

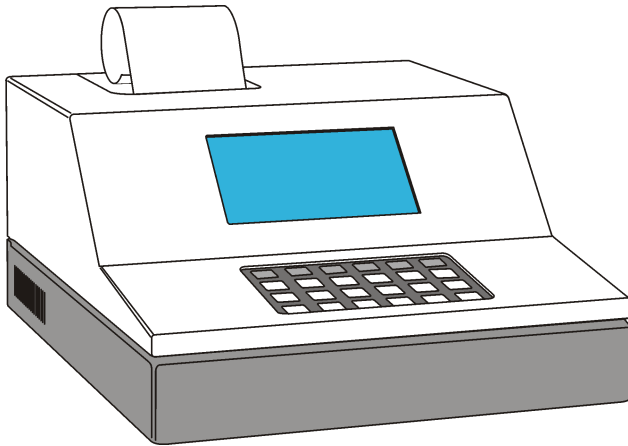


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8000A

05/2012, Edition 1

User Manual



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Specifications

Performance characteristics	
Liquid applications formats	Hydraulic industry: <ul style="list-style-type: none"> • ISO Solid Contamination Code • NAS1638 • Mil-STD-1246C
	Pharmaceutical industry: <ul style="list-style-type: none"> • USP 24< 788> • JP<13> • EP<99>
	User defined table
Aerosol applications	Clean room standard: Fed-Std-209E
Power requirements	100-230 Vac, 50/60Hz, 0.3 A
Physical characteristics	
Dimensions	Depth (16 in.) x Width (12 in.) x Height (6.5 in.) (406.4 mm x 304.8 mm x 165.1 mm)
Weight	12 lb (5 Kg)
Environmental characteristics	
Operating	Temperature: 5- 50 °C (44.6 - 125.6 °F) Humidity: 30 - 95% R.H. (Non-condensing)
Non-operating	Temperature: -40 - 71 °C (-40 - 159.8 °F) Humidity: 0-98% R.H. (Non-condensing)
Operating environment	For indoor use only
Altitude	3000 m (10,000 ft) max
Pollution Degree	2
Overvoltage category	II
Protection Class	I
Certifications	CE

General information

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. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.








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

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.
NOTICE
Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary labels

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment.
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol indicates the need for protective eye wear.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/98/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user. Note: For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.

Certification

Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

General risk statement

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Product overview

The Model 8000A Counter is a digital 8-channel particle counter for use in batch or online particulate contamination analysis.

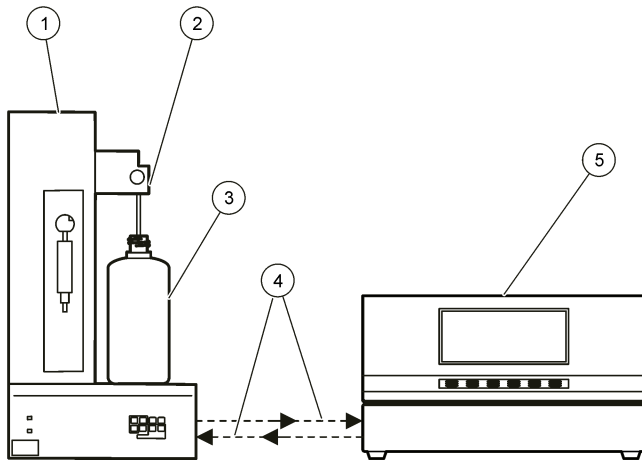
The instrument can be used in batch system analysis with typical configurations that include a sensor, sampler and counter. [Figure 1](#) on page 6 shows a typical system configuration. The instrument can also be the focal data processing point for small multi-sensor applications.

Other instrument features include:

- The ability to save 4 calibration curves in memory which lets a user change sensors quickly.
- Three levels of password-protected access.
- An auto calibration function to help calibrate compatible sensors.

System configuration example

Figure 1 Typical system with an 8000A



1 Sampler	4 Communications and sensor signal
2 Sensor	5 Particle counter
3 Sample container	

Sensor, sampler, and transducer compatibility

The instrument is compatible with existing ROYCO sensors and current HIAC equipment.

Sensors

- All air or liquid laser diode sensors are directly compatible.
- HIAC/ROYCO Sensor JS, JA, CM, HR & E Series are all compatible. These sensors must be interfaced with a Remote Power Supply (Model RPS-2).
- Model 346 is compatible. Cable 033C540-01 is required for connection.

Samplers

- HIAC/ROYCO Models 3000, 3000A, ABS, ABS 2 and the Syringe Driven Sampler (SDS).

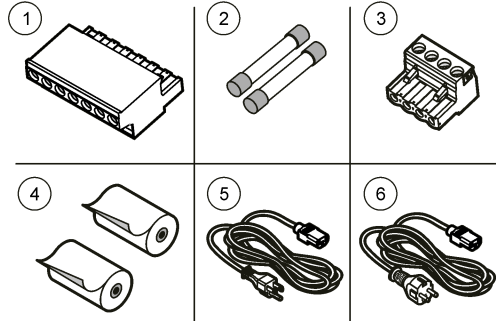
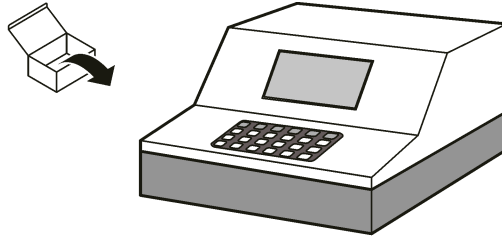
Transducers

- Analog transducers that furnish 4-20 mA current source signals are compatible. However, automatic conversion of the 4-20 mA signal to appropriate units is provided only for transducers sold by HIAC/ROYCO specifically for use with the Model 8000A. All transducers must use standard pinning in 9-pin amp connectors.

Product components

Make sure that all components have been received. Refer to [Figure 2](#). If any items are missing or damaged, contact the manufacturer or a sales representative immediately.

Figure 2 Instrument components



1 7 pin, auxiliary port connector	4 Thermal printer paper
2 Fuse (2x) (T, 1A, 250V)	5 Power cord (US)
3 4-pin Alarm port connector	6 Power cord (European)

Installation

⚠ DANGER	
	Electrocution hazard. Always remove power to the instrument before making electrical connections.

⚠ DANGER	
	Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Installation guidelines

Obey the suggestions and requirements below to install this instrument.

- Put the instrument next to the sensor.
- Do not put the instrument in an area where electronic noise, mechanical vibration, liquid spills or leaks from other equipment are possible.
- Do not use extension cords with the instrument.
- If several system components are line-powered, make sure that all components are connected to the same supply circuit. The use of separate circuits may increase system noise levels.
- Install the instrument in an area with convenient access for operation, maintenance, testing, ventilation and the on/off switch.
- Connect all cables before power is applied to the system.

- Apply power only after all electrical and mechanical connections are made.

Rear panel connections

⚠ DANGER

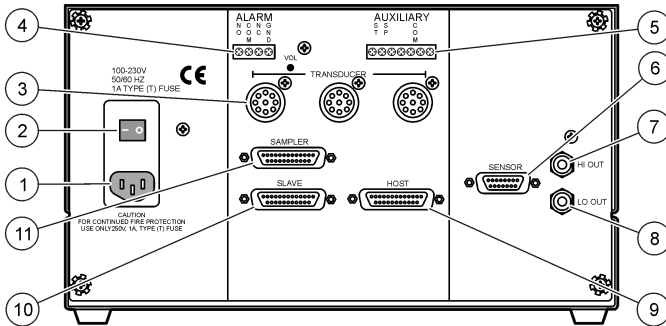


Electrocution hazards. Connect the instrument only to ancillary equipment that has an appropriate safety assessment.

Figure 3 shows the connections on the rear panels of the counters.

Install all system components before connections are made.

Figure 3 Rear panel connections



1 Power connector (Common housing includes connector, power fuse)	7 Scatter signal output from Dual Mode sensors (Not for use with 8011 or 8012 systems. No user connection detail provided.)
2 On/Off switch	8 Extinction signal output for Dual Mode sensors and for HRLD sensor signal (Not for use with 8011 or 8012 systems. No user connection detail provided.)
3 Transducer connection (3x)	9 Host connection (Not for use with 8011 or 8012 systems. No user connection detail provided.)
4 Alarm input (Not for use with 8011 or 8012 systems. No user connection detail provided.)	10 Slave connection (Not for use with 8011 or 8012 systems. No user connection detail provided.)
5 Auxiliary input (Not for use with 8011 or 8012 systems. No user connection detail provided.)	11 Sampler or SDS connection (8012 systems). (Not for use with 8011 systems. No user connection detail provided.)
6 Sensor connection (DP-15P)	

Connect the instrument

1. If a direct connection, connect the control and signal cable to the instrument (sensor) and the sensor unit. If the RPS-2 interface is necessary, connect the control and signal cable to the instrument (sensor) and the RPS-2.
2. Connect the control cable to the instrument (sampler) and the sampler unit if used.
3. Connect the RS232 cable to the instrument (host) and the host computer (COMn where n = the software designated communications port), if this system is in use.
4. Connect the environmental transducers if in use. Make sure that a 4-20 mA analog transducer is installed and that the connector and wiring are compatible. Connect to any of the transducer ports (1, 2 or 3).
5. Connect the alarm circuit if used.
6. Connect the remote control (Auxiliary) circuit, if used.

