



701113

# **MET ONE 4800 Series Particle Counter**

User Manual

11/2013, Edition 6



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# Table of Contents

<b>1</b>	<b>Introduction</b>	
1.1	Overview .....	7
1.2	Dimensions .....	8
1.3	Unpacking and Initial Inspection .....	8
<b>2</b>	<b>System Setup</b>	
2.1	Interpreting Indicators .....	9
2.2	Programming the Remote Counter .....	9
2.3	Multiple Counter Installation.....	12
<b>3</b>	<b>System Operation</b>	
3.1	Overview .....	15
3.2	Remote Counter and Computer Interface.....	15
3.3	Data Record Format .....	18
<b>4</b>	<b>Cleaning the Sensor</b>	
4.1	Removing the Remote Counter Cover.....	21
4.2	Cleaning the Sensor .....	21
4.3	Serial Interface Information.....	22
	<b>Appendix A:Service Procedures</b>	
A.1	Calibration Procedures .....	25
A.2	Return Procedures.....	25
	<b>Appendix B:Specifications and Accessories</b>	
B.1	Specifications.....	26
B.2	Accessories.....	27



# Manual Overview

## About This Manual

The information in this manual has been carefully checked and is believed to be accurate. However, the manufacturer assumes no responsibility for any inaccuracies that may be contained in this manual. In no event will the manufacturer be 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.

## Safety Conventions



### WARNING

*A warning is used to indicate a condition which, if not met, could cause serious personal injury and/or death. Do not move beyond a warning until all conditions have been met.*

### CAUTION:

*A caution is used to indicate a condition which, if not met, could cause damage to the equipment. Do not move beyond a caution until all conditions have been met.*

### Note:

*A note is used to indicate important information or instructions that should be considered before operating the equipment.*

## General Safety Considerations

- All service procedures should be conducted by properly trained service personnel.
- Follow all procedures in “[Return Procedures](#)” on page 25 before shipping a unit to a service center for repair or re-calibration.
- Additional safety information is included in the *Particle Counters for Air* manual. For additional assistance, contact technical support.



### WARNING

*Attempts by untrained personnel to disassemble, alter, modify or adjust the electronics may result in personal injury and damage to the R4803, R4805, R4815 Remote Airborne Particle Counters.*

## Laser Safety Information

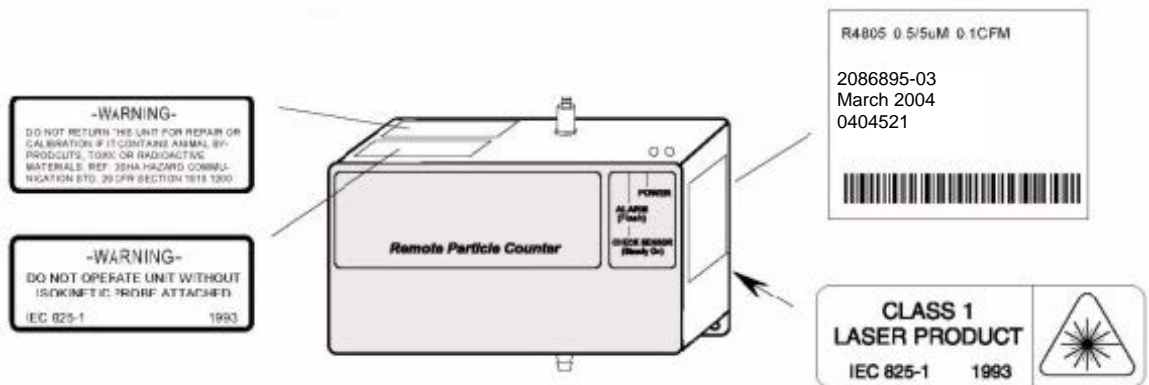
- Laser Safety -- Class 1 Laser Product -- Complies with 21 CFR Chapter 1, Subchapter J.
- Evaluated and tested in accordance with EN 61010-1:1993, "Safety requirements for Electrical Equipment for Measurement, Control, and Laboratory Use" and IEC 825-1:1993, "Safety of Laser Products."



### WARNING

*Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure that may cause blindness.*

Several labels are attached to the unit for safety and awareness. Reproductions of the labels are shown here:



## Electrostatic Safety Information

### CAUTION:

*Electrostatic discharge (ESD) can damage or destroy electronic components. All maintenance work on R4800 Series particle counters should be done at a static-safe work station, observing all ESD safety procedures and precautions.*

The following practices support ESD safety procedures.

- Use a grounded conductive table mat and resistor-isolated wrist strap combination.

**WARNING**

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

- Earth-ground all test instruments to prevent a buildup of static charge.

