ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Met One A2100* at our website: *Click HERE*

Model 2408
Laser Particle Counter

Operating Guide



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Published by

Pacific Scientific Instruments

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

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

© Copyright 1993 Pacific Scientific Instruments,
Grants Pass, Oregon 97526-8882
Printed in the United States of America.

No part of this publication may be reproduced in any form without the prior written permission of Pacific Scientific Instruments.

ALL RIGHTS RESERVED

Major revisions of this manual are indicated by a new revision level. Minor corrections or additions may be made at any time without changing the revision level. Changes made to this manual causing the new revision are documented under "Manual Backdating" at the back of this manual. Pacific Scientific Instruments is not liable for personal, property, or financial damages resulting out of the use of this product or the material contained in this manual.

Published September, 1993; last revised April, 1999.

Manual Part Number 701087		
REV.	DESCRIPTION	DATE
A	Original Issue	9/93
*B	Update	6/95
*C	Update	4/99

*refer to "Manual Backdating" section for changes

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Contents

Safety iv
Introduction **1**
Unpacking and Initial Inspection 1
Options, Accessories 2
Using the Counter for the First Time **3**
Front Panel Overview **4**
Display Field Group 4
MODES Group 5
DISPLAY/PROGRAM Group 5
PRINTER Group 7
Setting and Changing Functions **8**
Count (Alarm Limits) 8
Location (Number) 8
(Number of) Count Cycles 9
Date/Time 9
Period/Hold (Time) 10
Turning Beeper On or Off (AFb) 10
Volume Units (UOL) for Concentration Mode and Fed-Std-209 Calculations 11
Baud Rate (bd) 11
Adjusting Airflow (FLO) 11
Using Special Features **12**
Concentration (Concen.) Mode 12
Audible (Beep) Mode 12
Count Cycles Average Calculations 13
Fed-Std-209 Calculations 14
Generating a Configuration 15
Using the Printer **17**
Loading Printer Paper 17
Selecting Printer Function 18
Printing Fed-Std-209 Calculations 18
Interpreting the Printout 19
Clearing Data Stored in Rotating Buffer 20
Setting up an External Printer 20
Using Accessories **21**
Environmental Probes 21
Setting Temp/RH Probe Alarm Limits 21
Setting Air Velocity Probe Alarm Limits 22
Serial Port Protocol and Commands **23**
Serial Cables 23
Communication Protocol 24
Commands 24
Data 25
Technical Data **26**
Specifications 26
Component Location 27
Resetting Counter Options 28
Manual Backdating 28
Declaration of Conformity Page/Warranty Page (back of manual)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Safety

Safety Considerations

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

WARNING

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

CAUTION

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

Note

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

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Safety

There are several classifications of Warnings defined as follows:

Laser — pertaining to exposure to visible or invisible laser radiation
Electrical and Electrostatic — pertaining to electrical shock and to static hazards

Laser Safety Information

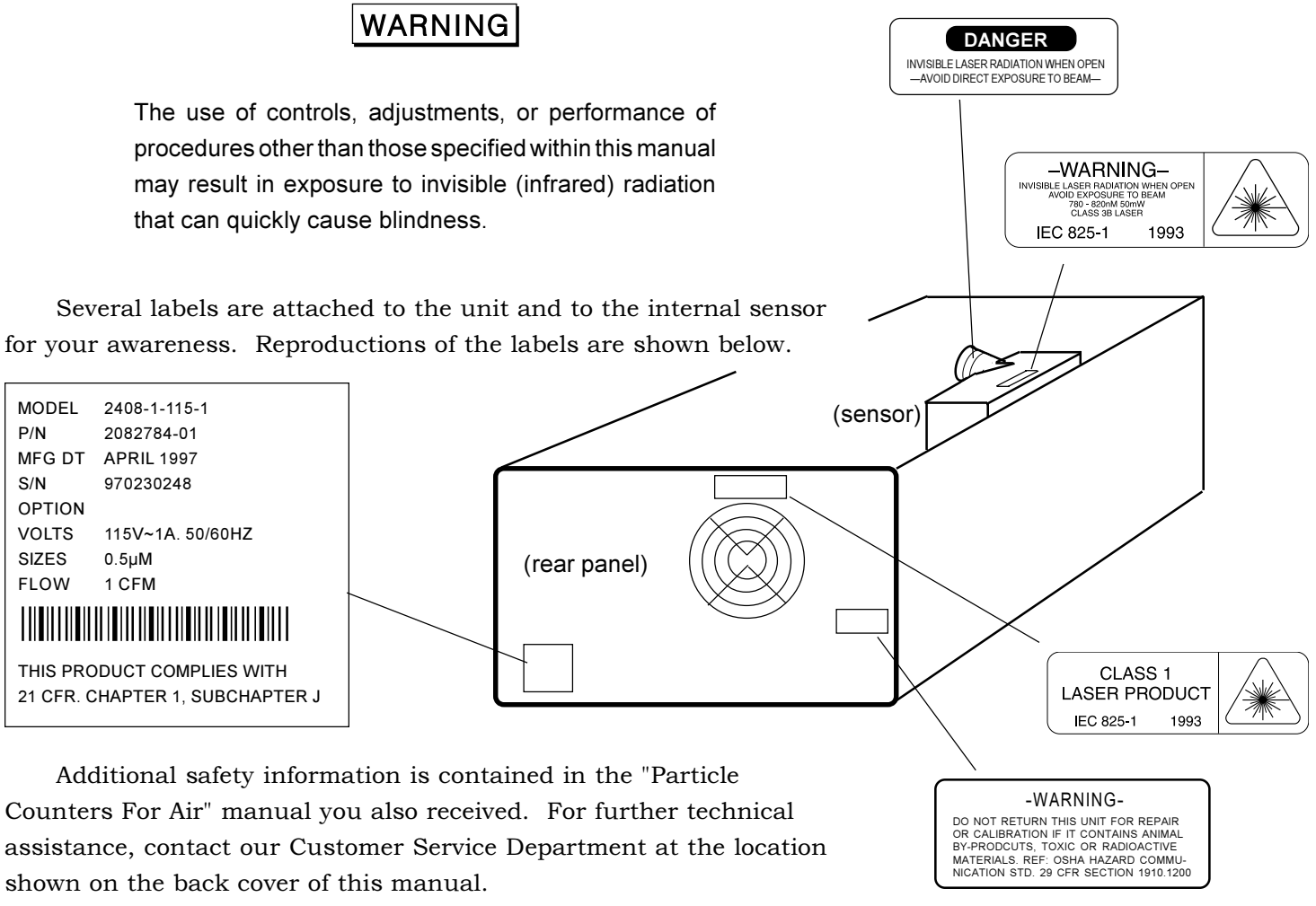
This Model 2408 particle counter contains a laser-based sensor that is a Class 1 product (as defined by 21 CFR, Subchapter J, of the Health and Safety Act of 1968) when used under normal operation and maintenance. The manual contains no procedures for service of internal parts within this unit. Service should be performed only by factory-authorized personnel.

The particle counter has been evaluated and tested in accordance with EN 61010-1:1993, "Safety Requirements For Electrical Equipment For Measurement, Control, and Laboratory Use" and IEC 825-1:1993, "Safety of Laser Products".

WARNING

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

Several labels are attached to the unit and to the internal sensor for your awareness. Reproductions of the labels are shown below.



Additional safety information is contained in the "Particle Counters For Air" manual you also received. For further technical assistance, contact our Customer Service Department at the location shown on the back cover of this manual.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Safety

Electrical Safety Information

Potential shock hazard exists as soon as a cover is removed from a particle counter. Extreme care should be used whenever a cover is removed.

WARNING

Failure to disconnect electrical power cord before removing instrument covers can result in severe electrical shock.