Connect AC power

Note: Do not turn on the instrument until all system components are connected and the connections have been verified and the system is ready to use.

1. Make sure that the power cord has the correct plug for the location where the instrument is used. If an alternate power cord is used, the cord must also

1. have a rating applicable for the supply voltage
2. have at least a 10 A current capacity
3. meet or exceed local electrical code requirements

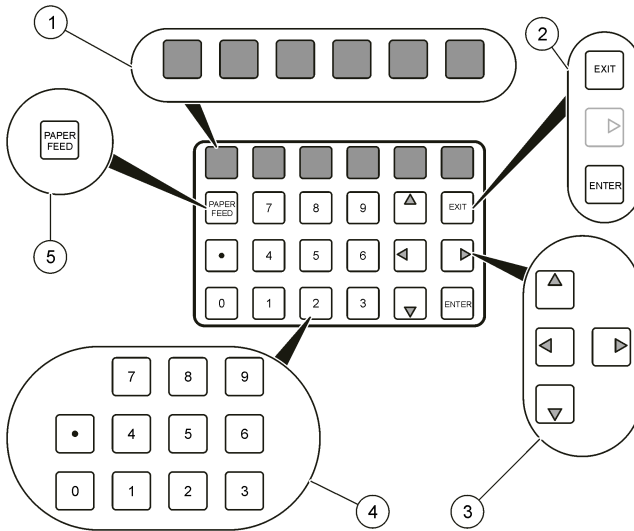
Note: A user-supplied adaptor may be necessary for some locations.

2. Connect the power cord supplied with the instrument to the power connection on back of the instrument ([Figure 3](#) on page 8).

User interface and navigation

A 24-key keypad and the display operate as the instrument user interface. [Figure 4](#) shows the keys grouped by function. [Table 1](#) describes the functions of a key or key type.

Figure 4 Keypad



1 Function keys	4 Numeric entry keys
2 Data entry keys	5 Paper feed
3 Arrow keys	

Table 1 Key descriptions

Key or key type	Description
Function keys	The display above each key shows the current function of that key. The key functions change as the menus change. If a function affects more than one counter in the system, the display shows SELECT CNTR above the function key when the key is pushed. The display shows the threshold settings for the first counter. To show settings for the next counter in the system, push the SELECT CNTR key again.
Data entry keys	The ENTER and EXIT keys control input and output operations. The ENTER key accepts numeric input. The EXIT key completes an operation.
Arrow keys	The arrow keys control movement of the screen cursor. The up and down arrows give access to the alphabet and special characters and will toggle through two or more predefined statements. The up and down arrows also control the display contrast when in a menu screen selection mode.
Numeric keys	There are ten numeric keys (0-9) and a decimal (.) key. These eleven keys control all operations not given above.
Printer control	Push the PAPER FEED key one time to move the printer paper one line forward. Push and hold the key to continuously move the paper forward. When the instrument is not doing a soft key function, push the right arrow key to send the contents of the LCD display (not including graphics) to the printer. Only the center portion of the display is printed.

Operation

Counter setup

CNTR SETUP is part of the Parameter Setup menu. Counter Setup parameters must be defined for all counters. The selection of a specific testing standard may cause some of the screen items to change.

Push EXIT to exit the Counter Parameters Menu.

- From the Parameter Setup menu, select CNTR SETUP.
- Use the up and down arrow keys to enter up to 4 identifiers for a sample in the fields. Identifiers can be used for the product name, batch number, lot number, sample runs, etc. Each field entry can be up to 8 characters long. Push Enter to move to the next field.
- Activate or inactivate the background subtraction feature. Background Subtraction compensates for background counts in a diluent when a diluted sample is analyzed.
 - Do several sample runs with the volume of diluent present in the diluted samples.
 - Use the SAVE BKGRD function to save the run data (or averaged data) as a background, then activate background subtraction. Background subtraction occurs before dilution factor multiplication.
- Enter a Dilution Factor between 1.00 and 1,000,000. This value is the dilution factor needed to bring a viscous or concentrated solution within the limits of the sensor.
- Select a standard. The firmware of the Model 8000A has the standard parameters for NAS 1638, ISO4406, MIL-STD-1246C, USP <788>, JP<13>, EP<99> and Fed-Std-209E analyses. A User Defined Standard can be entered in the User Defined Standard Functions Menu. Only one User Defined Standard can be entered.

Option	Description
NAS 1638	Industry standard for classification of liquids according to cleanliness level.
ISO4406	Industry standard for classification of liquids according to cleanliness level.
MIL-STD_1246C	Industry standard for classification of liquids according to cleanliness level.

Option	Description
USP<788>	Industry standard for classification of liquids according to cleanliness level.
JP<13>	Standard used by the parenteral drug industry (Japan).
EP<99>	Standard used by the parenteral drug industry (Europe).
Fed-Std-209E	Industry standard for classes of air cleanliness for airborne particulate levels in cleanrooms and clean zones.
User defined standard	Standard created by the user.

6. Select a mode. The choice of mode may affect the parameters shown on the screen.

Option	Description
Time	Sets the amount of time that particles are counted. Time Mode is automatically entered when Fed-Std-209E is selected.
Manual	Start or stop the counter with the START and STOP buttons.
Counts	The counter samples until a specific count is exceeded in a designated count channel. The channel and count values are designated in the counter parameters page of Setup. The number of counts in the count channel may exceed the limit before counting stops.
Volume	Select this mode if sampling is controlled by an external volume sampler. Volume mode is automatically selected when <788>, JP<13> or EP <99> is used.

- Enter a value for the Stabiliz Delay in 00 H, 00 M, 00S to 02 H, 59 M, 59 S. A typical delay time is less than one minute.
- Enter the number of the channel, between 1 and 8. This is the channel that will be periodically monitored by the counter to determine if the cumulative counts have been exceeded. The default channel number is 1. This field is only active if the Counts Mode has been selected.
- Enter a value for the Cumulative Limit from 1 to 9999999. When the counter monitors the Counts Channel, the counts value is compared to the Cumulative Limit. If the limit is exceeded, the sample run stops. It is possible for the count to exceed the Cumulative Limit before the run is terminated. The default Cumulative Limit value is 9999999. This field is active only if Counts Mode is selected.
- Enter a value for the Sample Time between 00 H, 00 M, 00 S and 02 H, 59 M, 59 S. This value is the length of each sample run. This field is active only if Time Mode is selected. If Fed-Std-209E is selected, Sample Time is calculated from the sample volume specified in the 209E SETUP function, assuming a flow rate of 1.0 cubic feet per minute. The sample time cannot be changed directly.
- Enter a value for the Sample Volume between 0.1 and 9999 mL. This is the quantity of fluid that will be sampled in each analysis. This value is preset to 5 mL if USP24<788>, JP<13> or EP<99> is selected and a glassware check is being run. For MANUAL and TIME modes, set the sample volume to match the sample volume delivered during the run.
- Enter a value for the Pooled Volume between 20 and 9999 mL. This value is the quantity of fluid removed from the Pooled Containers and placed in a common container from which the sample is drawn. Pooled Volume will vary depending on which standard is used. The Pooled Volume field is available only when USP24<788>, JP<13> or EP<99> is selected.
- Enter a value for the Containers Pooled between 10 and 9999. This is the number of containers the Pooled Volume is drawn from. The value will vary depending on which standard is used. The Containers Pooled field is available only when USP24<788>, JP<13> or EP<99> is selected.
- Select the Test Type, i.e., Glassware test or Sample test. The glassware test makes sure that the environment is suitable for the analysis, the glassware is clean, and the water used for analysis is free of particles. Sample Test refers to the testing of the Sample Volume. The Test Type field is available only if USP24<788>, JP<13> or EP<99> is selected.

Set passwords and access levels

The counter has three levels of operator access: High, Medium and Low. Operators with High level privileges can access all the functions available to operators with Medium and Low access. Low level access does not require a password.

On start up, an operator must enter a password when prompted by the instrument. If the operator pushes only the ENTER key, or enters an invalid password, the operator has only low level access.

Make sure that the date and time for the counter are correct before access levels and passwords are set.

1. In the Password functions menu, select an option.

Option	Description
SET LEVEL	Sets the access level lower than the current level. This is the only password button enabled for medium level operators.
SET PASWD	Sets the passwords for high and medium level access. The password must be typed in once, then typed in again for verification. Passwords are alphanumeric entries of up to 16 characters.
SET ACCES	Only available to high level users. Controls the functions available to medium and low level operators. The medium level operator has access equal to or greater than the low level operator access. If a high level operator grants a low level operator access to a function, the medium level operator access is automatically enabled.

2. Update or change the settings for the selected function.

Set the clock

Set the instrument clock as soon as possible after installation. Push ENTER to accept the data in a field segment and move to the next one.

1. In the Miscellaneous functions menu, push SET CLOCK.
2. Enter the date and time data in the format MM/DD/YY HH:MM:SS.

Set the display preferences

Use the DISP PREFS function to set the system display and print parameters.