**Acknowledgements**

- Belden is a registered trademark of Belden Inc.
- PROCOMM is a registered trademark of Symantec, Inc.
- Windows and HyperTerminal are registered trademarks of the Microsoft Corporation.





# 1 Introduction

## 1.1 Overview

This operating guide provides specific information on the following topics for the Met One R4803, R4805, R4815 Remote Airborne Particle Counters:

- Initial inspection
- Operating the counter
- Maintaining the counter

The remote counter is manufactured in three standard configurations.

- The Model R4803 counts particles in the 0.3  $\mu\text{m}$  and 0.5  $\mu\text{m}$  size range at 0.1 cfm (2.83 lpm) flowrate.
- The Model R4805 counts particles in the 0.5  $\mu\text{m}$  and 5.0  $\mu\text{m}$  size range at 0.1 cfm (2.83 lpm) flowrate.
- The Model R4815 counts particles in the 0.5  $\mu\text{m}$  and 5.0  $\mu\text{m}$  size range at 1.0 cfm (28.3 lpm) flowrate.

All three units can be used for remote counter applications in class 10000 or better cleanroom requiring low zero counts.



*Fig 1-1 : Remote Airborne Particle Counter*

The R4800 Series particle counters use 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.

## 1.2 Dimensions

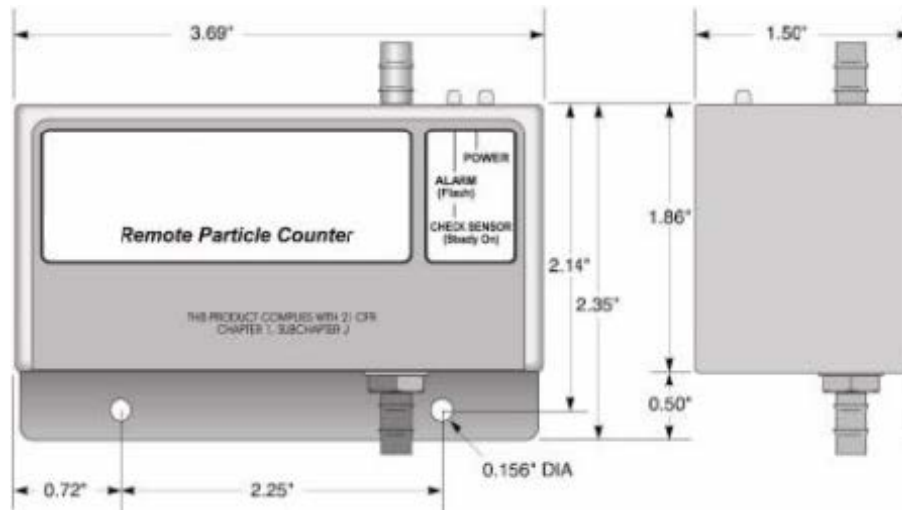


Fig 1-2 : Overall Unit Dimensions

## 1.3 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 when the counter needs to be returned to the factory for its annual calibration.

## 2 System Setup

### 2.1 Interpreting Indicators

Both front-panel indicators have a specific meaning when illuminated. [Figure 2-1](#) shows the location of each indicator.

- The ALARM/CHECK SENSOR LED comes on steady when laser power is low, sensor optics are dirty, or view volume contains a foreign object. The LED flashes when a count alarm has been exceeded.
- The POWER LED lights when power is received through the 15-pin connector.

**Note:**

*When the unit is first powered up, the ALARM/CHECK SENSOR LED will temporarily light. This is normal and does not indicate an error. After one minute, the ALARM/Check Sensor LED will turn off and the count cycle will begin.*



Fig 2-1 : Front Panel Lights

### 2.2 Programming the Remote Counter

The firmware of the remote counters allow parameters to be entered after power is turned on. Once the configuration is entered, it is retained in nonvolatile memory. On each subsequent power up, the remote counter will look for a new configuration and if the setup dialog is not