The label pertaining to shock safety is attached to the power supply inside the unit for your awareness. Reproductions of the label is shown below:

DANGER
HIGH VOLTAGE

Electrostatic Safety Information

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work inside the particle counter should be done at a static-safe work station. A static-safe work station can be created by doing the following:

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

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

WARNING

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Introduction

This operating guide describes how to use the Model 2408 Particle Counter. Together, this operating guide and the “Particle Counters for Air” manual provide complete operating, application, and maintenance information for the particle counter. Any changes of instrument operation due to design changes are covered at the back of this guide.

The 2408 can be ordered with two, four, five, or six particle-size ranges and a built-in printer (standard configuration). It meets requirements for a light scattering automatic particle counter as described in Japanese Industrial Standard JIS B 9921. A microprocessor controls all instrument functions. Count data is displayed as cumulative count or differential count. A typical counter, for example, could have 0.5 micron sensitivity and six particle size ranges (0.5, 1, 2, 3, 5, 10 microns).

The counter uses a laser-diode light source and collection optics for particle detection. Particles scatter light from the laser diode. Collection optics focus the light onto a photo diode that converts the bursts of light into electrical pulses. The pulse height is proportional to particle size. Pulses are counted and their amplitude is measured for particle sizing. Results are displayed as particle counts in the specified size range.

Unpacking and Initial Inspection

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

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



Figure 1. The 2408 Laser Particle Counter

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Introduction

Note

The Model 2408 also supports the 16-port Model 2431 manifold which is no longer manufactured.

Options

One of the two following options (*not both*) is available when you order your counter. The manifold is standard if no option is specified. The "configuration" feature can be installed at time of order or any time thereafter if you return your counter to the factory. See back cover of this manual for address and telephone number.

Manifold—The Model 2432 manifold (32 location) with controller allows the 2408 to sample many different locations. The manifold routes the sample from each location to the 2408 for analysis, one location at a time. This option and the "configuration" option are not both available simultaneously.

"Configuration"—The configuration capabilities option (see Generating a Configuration on following pages) allows the user to program up to 10 sets of count parameters (period, hold time, count alarm limit, etc.) in advance for quick setting of parameters. This option and the "manifold" option are not both available simultaneously.

Accessories

You can order several accessories to tailor the counter to your needs. These accessories can be either ordered from the factory during the week from 8:00 a.m. to 5:00 p.m. PST or from your local agent.

High Pressure Diffuser—connects to the sensor inlet tube. Permits direct sampling of pressurized air and nitrogen at pressures from 30 to 150 psi (2 to 10 Bar).

RH/Temp Probe—plugs into the counter rear panel. The probe monitors relative humidity (10% to 90%) and temperature (0 to 100 °F or -17 to +38°C). The results are displayed and printed.

Air Velocity Probe—plugs into the counter rear panel. The probe monitors air velocity from 10 to 200 feet/minute (3 to 60 meters/minute). The particle counter displays the reading of the probe.

Isokinetic Probe (provided with counter)—for use in unidirectional air flow to maximize correlation between counts and actual particle-size distribution. Can also be hand-held for spot location particle counting.

Purge Filter—attaches to sensor inlet; keeps external particles from contaminating sensor while purging sensor of internal particles.

Carrying Case—protects the counter during shipment and storage.

PortAll Software—when installed, automatically retrieves and stores count data from the rotating buffer of both airborne and liquid particle counters. PortAll does not work when the "Configuration" option is installed.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using the Counter for the First Time

Your particle counter is ready to use directly out of the shipping carton. You may want to take a sample count prior to setting up the programmable functions. To count particles, proceed as follows:

WARNING

Do not attempt to sample reactive gases (such as hydrogen or oxygen) with the particle counter. Reactive gases create an explosion hazard in the counter. Contact the factory for more information.

1. Locate counter in a clean environment.
2. Plug ac power cord into facility power outlet; plug other end of cord into rear panel connector marked AC INPUT.
3. Remove red protective cap from the inlet tube (on top of counter). If using the isokinetic probe provided, install probe by connecting probe tubing to counter inlet tube.

WARNING

Exposure to infrared radiation may cause eye injury. Do not look into counter inlet tube while counter is on.

4. Set 

on rear panel to 1 (on).
5. To start counting particles, press Run key. The number on the display is the number of particles being counted. Check that the indicated flow rate is nominal. The flow is always in cfm unless "Concentration Mode or "Fed-Std-209 Calculations" is selected. To adjust airflow, see “Adjusting Airflow" on pages that follow.
6. Press Stop to stop counting. The total number of particles counted during the “run” time will be displayed.
7. (Optional) You may want to read “Front Panel Overview” on the next page to learn about the keys and displays that run your counter.

CAUTION

To prevent sensor damage, water, solvents, or other liquids of any type should never be put into the sensor via the inlet tube.

Never operate the counter with the inlet tube capped or plugged as damage can occur to the internal pump.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Front Panel Overview

Each front-panel key has a specific function. The keys are grouped into operating functions such as display field, modes, display/program, and printer. Some keys are used in conjunction with others. Some keys select the desired mode while others select functions to be set such as count alarm limits, particle size range, time, date, etc. In this subsection, you will learn the function of front-panel keys and displays of each group.

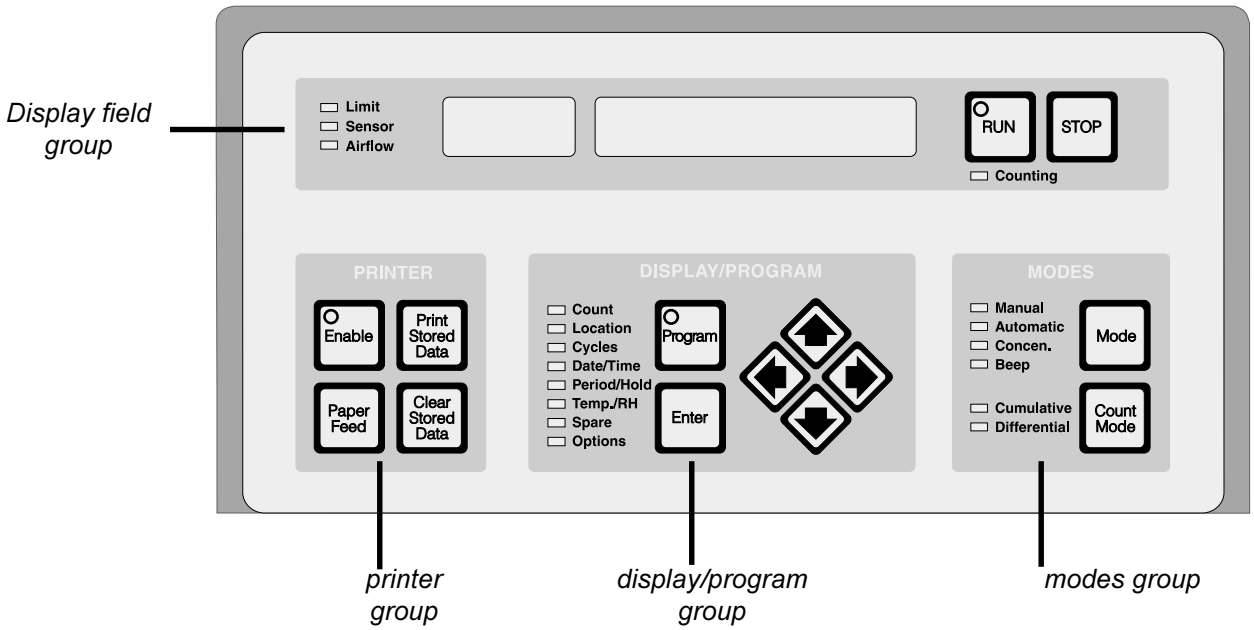


Figure 2. Front Panel Keys and Indicator Lights

Display Field Group

Run	Starts the count cycle.
Stop	Stops the count cycle. (Infinite hold time when stopped.)
Counting	When on, indicates the counter is counting.
0001234	(Seven Digit Display) Displays total particle count, time-of-day, date, etc.
003	(Three Digit Display) Displays particle size range selected.
Limit	When flashing, indicates the programmed count and/or analog alarm limit has been surpassed.
Sensor	When flashing, indicates either a failure of the laser diode electronics or contamination in the sensor.
Airflow	When flashing, indicates airflow through sensor is high or low.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Front Panel Overview

MODES Group

Mode — Selects one of four operating modes: Manual, Auto, Concen. (concentration), or Beep.