1. From the Main Functions menu, push DISPL.
The display shows the Display Functions menu.
2. Push DISP PREFS.
The display shows the Display preferences screen for the first counter.
3. Change or update the settings. Push Enter to confirm a setting.

Option	Description
Counts format	Liquid standards: Counts (particles detected in each channel) or Counts/xxx mL (Counts in a operator specified volume of fluid). The sample volume must be entered in the sample volume field of the CNTR SETUP function. Aerosol Standards: Counts, Counts/CM (Cubic Metre) or Counts/CF (Cubic Foot). Valid only in TIME mode. Assumes a flow rate of 1.0 CFM (Cubic Feet per Minute). Do not use this format if the flow rate is not 1.0 CFM.
Counts per volume	Value between 0.1 and 100,000 mL for calculating counts/xxx mL.
Size format	The format for identification of particle size on the counter display or printout. Size: results are displayed in microns. mV/range: results are shown in mV over the range of E1/E2/S1/S2.
Display format	Histogram: Values are shown graphically as vertical bars. Tabular: Values are shown in columns with headings.

Option	Description
Print format	Histogram or Tabular , similar to Display format.
Histogram type	<p>Cumulative: Counts for each channel (bin) equal the sum of the counts that are greater than the channel threshold setting and the counts in all channels above.</p> <p>Differential: Counts for each channel (bin) are those between the threshold of the current channel and the threshold of the next higher channel.</p>

DISP RUN, DISP AVG, DISP BACK and DISP RESULT functions

These functions are found in the Display Functions menu. Each function is described in [Table 2](#).

Table 2 Display Run, Average, Back and Result functions

Display function	Description
DISP RUN	Shows the current run information for a counter on the system. Display parameters are set up in Display Preferences.
DISP AVG	Shows the average values for each channel in Size or mV/range, similar to the Size Format parameter in Display Preferences.
DISP BACK	Shows the current background information for a counter on the system. Parameters are set up in Display Preferences.
DISP RESULT	Shows the latest Fed-Std-209E analysis, if available. The limit, mean, standard deviation and UCL fields are given in units of counts/CF, regardless of the unit chosen in the Counts Format field in Display Preferences.

Make a counter active or inactive

- In the Miscellaneous functions menu, push CNTR COMM. The display shows the Counter Communications menu.
- Push ACTIV CNTRS. The current state of each counter is shown.
- Use the arrow keys to change a counter to active or inactive. Push ENTER to confirm the selection. Inactive counters do not respond to the START key. All counters in the system are set to the active state by default when the counter is powered on. At least one counter must be active at all times.

Configure a global setup

Global Setup is part of the Parameter Setup functions menu. Global setup parameters apply to all counters in the system.

- In the Parameter Setup functions menu, push GLBL SETUP. The Global Parameters screen appears.
- Use the up and down arrow keys to enter the Operator ID. This field has a limit of 12 alphanumeric characters.
- Enter the number of runs (1-99), then push Enter. This is the number of analyses for a specific testing cycle and the value used to calculate run averages.
- Enter the Delete Time — 00 H, 00 M, 00 S and 02 H, 59 M, 59 S. Delete Time is a period of time to select whether to keep or delete the run data. The default value is 00 H, 00 M, 015 S. Delete Time is active only if the number of runs is set to greater than 1. The Delete Time clock operates at the completion of each run. The next run cannot start until the Delete Time cycle is complete or the KEEP RUN or DELET RUN key is pushed.
- Enter the Delay Time between 00 H, 00 M, 00 S and 99 H, 59 M, 59 S. This is the time between the end of a run and the start of the next. The default Delay Time is 00 H, 00 M, 15 S. The Delay Time clock starts after the last Delete Time period of a run series is complete.
- Select English or Metric for the units of measure for all displays, then push Enter.

7. Enter the Quick Adjust Rate between 00 H, 00 M and 48 HH 59 MM. The counter automatically does an internal calibration cycle (or quick adjust) at this interval. A rate of 00 H, 30 M is recommended. To disable the feature, enter 00 H, 00M.
If a quick adjust cycle is set to start while a sample is being run, the quick adjust cycle does not start until after the sample run is complete. If a host command is received before a quick adjust cycle is complete, the command is held until the end of the quick adjust cycle.
8. Push Exit to save the settings and go back to the Parameter Setup menu.

209E setup parameters

Use this function to set up the counter for a FED-STD-209E aerosol analysis. The first screen contains the variables, and the second screen contains the bin size thresholds. Push ENTER to confirm a menu selection.

1. In the Parameter setup functions menu, push 209E SETUP.
The display shows the FED-STD-209E Parameters screen.
2. Enter the setup parameters for the first screen.

Option	Description
Volume units	English (particles per cubic foot) or Metric (particles per cubic meter)
Cleanliness class	The number of particles greater than 0.5 micrometers in diameter per given volume.
Locations	The number of sample points available—2 to 992.
Min samples/Location	The number of samples taken at each location. Range: 1 to 99.
Sample time	The length of each sample interval in seconds.
Last display channel	The number of the highest channel that appears in the displays. Used to remove the display of higher channels when the channel data is not necessary. Range: 1 to 8.
Print results	YES or NO <ul style="list-style-type: none"> • YES--print the results of the analysis after samples have been taken at all designated locations. • NO-- do not print the results. Print functions for individual samples or averages are set in the Printer Functions menu.
Sample volume	This read only value is the sample volume selected by the user. The value is calculated from the rate of sample flow through the sensor and is shown in the units specified in the Volume Units field.

3. Push NEXT PAGE to view the second screen.
4. Enter a value for the threshold setting for each of the 8 channels between 0.01 and 9999.00 μm . The lowest threshold value is assigned to the lowest designated channel, and each succeeding channel has a larger value. If this does not happen, an error message will appear. The error message must be cleared before operation can continue.
5. Make sure that at least one YES appears in the Affects Results? column. This column specifies whether or not data in the channel is used to determine if the data is in accordance with the specified cleanliness class.
By default, the display shows YES in this column for Channel 1.
6. Push EXIT to go back to the Parameters Functions Setup Menu.

3000A setup parameters

This menu is used to set up a 3000A auto sampler for use with the instrument.

1. In the Parameter Setup Functions menu, push 3000A SMPLR.
2. Push 3000A SETUP.
The display shows the setup screen.

3. Update or change the parameters.

Option	Description
Flow rate	Flow rate through the sampler. Range: 10 to 100 mL/minute.
Syringe size	The size of the syringe used—1, 10 or 25 mL
Tare volume	The sampler draws this volume in mL before counting begins to make sure the flow rate is stable. The default tare volume is 5% of the syringe size. This is the recommended tare volume. The value can be changed.

LOAD SYRNG, BACK FLUSH, PRIME and TARE ONLY functions

These functions are part of the Model 3000A Sampler Functions Menu. The functions are described in [Table 3](#).

Table 3 LOAD SYRNG, BACK FLUSH, PRIME and TARE ONLY functions

Function	Description
LOAD SYRNG	Makes the counter pull the syringe plunger drive screw to the bottom travel point. This allows the syringe to be loaded or unloaded. Refer to the Model 3000A Operator Manual for more information on how to load or unload syringes.
PRIME	Makes the Model 3000A run three consecutive samples through the system. This can clear air bubbles that can affect results.
BACK FLUSH	Reverses the flow through the system. This action can help clear sensor blockages.
TARE ONLY	Makes the Model 3000A pull only the tare volume through the instrument. This is useful for the volumetric accuracy test necessary for USP <788>, JP <13> or EP <99> standards.

Set the instrument alarms

Use the alarm function to display and change the alarm settings for each counter. Each counter alarm condition can be controlled independently.

Alarms can be set to test for Rate, Greater Than (>) or Less Than (<) conditions.

Alarm volume can be adjusted on the rear panel of the instrument.

1. In the Miscellaneous functions menu, push SET ALRMS.
The Alarm settings screen appears.
2. Update or change the Alarm settings.

Option	Description
Alarm channel	Enter a value between 1 and 8 to designate which channel to test for an alarm condition. Cumulative data is used for the test for all three alarm conditions.
Rate alarm limit	The frequency, in counts per minute, at which the system checks the input pulse rate during a sample run-0 to 999999. For values above 1000, the rate is measured once every three seconds. After an alarm is triggered, the rate is measured once per second until the alarm is reset. For values equal to or less than 1000, the rate is measured every 60 seconds. After an alarm is triggered, the rate is measured every 20 seconds until the alarm is reset. Push [.] to disable the alarm.
> Alarm limit	Enter a value between 0 and 9999999. This alarm is measured at the end of each sample run. The alarm stays set until the end of the next sample run. The alarm is set if the counts are less than or equal to the limit or until it is disabled by the operator. Push [.] to disable the alarm.

Option	Description
< Alarm limit	Enter a value between 0 and 9999999. This alarm is measured at the end of each sample run. The alarm is reset if the counts are greater than or equal to the limit or until it is disabled by the operator. Push [.] to disable the alarm.
Alarm print	If this function is activated, sample run data is sent to the printer after runs which make an alarm turn on. The data is not sent to the printer after runs that do not turn on any alarms. This is true even if automatic printing of run data has been enabled with the AUTO PRINT soft key function. The alarm print feature does not affect printing of averaged data after a multiple run cycle.

