R4803, R4805, R4815 Remote Airborne Particle Counters Operating Guide

August 2004

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Manual Overview

About This Manual

The information in this manual has been carefully checked and is believed to be accurate. However, Hach Ultra Analytics assumes no responsibility for any inaccuracies that may be contained in this manual. In no event will Hach Ultra Analytics 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, Hach Ultra Analytics reserves the right to make improvements in this manual and the products it describes at any time, without notice or obligation.

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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 the Hach Ultra Analytics Technical Support representatives at 800.866.8854 or +1 541.472.6500.

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.

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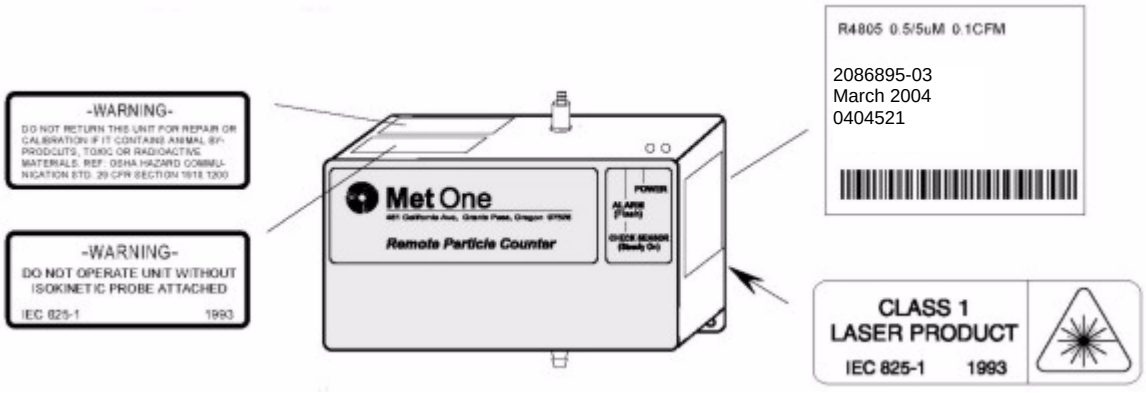
Laser Safety Information

- 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.

Warranty

Hach Ultra Analytics warrants that this instrument will be free of defects in materials and workmanship for a period of one (1) year from the shipping date. If any instrument covered under this warranty proves defective during this period, Hach Ultra Analytics 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.

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

This warranty shall not apply to any defect failure or damage caused by improper use or maintenance or by inadequate maintenance or care. This warranty shall not apply to damage resulting from attempts by personnel other than Hach Ultra Analytics 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.

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Revision History

- Revision A, February 1995, Pacific Scientific Instruments.
- Revision B, September 1995, Pacific Scientific Instruments.
- Revision C, November 2000, Pacific Scientific Instruments.
- Revision D, November 2001, Pacific Scientific Instruments.

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.

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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 μm and 0.5 μm size range at 0.1 cfm (2.83 lpm) flowrate.
- The Model R4805 counts particles in the 0.5 μm and 5.0 μm size range at 0.1 cfm (2.83 lpm) flowrate.
- The Model R4815 counts particles in the 0.5 μm and 5.0 μm 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.

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1.2 Dimensions

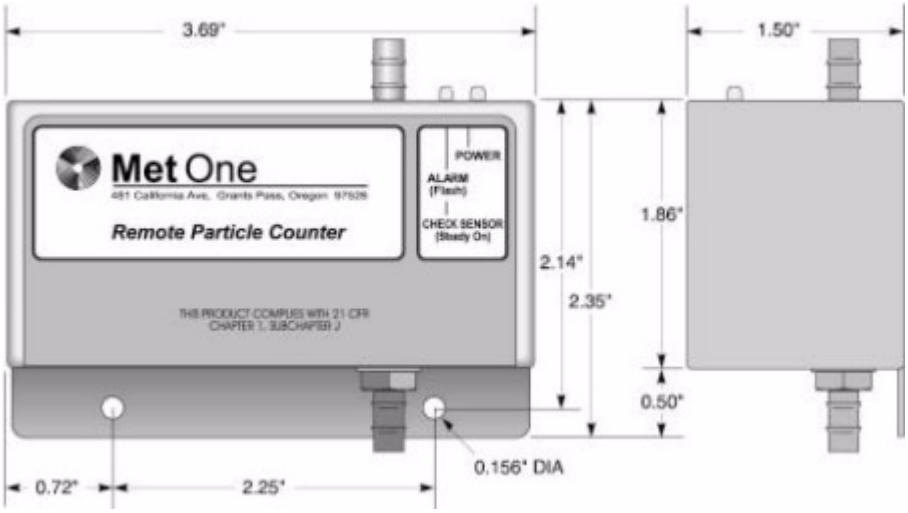

Fig 1-2 : Overall Unit Dimensions

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.