Manual — When on and Run is pressed, the counter will count for one count cycle then turn off.

Automatic — When on and Run is pressed, the counter will repeat count and hold cycles for the programmed number of count cycles and then pump will turn off.

Concen. — When on, the counter will calculate particle concentration in counts/ft^3 (or counts/1000 liter) of air; display is updated once each second; the counter runs for programmed number of count cycles. The concentration value is saved as stored data.

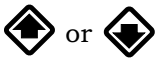
Beep — When on, the counter will give one beep when count alarm limit is reached, then beep once for every multiple of the limit; the counter runs until Stop is pressed.

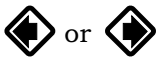
Count Mode — Selects differential or cumulative count mode for display.

Cumulative — When on, the count readout being displayed is the total count of all particles of the size channel selected and larger.

Differential — When on, the count readout being displayed is the count of particles only in the size channel selected.

DISPLAY/PROGRAM Group

 — Selects what will be displayed in the seven-digit display: Count, Location, Cycles, Date/Time, Period/Hold, Temp./RH, Spare, or Options. Temp./RH will not come on if probe is not connected. Spare (containing air velocity probe information) will not come on if probe is not connected.

 — Steps through or toggles between choices when a program has more than one selection (e.g., Count, Date/Time, and Options). Also changes digit value when in Program status.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Front Panel Overview

Program	For entering the programming mode to set a limit (e.g., alarm limit), change a number (e.g., number of cycles to be taken), change date/time, or change an option; also displays the alarm limits of the selected size. The appropriate indicator light must be on to make a change within the program functions (description of indicators given below).
Enter	Saves to memory the new limit set during programming (see description of Program above); exits program mode.
Count	When on, indicates the particle size range is being displayed. This light must be on to program the count alarm limit of the displayed size range. When blinking, indicates a count alarm limit has been exceeded.
Location	When on, indicates the location assigned to a test run is being displayed. This light must be on to select a new location.
Cycles	When on, indicates the programmed number of count cycles to be taken is being displayed. This light must be on to program a new number of count cycles.
Date/Time	When on, indicates date or time of day is being displayed. This light must be on to change either function.
Period/Hold	When on, indicates either the sample period or hold time is being displayed. This light must be on to program period or hold time.
Temp./RH	When on, indicates current temperature or relative humidity is being displayed. This light must be on to program alarm limits; will not come on if environmental probe is not connected. When blinking, indicates the probe alarm limit has been exceeded.
Spare	When on, indicates air velocity is being displayed. This light must be on to program air velocity alarm limits; will not come on if probe is not connected. When blinking, indicates the probe alarm limit has been exceeded.
Options	When on, indicates one of the available options is being displayed: **AFb** - turns audio feedback (beeper) on or off; **FLO** - gives flowrate through the counter; **bd** - selects baud rate; **UOL** - selectable units of volume between cu. ft. (CF) or liters (L)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

when in Concen. mode or when printing Fed-Std-209 calculations; **Prn** - selectable between:

ALL - when printer enabled, prints results, **209E** - calculates and prints stored data as Fed-Std-209-calculations; and **ALr** - prints results only if a count or analog alarm occurs.

PRINTER Group



Enables printer to print results of the choice selected in Options. The LED is a reminder the printer is enabled.



When printer is enabled, will print all the count cycles stored in the rotating buffer. Contents remain in the buffer.



When momentarily pressed, gives number of count cycles presently stored in the rotating buffer. When held down for more than two seconds, clears rotating buffer of its contents.



When printer is enabled, will advance paper.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting and Changing Functions

Note

For basic operation of the particle counter, refer to "Using the Counter for the First Time" on earlier pages.

To turn off the alarm, enter a limit value of 0 (zero) for all particle size ranges. To silence the alarm, press any key except Run or Stop. To hear one beep when the count limit is reached and at each multiple thereafter, select the beep mode.

Note

For any of the following programming functions, if the counter is in the run mode when it is turned on, press Stop.

Operating functions of the counter (count alarm limits, period and hold times, etc.) are changed using front panel keys. You can also change some set-up functions (environmental probe limits, baud rate, etc.) via the front panel.

Reference is made in the following procedures to digits of the front panel display. Refer to the following example for more digit information:



Procedures below provide step-by-step instructions to change all programmable functions.

Count (Alarm Limits)

An audible count alarm can be set to occur when the count exceeds any number. The range is from zero (turns alarm off) up to 9,999,999. Each particle size range may have a different count alarm limit. The alarm will sound as soon as any count alarm limit is exceeded. Set count alarm limits as follows:

1. Turn counter on; press Stop.
2. Press ◆ or ◆ until Count ▭ is on. Press ◆ or ◆ until size range of the limits to be changed appears.
3. Press Program (program LED comes on); the current count alarm limit will be displayed and the smallest digit of the alarm limit will blink.
4. Press ◆ or ◆. The smallest digit of alarm limit will blink. Press ◆ until digit requiring change is blinking.
5. Press ◆ (or ◆) once to increment (or decrement) digit to the next value. To scroll, press and hold either arrow key.
6. To change another digit, press ◆ then repeat step 5 above.
7. Press Enter to save changes and exit programming mode (Program LED is off).
8. To change count alarm limits for another particle size range, press ◆ until desired size range is displayed then repeat steps 3 through 7 above.

Location (Number)

Any number from zero to 999 can be assigned to a location. You can assign a different number each time you change locations. The number will appear on the printout and as part of the stored data.

During remote operation, this number is also used as the device

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

number (from 0 to 63). Refer to "Serial Port Protocol and Commands" for more information. Change location number as follows:

1. Press ◆ or ◆ until Location ▭ is on. Current location number will appear on the readout display.
2. Press [Program] ("ones" digit will blink) then press ◆ (or ◆) once to increment (or decrement) digit to the next value. To scroll, press and hold either arrow key.
3. To change "tens" or "hundreds" digit, press ◆ then press ◆ to increment number. To scroll, press and hold ◆ key.
4. Press [Enter] to save changes and exit programming mode (Program LED is off).

(Number of Count) Cycles

The number of count cycles is the number of times the counter will count then hold, count then hold, etc., before stopping. Up to 999 cycles can be made while in the Automatic mode. To repeat count cycles indefinitely, set the number to zero. Change the number of count cycles as follows:

1. Press ◆ or ◆ until Cycles ▭ is on. The current number of count cycles programmed will appear on the readout display.
2. Press [Program] ("ones" digit will blink) then press ◆ (or ◆) to increment (or decrement) the number to the next value. To scroll, press and hold either arrow key.
3. To change "tens" or "hundreds" digit, press ◆ then press ◆ to increment number. To scroll, press and hold either key.
4. Press [Enter] to save changes and exit programming mode.