About the instrument relay

In the deactivated state, Terminal 1 on the rear of the instrument is normally open (NO). Terminal 3 is normally closed (NC). In response to an alarm condition (unless the alarm relay is disabled), Terminal 1 closes and Terminal 3 opens. The relay stays closed as long as the alarm condition exists. The relay can be disabled through the SET ALRMS function.

Alarm display

Alarm conditions are displayed in the error display line of the instrument display or on printed results. The display shows alarms in abbreviated form as in the example.

ALARM EXAMPLE: 1[R><] 2[R<] 4[R]

This display shows that:

- Counter 1 shows all three alarm conditions (Rate, Greater Than and Less Than)
- Counter 2 shows Rate and Less Than alarms
- Counter 3 shows no alarms
- Counter 4 shows only the Rate alarm

Alarm printouts

Alarm printouts show counter alarms individually. If automatic printing is activated for a counter, the alarm conditions are printed as they occur. When sample run data is printed, the pass and fail status of each activated alarm is printed after the data.

If the rate alarm is activated in a sample run, the run fails the rate alarm test. Even though the alarm condition may have reset before the end of the run, the alarm status line will show **Rate fail**. However, the rate alarm condition may not show in the display and the alarm relay may be open.

Host setup

Host Setup sets up the way data is sent to a host computer.

1. In the Miscellaneous Functions menu, push HOST SETUP. The Host Setup screen appears.
2. Change the entries if necessary. Push ENTER to confirm.

Option	Description
Host interface	Activates or Inactivates data transmission
Report runs	Select whether or not run information is sent to the host computer.
Report averages	Select whether or not run average information is sent to the host computer.
Report format	Select a long or short format for the run and average data that is sent to the host computer.
Data format	Select the cumulative or differential format for data that is sent to the host computer.
Baud rate	Select the baud rate at which the data transfer occurs—150, 300, 600, 1200, 2400, 4800, 9600 or 19200. The selection must equal the baud rate of the host computer I/O port.
Parity	Select odd, even or no parity. The transmitting and receiving devices must have the same parity. Most counter applications are configured for no parity.

Option	Description
Number of data bits	Select the number of bits (7 or 8) for the data sent from the counter to the host computer. Instrument applications typically use 8 data bits.
Number of stop bits	Select the number of stop bits (1 or 2) that are put after each character sent from the counter to the host computer. Most applications use 1 stop bit. For some applications that use a baud rate of 150, 2 stop bits may be necessary.

Calibration

Load a calibration

The instrument stores up to four calibration curves.

1. In the Main Functions menu, push CAL to enter the Calibration Functions Menu.
2. Push SET CAL to access the Set Calibration Functions menu.
3. Push LOAD CAL to select an active calibration curve for the run. The LOAD CAL button changes to a NEXT PAGE button and the counter shows information about one of the calibration curves for the counter.
4. Push the SELCT CNTR key to select a counter, push ENTER and then select a calibration curve.
5. Push ENTER to load the calibration curve in the display or push NEXT PAGE to show information about another calibration curve.

Change a calibration

1. In the Main Functions Menu, push CAL to select the Calibration Function Menu.
2. Push SET CAL to go to the Set Calibrations Functions menu.
3. Push ALTER CAL to change the current Sensor Calibration Parameters for a counter. The number of screens shown depends on the number of counters and the algorithm method used for each counter.
4. Update or change the parameters.

Option	Description
Sensor model	The sensor model as shown on the body. The model can be up to 14 alphanumeric characters long.
Serial number	The serial number as shown on the sensor body. The serial number can be up to 14 alphanumeric characters long.
Comments	Information about the calibration that is used for identification purposes. Can be up to 14 alphanumeric characters long.
Calibration date	The date of the calibration in MM/DD/YY format.
Material	The material used for calibration. Choices are: ISO MTD in oil, ACFTD in oil, ACFTD in water, latex in oil, latex in water, glass in oil, glass in water or other. If ISO MTD in oil is selected, all size readings and printouts will reflect UM(C) to indicate that a certified material was used in calibration.
Flow rate	The flow rate used in the sensor calibration in mL/min. This information is recorded on the calibration curve supplied with the sensor.

Option	Description
Sensor type (with common sensor examples)	Extinction—HRLD Dual Mode: MicroCount-05 Note: <i>The selection of sensor type affects algorithm selection.</i>
Algorithm	<p>The algorithm is the method used to relate particle size to sensor voltage. Choose Equation or Interpolation.</p> <p>The Equation method requires user-entered constants and variables for the calibration equation. This option is used with extinction sensors.</p> <p>The calibration equation used in the Equation mode is $V = A \times d^s + N$ where:</p> <ul style="list-style-type: none"> • V = threshold voltage (mV) • A = intercept (mV) • d = particle diameter (µM) • s = slope (Range 1.0 - 3.0) • N = noise (mV) <p>The Interpolation method uses four or more calibration voltage points to calculate the calibration data. This method is automatically selected in scatter and dual sensor modes.</p> <p>The interpolation algorithm requires entry of extinction and scatter points. Enter points in order of increased size.</p>

5. Push EXIT to save the new calibration.
The counter prompts for the storage slot (1, 2, 3 or 4) to save the new data in. The counter recommends new slots first. If all slots are full, the counter recommends the number of the calibration currently loaded. If the chosen slot number already has a calibration, the counter shows a message whether that calibration should be overwritten. The counter uses a new or modified calibration as the active calibration until changed.

Enter bin sizes

1. In the Main Functions Menu, push CAL.
The display shows the Calibration functions menu.
2. Push BIN SIZE.
3. Enter the number of channels for the counter.
4. Enter values for the bin thresholds according to particle size— 0.01 to 9999 µm.
The instrument uses sensor calibration data to calculate the corresponding millivolt settings.

Enter bin sizes as mV

To enter range information with the Bin mV function, it is necessary to know the sensor type and have access to the sensor calibration curve.

1. In the Calibration function menu, push BIN MV.
The display shows the Bin millivolt settings for the counter. Ranges are S1 (High Gain) and S2 (Low Gain) for scatter type sensors, and E1 (High) and E2 (Low) for extinction sensors.
2. View or update the bin threshold millivolt settings. Values must be between 0.01 and 10000.00.

Auto adjust

The auto adjust function lets bin thresholds be set more accurately. The instrument display shows "Pass" or "Fail" for each counter.

Do Auto Adjust at least once a day before the counter is used and when the counter has the correct operating temperature. The counter has the correct operating temperature approximately 30 minutes after it is turned on.

The Auto Adjust function takes about 3 minutes to complete. If the counter operates correctly, the display shows **Counter (ID) auto-adjustment OK**.

If a counter fails an auto adjustment, instrument service is necessary.

Quick Adjust

With the Quick Adjust function, the counter makes an estimate for the settings for the comparator threshold values. These estimates are based on values from the Auto Adjust function. The Quick Adjust function takes 10 to 15 seconds for each counter.

Do a Quick Adjust after an operator has changed the bin threshold settings, the calibration curve or analog circuit constants. The Quick Adjust function does not happen unless an Auto Adjust has been done.

The counter can be configured to do a quick adjust cycle automatically at periodic intervals. Refer to the Quick Adjust rate parameter in GLOBAL SETUP.

A counter may occasionally fail a Quick Adjust even when the counter is in good working condition. The typical reason for a counter to fail a Quick Adjust is a change in operating conditions since an Auto Adjust was done. Do another Quick Adjust.

If no errors occur, the counter can be used. If an error persists, do an Auto Adjust before continuing.

Dual sensor calibration

A dual range sensor gives two outputs. The possible outputs are:

- A scattering signal for small particles and an extinction signal for large particles
- A high gain signal for small particles and a low gain signal for large particles

Thus, two calibrations are supplied with this sensor. One curve is for the scattering or high gain signal, i.e., the small curve. The other curve is for the extinction or low gain output, i.e., the large curve.

1. In the Main Functions menu, push CAL.
The Calibration functions menu appears.
2. Push SET CAL.
The display shows the Set calibration functions menu.
3. Push ALTER CAL.
The display shows the ALTERCAL screen.
4. Enter the sensor model, sensor serial number and the sensor type.
5. Push the up or down arrow key to select Dual Mode, then push Enter.
The display shows the Calibration #1 screen. There must be some overlap between the small and large calibration curves.
6. Enter values for the screen parameters.

Option	Description
Sensor noise	The value in mV that represents sensor noise
Scatter data points	The number of calibration data points in the small calibration curve. Enter at least 6 data points. Enter the particle size in micrometers or in micrometers certified and the corresponding sensor output in millivolts. Enter the data in ascending order according to particle size.
Extinction data points	The number of calibration data points in the large calibration curve. Enter at least 4 data points. Enter the particle size (μM) and the corresponding sensor outputs (mV) in ascending order by particle size.