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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

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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.

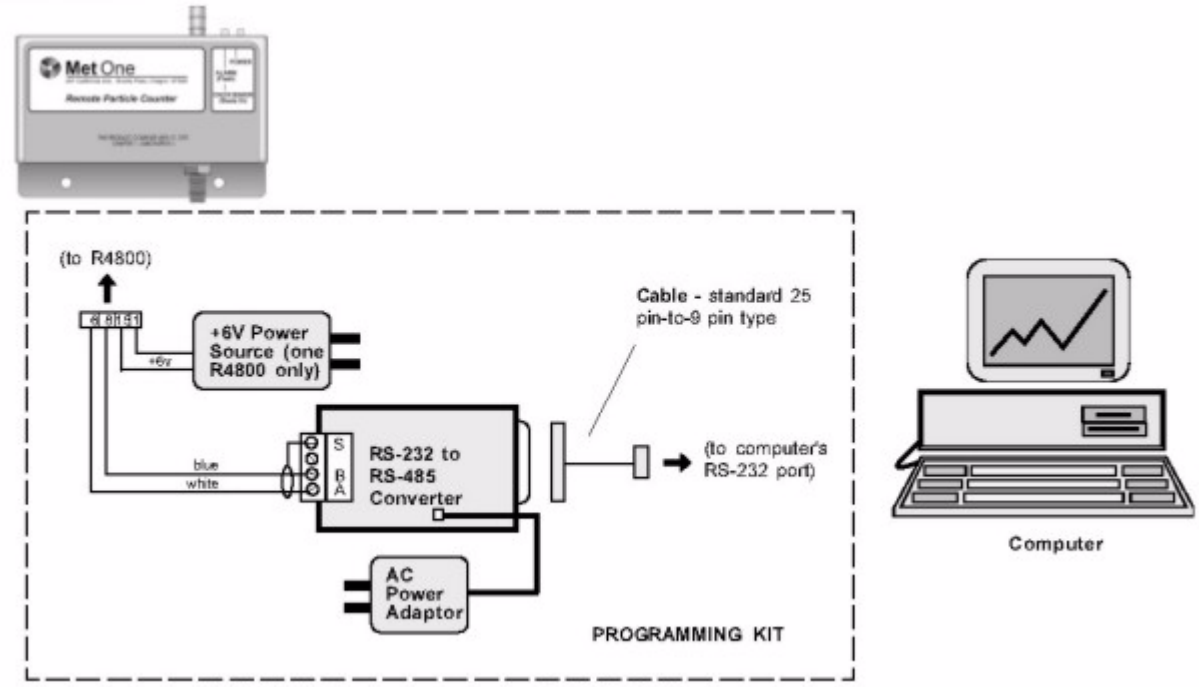

Fig 2-2 : Setting Programming Parameters Using Programming Kit

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.

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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.

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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 Hach Ultra Analytics.

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

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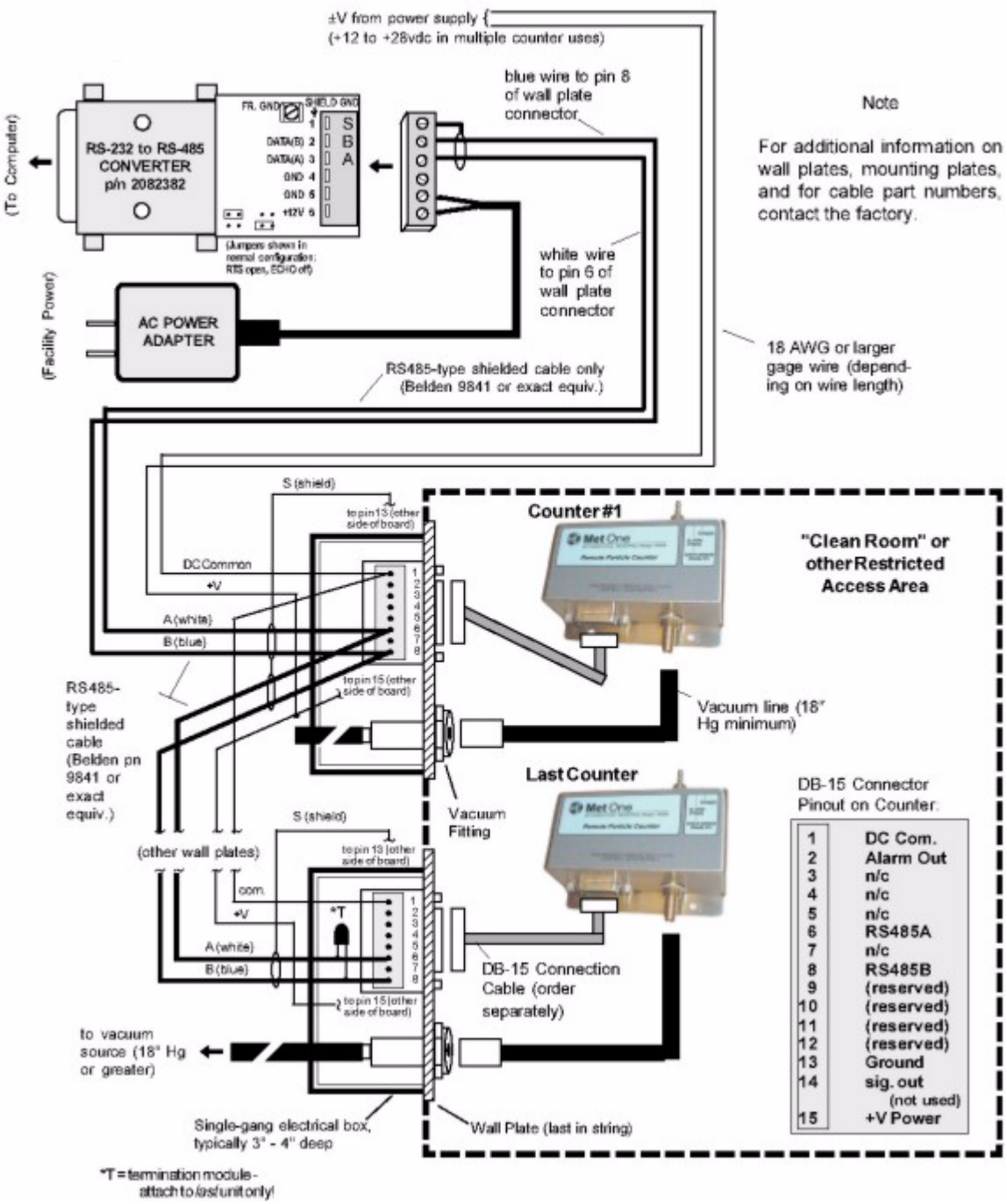

Fig 2-4 : Typical RS-485 Network Installation Diagram Using Wall Plates

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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.

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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 for most Hach Ultra Analytics software 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>).

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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.

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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.

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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.

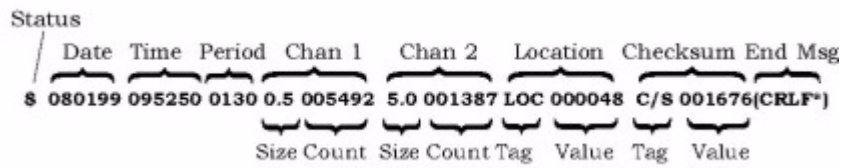

Fig 3-1 : Data Record Format Example

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	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.

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

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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 Figure 3-1 on page 18, 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.

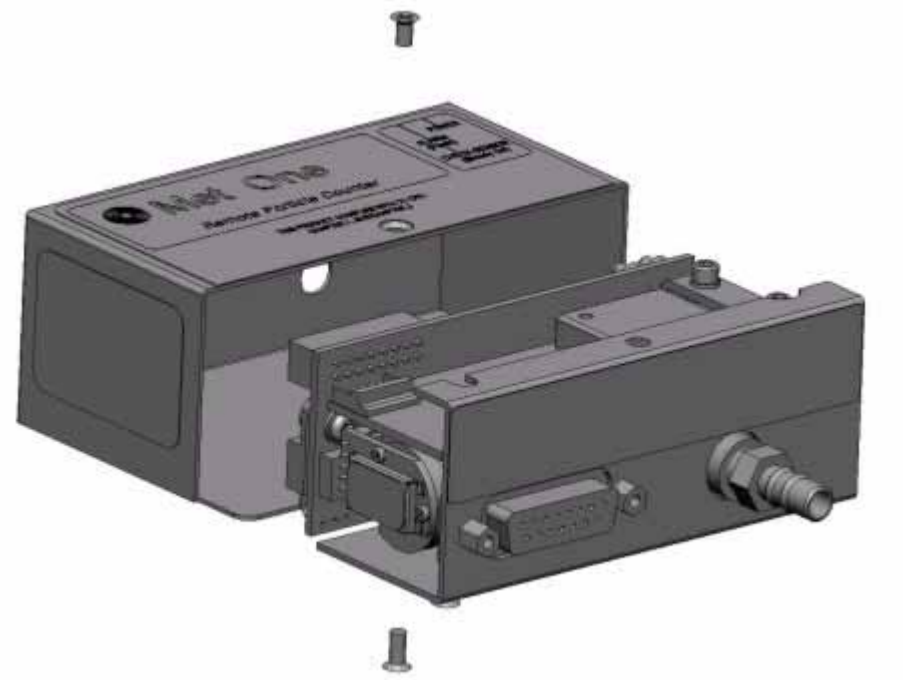

Fig 4-1 : Remote Counter Cover Removal Diagram

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

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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.

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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.

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

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 FFFFFF	

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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 the R4803, R4805, R4815 Remote Airborne Particle Counters for service, complete the appropriate form that appears at the end of this section. For the most recent return procedure information, including copies of all required forms, call Hach Ultra Analytics at 800.866.8854 or +1 541.472.6500.

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, Hach Ultra Analytics reserves the right to have the unit removed and destroyed by a hazardous materials disposal team at the shipper's expense.

A.3 Technical Support Information

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

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

Call +1 (541) 472-6500
Toll Free (800) 866-8854 (US/CA)
Fax +1 (541) 472-6555
6:30 AM to 5:00 PM Pacific Time
Monday through Friday
Email: TechSupportGP@hachultra.com

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Date:_____

RETURN AUTHORIZATION / PURCHASE ORDER

RA#_____ MUST BE MARKED ON THE OUTSIDE OF THE BOX OR YOUR UNIT WILL BE RETURNED.

In order for you to obtain a Return Authorization, this form must be completed

SHIP YOUR UNIT TO: Hach Ultra Analytics, 481 California Avenue, Grants Pass, OR 97526

You are responsible for properly draining and/or decontaminating your unit prior to shipment. If we receive a contaminated unit we reserve the right to have the unit removed and destroyed by a haz mat team at the owners expense.

TO:	Contact Providing Info:		Tel: Fax:		
	Alternate Contact:		Tel: Fax:		
	BILLING INFORMATION:			***SHIPPING INFORMATION:***	
FULL COMPANY NAME (do not abbrev):			**FULL COMPANY NAME (do not abbrev):**		
Addr 1			Addr 1		
Addr 2			Addr 2		
City			City		
State		Zip	State		Zip
Country			Country		
Contact:			Contact:		
Tel:			Tel:		
Fax:			Ext:		

Model:	**S/N:**	**Sizes:**	**Problem:**	
Model:	**S/N:**	**Sizes:**	**Problem:**	

"As Received" data required? ☐ Fee: $125.00 (No charge if equipment is covered under Service Contract)	**Are services covered under contract? Yes ☐ No ☐ Contract # _____**

NOTE: MINIMUM $150.00 EVALUATION FEE PER UNIT APPLIES FOR REPAIRS.

IF YOUR AUTHORIZATION / APPROVAL TO PROCEED WITH SERVICE IS NOT RECEIVED WITHIN 30 DAYS, YOUR EQUIPMENT WILL BE RETURNED UNREPAIRED AND YOU WILL BE BILLED THE MINIMUM EVALUATION FEE ABOVE.

Estimate:		**Revised:**	

If the actual cost exceeds the initial estimate, a revised estimate will be faxed for approval.

P.O.#	**Revised:**	**Taxable: Yes ☐ No ☐ Reason: _____** **Please provide exempt certificate if applicable**

Ship Method: FEDX 3DAY ECON/PPB **FOB:** Grants Pass, Oregon **Payment Terms:** Net 30

Visa/MC/AMEX accepted. If paying by credit card, please request credit card form.

Authorization Signature:		**Date:**

NOTE: Upon your approval with your P.O.# denoted above, this form becomes a binding agreement between you, the customer, for payment of services performed by Hach Ultra Analytics.

From: _____ **Tel: 800-866-7889** **Fax: 541-472-6170**

Approved: _____ Date to Ship: _____

IMPORTANT INFORMATION!

INSTRUCTIONS FOR SENDING YOUR PARTICLE COUNTER IN FOR REPAIRS OR CALIBRATION

1) Enclosed is the "RETURN AUTHORIZATION/PURCHASE ORDER" Form that must be filled out completely in order to obtain a Return Authorization Number (RA#) from Hach Ultra Analytics.

2) The **RA# must be marked on the outside of the box** before shipping any unit to us for repair or calibration. **Boxes received with no RA# marked on them will be returned.**

3) You are responsible for properly draining and/or decontaminating your unit prior to shipment. If we receive a contaminated unit we reserve the right to have the unit removed and destroyed by a haz mat team at the owners expense.

4) Following are Instructions for Filling out RA/PO Form. Please make sure every line is filled out completely, providing the following information:
   a) Main Contact: Full name of contact person; include phone/fax numbers.
   b) Billing and Shipping Information: Include addresses, phone/fax numbers, and contact person.
   c) Equipment Information: Include model number(s), Serial number(s), and the reason for sending the equipment in (i.e., calibration and repair). Provide a detailed description of what is wrong with the unit.
   d) Call Customer Service @ 800-866-7889 and ask the Customer Service Rep for a "NOT TO EXCEED" amount for your RA/PO Form by giving them the model number(s) of the instrument and the reason for the return.
   e) Method of Payment: Mark the appropriate box on the bottom of the form (for credit card payment, please provide credit card information including signature of the card holder),
   f) If you require "As Received Data", please check the appropriate box.
   g) Provide Taxable Information (not applicable for International service).
   h) If you want your unit shipped back to you other than FedEx Economy (3 Day), please cross out this ship method, and provide us with the account number and ship method you wish us to use when returning your unit.

Once the form is complete, please FAX to 541-472-6170. You will be given a Return Authorization Number within 24 hours. If you need the RA# immediately, please call after faxing it and the Customer Service Rep can give you the number verbally.

This form helps us to better serve our customers, and it has reduced turn around time considerably. If you have any questions filling out this form, please do not hesitate to call our Customer Service Reps at 1-800-866-7889.

THANK YOU FOR YOUR COOPERATION IN OBTAINING AN RA#

RA Number:	Date:

Return Authorization / Service Order (International only)

A. To obtain RA number, complete this form and email/fax it to Service at 541-472-6170.
B. **Mark the RA number on outside of the box.** Unmarked boxes will be returned with no action.
C. Ship your unit to: HACH Ultra Analytics, 481 California Avenue, Grants Pass, OR 97526
D. If the actual repair cost exceeds your approval, then we will contact you with an estimate.
E. Revise your original approval / purchase order for the new amount. If we don't receive your revised order within 60 days, we will return your unit and bill you $ 150 evaluation fee.

Your Information

Your name	
Tel, Fax & Email address	

Your Company

Company Name	
Bill to Address Tel, Fax, Email, Contact Person	
Ship to Address Tel, Fax, Email Contact Person	

Your Product

Model number	Serial number	Problem

Payment & Shipping Information

1) We approve repair/service charges up to $ _____ on our Purchase order number:_____

Authorized signature_____ Date_____

2) Shipment method, your carrier account number and other shipping instructions:

3) Value of the instrument for customs purposes only: $_____

IMPORTANT NOTE ON CUSTOMS VALUE: Our invoice will include the repair value as the commercial value of the invoice. This value will be declared in our invoice and shipping documentation. We would also need to declare the value of the unit itself for customs purposes. This value is for customs only and has no commercial value. Please provide us with the reasonable value of the instrument for customs purposes.

Tel: 800-866-7889 Fax: 541-472-6170 EMAIL: customerservice@hachultra.com

RETURNING UNITS FOR REPAIRS

PROCEDURES

A. To obtain RA number, complete the attached form and email/fax it to Service at 541-472-6170. Please provide all the information required including your company information (Bill to and ship to addresses), product information (Model number, serial number and detailed problem statement), your not to exceed amount and purchase order number, payment method and complete shipping instructions.

B. **Mark the RA number on outside of the box.** Unmarked boxes will be returned with no action.

C. Ship your unit to: Hach Ultra Analytics, 481 California Avenue, Grants Pass, OR 97526

D. If the actual repair cost exceeds your approval, then we will contact you with an estimate.

E. Revise your original approval / purchase order for the new amount. If we don't receive your revised order within 30 days, we will return your unit and bill you $150.00 USD evaluation fee.