Date/Time

These parameters can be displayed while in either the run or stop mode by pressing ◆ or ◆ until the Date/Time ▭ comes on then by pressing ◆ or ◆ to switch between date and time. To change date or time-of-day, perform the following steps:

1. Turn counter on; press [Stop].
2. Press ◆ or ◆ until Date/Time ▭ is on. Current date will be displayed. The MMDDYY numerical format is used.
3. Press [Program]; the month digits will blink. To advance to week or day digits, press ◆.
4. To increment (or decrement) digits to the next value, press ◆ (or

Setting and Changing Functions

Note

Press [Run] to start a new count cycle; display automatically goes to count and displays the last size selected.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting and Changing Functions

) once. To scroll, press and hold either arrow key.

5. To change additional digits, press and repeat step 4 above.
6. Press Enter to save changes and exit programming mode (Program LED is off).
7. To change time of day, press then repeat steps 3 through 6 above for hours, minutes, and seconds.

Period/Hold (Time)

The period (sample time) is the length of time you want to sample air. Period can be set to any value from 0 (zero) up to (but not including) 24 hours. Hold time is the length of time between samples and can be set to any value from 1 second up to (but not including) 24 hours. If the period is set to 0 (zero), the counter will count indefinitely or until Stop is pressed. In the Manual mode the counter counts for the period (sample time) then stops. In the Automatic mode, the sample and hold cycles repeat for the number of times programmed under Cycles. The final count value will be displayed during the hold time. Change period or hold time as follows:

1. Turn counter on; press Stop.
2. Press or until Period/Hold is on. Existing period will be displayed in hours, minutes, and seconds. To change hold time, press then go to step 3. To change period, go to step 3.
3. Press Program; seconds digits will blink. To advance to minutes or hours digits, press .
4. To increment digits to the next value, press once. To scroll, press and hold either arrow key.
5. To change additional digits, press and repeat step 4, otherwise press Enter to save changes and exit programming mode (Program LED is off).

Turning Beeper On or Off (AFb)

The audible feedback system (beeper) can be turned on or off except for an environmental probe alarm. Turn beeper on or off as follows:

1. Press or until Options is on then press or until **AFb** is displayed. The current status (on or off) of the beeper will appear on the readout display.
2. Press Program (the status will blink) then press or to change to either OFF or ON.
3. Press Enter to save changes and exit programming mode (Program LED is off).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting and Changing Functions

Volume Units (UOL) for Concentration Mode and Fed-Std-209 Calculations

The concentration mode provides an estimation of the counts per cubic foot (CF) or counts per cubic meter (1 cubic meter = 1000 L). Change from one set of units to another as follows:

1. Press ◆ or ◆ until Options ▭ is on then press ◆ or ◆ until **UOL** is displayed. The current units (CF or 1000 L) will appear on the readout display.
2. Press [Program] (existing units will blink) then press ◆ or ◆ to toggle to other choice.
3. Press [Enter] to save changes and exit programming mode (Program LED is off).

Baud Rate (bd)

The baud rate may be set to either 300, 1200, 2400, or 9600. Set baud rate as follows:

1. Press ◆ or ◆ until Options ▭ is on then press ◆ or ◆ until **bd** is displayed. The current baud rate will appear on the readout display.
2. Press [Program] (existing baud rate will blink) then press ◆ or ◆ to cycle through selections; stop when your choice is displayed.
3. Press [Enter] to save selection and exit programming mode (Program LED is off).

Adjusting Airflow (FLO)

Nominal airflow through the sensor is 1 (one) cfm. Airflow is monitored and adjusted during a count cycle only. Adjust airflow as follows:

1. Press ◆ until Options ▭ is on then press ◆ or ◆ until **FLO** is displayed.
2. Press [Run] to start a count cycle. After airflow readout has stabilized, turn AIRFLOW ADJUST knob on rear panel for a reading of 1.00. Turning knob clockwise increases airflow.
3. Press [Stop] to stop the count cycle.

Note

You may want to set a period (sample time) of three minutes or more to give ample time for airflow adjustment.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using Special Features

Your counter offers several special features for sampling air. The following procedures give detailed instructions for using these features.

Concentration (Concen.) Mode

This mode gives a quick (within seconds) calculation of the particle concentration. The mode averages the number of particles counted in one-second samples to give the calculation of count-per-cubic-foot (or count-per-cubic meter = 1000 L) of air. The displayed count is updated every second. Counting continues for the period and number of samples programmed in "Period/Hold" procedure. There is no computer serial interface capabilities while in this mode. If printer is enabled, concentration mode results are printed at the end of each count cycle. Results are also stored in memory and can be printed out at a later time.

1. Turn counter on; press Stop.
2. Press Mode until Concen. is on.
3. Select units (ft./min. or meters/min.) required for the concentration reading. Refer to "Volume Units (UOL) for Concentration Mode and Fed-Std-209 Calculations" procedure in this section to determine units currently programmed or to change units.
4. To start counting, press Run.

Note

One cfm means one cubic foot of air passes through the sensor in one minute.

After each second, the oldest period's count is deleted from the average and the newest is calculated into the average and the new result is displayed.

Audible (Beep) Mode

The beep mode changes the count alarm feature to a single audible sound (beep) once each time the count alarm limit is reached and then once again for every count multiple of the count limit. A beep will sound for each particle size range count limit. In order to focus attention on one particle size range, we suggest you set a limit for only the size range of interest and set the remaining ranges to zero (no alarm). The beep mode limits and count alarm limits are one and the same.

1. Press Mode until Beep is on.
2. The count number that was set in the "Count Alarm Limits" procedure will be the number that applies also for the beep mode. To change when the audible sound occurs, perform "Setting Count (Alarm Limits)" procedure.
3. To begin sampling, press Run. Sampling will continue until Stop is pressed.

Note

The counter will count in this mode until Stop is pressed.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using Special Features

Count Cycles Average Calculations

Your counter will automatically calculate and print out the results of the average of the counts taken in up to 999 count cycles. To use this averaging feature, perform the following steps:

1. Position the counter at the sample location; turn power on.
2. Press the Mode key until Automatic is on.
3. Set the sample Period and Hold functions to the desired duration; set the number of Cycles to be taken (procedures located elsewhere in manual).
4. Choose "209E" from "Prn" (Options) using "Selecting Printer Function" procedure on following pages.
5. From the printer control keys, press Enable then press Run. The counter will run for the number of cycles you programmed, print the results of each cycle, and stop.
6. Press Print Stored Data key. The counter will print the averages of each particle size range for the number of cycles you programmed in step 3 above. These averages represent particles/cubic foot.
7. If more than one location is to be sampled, perform "Fed-Std 209 Calculations" procedure.

Note

The averages will be calculated and displayed in particles per cubic foot.

The average value includes only the last sample run, not buffer contents from previous runs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using Special Features

CAUTION

Make sure you no longer need the stored data before you press and hold down Clear Stored Data key.

Note

In the Fed-Std-209 calculations, a period of 60 seconds must be selected so that at a nominal flow rate of 1 cu. ft./min, a total volume of 1.000 cu. ft will be sampled. The count is calculated on one cubic foot of sampled air.

Note

Number of count cycles must be 1 (one) or greater. If set to 0 (zero) or manual, Fed-Std-209 calculations will not be made.

Note

If you want to retake the samples at the same location, press Run again. The data from the retaken sample will then be used in the calculations.

Fed-Std-209 Calculations

Your counter will automatically calculate the statistical data required for compliance with Fed-Std-209. This selection is made as one of the print modes when setting Options. Calculations are made on the last data stored at each location (up to 400 samples). Sampling must take place at two or more locations for calculations to be made. When all locations have been sampled, the printer prints the mean of averages, standard deviation, standard error, and upper 95% confidence limit. The upper confidence limit is only calculated for nine or fewer locations.