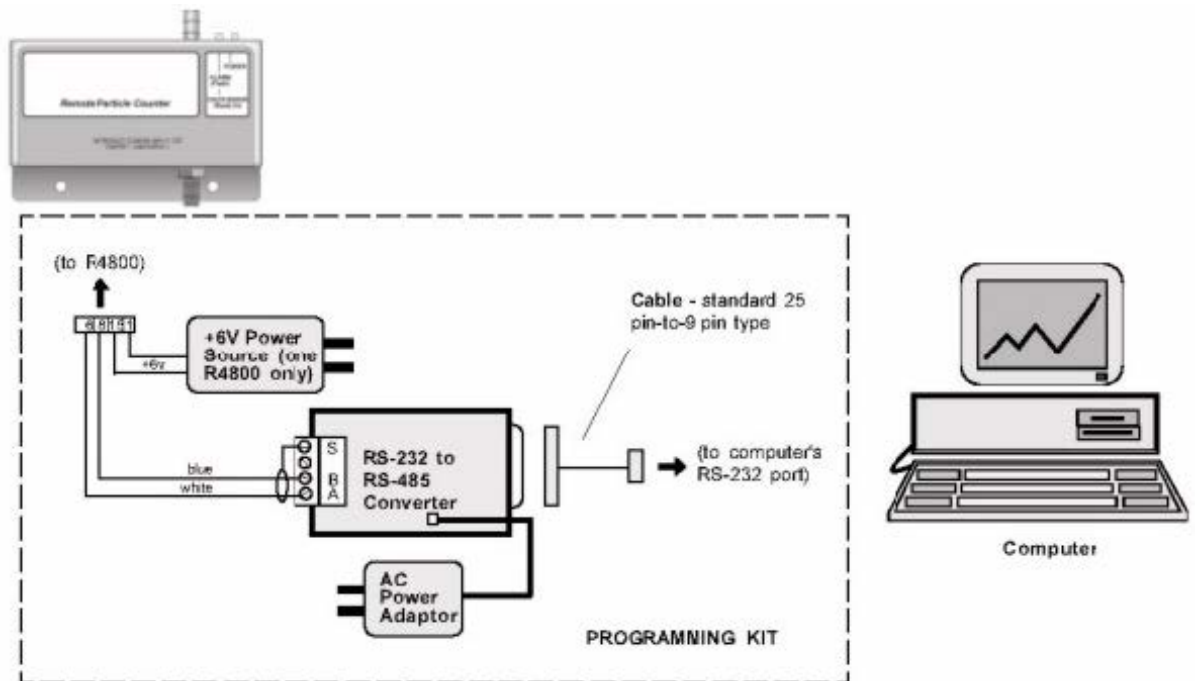
opened in the first minute after power is applied, the previously saved configuration will be used. The current configuration will be kept if a setup dialog is not opened.

**Note:**

*While programming the sensors, ignore the Check Sensor/Alarm LED.*

Change the internal setup program in remote counters as follows:

- 1) Connect the programming kit, computer, and a remote counter as shown in [Figure 2-2](#) or connect a remote sensor to a computer through an RS-232 to RS-485 converter as shown in [Figure 2-4](#). For proper program setup, only one counter can be connected at a time.



*Fig 2-2 : Setting Programming Parameters Using Programming Kit*

- 2) Apply power to the computer, then verify the following computer settings:
  - 9600 baud
  - No parity
  - Eight data bits
  - One stop bit
- 3) Turn the power switch on the programming module to ON. Access to the change menu for configuration of the remote counter is limited to the first 60 seconds after the power is turned on.
- 4) To change the operating configuration, send the ASCII command "LOAD <Enter>" to the counter using a serial communications software package, such as PROCOMM® or Windows® HyperTerminal®. The load menu format of a typical configuration is shown in [Figure 2-3](#).

**Note:**

The word “load” is case-sensitive. Period and hold times must have a colon (:) separating the hours, minutes, and seconds (backslashes for date). See the example in [step 5](#).

```

Enter Command (Space) Data (Return) or Command (Return)
D Date (MM\DD\YY).....010195
T Time (HH:MM:SS).....083406
P Period (HH:MM:SS).....000030
H Hold (HH:MM:SS).....000012
A Alarm (XXXXXX).....000100
B Baud Rate (1200,9600)..9600
L Location (00-63).....32
M Mode (A=Auto, N=Norm)..Norm
Q Quit
Command? Q

Program EEPROM (Y/N) ? N

```

Fig 2-3 : Typical Configuration of a Load Menu Format

- 5) To change the operating configuration, type the letter of the parameter followed by a space. Then enter the desired configuration data, ending with <Enter>. For example, to change the hold time to 20 seconds, type:

H<space>00:00:20<Enter>

**Note:**

When changing the alarm limit, enter six digits. For example, to set Ch. 1 full scale limit to 100 counts, type:

1<space>000100<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 except for the date and time. Two beeps will be heard when the EEPROM has finished reprogramming.

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 counter for the first sample. The output will remain at that value until the end of the next sample and then be updated.

- 7) Repeat [step 1](#) through [step 6](#) for the remaining remote counters.

## 2.3 Multiple Counter Installation

The R4800 Series remote counters all feature serial RS-485 data communication. RS-485 serial network circuitry provides asynchronous communications between up to 32 remote counters and a controlling computer. The host computer controls activity on the serial link using protocol which is compatible with systems supplied by the manufacturer.

Since single twisted-pair wiring is used, only one station can transmit at a time. This is accomplished when the computer sends a select code to make one remote counter an active talker. Once a station is made active, half duplex communication between the host and the remote counter can proceed. An active talker will remain active until the computer deactivates it by sending any select code not belonging to the current active station. It is a requirement of the system that each station have a unique select code. These select codes must be set during the installation (see [“Programming the Remote Counter” on page 9](#)).