7. Select BIN SIZE from the control panel and enter the bin sizes (μM). Set the bin sizes as required by the application and the specifications of the sensor (min/max particle resolution).
The counter assigns each channel to one of the sensor outputs. This screen is accessible by pushing BIN MV. The determination is based on the overlap between the small and large calibration curves. The midpoint of the overlap between the small and large curves is found by averaging the largest particle size in the small curve and the smallest particle size in the large curve. Any channel set to a particle size greater than the mid-point of the overlap is assigned to the low gain or extinction channel.
8. Push PRNT CAL to get a hardcopy of the calibration parameters.

Additional calibration functions menu

1. In the Main Functions menu, push CAL.
The Calibration Functions menu appears.
2. Push **More**.
The Additional Calibration Functions menu appears.
3. Push the key for a function. (Push EXIT to return to the Main Function menu.)

Option	Description
Auto Adjus	Does an automatic adjustment of counter circuits.
Quick Adjus	Does a quick adjustment of channel threshold voltages
Show Xdus	Shows transducer values. If no transducers are connected, the display will show No Transducers Present.
Print Xdus	Prints transducer values. If no transducers are connected, the display will show No Transducers Present and no printout will occur.
Sensr Cal	Shows the sensor calibration functions menu. Typically used by service personnel.
Maint Funcs	Shows the maintenance functions menu

User standards

The instrument can save up to four user defined standards.

Change a user defined standard

Use the ALTER STD function to change entries in the current User Defined Standard or to make a new standard.

There are four screens which together define the standard parameters. Changes can be made to any of the four screens.

Push ENTER to move to the next screen. Push EXIT to save the standard and return to the Main Menu.

1. In the Main Function menu, push MORE.
The display shows the Miscellaneous Functions menu.
2. Push USER STD.
The display shows the User Defined Standards Function menu.
3. Push ALTER STD.
The display shows the first of four screens.
4. Update or change the entries in the first screen.

Option	Description
Standard name	Enter a name for the standard. The name can be up to 14 characters in length. The name can be a mix of alpha and numeric characters. If a standard is not named, the standard cannot be selected.
Number of classes	Enter the total number of classes, from 1-16.
Cumulative or Differential	Select either Cumulative or Differential. Cumulative : The total of all counts which exceed a channel threshold setting. Differential : The counts between the threshold of a channel and the threshold of the next higher channel.
Class Limit Units	The mathematical units used with reference to the class limits. Counts or counts/xxx mL of the liquid medium.
Sample volume	Enter a value between 0.1 and 9999 mL. This is the size of the sample.
Classify	Select whether the standard is applied to individual runs, to multiple run averages or to both.

Option	Description
Number of runs	Enter a value between 1 and 99 for the total number of runs done in each test cycle. This value is also used to calculate run averages.
Number of channels	Enter a value between 1 and 8 for the number of channels that will appear in the displays and printouts. If the number entered is less than eight, the cumulative count for the last channel will include particles larger than the threshold of that channel. In this situation, the cumulative and differential counts will be identical.
Counts per ?? mL (This field is active only if the class limits field is set to Counts/xxmL.)	Sets the maximum limits for each class. For example, if the operator enters a value of 100, the limits are specified in terms of counts per 100 mL of sample. This will be the case regardless of sample volume.

5. Push ENTER.
6. Enter a name up to 8 characters long for each class. Push ENTER.
7. Enter a threshold value in micrometers for each channel. Values must be within the sensor range. Push ENTER.
Note: Make sure that there is a threshold value in Channel 1 for cumulative mode operation. For differential mode, Channels 1 and 2 must have a threshold value. Threshold values must ascend along with the channel sequence. Channels must be adjacent and must start with Channel 1.
8. Enter a value for the maximum number of particles for each class between 0 and 9999999, in the units defined in Class Limit Units.
 Class limits are entered with the cleanest class entered first, and the dirtiest class last. The counter identifies the class based on the counts per channel and the maximum values. The printout shows this information.
9. Push EXIT to save the new standard.
10. Do one of options below:
 - a. Select a slot to store the altered standard. Push ENTER to confirm the selection.
 - b. Push EXIT to cancel the Save Standard screen. The modified or new standard is discarded. Existing standards and locations are not modified.

Printer functions

The Printer Functions menu allows the operator to printout current run data, run average data, background data and setup screens. The instrument can be put in automatic print mode for each counter.

PRINT RUN, PRINT AVG and PRINT BACK functions require selection of a specific counter. Push SELECT CNTR and select the counter, then push PRINT.

1. In the Main Functions menu, push PRINT.
 The display shows the Printer functions menu.
2. Select a function.

Option	Description
AUTO PRINT	Automatically prints data after each run, after runs are averaged or both, or disables printing. Use the arrow keys to select an option. Push ENTER to confirm the selection.
PRINT RUN	Prints the current information for a selected counter.
PRINT AVG	Prints the current run average information for a selected counter. The printout is formatted in accordance with the parameters shown in the Display Parameters screen.
PRINT BACK	Prints the current background information for a selected counter. The printout is formatted in accordance with the parameters shown in the Display Parameters screen.

Option	Description
PRINT RESULT	Prints the current 209E analysis information.
PRINT SETUP	Prints the current setup screen, global data or counter-specific data. Screens must be selected individually to print. When the screen to be printed is shown in the display, push ENTER.

4-20 mA communication

Optional 4-20 mA communication devices can be used with this instrument. 4-20 mA devices let the counter connect to chart recorders, voltmeters and other devices used to monitor processes. The counter updates the analog output at the end of each counting period.

The 4-20 mA device connects to the counter at the host connector on the instrument rear panel.

For 4-20 mA communication, the manufacturer recommends the counter setup shown in [Table 4](#).

Table 4 Counter setup for 4-20 mA communication

Parameter	Setting
Report runs	Activated
Report averages	Activated
Report format	Short
Baud rate	9600
Parity	None
Data bits	8
Stop bits	1

Maintenance

Note: Only qualified personnel must conduct the tasks in this section of the manual.

Clean the instrument

Note: Before the instrument is cleaned, turn off the power and disconnect the power cord. Make sure that all instrument panels are installed and all of the interior components are covered before the instrument is cleaned.

1. Wipe the exterior surfaces of the instrument with a moist cloth.
2. If the instrument is still not clean, wipe the exterior surfaces with a cloth made moist with a mild soap and warm water.
3. If the instrument is still not clean, wipe the exterior surfaces with a lint-free tissue and isopropyl alcohol.

Fuse replacement

⚠ DANGER	
	Fire hazard. Use the same type and current rating to replace fuses.

⚠ DANGER	
	Electrocution hazard. Always remove power to the instrument before making electrical connections.

1. Move the assembly door down.

2. Pull the fuse pull lever out and to the left.
The fuse will be pulled from the power assembly.
3. Install a new fuse (T, 1A, 250V).
4. Move the assembly door up and over the fuse and circuit card compartment.

Load the printer paper

▲ WARNING



Pinch hazard. Parts that move can pinch and cause injury. Do not touch moving parts.

1. Open the paper cover. If paper is still on the used roll, cut the paper at the spool and remove the spool from the paper tray.
2. Push Paper Feed until there is no paper remaining in the paper tray.
3. Cut the end of the new roll of paper to a clean straight edge.
4. Put the paper roll in the tray so that the paper moves toward the print mechanism from the bottom of the roll.
5. Put the edge of the paper in the slot of the feed mechanism (near the bottom of the paper tray). Push Paper Feed until the paper is pulled through the printer and close the paper cover.
Note: The Fujitsu printer has a paper tension release lever that must be in the down position for the printer to operate correctly.

Troubleshooting

Errors and warnings

Error and warning messages flash in the lower part of the display. Errors are more severe than warnings.

Many different warning and error messages can appear depending on the setup and application. Messages include information that assist the operator in clearing the condition if possible.

X and Y in the examples will be shown as numeric values in the message.

Push [.] to move beyond an error condition.

Example of a message related to data values

Error or warning	Description
Error - value must be $\geq X$ and $\leq Y$	The entered value is out of range. X and Y are shown as numeric values in the message. Enter different values.

Example of a message related to communications

Error or warning	Description
Warning Cntr x Cal not defined	The operator is attempting to set channel thresholds without having first defined the sensor calibration.

Examples of messages related to Auto and Quick adjust

Error or warning	Description
Error Cntr x: Auto adjust, nonlinear	Do an AUTO ADJUS, then a QUICK ADJUS. If both pass, the counter can be used.

Parameter entry errors

Error	Description
Error-value must be > 0 Error - value must be <= X Error - value must be >= X Error - value must be >= X and <= Y Error - value must be >= 1 Error - must be >= X, <= Y Error - channel must be between 1 and 8	The value put in by the operator is not within the correct range. X and Y show as numerical values in the error message and give the legal value range.
Error - must be in increasing order	The values for bin sizes, etc. must be put in from smallest to largest.
Error - scatter points out of order Error - calibration points out of order	The sensor calibration data points must be put in from smallest to largest by particle size.
Error - small and large sizes must overlap	In a calibration for a dual-mode sensor, there must be some overlap between the high-gain and the low-gain data. It is sufficient for the large size data to start where the small size data ends but a greater degree of overlap is recommended.

Communications errors and contamination PCB failures

These kinds of messages show when

- There is a problem in the communications between the front panel processor and the processor on the contam (counter) board
- The contam board reports a failure to the front panel

SIC refers to the Serial Instrument Communications protocol. The x is a numeric value that shows the counter number where the error occurred.

Table 5 Communication and contam board errors

Error	Description
SIC error Cntr x PROM checksum error	The PROM (programmable read-only memory) chip on the contam board is faulty and must be replaced.
SIC error Cntr x RAM read/write error	A memory diagnostic on the contam board has found an error in the system RAM. The system must be repaired.
SIC error Cntr x TRAP instruction	The contam board processor executed a TRAP instruction. A microprocessor chip or PROM or RAM chip may be defective. The system must be repaired.
SIC error Cntr x A/D failure	There is a failure in the analog to digital (A/D)circuitry on the contam board. The A/D circuitry supports transducers.
SIC error Cntr x RAM checksum error	This error is typically caused by a battery failure or a faulty memory chip. All stored parameters and data are lost if this error occurs.
SIC error Cntr x floating point error	A floating point arithmetic error (such as division by zero) has occurred on the contam board. A hardware failure or a firmware bug are possible causes. If it is possible to do so, note the conditions when this error occurred for diagnostic purposes.
SIC error Cntr x clock failure	A failure has occurred in the real-time clock chip or the battery is low.
SIC error Cntr x SIC timeout	The contam board did not respond to a command from the front panel processor. The typical cause is a fatal hardware error condition on the contam board. In early firmware versions, this error can also be caused by system noise. Contact the manufacturer for information about firmware upgrades.

Table 5 Communication and contam board errors (continued)

Error	Description
SIC error Cntr x bad character rcvcd	A character specified by the SIC protocol was expected, but a different character was received. Refer to the description of SIC timeout. In early firmware versions, this error can be caused by system noise. Contact the manufacturer for information about firmware upgrades.
Error Cntr x: sampler not connected	This message appears if the counter is made to run in Volume mode, but there is no volumetric sampler connected.
Error Cntr x: Math overflow	A particle size to millivolt or millivolt to particle size conversion gave an unreasonably large result. Data in the sensor calibration may be corrupt, or a channel may be set to a particle size outside the range of the calibration data.
Error Cntr x: Block size error	The contam board received a data or parameter block from the front panel board that is not the expected size.
Error Cntr x: Block not found	These errors are reported by the memory management firmware on the contam board. A firmware bug may be the cause. Report these errors to the customer service department of the manufacturer.
Error Cntr x: Duplicate allocation	
Error Cntr x: Directory full	
Error Cntr x: Memory full	
Error Cntr x: Block checksum error	
Error Cntr x: Block offset error	
Error Cntr x Analog consts undefined	
Warning Cntr x Cal not defined	This warning shows if channel thresholds are set when there is no sensor calibration.
Warning Cntr x can't calc. size	The board firmware tried to use sensor calibration data to calculate a particle size from a millivolt value. The calculation was not successful. This message can occur after channel threshold voltages are set with the BIN MV function.
Warning Cntr x mV limited to max	The threshold voltage calculated from a particle size is greater than the counter full-scale potential (10 V). The threshold voltage of that channel was set to the full-scale value.
Warning Cntr x Bin mV < 2 * Noise	This message appears only in early firmware versions. The channel is being set to a threshold voltage close to the sensor noise value.
No online counters	The front panel was not able to communicate with the contam board. The instrument must be repaired.
Error: X online counters (Y is max)	There are too many counters online. For front panel firmware versions lower than 5.0, the maximum number of counters is 4. For firmware versions 5.0 or higher, the maximum number of counters is 2.
Error: Trap instruction	The instrument may be out of paper.

Auto and quick adjust errors

Error	Description
Error Cntr x: Auto adjustment timeout	These errors show that a problem has occurred on the contam board. The instrument must be repaired. Contact the manufacturer or a field service representative.
Error Cntr x: Auto adjust, counts high	
Error Cntr x: Auto adjust, counts low	
Error Cntr x: Cal pulse generator bad	
Error Cntr x: Auto adjust, offset low	
Error Cntr x: Auto adjust, offset	
Error Cntr x: Auto adjust, nonlinear	Problems associated with these errors are typically not serious or permanent. Do an AUTO ADJUS and then a QUICK ADJUS. If the system firmware is version 13 or lower, an upgrade may help keep the system stable.
Error Cntr x: Auto adjust, unstable	
Error Cntr x: Auto-adjustment not done	An AUTO ADJUS has not been done. Refer to the AUTO ADJUS function for more information.

Miscellaneous errors and warnings

Error or warning	Description
Warning – Standard selection overridden	The selected bin sizes are not compatible with the standard specified in the Standard field of the CNTR SETUP function. The standard is overridden and the standard field will show None.
Warning – Extrapolating beyond cal points	Some bin sizes are not in the range of particle sizes contained in the sensor calibration data. The firmware will make an estimate for the threshold voltage value. This value may not be accurate.
Error – No calibration points entered	The user has not entered any calibration points in the ALTER CAL function.
Error – Too many calibration points	The maximum number of calibration points is 20 for a dual range sensor, 16 for other sensors. For dual range sensors, both the high and low gain parts of the calibration curve can have up to 16 points. But the total number of points cannot be greater than 20.
Printer timeout	The strip printer is not responding. This may be caused by an internal cable problem or another printer fault.
Host Interface: Overrun error	There is a problem in the counter to host computer interface. These errors can occur if the settings in the HOST SETUP function do not match the settings of the host computer. These errors may also occur if power to the host computer is applied or removed while the host is connected to the counter. The error is not significant in this case.
Host Interface: Parity error	
Host Interface: Framing error	
Host interface: Buffer overflow	This error occurs if the host computer sends commands faster than the counter can process the data. There may be an error in the host software.
Error – Running, can't do quick-adjust	This error occurs if the QUICK ADJUS key is pushed while the counter is running. The run data is corrupted.
Password didn't verify	The password was not verified. The original password is not changed.

Error or warning	Description
Error – A/D overflow	An out-of-range condition occurred when the A/D chip read the voltage from an input. The firmware tries to read the voltage twice before this error shows. There may be a problem with the transducer.
Error – Cal curve undefined	A calibration curve is necessary and no sensor calibration data has been entered.
Error – Counter x cal curve undefined	
Block of wrong size recvd from cntr	The data or parameter block sent by the firmware to the front panel processor was not the expected size. This error can occur when the unit is powered up after a firmware change. If the error continues to occur, contact the manufacturer.
Warning – Chan 1 < Noise + 2 mV	The lowest channel setting is set to a threshold voltage that is too close to the sensor noise level.
Warning – Cntr x, Chan 1 < Noise + 2 mV	
Error – Two or more dual transducers	The system supports only one dual output transducer at a time.
Error setting clock	An attempt to set the real-time clock has failed.
Warning – Reversal at X to Y um	The sensor calibration data contains a reversal (a region where the calibration curve is not monotonic) in the indicated size range. Channel thresholds cannot be set to sizes in that range.
Error – Cannot set bin to X um	A channel cannot be set to a size threshold that lies within a reversal.
Warning – Bin X mV setting < Bin	Thresholds do not increase with increasing particle size. There may be an error in the calibration data points.
Error Cntr x: Baseline high	The sensor baseline output voltage was greater than the channel 1 threshold voltage for 50 milliseconds or more. Causes of this error include over-concentrated samples, bubbles in liquid samples or a failure of the laser diode or the sensor. The sensor may need to be cleaned.
Error Cntr x: Baseline low	The sensor output voltage was below –800mV for 500 microseconds or longer. The sensor may need maintenance.

Errors related to FED-STED-209E

Error	Description
Error – Some channel must affect result	This message appears if all channels are set to NO on the second page of the 209E SETUP function.
Error – Too many sizes specified	This message shows if more than 4 channels are set to YES in the second page of the 209E SETUP function. A maximum of 4 particle sizes can be used to determine compliance.
Error – Minimum sample volume =	The specified sample volume is smaller than the required minimum sample volume for the specified 209E class. X is the minimum volume necessary for the standard.
Error – Location already done	The sample location has already been tested.
Error – Cannot use x	In the 209E SETUP function, a particle size was set to Yes that is invalid for the specified cleanliness class.

Error	Description
Error – Must display	The operator must show all channels that are set to Yes in the 209E SETUP function.
Error – FED-STD-209E and > 1 Cntr active	If the 209E function is used with an 8000 instrument with an 8000s slave attached, all counters must be disabled except for the one where the 209E function runs.

Errors specific to the 8000

Error	Description
Error–Some counter(s) in Manual Mode	This error can occur if an 8000s slave counter is in the system. The firmware does a check to make sure that all counters are in compatible counting modes. This error shows that the counter is in Manual Mode.
Error – Invalid slope value	An entry for slope value in the ALTER CAL function is invalid. The valid range of values shows in the Help line when the operator makes the entry.
Error – Invalid intercept value	An entry for intercept value in the ALTER CAL function is invalid. The valid range of values shows in the Help line when the operator makes the entry.
Error–USP <788> and > 1 cntr	If the system uses an 8000s slave counter with these standards, all counters must be disabled except for the one used to measure compliance.
Error–JP <13> and > 1 cntr	
Error–EP <99> and > 1 cntr	
Error – Must be at least 1 active	In the ACTIV CNTRS function, all counters in the system have been deactivated.

Remote commands

Host computer control commands

The instrument can accept commands from a host computer and send data back to the host. It is not necessary for the host to send commands for the instrument to only report data. The system does not need to be in REMOTE+ mode for the host to receive data.

Before the counter gives a result for a host command, the operator must start the host interface and set up the communication parameters from the front panel keyboard. The communication parameters and interface status are stored in random access memory in the instrument and the memory is backed up by battery power. Thus, it is not necessary to start the host interface and set up the parameters more than once.

Command structure

The basic structure of a command is **CMDx, param1, param2...** where x is the counter number. If the counter number is not given, the command is sent to counter one by default. Global commands do not have counter numbers.

Successful commands are sent back or "echoed" with a ! at the start of the command. Refer to [Table 6](#).

Table 6 Examples of successful commands

Command sent	Command echo
REMOTE+	!REMOTE+
DDD	!DDD

Commands with bad parameters are echoed with a ? at the start of the command. Another ? shows the location of the first character of the bad parameter. Refer to [Table 7](#).

Table 7 Examples of commands with bad parameters

Command sent	Command echo and error
C1, 9	?C1, ? limit of 8 channels
N, 150	?N, ?150 number of runs limit of 99
Tx2	?CMD? (the counter is out of range or off line)

If an error occurs and a command with legal parameters does not complete successfully, the command is echoed as ?CMD plus an error message. The limits on parameters are the same as the limits from the keypad.

Each command must be terminated with a carriage return character. Do not include other characters such as a line feed. Responses that are sent to the host are also terminated with a carriage return.

Commands that are not recognized give a ? character terminated with a carriage return. An example is if the command sent is a legal command but the counter is not in REMOTE+ mode.

If the operator deletes a run (pushes the DELET RUN soft key) while run data or average data is enabled, the instrument sends the !ND (carriage return) message to the host.

General remote commands

Successful commands are echoed with a ! before the command.

Command	Description
REMOTE+	Makes remote commands possible. This command must be sent before any other commands (except REMOTE-) are recognized. This command disables the front panel keyboard.
REMOTE-	This command disables remote commands and makes the front panel keyboard operational.
DD	This command returns the format of data reports. !DDC = cumulative. !DDD = differential.
DDC	Sets the data report format to cumulative (for the host computer interface only).
DDD	Sets the data report format to differential (host computer interface only).
S	Starts the counter(s). If a counter is running when the command is received, the echo is !S-.
H	Stops the counter(s). If run data is enabled and the counter is already operational in manual mode, a report of the data follows the command echo.
PA+	Makes the instrument able to give averages. Average data is reported after all runs are complete. (The number of runs must be > 1).
PA-	Disables the average reports feature.
PAX	Sends a request for the last computed average data for the counter. If no data are available, the echoed command is !PAX-.
PR+	Makes the instrument automatically give data to the host after each run.
PR-	The instrument does not automatically give data to the host.
PRx	Makes the instrument give data from the last run on the specified counter. If no data are available, the echoed command is !PRx-.
Tx,HH:MM:SS	Sets the sample time.
Tx	Gets the current sample time.
SDx,HH:MM:SS	Sets the stabilization delay.
SDx	Gets the stabilization delay.
DT,HH:MM:SS	Sets the delay time.
DT	Gets the delay time.

Command	Description
N,##	Sets the number of runs.
N	Gets the number of runs.

Quick adjust commands

Command	Description
Ax	Makes the specified counter do a quick adjust cycle. A delay up to 25 seconds is possible before the response is sent. If a sample run is in progress when the command is received, the quick adjust is not done and the !QAx- result is sent. The counter number is included in the response even if it was not in the command.
QAR	Gets the current setting of the quick adjust rate parameter. The response is sent in a !QAR,HH:MM format.
QAR,HH:MM	Sets the quick adjust rate parameter. The maximum value is 48 hours. A value of 00:00 disables the automatic quick-adjust feature.

Sample mode commands

Command	Description
Mx	Gets the current mode. <ul style="list-style-type: none"> • !MMx= manual mode • !MTx=time mode • !MCx= counts mode
MMx	Sets the mode to manual.
MTx	Sets the mode to time.
MCx	Sets the mode to counts.
CCx,ch#	Sets the channel for counts mode.
CCx	Gets the channel for counts mode.
CLx,counts	Sets the count limit for counts mode.
CLx	Sets the count limit for counts mode.

Scanner commands

SCP is the only scanner command supported by the instrument. This command allows the host software to determine that no scanner is present.

Alarm commands

Command	Description
RAx	Gets the rate alarm setting in counts per minute.
RAx,counts	Set the rate alarm in counts per minute.
RAx,-	Disables the rate alarm.
LAx	Gets the less than alarm setting.
LAx,counts	Sets the less than alarm.

Command	Description
LAX, -	Disables the less than alarm.
GAX	Gets the greater than alarm setting.
GAX,counts	Sets the greater than alarm.
GAX, -	Disables the greater than alarm.
CAX	Gets the channel that is set for alarms.
CAX,ch#	Sets the channel number for alarms.
E+	Sets the alarm relay to active.
E-	Disables the alarm relay.

System parameters

Command	Description
OP,Operator ID	Sets the operator ID.
OP	Gets the operator ID.
V	Gets the firmware versions. The response contains the firmware version of the front panel firmware, then the version of the firmware in each counter board in the system.
DLT,hh:mm:ss	Sets the delete time.
DLT	Gets the delete time.
SPLn,field1,field2,field3,field4	Sets the sample ID fields.
SPLn	Gets the sample ID fields.
BKn,x	Sets the background subtraction to On (x=1) or Off (x=0).
BKn	Gets the status of background subtraction.
BKGn,mm/dd/yy,hh:mm:ss,c1,c2...c8	Sets the background data for counter. c1...c8 are the channel data. The date and time are the date and time of data collection. All eight channels must be sent, in differential form. The command does not change the background enable/disable status. Use the BK command to enable the background after the background data are set.
BKGn	Gets the background data for the counter in differential form. If not background data is stored for the counter, a !BKGn- response is sent.
DFn,x.x	Sets the dilution factor.
DFn	Gets the dilution factor.
STDn,X	Sets the standard. X values: I (ISO), N (NAS 1638), P (USP 24<788>), J (JP<13>), E (EP<99>), M (Mil-Std-1246A), F (Fed-Std-209E), U (User defined), Z (Zone).
STDn	Gets the standard.
VOLn,x.xx	Sets the sample volume (mL).
VOLn	Gets the sample volume (mL).
USN,x	Loads a user-defined standard number, x=1...4. If the specified standard is not defined, a ?USN, "Standard #x not defined" message is sent.
USN	Gets the number of the loaded user-defined standard.

Command	Description
USI	Gets identification information about the user-defined standard that is currently loaded. The response gives the standard number, the standard name, then the number of defined classes. These values cannot be set by the host.
CK,mm/dd/yy, hh:mm:ss	Sets the counter date and time clock.
CK	Gets the counter date and time clock.

Transducer related commands

Command	Description
XUN, X	Sets the transducer units. X=E (English) or M (Metric).
XUN	Gets the transducer units.
XDU	Gets the transducer values. All 4 values are sent. If fewer than 4 transducers are connected, some fields will be empty, but the commas that separate the fields will show. Refer to Run Data Format for the format of the transducer values.

Channel threshold settings

Command	Description
CSx,size1,size2,size3,size4,size5,size6,size7,size8	Sets the channel sizes (floating point numbers), specified in micrometers.
CSx	Returns the sizes of channel settings in floating point numbers to 2 decimal places.
CVx	Gets or sets the calibration curve for the sensor on the counter (x). Refer to More information about the CVx command for more information about the response to the command.
CVx, T, Model, Serial, noise...	Sets the calibration curve for the counter (x). ¹

¹ For a dual mode sensor, the CVx, A... command must be sent first. When the !CVx, A... response is received, enter the CVx, B... command. Send data points of the curve in increasing order by particle size. The number of points in a curve must be at least 4 and not greater than 20. For dual mode sensors, this is the total for both curves. A delay may occur before the response is sent while an automatic calibration cycle occurs (up to 15 seconds). If a parameter error occurs, the bad parameter is marked with a ? character. For other errors, an error message enclosed in double quotes is returned.

Response to the CVx command

The CVx command is used to get or set the calibration curve for the sensor on a specified counter (x). All numeric values are floating point numbers with decimal points.

The response to the CVx command shows in one of the three formats shown below. The individual elements of the responses are described in [Table 8](#). For more information, refer to the ALTER CAL soft key function.