To use Fed-Std-209 calculations feature, perform the following steps:

1. Position the counter at the first sample location; turn power on.
2. To keep from using previous data in the calculations, clear stored data by pressing and holding Clear Stored Data.
3. If you are taking temperature, relative humidity, or air velocity readings at location 1, position the probes now.
4. Set “Location” to 1 using “Location (Number)” procedure.
5. Set number of cycles to be taken at each location using “Number of Count Cycles” procedure; set sample time of each cycle to one minute (hold time, your choice) using “Period/Hold (Time)” procedure.
6. Set mode to “Automatic” or “Concentration” (not “Manual”) then press Run. The Counting will come on while samples are being taken. Verify flow rate is 1 cfm as described on earlier pages. The counter will stop when samples are complete.
7. Turn the counter off then move counter to the next location.
8. Set “Location” to 2 then press Run. Samples will be taken at location 2.
9. Repeat steps 5 and 6 above for the remaining locations.
10. Decide if calculations are to be in cubic feet (CF) or cubic meters (1000 L) then make selection using Volume Units (UOL) for Concentration Mode and Fed-Std-209 Calculations.
11. Choose “209E” from “Prn” (Options) using “Selection Printer Function” procedure on following pages.
12. From the printer control keys, press Enable then press Print Stored Data. The average particles per unit volume at each location will be printed out, followed by Fed-Std-209 calculations of all locations. The following is a typical printout of three samples taken at two locations.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

```
FEDERAL STANDARD 209E STATISTICS
AVERAGE PARTICLES /CUBIC FOOT

LOCATION 001,09:45:39 MAY 7, 99
CYCLES = 003,VOL = 1.000 CU FT
TEMP. = 71.3 F      RH = 29.5%
SIZE   CUMULATIVE   DIFFERENTIAL
0.5µ       3256.3          2634.7
1.0µ        621.7           361.3
2.0µ        260.3            58.3
3.0µ        202.0            31.7
5.0µ        170.3            22.3
10.µ        148.0           148.0

LOCATION 001,09:45:39 MAY 7, 93
CYCLES = 003,VOL = 1.000 CU FT
TEMP. = 71.3 F      RH = 29.5%
SIZE   CUMULATIVE   DIFFERENTIAL
0.5µ       4478.7          3954.3
1.0µ        524.3           435.0
2.0µ         89.3            43.0
3.0µ         46.3            18.7
5.0µ         27.7             9.3
10.µ         18.3            18.3

      MEAN OF THE AVERAGES
SIZE   CUMULATIVE   DIFFERENTIAL
0.5µ       3867.5          3294.5
1.0µ        573.0           398.2
2.0µ        174.8            50.7
3.0µ        124.2            25.2
5.0µ         99.0            15.8
10.µ         83.2            83.2

SIZE  STD DEV   STD ERR  95% UCL
0.5µ   864.3    611.2     7724.0
1.0µ    68.8     48.7      880.1
2.0µ   120.9     85.5      714.3
3.0µ   110.1     77.8      615.3
5.0µ   100.9     71.3      549.1
10.µ    91.7     64.8      492.3
```

} average of the three count cycles

Figure 3. Typical Fed-Std-209 Printout

Using Special Features

Note

In the Fed-Std-209 calculations, a period of 60 seconds must be selected so that at a nominal flow rate of 1 cu. ft./min, a total volume of 1.000 cu. ft will be sampled. The count is calculated on one cubic foot of sampled air.

Generating a Configuration

If you ordered your counter with the "configuration" capabilities option, you can program a "configuration" that stores in memory count cycle information. The information is stored at a location number so that when the location is selected, the period, hold time, count alarm limit, and number of cycles will be automatically performed during a run cycle. Up to 10 different configurations can be generated. Any configuration can be stored in one or more of the 1000 location slots available.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using Special Features

To generate, apply, review, or delete a configuration, perform the following steps:

1. Decide on the "configuration" you want then set the configuration (count alarm limit, period/hold time, number of cycles) using procedures found elsewhere in this section.
2. Press ◆ or ◆ until Options ▭ is on then press ◆ or ◆ until **CFg** (configuration) is displayed.
3. Press [Program] (a configuration number will blink) then press ◆ or ◆ to select the configuration number (any number from 1 to 10) that will be assigned to contain your "configuration" (as set in step 1).
4. Press [Enter] to enter into memory the assigned number and to exit the programming mode (Program LED will go off).
5. To apply this configuration (or any other programmed configuration) to a location number, press ◆ or ◆ until Location ▭ is on. The current location number (7-digit display) and the present configuration in this location (3-digit display) will be displayed. If "Loc" appears in 3-digit display, no configurations have yet been assigned.
6. Press [Program] then select the desired location number.
7. Press ◆ until configuration number in the 3-digit display blinks then press ◆ or ◆ to step through the ten configuration numbers until configuration number you want to apply is displayed.
8. Press [Enter] to configure the selected location and to exit the programming mode. A configuration must be programmed (using step 3 above) before a location can be programmed (see note to right).
9. To see what configuration is in a location, press ◆ or ◆ until Location ▭ is on, press [Program], then press ◆, ◆ and ◆, ◆ to step through locations. The assigned configuration number will be given in the 3-digit display. Press [Program] again when finished.
10. To print out a copy of how many and what configurations have been used, and the parameters of each configuration, repeat step 2 above then press [Print Stored Data].
11. To delete a stored configuration, repeat step 2 then press [Program], and with ◆ or ◆, select desired configuration number to be deleted (number will blink); press [Clear Stored Data]. Verify deletion by printing the configuration (repeat step 10).

Note

To abort a change, press [Program] again. To save a change, press [Enter].

Note

If "Loc" appears in the 3-digit display, presently programmed parmeters (count alarm limit, etc.) will be used when [Run] is pressed. If "Loc" appears in the 7-digit display, test parameters have been assigned to this location.

Note

The default configuration (**C 1** on the 3-digit display) will be used for all locations during count runs that have not been specifically programmed as described in this procedure.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using the Printer

The particle counter can be ordered with or without a printer. If ordered without a printer, a rear-panel connector is installed for use with an external (Centronics parallel-interface) printer. When enabled, the printer will print all count data as well as date, time, location, etc., automatically as a test run is completed. Sample time (period) of each test run must be greater than eleven seconds for the printer to be able to respond. All test run data is stored in a rotating buffer and can be printed out at any time. To print results, you must choose one of the "printer selections" (described below) and "enable" the printer. Operating the printer is described in these subsections:

Loading Printer Paper
Selecting Printer Function
Printing Fed-Std-209 Calculations
Clearing Data Stored in Rotating Buffer
Interpreting the Printout
Setting up an External Printer

Loading Printer Paper

1. Open paper cover then remove any remaining paper from last roll by snipping paper at spool and pressing Paper Feed until printer is empty.
2. Trim end of new roll to a clean, arrow-shaped edge.
3. Place paper roll in paper tray so that paper feeds toward print mechanism from bottom of roll.
4. Insert tip of paper into slot in feed mechanism (above the bottom of the paper tray) so that when Paper Feed is pressed, paper will be pulled through printer; close paper cover.

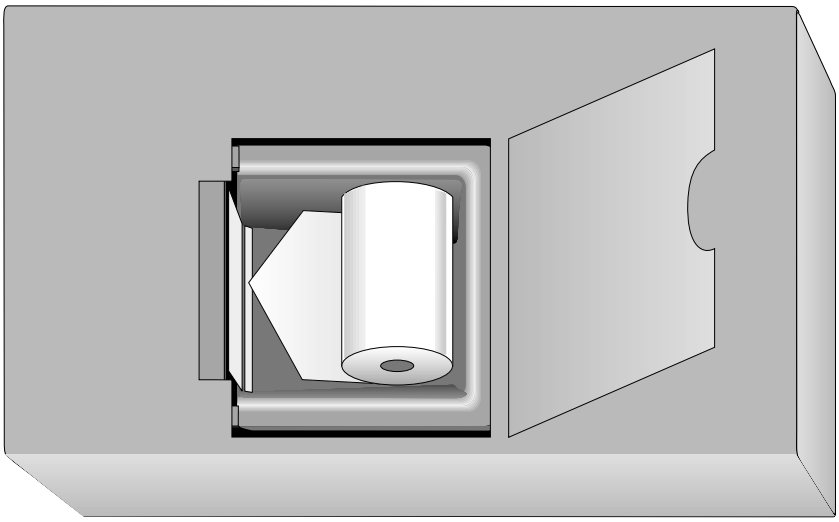


Figure 4. Loading Printer Paper in the Counter

CAUTION

The printer should not be operated without paper as damage may occur to the print head. If the particle counter must be operated without paper in the printer, be sure printer is not "enabled".