Data and commands are in the ASCII range while select numbers are not. Valid select numbers are in the range 128 (80H) to 191 (BFH) and are sent as a single character.

**Note:**

*When the remote counter is used with PVO software, the valid range of location numbers is 00 through 31.*

### a ) Hardware Setup With Wall Plates

If wall plates are to be used, some of the following equipment may be needed to accommodate multiple counter (RS-485) networking:

- RS-232/RS-485 converter: changes typical RS-232 serial output of computers to RS-485
- Termination module: as a network termination circuit (supplied)
- Wire, shielded, twisted pair cables (e.g., Belden® P/N 9841): for connecting remote counters
- Wall plates: for use in place of twisted-pair connections

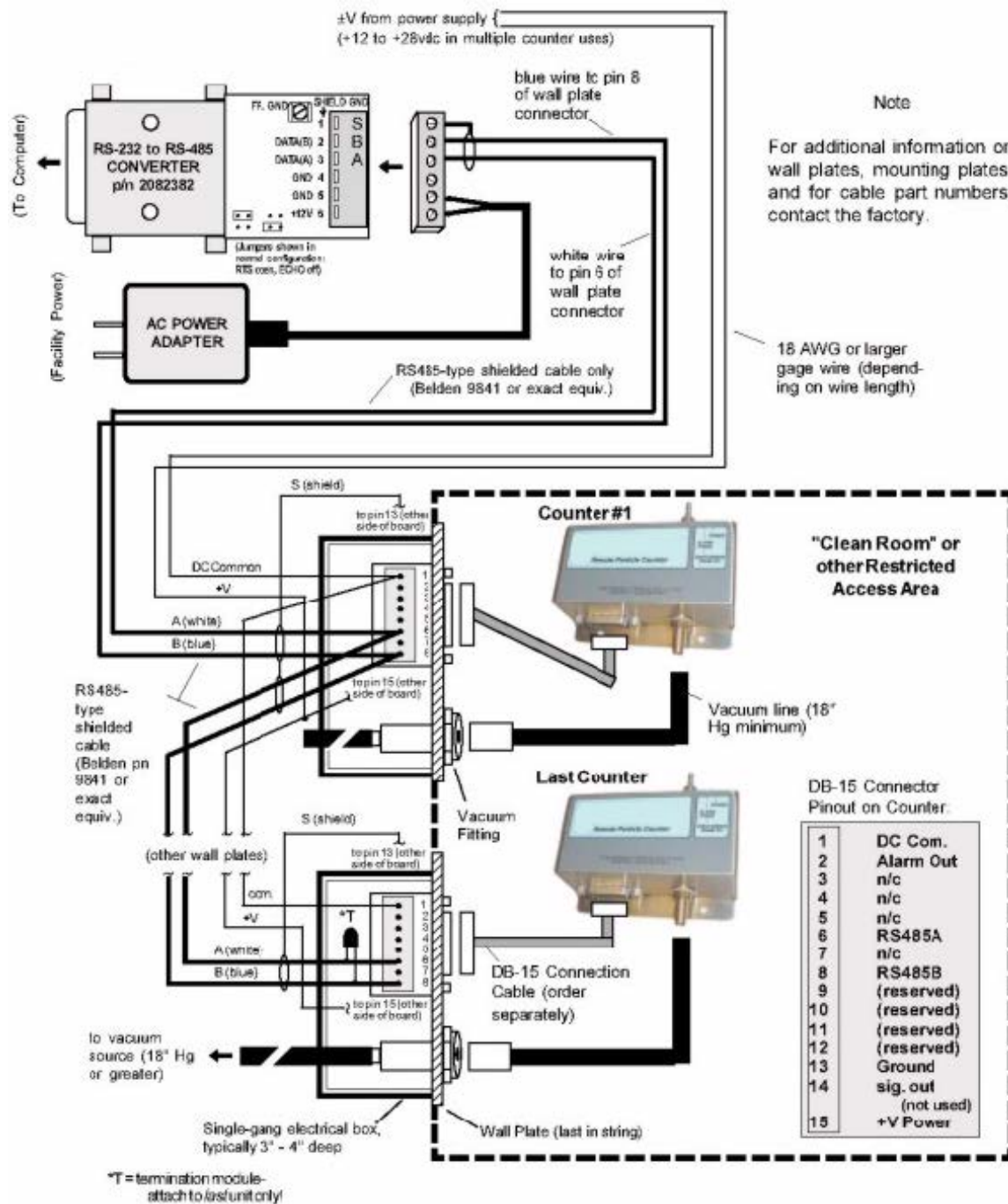


Fig 2-4 : Typical RS-485 Network Installation Diagram Using Wall Plates

Prepare for multiple remote counter operation by performing the following steps and by using [Figure 2-4](#):

- 1) Place remote counters in desired locations.
- 2) If using wall plates, install plates at the remote counter locations using standard construction methods.