- !CVx,T,Model,Serial,noise,n,size1,mV1, ..., sizen,mVn
- !CVx,Q,Model,Serial,noise,slope,intercept
- !CVx,U

Table 8 CVx command response parameters

Parameter	Definition
T, Q, U = Curve type. The value of T will have a value as shown in the next column.	<p>T = S for a scattering sensor with a single set of data points.</p> <p>T = E for an extinction sensor with a single set of data points.</p> <p>T = A for first set of data points (small points) if the sensor has two sets of data points.</p> <p>T = B for the second set of data points (large points) if the sensor has two sets of data points.</p> <p>Q = Parametric equation curve for an extinction sensor. For dual mode sensors, the response is two strings (!CVx,A... and !CVx,B...). Noise, slope and intercept are the equation parameters.</p> <p>U = No calibration curve has been defined.</p>
Model	Alphanumeric field of up to 14 characters that gives the model name of the sensor.
Serial	Alphanumeric field of up to 14 characters that gives the serial number of the sensor.
Noise	This is the noise value of the sensor in millivolts.
n	This is the number of points in the curve.
size1,mV1...sizen,mVn	These are the particle sizes in micrometers and the sensor outputs in millivolts for the data points.

Calibration related commands

Command	Description
CNn,x	Sets the number of channels to x (1...8). The number of channels is always set to 8 when the CS command with parameters is done. Thus, the CNn, x command is used after the CS command to set the number of channels back to a value less than 8.
CNn	Gets the number of channels.
CVNn,x	Loads the calibration curve number (x) on the counter (n). The range of x is 1-4. If no calibration is defined, the ?CVNn, "Calibration #x not defined" response is sent.
CVNn	Gets the calibration curve number.
CVIn,comments,mm/dd/yy,MS,x,x	<p>Sets the calibration identification information for the loaded calibration curve. This command does not store the calibration curve. Use the CV command after this command to set and store the calibration data.</p> <p>MS is a 2 character material solvent code:</p> <ul style="list-style-type: none"> • AW = ACFTD in water • AO = ACFTD in oil • LW = Latex in water • LO = Latex in oil • GW = Glass in water • GO = Glass in oil • ?? = Other or unknown <p>x.x is the flow rate in mL/min.</p>
CVIn	Gets the calibration identification information.

Data reporting format control

Command	Description
RF,x	Sets the data format for run data and average data. x is 0 for short format (default), or 1 for long format. The short format data uses the existing !PR and !PA strings for reporting to the host. The long format uses the new !LPR and !LPA strings. This command controls the reporting from all system counters.
RF	Gets the data reporting format.
LPRn	Gets the long format data from the last run.
LPA n	Gets the long format average data.

Run data or PRx command response

The short format for run data or a response to the PRx command is shown below.

!PRx,HH:MM:SS.SS,HH:MM:SS,BP,RP,GP,LP,XXXXXX,XXXXXX,...XXXXXX,Class BF,RF,GF,LF

The response parameters (left to right) are described below. If a run error occurs, the response is ? PRx and then the error message.

Parameter	Description
x	Counter number (1–4)
HH:MM:SS.SS	Elapsed run time (to the hundredths of a second)
HH:MM:SS	Stabilization delay
BP	Baseline pass/fail
RP	Rate alarm pass/fail
GP	Greater than alarm pass/fail
LP	Less than alarm pass/fail
XXXXXX	Counts (cumulative or differential) for channels 1–8
Class BF,RF,GF,LF	Classification string for the selected standard. If there is no standard in use, this field is empty but the comma before the field shows. If transducer support is added, the transducer values may show after the classification string.

Classification string for the selection standard

If there is no standard in use, the field is empty but the comma before a field will show.

Transducer	Metric	English
Temperature part of, temperature/relative humidity	x.xC	,x.xF
Relative humidity part	,x.x%	,x.x%
Differential pressure,	x.xPAS	,x.xxx"H2O
Air velocity	,x.xxxM/SEC	,x.xFPM
Mass flow rate (gas)	,xSLPM	,x.xSCFM
Unknown 4-20 mA transducer	,x.xxmA	,x.xxmA

The x's shown above represent numbers that appear in the output. The number of digits to the right of the decimal is the number sent. The number of digits to the left of the decimal will change depending on the size of the number (1 or more digits, with leading zeroes suppressed). Fields are

separated by commas and the first comma is shown. The last transducer value does not have a comma after it.

If an A/D error occurs when the transducer value is read, the number is replaced by three question marks (e.g., ???SCFM).

The transducer fields are preceded by the standard classification string. If no classification standard (NAS 1638, MIL-STD-1246A, etc.) is used, the classification string is empty except for the preceding comma.

The units may be Metric or English. The selection of units is controlled by a setup screen on the counter. The operator cannot control this over the host interface.

Table 9 Units description

C = Centigrade	F = degrees Fahrenheit
% = percent relative humidity	PAS = Pascals
"H2O = inches of water	M/SEC = meters per second
FPM = feet per minute	SLPM = standard liters per minute
SCFM = standard cubic feet per minute	LPM = liters per minute
CFM = cubic feet per minute	mA = milliamperes

Averaged data (short format)

The short format for Averaged data is shown below. The response parameters (left to right) are described in the table.

!IPAx,n,XXXXXXXX,XXXXXXXX,...,XXXXXXXX,Class

Table 10 Parameters for averaged data (short format)

Parameter	Description
x	Counter number
n	The number of runs included in the average
XXXXXXXX,...XXXXXXXX	The average counts (cumulative or differential) for channels 1–8
Class	The classification string for the selected standard. If a standard is not used, this field is empty but the comma before the field will show.

Run data (long format)

When the long format is enabled with the DF command, the counter sends the new !LPR and !LPA response strings instead of the !PR and !PA strings. The long format strings have additional fields, three character response names and there is no Stabilization delay field.

The long format of run data is shown below.

Note: The data string is shown on separate lines for clarity only. The data is sent as one continuous string terminated by a carriage return.

!LPRx,HH:MM:SS,XX,BP/BF,RP/RF,GP/GF,LP/LF,Channels,D/C

XXX.XX,XXX.XX,XXX.XX,XXX.XX,XXX.XX,XXX.XX,XXX.XX,XXX.XX,XXX.XX,

XXXXXXXX,XXXXXXXX...XXXXXXXX,

VV.VV,MM/DD/YY,HH:MM:SS,Operator ID, Sample ID1, Sample ID2...Sample ID4,

Class{,Transducer(s)}

Table 11 Descriptions of long format parameters

Parameter	Description
x	Counter number
HH:MM:SS.XX	Elapsed run time (to hundredths of a second)
BP/BF	Baseline pass/fail
RP/RF	Rate alarm pass/fail
GP/GF	Greater than alarm pass/fail
LP/LF	Less than alarm pass/fail
Channels,	Number of channels programmed (1–8)
D/C	Differential (D) or Cumulative (C)
XXX.XX...	Particle size thresholds for channels 1–8
XXXXXXX	Counts for channels 1–8
VV.VV	User specified sample volume in mL
MM/DD/YY	Date of sample run
HH:MM:SS	Time of sample run
Operator ID	Operator id
Sample ID1...Sample ID4	Sample ID fields
Class	Classification string for the selected standard. If no standard is used, this field is empty except for the comma that comes before the field. If transducer support is added, transducer values may come after the classification string.
Transducers	If transducer support is added, transducer values may follow the classification string.

Averaged data (long format)

The format for long format averaged data is shown below. The data string is shown on separate lines for clarity only. The data is sent as one continuous string terminated by a carriage return.

!LPAn,n,Channels,D/C,XXX.XX,...XXX.XX

XXXXXXXX,XXXXXXXX,...XXXXXXXX

VV.VV,MM/DD/YY,HH:MM:SS,Operator ID,Sample ID1...Sample ID4,Class

Table 12 Descriptions of averaged data parameters (long format)

Parameter	Description
x	Counter number
n	Number of runs included in the average
Channels	The number of channels programmed (1–8)
D/C	Differential (D) or Cumulative (C)
XXX.XX...XXX.XX	Particle size thresholds for channels 1–8
XXXXXXXX...XXXXXXXX	Averaged counts for channels 1–8. The number of digits will change and leading zeroes are not used.
VV.VV	User specified sample volume in mL
MM/DD/YY	Date sample average was taken
HH:MM:SS	Time sample average was taken

Table 12 Descriptions of averaged data parameters (long format) (continued)

Parameter	Description
Operator ID	Operator ID
Sample ID1...Sample ID4	Sample ID fields
Class	Classification string for the selected standard. If a standard is not used, this field will be empty except for the comma before the field.

Sensor calibration features

The instrument firmware contains Test Dust and Moving Window Calibration features. In order to use these features and accurately calibrate sensors, a user must understand the necessary methodologies.

To calibrate a sensor to meet the requirements of a National Institute of Standards (NIST), a user must use test equipment that has been certified by NIST. For some sensor calibration standards, it is necessary to do more intensive calibrations than the ones contained in the instrument firmware.

Check with the Quality Control/Quality Assurance department of the facility for more information on how to meet sensor calibration specifications.



HACH COMPANY World Headquarters

P.O. Box 389, Loveland, CO 80539-0389 U.S.A.
Tel. (970) 669-3050
(800) 227-4224 (U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

HACH LANGE GMBH

Willstätterstraße 11
D-40549 Düsseldorf, Germany
Tel. +49 (0) 2 11 52 88-320
Fax +49 (0) 2 11 52 88-210
info@hach-lange.de
www.hach-lange.de

HACH LANGE Sàrl

6, route de Compois
1222 Vézenaz
SWITZERLAND
Tel. +41 22 594 6400
Fax +41 22 594 6499