Do not pull paper from printer in opposite direction of normal feed. This will damage printer.

Paper used in this printer is temperature-sensitive on one side and thus must go into the printer as explained in the instructions.

Note

Leave natural "curl" in paper so that paper tracks properly through mechanism.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using the Printer

Selecting Printer Function

The print function currently selected is displayed when Option is on and Prn appears on the 3-digit display. The three selections available are: 1) print “ALL” - prints results after completion of each count cycle (if cycle is greater than eleven seconds), 2) print “Alr” - prints results only when a count alarm limit has been exceeded, 3) print “209E” - prints Fed-Std-209 calculations. The first two options, when selected, occur during particle counting. The third option, when selected, occurs after count cycles at at least two locations are completed and when Print Stored Data is pressed. For any of the selections to work, the printer Enable LED must be on. Choose desired print selection as follows:

1. Press ▲ or ▼ until Options ▭ is on.
2. Press ▲ or ▼ or until Prn is displayed. The current status (“ALL”, “209E”, or “Alr”) will appear on the readout display.
3. Press Program (current status will blink) then press ▲ or ▼ to step through the three choices (“ALL”, “209E”, or “Alr”).
4. Press Enter to save your choice and exit the programming mode (Program LED is off).

Printing Fed-Std-209 Calculations

Your counter will automatically calculate the statistical data required for compliance with Fed-Std-209 after sampling particles at two or more locations. The printer will print the mean of averages, standard deviation, standard error, and upper 95% confidence limit by simply enabling the printer then selecting “209E” from the print mode of the Options program. Refer to “Fed-Std-209 Calculations” in Using Special Features section for step-by-step instructions for taking samples and printing results.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using the Printer

Interpreting the Printout

The printer will print the particle size ranges and cumulative and differential counts for each range. It also prints environmental probe values if external probes are connected to the counter. Date, time, location, period and number of cycles are always added to each printout. If there is an alarm during a sample run, the printout will show what type of alarm occurred.

A typical printout when Print Stored Data has been pressed will look similar to this:

```
PRINTING 002 RECORD(S)

*******   COUNT ALARM     *******
*******   ANALOG ALARM    *******
LOCATION 001, 17:45:39  MAY 9, 93
CYCLES = 002,   PERIOD   00:00:30
TEMP.  =  75.3 F     RH  =  29.0%
SIZE   CUMULATIVE     DIFFERENTIAL
0.5µ        21205            12150
1.0µ         9055             6398
2.0µ         2657             2263
3.0µ          394              253
5.0µ          141              100
10.µ           41               41


*******   COUNT  ALARM    *******
LOCATION 001, 17:46:16  MAY 9, 93
CYCLES = 002,   PERIOD   00:00:30
TEMP.  =  71.3 F     RH  =  29.5%
SIZE   CUMULATIVE     DIFFERENTIAL
0.3µ        21934            12578
0.5µ         9356             6625
1.0µ         2731             2301
3.0µ          430              264
5.0µ          166              122
10.µ           44               44
```

Figure 5. Typical Printer Printout

In this example, two runs (cycles) were stored in the rotating buffer. The count of 21205 for size .5 micron is the cumulative (total) count. The differential count of 12150 is for the .5 micron range only (.50 through .99 micron) at location 001. The words COUNT ALARM above the count cycle data means the count exceeded the programmed alarm limit for that cycle at one of the six particle sizes. ANALOG ALARM means either the temperature or relative humidity reading exceeded the programmed limits during both count cycles. PRINTING 002 RECORD(S) appears at the top of the printout only when Print Stored Data has been selected.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using the Printer

CAUTION

Make sure you no longer need the stored data before you press and hold down Clear Stored Data key.

CAUTION

Before performing this procedure, load paper into external printer; refer to printer instruction manual. Operating printer without paper may damage the print head.

If an external printer is being used, the counter must be turned off before printer is connected. Connecting the printer while the counter is on may damage the counter.

Clearing Data Stored in Rotating Buffer

Count data taken while in the manual and automatic modes are stored in the counter's rotating buffer. Up to 400 data records can be stored in the buffer. At that time the oldest record is removed to make room for the newest record. Printing count data does not remove records from the buffer. To clear all data records from the rotating buffer, perform the following steps:

1. Momentarily press Clear Stored Data. The number of sample runs currently stored in the buffer will appear on the readout display.
2. Press and hold down Clear Stored Data for two seconds or longer; the display will go to 0, meaning no sample runs remain in the rotating buffer.

Setting up an External Printer

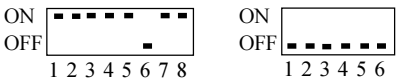
An external printer is considered an option because output to the external printer requires installation of a Centronics parallel interface connector at the time the counter is built.

Over the years, several external printers have been available as options from the factory. The Model DPU-414 is the latest printer available and supercedes the DPU-411.

If you ordered the external printer option (no built-in printer), connect the printer as follows:

1. Set 

to 0 (off).
2. Turn power off to printer.
3. If using a DPU-411 printer, verify switches on bottom of printer are set for parallel format. They should be set as follows:



If using the DPU-414 printer, DIP switch settings are made in software. Set the DIP switch for a parallel format by following the procedure in the printer's Operation Manual.

4. Connect ribbon cable between the printer and the connector marked PRINTER on rear panel of counter.
5. Set 

to 1 (on); set printer power switch to on.
6. Make printer selection changes, if desired, as described in “Selecting Printer Function” on earlier pages.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using Accessories

Accessories can be ordered from the factory at any time. Those accessories requiring additional discussion are the two environmental probes currently available.

Environmental Probes

The particle counter has rear-panel connectors for two environmental probes: RH/temp probe for monitoring relative humidity and temperature and an air velocity probe for monitoring air velocity. When a probe is connected to the counter, the front panel will display the probe reading when the appropriate "DISPLAY" is selected with the arrow keys. (Air velocity can be monitored when the Spare is on.)

When the printer is enabled, the probe readings present during each count cycle will automatically be printed with the count results. Otherwise, readings can be printed at a later time. Alarm limits can be set for each probe so that if either a high or low limit is exceeded, the Limit light will come on. A light will blink adjacent to the label of the probe in alarm if that probe's reading is being displayed. Refer to the "Probe Alarm Limits" earlier in this manual for setting alarm limits.

The following tips should be noted during use of the RH/temp or air velocity probe:

Never touch the sensing element of the probe; it is very fragile.

Sensing elements should not be exposed to caustic vapors (e.g., acetone, Freon, and RTV).

Keep the RH/temp probe away from exhaust fans for more accurate measurements of temperature.

For accurate measurements of relative humidity, allow probe to stabilize several minutes; take samples in still air.

When taking air velocity measurements, make sure the white sensing element is fully exposed to the direction of airflow.