**CAUTION:**

*Phasing of the conductors in the twisted pair must be maintained, i.e., the blue wire always goes to pin 8 of each wall plate board, etc.*

- 3) Connect shielded, twisted-pair cable to male plug of the RS-232/RS-485 converter as shown in [Figure 2-4](#).

**Note:**

*Some wall plates may not have the 100 ohm resistor mounted on the DB-15 connector. If this is the case, wire the braided shield to a 100 ohm resistor then to pin 13.*

- 4) Connect other end of twisted-pair cable in [step 3](#) to first wall plate and then to remaining wall plates (up to a total of 32). Install a termination module to the last wall plate between pin 6 and 8 of DB-15 connector.
- 5) Connect shielded twisted-pair cable from unenergized power source to each wall plate as shown in [Figure 2-4](#). Attach braid to male plug as in [step 3](#).
- 6) Prepare braided shield of both twisted pair of wires (signal and power) at each wall plate and attach to pin 13 of DB-15 connector.
- 7) Connect remote counter to wall plate with signal cable.



## 3 System Operation

### 3.1 Overview

This section describes the command and data syntax between remote counters and a computer. Several brands of software are available for controlling multiple counters using the command syntax. Software features include:

- Upload count data into the PC
- Sort, normalize, and calculate count data for cleanroom classification

For information about software, contact a local agent or the factory.

### 3.2 Remote Counter and Computer Interface

To communicate with any remote counter, it must first be made active by sending the correct location code. The location code is a single character in the range 128 (80H), equal to location "00," etc., to 191 (BFh), equal to location "63." Information on the following pages describes operation of the counters with a computer.

**Note:**

*The valid range is from location "00" to "31."*

#### a ) Command and Data Syntax

The remote counter responds to ASCII commands and sends a data record that varies in length based on content. The command and data syntax is defined below.

The ASCII commands listed in [Table 3-1](#), [Table 3-2](#), and [Table 3-3](#) are supported by the remote counter and are case-sensitive.

*Table 3-1 : Request for Data Commands*

Command	Description
"A" Send Buffered Record	The next data 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. A record of the most recent count cycle will always be sent first. 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.
"B" Send Current Record	The data record of the most recent sample period will be sent. Thereafter, if no new sample period has been completed, a "#" character will be sent. The rotating buffer is unaffected.
"C" Clear Buffer	Contents of the rotating buffer will be erased.
"D" Number of Records	The counter will send the number of records in the rotating buffer terminated by a carriage return and line feed. The number of records returned is varying length, no leading zeros, and has no limit. If no data records are available, a "0" will be returned (D0<cr><lf>).

Table 3-1 : Request for Data Commands

Command	Description
"E" EPROM Revision	The counter will send the EPROM number and latest revision. The format field length can vary, and is terminated by a carriage return and line feed.
"H" Hold Time	When an upper case "H" followed by a carriage return and line feed are sent, the counter will display the current Hold Time terminated by a "carriage return" plus "line feed" (<cr><lf>). Hold time will be in a format of HHMMSS (hours, min., sec.). To program hold time, enter upper case "H" followed by only relevant time information. Use the form of HHMMSS (hours, min., sec.), terminated by (<cr><lf>). Do not enter leading zeros.
"L" Sample Period	When an upper case "L" followed by a carriage return and line feed are sent, the counter will display the current Sample Period terminated by a carriage return line feed (<cr><lf>). Sample period will be in a format of HHMMSS (hours, min., sec.). To program sample period, enter upper case "L" followed by only relevant time information. Use the form of HHMMSS (hours, min., sec.), terminated by (<cr><lf>). Do not enter leading zeros.
"M" Mode Request	The counter will send its present mode. If counting, a "C" will be sent. If holding, an "H" will be sent. If stopped, an "S" will be sent.
"R" Retransmit Record	The last record sent will be retransmitted. The buffer will not be cleared. If there is no record to retransmit, a # following the echoed command will be sent.
"T" Identify Model	The counter will send an alphanumeric data string name label terminated by a carriage return and line feed. The "Name Label" field can vary in length.
"U" Universal Device Select	The counter will be placed in the "remote" mode, and will respond to all commands after receiving this command, regardless of which select code is programmed into the counter.
"V" Protocol Version	The counter will send an alpha data string terminated by a carriage return and line feed. The "Protocol Version" field will contain FX (enhanced Standard FIX Protocol).

Table 3-2 : Action Commands

Command	Description
"128-191" Device Select	The counter will respond to all subsequent commands when a number is sent that matches its select code. The counter is deselected (made unresponsive to computer commands) by selecting another counter, i.e. sending a number between 128 (corresponding to Loc = 0) and 191 (corresponding to Loc = 63) that does not equal the counter's select code. To send a number, press and hold <Alt> key then enter number.
"a" Auto	When the "d" command is used, the counter will count in the auto mode.
"b" Manual	When the "d" command is used, the counter will count in the manual mode.
"c" Start Counting (computer controlled)	The counter will begin counting without waiting for an even second boundary (immediate start). Counting will continue until stopped by the computer. The count cycle should be controlled by the computer.

Table 3-2 : Action Commands

Command	Description
"d" Start Counting (counter controlled)	The counter will begin counting on an even second boundary (using internal clock; not in the middle of a second) and control the count cycle based on the front-panel setting for the period (sample time).
"e" Stop Counting	The counter will immediately stop counting without waiting for an even second boundary.
"g" Active Mode	This device will enter a mode that prepares it for counting. For example, the air pump will turn on to purge the air path, and the sensor's laser will turn on.
"h" Standby Mode	The device will enter a mode that will turn off air pumps and shut down laser sensors to conserve power or reduce equipment wear, if applicable. Only this command can turn off the pump and laser.

Table 3-3 : Universal Action Commands

Commands	Description
"ua" Universal Auto Sample Mode	Puts the counter(s) in the "Auto" count mode. When the "ud" command is used, the device(s) will count in the auto mode. Auto mode causes the device(s) to continuously cycle through their own Sample and Hold period settings. This command is not echoed.
"ub" Universal Manual Sample Mode	Places the counter(s) in the "Manual" count mode. When the "ud" command is used, the device(s) will count in the manual mode. Manual mode causes the device(s) to cycle through their own Sample period once. This command is not echoed.
"uC" Universal Clear Buffer	The contents of the buffer will be erased. This command is not echoed.
"uc" Universal Auto Sample Mode	The counter(s) will start counting in either pre-selected counting mode (Auto, Manual). This command is not echoed. The device will start counting without waiting for an even second boundary (quick start). Counting will continue until stopped by the computer. The count cycle of the computer will control time.
"ud" Universal Start Count	The counter(s) will start counting in either of the two preselected counting modes (Auto or Manual). This command is not echoed.
"ue" Universal Stop Count	The counter(s) will stop counting and will build a data record. This command is not echoed.
"ug" Universal Active Mode	The counter(s) will enter a mode that prepares it for counting. For example, the air pump will turn on to purge the air path, and sensor's laser will turn on. This command is not echoed.
"uh" Universal Standby Mode	The counter(s) will enter a mode that will turn off air pumps and shut down laser sensors to conserve power or reduce equipment wear, if applicable. Only this command can turn off the pump and laser. This command is not echoed.

### Command Responses

The remote counter will respond to all commands and select codes by sending the command character back to the computer. If the counter does not recognize a command, it will send a "?" character. If the computer is asking for a record from an empty buffer, the counter will send a "#" character. If the computer is asking for a record that has already been sent, the counter will send a "#" character unless the computer uses the Resend Record command.

The remote counter will not echo any command characters if a parity or framing error occurs.

### 3.3 Data Record Format

Each remote counter can send a record of its data. The data record is a string of ASCII characters where the position in the string identifies the character's meaning.

Figure 3-1 shows the serial communications format of a two-channel remote counter. Table 3-4 defines the data elements. CRLF is the carriage return and line feed command.

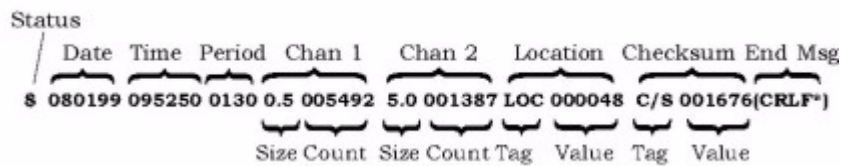


Fig 3-1 : Data Record Format Example

In Figure 3-1, the ASCII character "\$" translates to a status byte that is indicating a "Count Alarm."

Table 3-4 : Data Record Element Descriptions

Information	Description																				
Status	<p>When translated to a binary byte, this character will indicate the status of the counter. As shown below, ASCII character "\$" has a decimal value of 36, which when converted to a binary byte, sets the third and sixth (always 1) bits. Bit 0 is considered the first bit.</p> <table border="1"> <thead> <tr> <th>ASCII Character</th> <th>Meaning</th> <th>Decimal Equivalent</th> <th>Binary Equivalent (bit 76543210)</th> </tr> </thead> <tbody> <tr> <td>(blank space)</td> <td>no alarms</td> <td>32</td> <td>00100000</td> </tr> <tr> <td>!</td> <td>Check Sensor</td> <td>33</td> <td>00100001</td> </tr> <tr> <td>\$</td> <td>alarm/count alarm</td> <td>36</td> <td>00100100</td> </tr> <tr> <td>%</td> <td>Check Sensor and alarm</td> <td>37</td> <td>00100101</td> </tr> </tbody> </table>	ASCII Character	Meaning	Decimal Equivalent	Binary Equivalent (bit 76543210)	(blank space)	no alarms	32	00100000	!	Check Sensor	33	00100001	\$	alarm/count alarm	36	00100100	%	Check Sensor and alarm	37	00100101
ASCII Character	Meaning	Decimal Equivalent	Binary Equivalent (bit 76543210)																		
(blank space)	no alarms	32	00100000																		
!	Check Sensor	33	00100001																		
\$	alarm/count alarm	36	00100100																		
%	Check Sensor and alarm	37	00100101																		

Table 3-4 : Data Record Element Descriptions

Information	Description
Date	Date information is carried in the 3rd through 8th characters of the record. The 2nd character is always a space, to separate the status character from the date characters. The date is arranged as MMDDYY (Month Day Year). In the serial communications example on the previous page, the date is August 1, 1999. The day the counter collected the data.
Time	Time information is carried in the 10th through the 15th characters of the record. The 9th character is always a space, to separate the date from the time. The time is arranged as HHMMSS (Hours Minutes Seconds) military time. In the example on the previous page the time is 9:52 A.M. and 50 seconds.
Period	The period is the sample time, or the length of counting time. The period information is carried in the 17th through 20th characters. The 16th character is always a space, to separate the time and period. The period is presented in minutes and seconds. In the example on the previous page the period was 0130 or one minute, 30 seconds. When the period is controlled by the computer (c command), the period characters will be zeros. When the period is controlled by the counter (d command), the characters will represent the sample time.
Tags	The tags contain three characters that identify the type of data that will follow. If the data is particle count, the tag will indicate the particle size. If the data is location number, the number programmed during setup as the remote counter's location number (any identifying number from zero to 31 can be assigned) will be indicated.
Chan 1, Chan 2	These characters contain count data from the measurements the counter has made. The size and count are each preceded by a space character for separation.
Size	The size is three characters, preceded by a space, and indicates the particle size range.
Count	The count is six characters, preceded by a space, and indicates the number of particles counted for the particle size range preceding the number. In the data string example in <a href="#">Figure 3-1 on page 18</a> , the count in the channel 1 size range was 5492 particles.
Location	A unique number assigned to each unit in multiple counter installations. The assigned number applies to the "device" select code number and eliminates simultaneous talking on the bus during serial networking of multiple counters.
Checksum	The checksum is a six-character hexadecimal number (with two leading zeros), preceded by a three-character tag and a space. The numerical value of the checksum is equal to the sum of the decimal equivalent of each ASCII character in the record, including spaces. Used for testing accuracy of data transmission.



## 4 Cleaning the Sensor

### 4.1 Removing the Remote Counter Cover

The remote counter cover must be removed before cleaning the sensor. To remove the cover, perform the following steps using figure below:

- 1) Remove the three screws holding cover to remote counter assembly.
- 2) Unscrew barbed extension (stainless steel) from sensor.
- 3) Gently slide the remote counter assembly away from the cover.

**CAUTION:**

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

- 4) When finished cleaning sensor, reposition cover over remote counter assembly (make sure the two LEDs fit through holes in cover). Attach cover using the three screws.

