have a colon or other character separating the hours, minutes, and seconds. See example in step 5.

When entering other parameters, enter six digits. For example, to set Ch. 1 full scale limit to 100 counts, type:

1<space>000100<Enter>

Note

During programming of the sensors, the CAL/ALARM LED will remain lit and may be ignored .

When programming the sensors, loop power need not be applied.

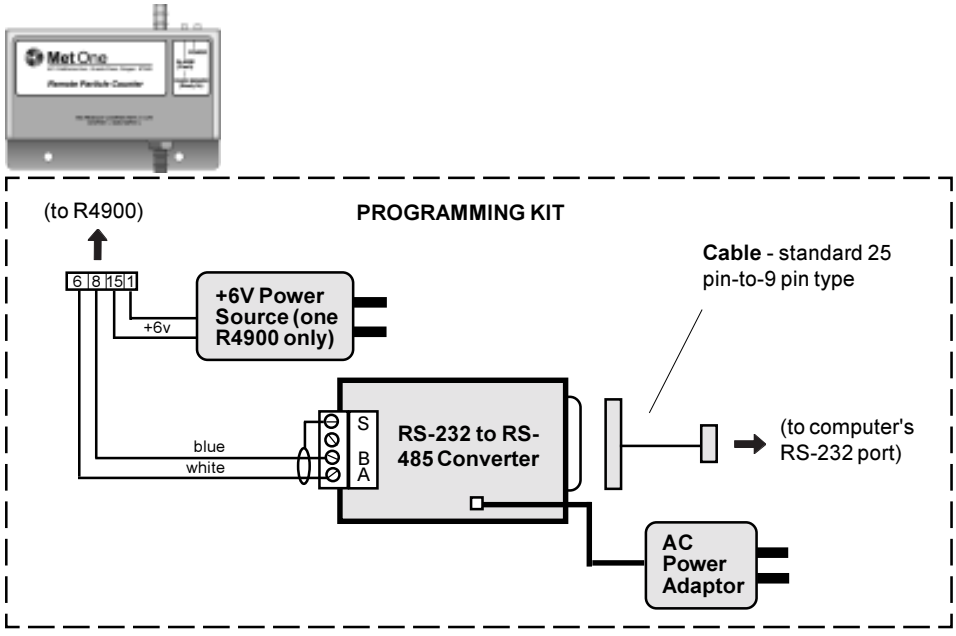


Figure 4. Setting Programming Parameters Using Programming Kit

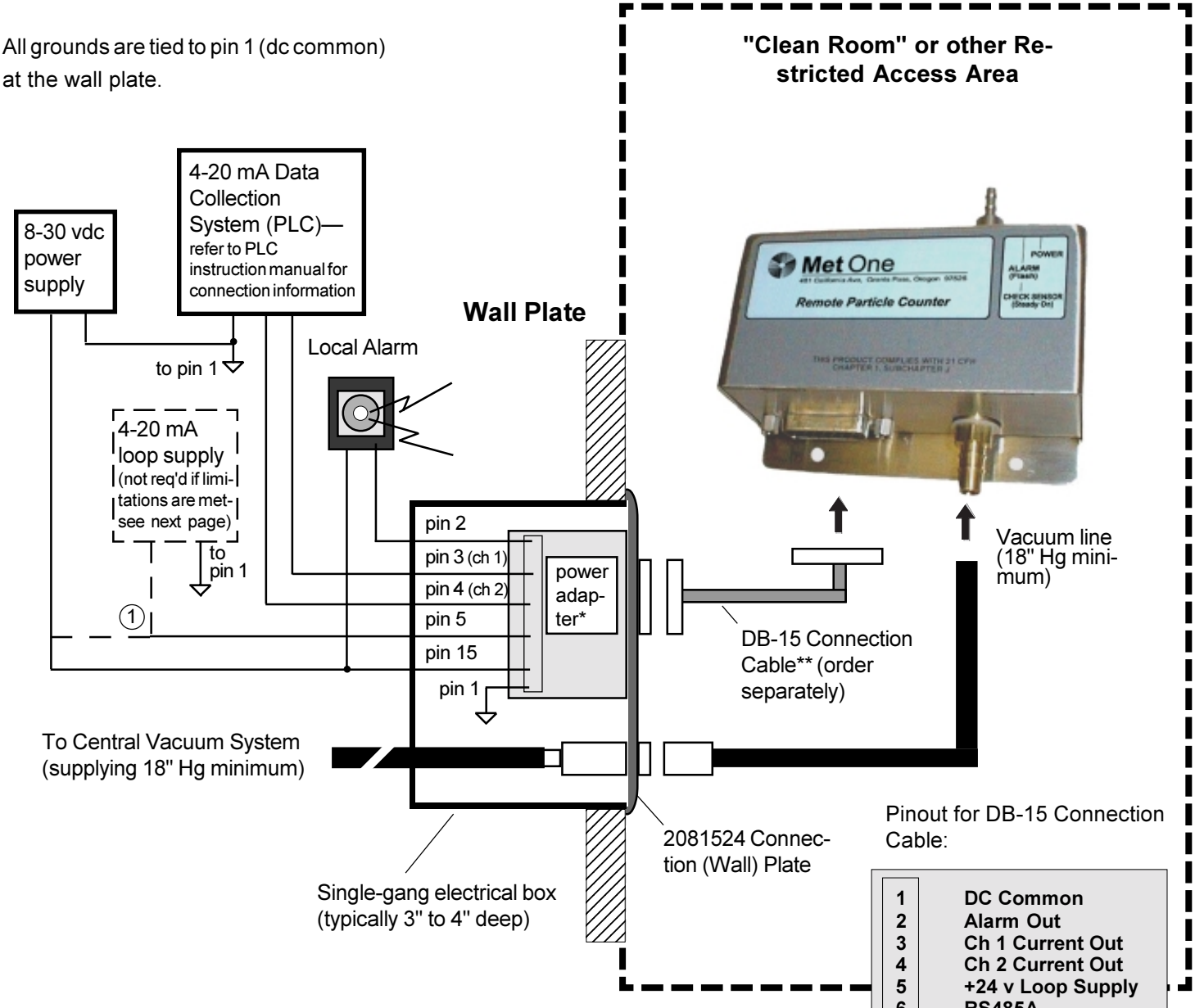
Operation

Installation Using Wall Plates

The figure below shows a typical installation using wall plates. Pin assignments at the R4900 15-pin connector as well as at the wall plate are shown in the pinout table below.

Note

All grounds are tied to pin 1 (dc common) at the wall plate.



Pinout for DB-15 Connection Cable:

1	DC Common
2	Alarm Out
3	Ch 1 Current Out
4	Ch 2 Current Out
5	+24 v Loop Supply
6	RS485A
7	n/c
8	RS485B
9	(reserved)
10	(reserved)
11	(reserved)
12	(reserved)
13	Ground
14	(reserved)
15	+V Power

① loop power must be supplied from either source

*Provides +6 v to R4900 from any +12 v to +30 v power supply

**9 Pin: P/N 400119
15 Pin: P/N 400150 (10 ft)
or P/N 400156 (6 ft)

Figure 5. Block Diagram of Interfacing Connections

Operation

Basic Operation

Once the remote counter is connected and power has been applied, updating the 4 to 20 mA output will occur automatically after each hold and count period. An output of 20 mA represents the full scale particle count value as set in the operating configuration for channel 1, 4 mA represents zero particle counts, and zero mA output indicates a sensor calibration failure. If the alarm output is to be used, the remote counter will need to be reprogrammed for count and hold times, full scale value for both outputs, the alarm limit and alarm delay. Refer to "Changing Operating Configuration" to change the remote counter's internal setup.

When using a +24 vdc power supply (refer to figure 5) as the voltage supply to the counter (via the wall plate power adapter), the power supply can also be used as the 4 to 20 mA loop power source if loop resistance (see curve below) is met. The graph below shows the maximum limits of the total loop resistance allowed.

The remote counter will run for the set sample period. At the end of the sample period the output will be updated to the number of counts for the first sample. The output will remain at that value until the end of the next sample and then be updated.

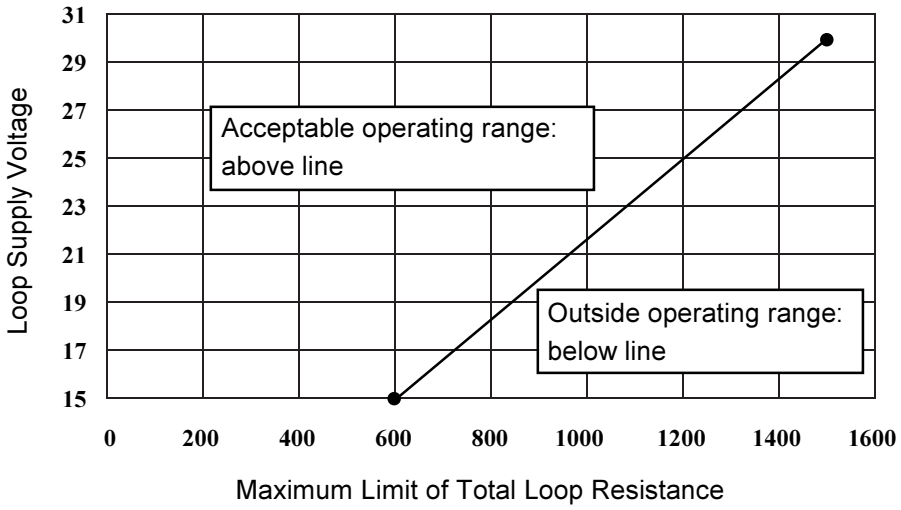


Figure 6. 4-20 mA Output Limitations Curve

Technical Data

CAUTION

Take care not to touch the laser driver board components as the laser diode is extremely static sensitive.

Removing Remote Counter Cover

The sensor cover must be removed before you change jumper JP1 setting or clean the sensor (see following pages for these procedures). To remove sensor cover, perform the following steps using figure below:

1. Remove two screws holding sensor cover to sensor assembly.
2. Unscrew barbed extension (stainless steel) from sensor.
3. Gently slide the sensor assembly away from the sensor cover.
4. Reinstall sensor cover over sensor assembly using two screws. Make sure the two LEDs fit through holes in cover.