Setting Temp/RH Probe Alarm Limits

Temperature and relative humidity can be displayed while in either the run or stop mode by pressing or until Temp/RH is on. Program the probe high- and low-alarm limits or change from °F to °C or from °C to °F as follows:

1. Turn counter off. Connect RH/temp probe to the counter rear-panel connector marked RH/TEMP then turn counter on.
2. To read temperature or relative humidity, press until Temp/RH is on. Current temperature will be displayed. Press for relative humidity reading.
3. To change the high-alarm limit or to change readout to °F or °C,

Note

Alarm limits for relative humidity and temperature can only be displayed or programmed when the probe is connected to the counter.

To silence the alarm, press any front-panel key *except* Run or Stop.

To turn off the alarm, enter both an upper and lower limit value of 0 (zero).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Using Accessories

press Program then press ◆ until the digit you want to change is blinking.

4. To increment digit to the next value, press ▲ or ▼ once. To scroll, press and hold down either arrow key.
5. To change other digits, press ◆ and repeat step 4.
6. To set low-alarm limit, press ◆ until "HI" blinks then press ▼; "LO" will blink. Press ◆ to select digit to be changed then repeat steps 4 and 5 above.
7. Press Enter to save changes and exit programming mode (Program LED is off).
8. To set relative humidity alarm limits, while RH/Temp ▭ is on press ◆ (current relative humidity reading will be displayed) then press Program. Using ◆ select digit to be changed, then repeat steps 4 through 7 above.

Setting Air Velocity Probe Alarm Limits

When air velocity probe is connected, air velocity can be displayed while in either the run or stop mode by pressing ▲ or ▼ until Spare ▭ is on. Program the probe high- and low-alarm limits or change readout units to ft./min. or meters/min. as follows:

1. Turn counter off. Connect air velocity probe to the counter rear-panel connector marked AIR VELOCITY then turn counter on.
2. To read air velocity, press ▼ until Spare ▭ is on. If a decimal point is in the three-digit readout, results are in meters/minute, otherwise results are feet/minute.
3. To change the high-alarm limit or to change readout to ft./min or meters/min, press Program. "HI" will be blinking. Then press ◆ until the display you want to change is blinking. A blinking "-" means readout is in meters/min; blinking "F" is ft./min.
4. To increment digits to the next value, press ▲ or ▼ once. To scroll, press and hold down either arrow key.
5. To change other digits, press ◆ and repeat step 4.
6. To set low-alarm limit, press ◆ until "HI" is again blinking, then press ▼; "LO" will blink. Select digit to be changed using ◆ then repeat steps 4 and 5 above.
7. Press Enter to save changes and exit programming mode (Program LED is off).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Serial Port Protocol and Commands

This section describes operating the particle counter with a computer. Your counter has been set up for both serial-type data communications capabilities: 1) RS-232 serial interface circuitry provides asynchronous communications between the counter and computer, or 2) RS-485 serial network circuitry provides asynchronous communications between up to 64 counters and a controlling computer.

Software is available from the factory that will provide a variety of features including controlling your counter from a computer; uploading count data into the PC; sort, normalize, and calculate count data for cleanroom classification. For additional information about software, contact the factory. Also, the "Particle Counters for Air" manual you received with your counter will provide more detail information on this subject.

Serial Cables

All counters are connected to a computer with a serial cable. If you purchased PortAll software, you will also receive an adapter you can use with a standard 9 pin-to-9 pin serial cable. The cabling diagram below is provided for those who wish to make their own custom-length cable.

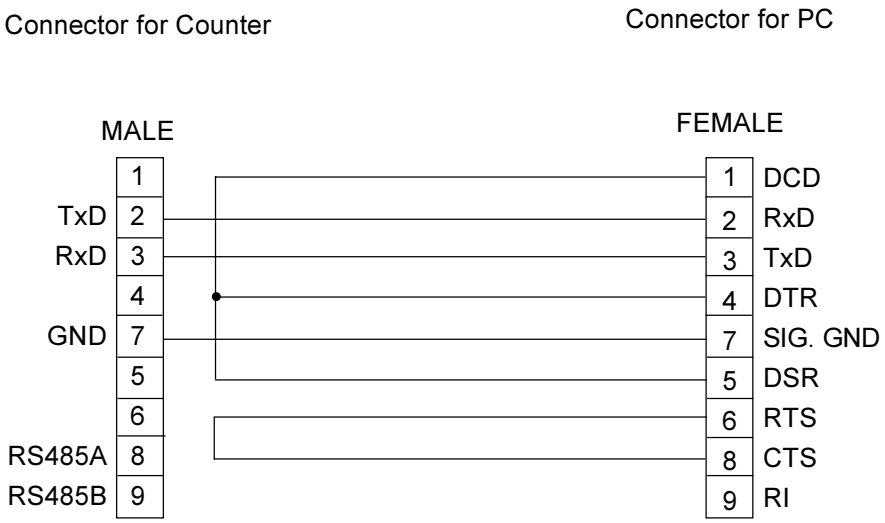


Figure 6. Serial Cable

CAUTION

To avoid internal circuit board damage, configure the cable as shown in figure 6. The figure shows wiring for a nine-pin connector on the computer. If your computer is a 25-pin type, use a 25-pin to nine-pin adapter cable. Both cables are available from your local distributor or Pacific Scientific Instruments.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Serial Port Protocol and Commands

Communication Protocol

The counter has the following fixed parity and protocol:

Eight (8) data bits
One (1) stop bit
No parity

The device number (select code) and baud rate are selected from the front panel of the counter. Make these selections as described in "Location (Number)" and "Baud Rate (bd)", respectively, covered earlier in this manual.

Commands

The following ASCII commands described below are supported by your particle counter:

"**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 (quick start). Counting will continue until stopped by the computer. The count cycle should be controlled by the computer.

"**d**" **Start Counting** (counter controlled)—The counter will begin counting and control the count cycle based on the front-panel setting for period (sample time).

"**e**" **Stop Counting**—The counter will immediately stop counting without waiting for an even second boundary.

"**C**" **Clear Buffer**—The rotating buffer will be erased.

"**E**" **Send EPROM Revision**—The counter will send the EPROM number (e.g. E2082179-1A Note: your EPROM number or letter may not match the letter shown in this manual).

"**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.

"**T**" **Identify Model**—The counter will send a four character model number (e.g. 2408).

"**A**" **Send Record**—The next 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.

If no count cycles have been completed since the counter was turned on, then a "#" will be sent. The record can not be sent until the current count cycle is complete.

"**R**" **Resend Record**—The last record sent will be resent. Records sent prior to the last record have been permanently erased.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

"**h**" **Standby Mode**—The counter will enter a mode that turns off the air pump and shuts down the sensor to conserve power and reduce equipment wear.

"**g**" **Active Mode**—The counter will enter a mode that prepares it for counting. The air pump will turn on to purge the air path.

"**l**" **Local Mode**—(for factory test purposes) The counter will be set to off-line.

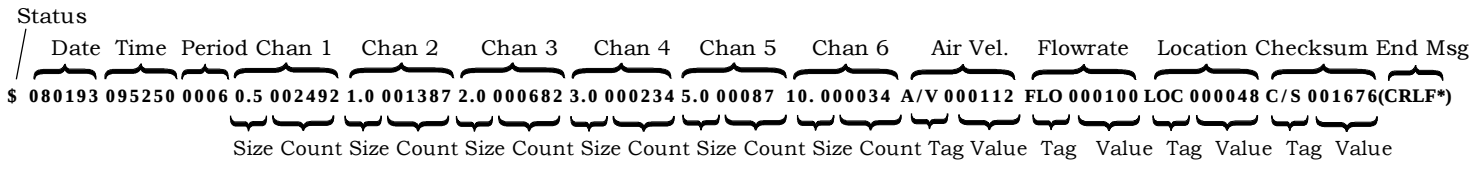
"**U**" **Universal Select**—The counter will respond to all commands after receiving this command, regardless of which select code is programmed into the counter.