RETURNING UNITS

All units should be sent to Hach Ultra Analytics at the address below. AWB should contain the following information:

Consignee	**Hach Ultra Analytics** 481 California Ave., **Grants Pass, Oregon 97526 USA**
Notify	**Expeditors International** 2508 North Marine Dr., Portland, OR 97217 Tel: 503-254-3707
Airport of destination	**Portland Airport, Oregon, USA**

COMMERCIAL INVOICE

Please make sure that your commercial invoice clearly states that units are ***Made in USA by Hach Ultra Analytics*** and are being returned for repair or replacement. **Customs will hold shipment if no invoice is included.**

FREIGHT CHARGES

If the returned items are not covered under warranty, you are responsible for freight charges. If the item is covered under warranty, you will pay freight for returning the item to Hach Ultra Analytics. Hach Ultra Analytics will pay the freight to ship the replaced or repaired item covered under warranty. Hach Ultra Analytics will return the repaired unit by the same method it was shipped to Hach Ultra Analytics.

IMPORT CHARGES

When you use airfreight to return items, our broker charges an average of $100.00 to $150.00 to clear and deliver the shipment to us. Hach Ultra Analytics will bill you for these import charges. Attached is a declaration form that, if completed and included with your shipment to Expeditors International, may reduce or eliminate these customs fees altogether. Please forward a copy of this form to us as well because there is a similar form that we need to complete and forward to them verifying your information. As an alternative to using Expeditors International you can ship via a courier service such as Federal Express or UPS, who deliver directly to us bypassing the customs broker.

CUSTOM'S VALUE FOR REPAIR OR REPLACED ITEMS

Please provide us with the "Declared value for customs" when completing the RA form. Our invoice will include the repair value as the commercial value of the invoice. This value will be declared on our invoice and shipping documentation. We would also need to declare the value of the unit itself for customs purposes. This value is for customs only and has no commercial value. As the shipper Hach Ultra Analytics bears the burden of proof for the value, if you do not provide a reasonable value of the instrument, Hach Ultra Analytics will override the given amount. Hach Ultra Analytics assumes no responsibility for damage to the product during shipment/transit. Please note that in case of transit damage, the amount you can claim from your insurance will be limited to the declared value.

Declared Value/American Manufacturer's Affidavit
Goods have no commercial value they are being returned for repair/calibration

Date: _____

Name of Manufacturer: Hach Ultra Analytics
Address of Manufacturer: 481 California Avenue
Grants Pass, OR 97526

Description of returned articles:_____

_____

_____

_____

I declare that the information given is true and correct to the best of my knowledge and belief.

That the articles described above are the growth, produce or manufacture of the United States and have been returned to the United States without having been advanced in value or improved in condition by any process of manufacture or other means, and that no drawback has, or will be, claimed on such articles. The article was returned for the sole purpose of repairing/calibration either under warranty or at the expense of the owner. This value of $_____ is for customs only and has no commercial value.

Name: _____

Title: _____

Signature: _____

Appendix B: Specifications and Accessories

B.1 Specifications

Sensitivity	
R4803	0.3 μm @ 0.1 cfm (2.83 lpm)
R4805	0.5 μm @ 0.1 cfm (2.83 lpm)
R4815	0.5 μm @ 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 (±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

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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 Hach Ultra Analytics representative or from the factory by calling 800.866.8854 or +1 541.472.6500 from 8 AM to 5 PM PT.

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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Appendix C: Certifications

C.1 Declaration of Conformity

The Declaration of Conformity appears on the next page.

DECLARATION of CONFORMITY

We,

Hach Ultra Analytics
481 California Avenue
Grants Pass, OR 97526

declare under sole responsibility that the

Model: R4800 Series, Part Number: 2086895-All

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

EN 61326:1998, Class A, Group 1, Emissions:

EN 55011:1991 Class A Radiated

EN 61326:1998, Immunity:

EN 61000-4-2 Electrostatic Discharge
EN 61000-4-3 Radiated Immunity, Amplitude Modulated
EN 61000-4-4 Electrical Fast Transient
EN 61000-4-5 Surge Transients
EN 61000-4-6 Conducted Immunity
EN 61000-4-8 Immunity to Power Frequency Magnetic Fields

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

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

Hach Ultra Analytics
18-MAR-04
(Place and date of issue)

Shawn Hogan, Engineering Supervisor
Shawn Hogan
(Name/signature of authorized person)

Annex

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User Notes

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