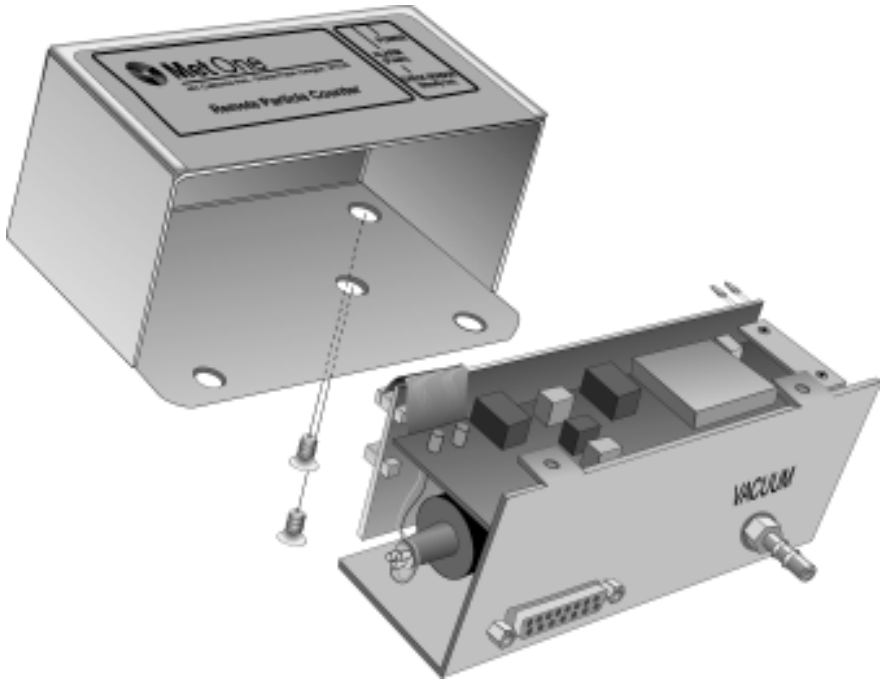


Figure 7. Remote Counter Cover Removal Diagram

Cleaning the Sensor

Contaminants may build up on the internal lens and reflector causing a remote counter alarm to occur (CAL LED comes on). These surfaces can often be purged clean by drawing clean air through the sensor. Before trying the cleaning procedure, sample clean air that has passed through a filter at the nominal flow rate. Allow remote counter to be purged in this manner for up to 24 hours. If the CAL LED goes out, you will not need to do this procedure. Otherwise, perform the following cleaning procedure using figure on the following page (figure shown with mini-remote PCBA removed for clarity only):

1. Remove all connections to the remote counter.
2. Remove counter cover using procedure above.
3. Remove brass barbed fitting (VACUUM end).

Technical Data

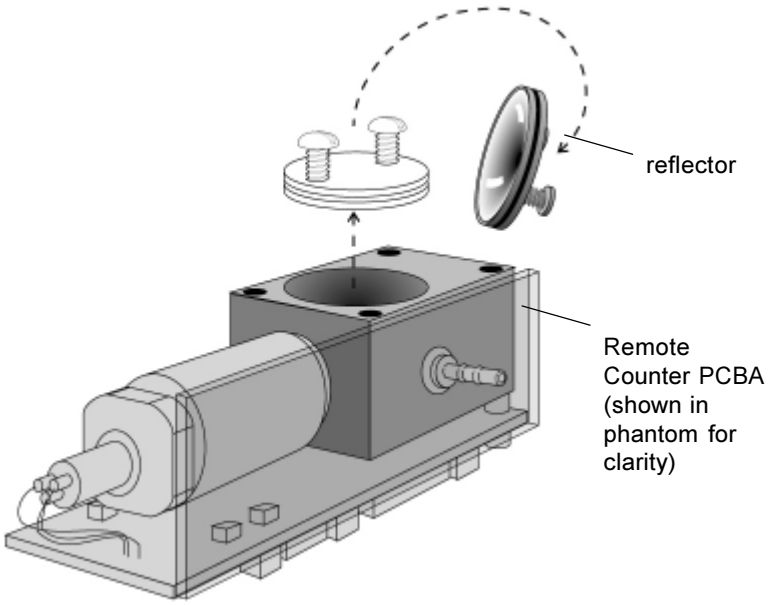


Figure 8. Sensor Cleaning (mini-remote PCBA shown removed for clarity)

4. Remove two flat-head screws holding sensor onto mounting plate.
5. Rotate sensor away from mounting plate enough to expose reflector (refer to figure above for location of reflector).
6. Screw in two 2-56x3/4-inch machine screws into holes in the sensor reflector.

WARNING

Removing reflector before turning power off can quickly cause blindness.

7. Using the two screws as handles, pull reflector outward while twisting reflector slightly.
8. Clean the reflector with a medical-grade cotton applicator wetted with reagent-grade alcohol. Clean the lens located inside the housing with another applicator wetted with alcohol.
9. Insert reflector into sensor housing with a slight twisting motion until reflector bottoms out. Remove two 2-56x3/4-inch screws.
10. Reinstall sensor by following in reverse order steps 1 through 7 above.

CAUTION

Take care not to touch the laser driver board components as the laser diode is extremely static sensitive.

CAUTION

Do not overtighten barbed fittings.

Manual Backdating

Changes to the remote counters prompted revision B to the manual. These changes are summarized below:

Product overlay labeling changed from "CALIBRATE" to "CHECK SENSOR" to more accurately reflect LED function.