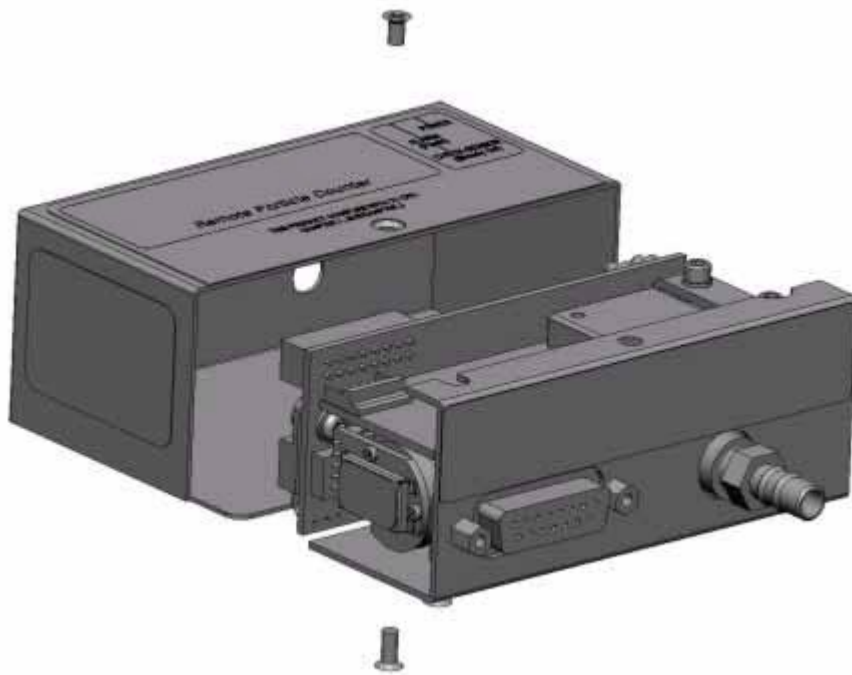


Fig 4-1 : Remote Counter Cover Removal Diagram

### 4.2 Cleaning the Sensor

Contaminants may build up on the internal lens and reflector causing a remote counter alarm to occur (CHECK SENSOR 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 CHECK SENSOR LED goes out, do not do this procedure. Otherwise, perform the following cleaning procedure referring to [Figure 4-2](#):

- 1) Remove all connections to the remote counter.
- 2) Remove remote counter cover using procedure above.
- 3) Remove brass barbed fitting (VACUUM end).
- 4) Remove two flat-head screws holding sensor onto "L"-shaped mounting plate.



*Fig 4-2 : Sensor Cleaning*

- 5) Rotate sensor away from mounting plate enough to expose reflector (refer to figure above for location of reflector; mounting plate not shown for clarity).
- 6) Screw in two 2-56 x 3/4-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 2-56 x 3/4-inch screws.
- 10) Reinstall sensor by following in reverse order steps 1 through 7 above.

## **4.3 Serial Interface Information**

To write a driver program, adhere to the following constraints.



## a ) Delays

Wait 10 milliseconds after receiving a character before sending a new command. All commands are echoed before a new command can be sent.

$$\frac{(10 \text{ bits/character}) \cdot (\# \text{ characters transmitted}) \cdot 1000 \text{ ms/sec}}{(9600 \text{ bit/sec})}$$

## b ) Labels

The following list contains all the labels currently used in the R4803/R4805/R4815 remote counters. Labels are always three characters in length.

*Table 4-1 : Label Information*

Name	Symbol	Range	Notes
Size	(the value)	0.3 through 0.5	Decimal always included
Location	LOC	000000 to 999999	
Check Sum	C/S	000000 to FFFFFFFF	



## Appendix A: Service Procedures

### A.1 Calibration Procedures

The R4800 Series particle counters have a calibration period of one year.

### A.2 Return Procedures

To return an instrument for credit, please contact the local sales representative.



#### **WARNING**

*The following actions must be performed when returning any unit for any reason to prevent personal injury and/or damage to the unit.*

- Properly decontaminate the unit prior to shipment. If a contaminated unit is received, the manufacturer reserves the right to have the unit removed and destroyed by a hazardous materials disposal team at the shipper's expense.

## Appendix B: Specifications and Accessories

### B.1 Specifications

Sensitivity	
R4803	0.3 $\mu\text{m}$ @ 0.1 cfm (2.83 lpm)
R4805	0.5 $\mu\text{m}$ @ 0.1 cfm (2.83 lpm)
R4815	0.5 $\mu\text{m}$ @ 1.0 cfm (28.3 lpm)
Flow control	Critical orifice requires at least 18" Hg vacuum (<500 mbar)
Light source	Laser diode
Coincidence loss	5% at 2,000,000 particles per cubic foot
False count rate	One or less in five minutes
Inlet pressure	Ambient to 0.1" Hg vacuum
Indicators	Power and count alarm/calibration LEDs
Power	6 vdc ( $\pm 10\%$ ) at <250 mA
Weight	10.7 ounces (0.30 kg.)
Port sizes	R4803, R4805: 1/8-inch ID inlet, 1/4-inch ID outlet R4815: 1/4-ID inlet, 1/4-inch ID outlet
Environment:	
Temperature	Operating: 55 to 84°F (12 to 29°C) Storage: -40 to 160°F (-40 to 70°C)
Humidity	Operating: 20-95% relative, non-condensing Storage: Up to 98% relative, non-condensing

## B.2 Accessories

Several accessories are available to tailor the remote counter to the application. The accessories listed in [Table B-1](#) can be ordered from a local representative or from the factory.

*Table B-1 : Accessories*

Part	Description
Switching power supply	For operating up to 16 counters (6 vdc, 5 A)
Power adapter	Provides 6 vdc output for the 8-30 vdc input (adapter plugs in-line with cable to counter, one required for each counter).
RS-232-to-RS-485 converter	For computer RS-232 interface
Wall plate	Provides quick-disconnect to signals and vacuum
Programming kit	Provides for setting program parameters in counter







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