"**128-191**" **Counter Select**—The counter will respond to all subsequent commands when a number is sent that matches its select code. The counter is deselected, or 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.

"**192-255**" **Device Select**—When the counter is sent a number that matches a device number, the counter will select the manifold station (192 selects station 1). The station is deselected by selecting another station.

Data

Each counter, regardless of model version, 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. The length of the string changes with the amount of data points available from the counter. Each data point is preceded by a three-character tag that identifies the type of data that follows in the next six data characters. The following is an example to show the serial communications format of a six-channel counter with an air velocity probe:



*CRLF is the carriage return and line feed command

Figure 7. Typical Data Record

Refer to the "Particle Counters for Air" manual for a detailed explanation of the data record.

Serial Port Protocol and Commands

CAUTION

Do not use the Universal Select command when more than one counter is on the same serial port because more than one counter will respond at the same time, causing communication problems.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Technical Data

Specifications

Number of Size Ranges	2, 4, 5, or 6 (selected at time of order)
Particle Size Ranges	0.5, 5.0 microns (2 ranges) 0.5, 1, 5, 10 microns (4 ranges) 0.5, 1, 2, 5, 10 microns (5 ranges) 0.5, 1, 2, 3, 5, 10 microns (6 ranges)
Sample Flow Rate	1 cfm
Coincidence Loss	Less than 5% at 400,000 particles/cu. ft.
Counting Efficiency*	50% for 0.50 micron and 1 cfm
Minimum Counts Ratio*	2:1
Light Source	Laser diode (30,000 hours MTTF)
Count Display	7-digit LED
Maximum Count Displayed	9,999,999
Sample/Hold Times	1 second to 24 hours
Count Alarms	1 to 9,999,999 counts
Data Storage	400 samples, rotating buffer
Count Cycles	up to 999 while in Automatic mode
Locations	up to 999, number appears on printout
Output	RS-232C/RS-485 for computer
Sensor Type	70°-angle, laser diode
Pump Type	air vacuum, 1 cfm
Size	11.2" wide x 6.0" high x 18.0" deep (28.5 x 15.3 x 45.7 cm)
Weight	24 lbs. (11 kg.)
Power	150 watts, 100, 115, or 230 vac ±10% (specify), 50 - 60 Hz
Environment (Operating):	
Temperature	12 to 29°C (55 to 84°F), typical
Humidity	10 to 85% relative, non-condensing
Environment (Storage):	
Temperature	-40 to 50°C (-40 to 122°F)
Humidity	Up to 98% relative, non-condensing

* Overall particle counter performance exceeds Japanese Industrial Standard JIS B 9921

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Component Location

The following drawing can be used to help locate and identify components on your counter that are referenced in this operating guide or the “Particle Counters for Air” manual.

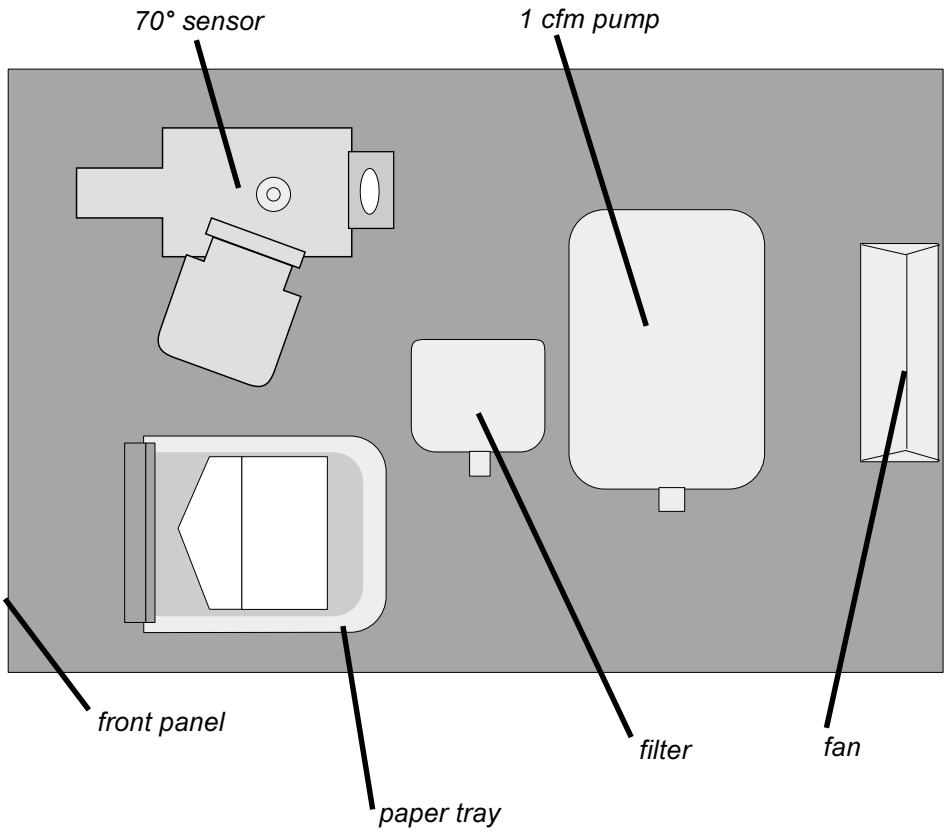


Figure 8. Layout of Major Components

Technical Data

CAUTION

All stored sample data will be cleared when the counter is reset. All functions you have programmed (time and date, count alarm limits, etc.) will also be cleared and reset to the factory default settings.

Note

If the results in step 2 do not occur, disconnect any external equipment (RH/temp probe, external printer if applicable) and repeat this procedure. Reconnect one piece of equipment and repeat procedure to determine if external equipment is the source of the problem.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Technical Data

Resetting Counter Options

This procedure clears the counter memory and restarts its microprocessor. Reset the counter as follows:

1. Set 

to 0 (off).
2. Press and hold Mode then turn power on. A beep will sound. Release Mode. The front panel displays should be as follows: Manual : on, Cumulative : on,

   dEF 1418 - 1F: shows default values have been reloaded ; gives your EPROM part number and revision level (Note: this part number is for the manifold option; your revision number or letter may not match the number (letter) shown in this manual).
3. Press Enter then reenter programmed functions.

Manual Backdating

Several additions and changes to the 2408 particle counter brought about revision level changes to the manual. These changes are summarized below:

to REV. C:

1) removed all references to 0.3 micron particle size range, as this size is no longer offered in the Model 2408 (0.5 micron is the smallest size range available).

2) reworded Options to clarify that the manifold option is standard if no option is specified.

3) reworded introduction to the Serial Port Protocol section.

4) modified Serial Cable figure to reflect the more common 9-pin configuration of a computer.

5) deleted the "A" as a prefix to the model number for consistency purposes within the product line.

to REV. B:

1) a "count cycles average" feature automatically calculates and prints out results of the average of counts taken. Up to 999 count cycles can be programmed.

2) a "configurations" feature has been added that when programmed into the particle counter and then selected, the period, hold time, count alarm limit, and number of cycles will be automatically performed during a run cycle. Up to 10 different configurations can be generated. Refer to "Generating a Configuration" for a step-by-step procedure. Particle counters with the "configurations" feature will display the EPROM number: dEF 2179 - 1A. Otherwise, dEF 1145 - 1b will be displayed for older units (Note: your

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

revision level letter may not match the letter shown in this manual).

3) all references to data storage in the rotating buffer changed from 500 to 400 samples, as firmware was changed to make room for storage of the "configuration" information.

4) testing was performed on the 2408 counter for conformance to electromagnetic compatibility (a requirement for European customers). A "Declaration of Conformity" certificate stating what requirements were met to achieve this goal appears at the back of this manual.

Technical Data

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP