MODEL GT-521
PARTICLE MONITOR
OPERATION MANUAL

GT-521-9800 REV C

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Model GT-521 Particle Monitor Operation Manual

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Technical Support

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Safety Notice

The contents of this manual have been checked against the hardware and software described herein. Since deviations cannot be prevented entirely, we cannot guarantee full agreement. However, the data in this manual is reviewed regularly and any necessary corrections included in subsequent editions.

Faultless and safe operation of the product presupposes proper transportation, storage, and installation as well as careful operation and maintenance. The seller of this equipment cannot foresee all possible modes of operation in which the user may attempt to utilize this instrumentation. The user assumes all liability associated with the use of this instrumentation. The seller further disclaims any responsibility for consequential damages.

NOTICE

CAUTION—Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

WARNING—This product, when properly installed and operated, is considered a Class I laser product. Class I products are not considered to be hazardous.

There are no user serviceable parts located inside the cover of this device. Do not attempt to remove the cover of this product. Failure to comply with this instruction could cause accidental exposure to laser radiation.

This system contains a laser operating at 785 nm. This wavelength is invisible to the naked eye and can cause damage to the eye if directly exposed. The unit is protected by a protective housing. To avoid the possibility of accidental exposure, always power down the system any time service or repair work is being preformed. There are no user serviceable parts located inside the cover of this device. Do not attempt to remove the cover of this product. Failure to comply with this instruction could cause accidental exposure to laser radiation. Repair of instrumentation manufactured by Met One Instruments, Inc. should only be attempted by trained manufacture service personnel.

Electrical & Safety Conformity

The manufacture certifies that this product operates in compliance with following standards and regulations:

- FDA / CDRH This product is tested and complies with 21 CFR, Subchapter J, of the health and Safety Act of 1968.
- European Community (CE) Directive 72/23/EEC
  EN 61010-1 (Safety)
- IEC 60825-1 Ed.1.1 (1998-01)
- EN 60825-1 W/A11 (1996)
- US 21 CFR 1040.10

Warranty

Products manufactured by Met One Instruments, Inc. are warranted against defects in materials and workmanship for a period of (1) year from the date of shipment from the factory. Offered products not manufactured by Met One Instruments, Inc. will be warranted to the extent and in the manner warranted by the manufacturer of that product.

Any product found to be defective during the warranty period will, at the expense of Met One Instruments, Inc. be replaced or repaired and return freight prepaid. In no case shall the liability of Met One Instruments, Inc. exceed the purchase price of the product.

This warranty may not apply to products that have been subject to misuse, negligence, accident, acts of nature or that have or modified other than by Met One Instruments, Inc. Consumable items such as bearings are not covered under this warranty.

Other than the warranty set forth herein, there shall be no other warranties, weather expressed, implied or statutory, including warranties of fitness or merchantability.

Table of Contents

1. Safety

1.1. Safety Indicators

This manual uses a **CAUTION** and a **WARNING** indication. Familiarize yourself with the following definitions for the meanings of these indicators.

A **CAUTION** indicates a hazard and calls attention to a procedure that if not correctly followed could result in damage to the instrument. Do not proceed beyond a caution indicator without understanding the hazard.

A **WARNING** indicates a hazard to you and calls attention to a procedure that if no correctly followed could result in injury or even death. Do not proceed beyond a warning without understanding the hazard.

2. Setting Up

2.1. Unpacking

When you unpack the GT-521 and accessories, inspect the carton for obvious damage. If the carton is damaged notify the carrier. Unpack everything and make a visual inspection. You should have the following:

- GT-521 Particle Counter
- Serial interface cable
- Isokinetic probe with a short piece of tubing
- Universal AC to DC converter module
- AC power cord
- Miniature screwdriver
- GT-521 operation manual
- GT-521 calibration data sheet
- GT-Comm software
- GT-Comm operation manual

If any of the above components are missing contact your supplier. Keep the carton and packing material for reuse.

2.2. Test Run

The battery pack inside the GT-521 was charged at the factory and the instrument should be ready to use. Turn the power switch located on the right side of the GT-521 on. The power switch is a small slide switch located just above the 9-pin serial communications socket. The LCD display on the GT-521 should represent the factory set default settings, as shown below. If there is no display or a dim display, or you here a long beep, the battery pack probably needs charging and you should refer to the maintenance chapter that covers charging the battery pack.

```
0.3m          0
0.5m          0
     COUNTS
     WAIT
```

Now do a test run and take an aerosol sample with the GT-521. The factory default settings shown below have been set so the GT-521 will take a one-minute sample. The result is displayed in particles per cubic foot for all particles larger than 0.3 µ in channel 1, and all particles greater than 0.5 µ in channel 2.

Note: Do not change any of the factory default settings before reading the chapter on Manual Operation.

2.2.1. Factory Defaults

Item	Description
Channel 1	0.3µ (micron)
Channel 2	0.5µ (micron)
Sample Time	60 Seconds
Hold Time	0 (Zero)
Samples	1
Count Mode	ACTUAL
Count Units	COUNTS
Temperature	Deg. C
Alarms	OFF

Remove the rubber cap from the GT-521 inlet nozzle. The inlet nozzle protrudes from a hole in the top of the GT-521 case. Turn on the GT-521 power switch and press the **<START>** key. You should hear the internal vacuum pump start running. After 1 minute the pump will stop and the 0.3µ and 0.5µ channels will each show a number representing the number of particles larger than 0.3µ and 0.5µ per cubic foot that were in the sample.

If the GT-521 failed the test run, first check to see if the factory set defaults are set, program them in if they are not, then try another test sample. If there is still a problem refer to the Troubleshooting chapter in this manual. Be sure to switch off the GT-521 power when you are finished sampling to conserve battery power. The GT-521 is now checked out and ready for use, however you should read the rest of this manual to better understand how to use and maintain this instrument.

3. GT-521 Overview

3.1. Description

The GT-521 was designed to be a small, easy to use and completely portable particle counter, with all of the flexibility and power of larger bench top instruments. The LCD display allows viewing of two discrete particle-counting channels in real time. The output format can be raw counts, counts per cubic foot or differential count. There are many features in the GT-521 that are user definable, for example, each counting channels particle size setting can be defined in 0.1µ increments in the range of 0.3µ to 5.0µ. The sample time is adjustable from 6 to 999 seconds. There are two programmable alarm levels for each channel. A temperature and humidity probe is available as an option.

Remote operation was another design goal. The GT-521 includes both RS232 and RS485 communications and has a robust remote command set. All of the operating functions that can be programmed manually can be programmed remotely using the command set. Besides portable particle counting, and data acquisition applications, the GT-521 can also function as a bench top instrument continuously powered by its AC converter. Here are some of the GT-521s key features:

- The GT-521 is three instruments in one, it can be used for portable, bench top, or data acquisition applications
- The sensor in the GT-521 incorporates a long life laser diode, an efficient light collecting elliptical mirror, and unique optics to provide a high concentration limit.
- The large LCD display provides an understandable and easy to learn, user interface. It also allows simultaneous viewing of two counting channels and other important parameters on one screen.
- The output format can be configured several ways, cumulative counts, differential counts or particles per cubic foot.
- The particle size setting for both channels is user defined in .1 micron steps. This significantly increases the analytical usefulness, no more special calibration or guess work.
- Another analytical feature, the differential count mode, allows the GT-521 to be programmed to respond to virtually any particle size range.
- Manual use of the GT-521 is enhanced by the on screen data recall and large memory buffer capacity.
- For remote operation the GT-521 sports both RS232 and RS485 are has a powerful remote command set.

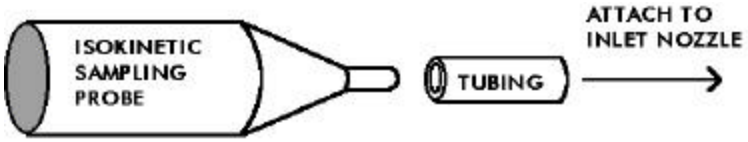
3.2. Applications

Because the GT-521 has so many features and can be configured in so many ways, It is finding use in quite a broad range of new applications.

- Clean room monitoring, verification, and hepa filter testing
- Process control monitoring in sawmills, grain elevators, quarries etc.
- Mines and ore processing plants
- Indoor and outdoor air quality studies
- Finding leaks and sources of contamination air ducts and filtration systems
- Concerned citizen groups that want to do their own air quality studies
- Hospitals and nursing homes
- Test the efficiency of residential air purifiers and vacuum cleaners
- Check filters for particle leaks
- Epidemiological studies
- Reentrainment studies

3.3. Isokinetic Sampling

The GT-521 comes with an isokinetic probe that attaches to its inlet nozzle with the short piece of Tygon tubing provided. Attach the other end of the tubing to the GT-521 inlet nozzle.



The isokinetic probe helps reduce count errors related to the sample flow velocity and the aerodynamics of small particles. The isokinetic probe should be used for most sampling applications. When taking a sample of typical indoor or outdoor aerosols the opening of the isokinetic probe should always face upward. The GT-521 can be held in your hand or placed on a flat surface with its display facing towards you. When sampling in an area having constant airflow, such as a clean room, duct, vent or the downstream side of a filter, always face the opening of the isokinetic probe into the air movement. The length of the connecting tubing going from the inlet on the GT-521 to the isokinetic probe can be increased if necessary but count losses, especially for larger particles, will become a problem after approximately a four-foot length. Try to keep the tubing length short.

The sampling height will affect the GT-521 reading. Taking a sample near the floor can give results several times higher than a sample taken at eye level.

When using the GT-521 to analyze a contamination problem be aware that not all contamination problems are continuous, some are the result of a short-term event or burst of particles. Locating the source will require taking a number of samples in the same area. It may be necessary to connect the GT-521 to a computer and log data over 24 hours to detect a fast contamination event.

4. Manual Operation

CAUTION: Never sample smoke, paint spray, oil mist, reactive, or pressurized gasses to avoid damaging the sensor optics.

CAUTION: Remove the rubber cap from the GT-521 aerosol inlet nozzle before taking a sample. Running the internal vacuum pump with the cap attached for any appreciable time may damage the pump.

4.1. Main Sample Screen

The main sample screen is viewed during normal operation of the GT-521. The display includes two real time counting channels and the particle size setting for each channel. Also displayed is the status of the counter, alarm status, battery condition, temperature, humidity, and type of count data. Relative humidity and temperature are only displayed on screen if an external sensor is connected to the unit. The screens below represent an ACTUAL count mode and a DIFFERENCE count mode.

```
0.3m        127821
0.5m          3567
     COUNTS
 23C RUN      38%
```

```
0.3-0.5m   124254
0.5m  ->     3567
     COUNTS
 23C RUN      38%
```

4.2. Menu Select Screen

Changing the operating parameters, accessing data and outputting data is done through the GT-521 menu selection screen. Each GT-521 is shipped with factory default operating parameters as described in the Test Run section of the Setting Up chapter of this manual.

All changes to the GT-521 operation, accessing data, and outputting data are accomplished in the following sequence.

- Press the **<MENU>** key to enter the Menu Select screen.
- Use the - and ¯ keys to select the selection containing the parameter to change, then press **<ENTER>.**
- In the sub-menu screen you just selected, use the ® key to sequence to the parameter you want to change and use the - ¯ keys to make a change. Press **<ENTER>** to accept the change and **<ESC>** to return back to the main menu.

```
SAMPLE SETUP    -
CH1/CH2/CNT/TMP
DATA RECALL
PRINT OPTIONS   ¯
```

4.3. ID, Sample Time Options

The SAMPLE SETUP menu selection is used for setting the location ID, sample time, hold time and number of samples. The location ID is used to Identify sample locations when sampling many different locations. Each location can be identified by its own number. Any number from 1 to 99 can be programmed. The sample time is the amount of time in seconds that the counter will actually sample the air and it can be programmed using any number from 6 to 999 seconds. The hold time is the amount of time, from 0 to 999 seconds, that the counter will wait between samples. The sample selection is the number of samples to take. The range is 1 to 999 or INFINITE (0). Select INFINITE for continuous sampling.

```
LOCATION ID  01
SAMPLE TIME  060
HOLD TIME    010
SAMPLES      010
```

4.4. Channel Size, Mode, Temperature Options

The CH1/CH2/CNT/TEMP menu selection is used to select the particle size, count type, and Deg C or Deg F for temperature. The channel 1 and channel 2 particle size thresholds can be programmed in 0.1µ steps from 0.3µ to 5.0µ in size. Channel 1 can not be equal to or greater than Channel 2. After the size is selected, it will be displayed on the main screen. After setting the CH1 and CH2 particle size the MODE is used to enable one of two counting modes.

```
CH1:0.3  CH2:0.5
MODE: ACTUAL
UNITS: COUNTS
TEMPERATURE: C
```

- ACTUAL – The CH1 and CH2 outputs are actual cumulative counts. The cumulative count represents the total number of particles larger than the particle size threshold.
- DIFFERENCE – The output is the absolute difference of the cumulative counts in CH1 and CH2. This differential is useful for examining a particle size range of interest.

The count UNITS setting determines how to display the count data—counts or concentration.

- COUNTS – This setting selection will indicate the number of particles for both CH1 and CH2.
- CUBIC FT – This setting selection will indicate the number of particles per cubic feet for both CH1 and CH2.
- LITER – This setting selection will indicate the number of particles per liter for both CH1 and CH2.

4.5. Data Recall Options

The DATA RECALL menu selection allows you to scroll through all of the data records viewing each record.

The date and time is displayed on line 1. The channel 1 particle size, alarm condition, and count or concentration value is displayed on line 2. The channel 2 particle size, alarm condition, and count or concentration value is displayed on line 3. An alarm condition is designated by an ***** character. The location ID, count units, temperature and RH is displayed on line 4. Count units are designated by **L** for Liters, **FT3** for cubic feet and blank for counts. An **ACTUAL** count mode screen is shown on the left and a **DIFFERENCE** mode screen is shown on the right.

```
05/14/1999 02:31
0.3m    * 1645372
0.5m    *   95124
02       22C  34%
```

```
05/14/1999 02:31
0.3-0.5* 1645372
0.5m ->*   95124
02       22C  34%
```

4.6. Print, Beep Options

The PRINT OPTIONS menu selection allows you to program enable or disable automatic sample printout, clear the memory buffer, print the entire memory content, and enable or disable the keypad beep. This screen also shows the memory percent full.

```
PRINTING   ON
MEMORY 50% FULL
PRINT MEMORY
KEYPAD BEEP OFF
```

4.7. Date/Time, Com. Port Options

The DT/TM/BAUD menu selection is used for setting the date and time. Date and time are used when storing data records to memory. The baud rate selection is used for remote operation. 9600 baud is the default setting. In most cases this setting is appropriate. If another setting is needed use the - ¯ keys to choose from 300, 600, 1200, 2400, 4800, and 9600 BPS. Comm Port allows for communication via RS232 or RS485, and data output to a 24 character serial printer (PRINT).

```
DATE 01/12/1999
TIME 05:00:42
BAUD RATE 9600
COMM PORT RS232
```

The PRINT output format looks like this:

```
MODE: ACTUAL, UNITS: COUNTS
     01    01/04/1999   16:23
     1.2u    9999999*    120C
     2.5u    9999999*     99%

MODE: ACTUAL, UNITS: /CUBIC FT
     01    01/04/1999   16:23
     1.2u    9999999 FT3 120C
     2.5u    9999999 FT3  99%

MODE: ACTUAL, UNITS: /LITER
     01    01/04/1999   16:23
     1.2u    9999999 L   120C
     2.5u    9999999 L    99%

MODE: DIFFERENCE, UNITS: COUNTS
     01    01/04/1999   16:23
     1.2-2.5 9999999*    120C
     2.5u -> 9999999*     99%

MODE: DIFFERENCE, UNITS: /CUBIC FT
     01    01/04/1999   16:23
     1.2-2.5 9999999 FT3 120C
     2.5u -> 9999999 FT3  99%

MODE: DIFFERENCE, UNITS: /LITER
     01    01/04/1999   16:23
     1.2-2.5 9999999 L   120C
     2.5u -> 9999999 L    99%
```

4.8. Alarm Options

The CH1 ALARMS and CH2 ALARMS selections on the menu can provide alarms that are shown on screen. If a count value exceeds the preset alarm value an asterisk is displayed on the screen next to the count data. These alarms are available on both channel 1 and channel 2.

```
CH1 ALARMS OFF
HI        0000000
HI HI     0000000
TEMP      50
```

```
CH2 ALARMS OFF
HI        0000000
HI HI     0000000
```

5. Remote Operation

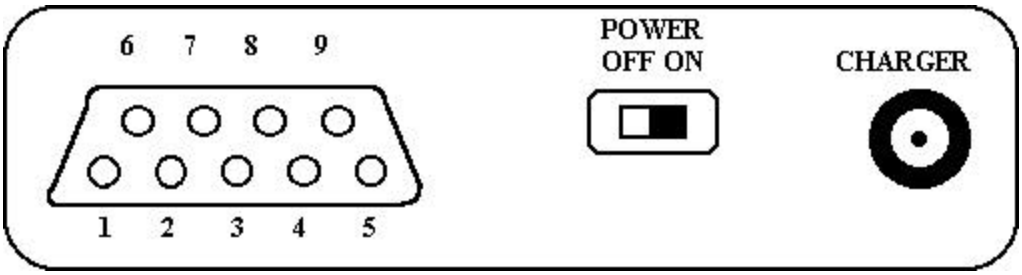
5.1. Serial Interface

The serial interface to the GT-521 is a standard 9 pin (DB-9) connector. It is located on the right hand side of the instrument as shown below. To communicate with the GT-521 requires a special serial cable P/N 2338.

CAUTION: Standard serial cables will not work and may cause damage to the instrument if connected**.**

Below is a description of the DB-9 connector.

Pin	Function	Comm. Type
1	Chassis Ground	
2	TX	RS232
3	RX	RS232
4	DTR	RS232
5	Ground	RS232 & RS485
6	A OUT 1	DAC
7	A OUT 2	DAC
8	A	RS485
9	B	RS485



5.2. Output Records

The counter's remote operation is similar to manual operation. Here is a description of the remote commands for operation of the GT-521. The protocol used is an ASCII based command structure. The Command Summary shows a list of all commands that are available with the GT-521. The output record is a comma-separated string containing information for one count cycle. The record format is as follows:

Date, Time, ID, Ch1 size, Ch1 count, Ch2 size, Ch2 count, RH, temp, status/alarms

07/17/98,10:25:00,10,0.3,123498,0.5,003487,34,23,ACFSZMNOPLTR

Status
A = Auto count
C = Temperature scaling in Degrees C
F = Temperature scaling in Degrees F
S = External AT/RH probe connected
I = Cumulative Counting mode
D = Differential Counting mode
U = Uncorrected Count value
Q = Count corrected to Cubic Foot value
Z = Count corrected to Liter value

Alarms
M = Hi alarm 1
N = HiHi alarm 1
O = Hi alarm 2
P = HiHi alarm 2
L = Laser cal alarm
T = Temperature alarm
R = Power Fail

Status and alarm on conditions are stored as flags along with the logged data. An alarm exists only if the letter associated with that alarm is placed in the output string.

5.2.1. Command Summary

Command	Description	Syntax	Example
U – Unit select	Selects a unit for communication	U and the # of the counter 1-99. The # is the Location ID.	U21 <enter>
S - Start counting	Starts remote counter	Location ID and S to start counting	U21 <enter> S
E - Stop counting	Stops remote counter	Location ID and E to stop counting	U21 <enter> E
L - Send last record	Sends the counters last record	Location ID and L to retrieve record	U21 <enter> L
Q – Firmware version	Shows the version of the firmware in the counter	Location ID and Q to retrieve information about firmware	U21 <enter> Q
I - Location ID Set	Sets the Location ID of the unit from 1 to 99	I and a number between from 1 to 99	V <enter> I22 <enter>
R – Diagnostic Information	Shows Diagnostic Information about the unit	Location ID and R	U21 <enter> R
T - Sample time	Selects sample time from 6 to 999 seconds	Location ID and T with sample time from 6 to 999 seconds.	U21 <enter> T10 <enter>
A – Automatic Counting mode	Automatic Counting as specified by sample and hold times. Unit will wait to be started and continue until stopped	Location ID and A followed by a: 1 = on 0 = off	U21 <enter> A1 <enter>
B – Clear Memory	Clears all records from memory	Location ID and B	U21 <enter> BY <enter>
F – Set Channel 1	Sets the channel 1 size. (0.3 ~ 5.0)	Location ID and F followed by particle size	U21 <enter> F0.4 <enter>
G – Set Channel 2	Sets the channel 2 size. (0.3 ~ 5.0)	Location ID and F followed by particle size	U21 <enter> F4.5<enter>
H – Hold time	Sets the amount of time in seconds that the counter will wait before starting the next sample (0 – 999 seconds).	Location ID and H followed by time in seconds	U21 <enter> H060<enter>
J – Set Date	Sets the date that's stored in the counter	Location ID and J followed by date	U21 <enter> J12/21/1998<enter>
K – Set Time	Sets the time that's stored in the counter	Location ID and K followed by date	U21 <enter> K12:51:00 <enter>
M – Send all records	Sends entire memory contents	Location ID and M	U21 <enter> M
N – Start Pump	Starts the internal pump	Location ID and N	U21 <enter> N
D – Auto Records	Enabled and disables records sent after a sample is complete	Location ID and 1 for enable or 0 for disable	U21<enter> D1<enter>
r – Set Channel 1 Hi Alarm	Sets the channel 1 Hi alarm trigger value	Location ID and r followed by the number of actual counts	U21<enter> r100000<enter>
s – Set Channel 1 HiHi Alarm 1	Sets the channel 1 HiHi alarm trigger value	Location ID and s followed by the number of actual counts	U21<enter> s200000<enter>
t – Set Channel 2 Hi Alarm	Sets the channel 2 Hi alarm trigger value	Location ID and t followed by the number of actual counts	U21<enter> t100000<enter>

u – Set Channel 2 HiHi Alarm	Sets the channel 2 HiHi alarm trigger value	Location ID and u followed by the number of actual counts	U21<enter> u200000<enter>
v – Set Temperature Alarm	Sets the temperature trigger value	Location ID and v followed by the temperature value	U21<enter> V40<enter>

6. Maintenance

6.1. Service Schedule

WARNING: There are no user serviceable components inside this instrument. The covers on this instrument should not be removed or opened for servicing, calibration or any other purpose except by a factory authorized person. To do so may result in exposure to invisible laser radiation that can cause blindness.

Sensor, vacuum pump and filter replacement requires access to the inside of the GT-521 and a factory-authorized person must do this. Contact Met One Instruments for service information.

Calibrating particle sensors like the one in the GT-521 requires specialized equipment and a skilled technician. Met One Instruments, Inc. maintains a calibration facility for calibrating particle counters according to industry accepted methods like ASTM and JIS using NIST traceable standards. The sensor in the GT-521 should be calibrated on a yearly basis.

6.2. Service Schedule Table

Item To Service	Frequency	Done By
Zero test	Weekly	Customer or Factory Service
Flow rate test	Monthly	Customer or Factory Service
Replace internal filter	Yearly	Factory service at time of recalibration.
Calibrate Sensor	Yearly	Factory service only

6.3. Battery Pack

CAUTION: The battery pack is not a user replaceable item, do not attempt to change the internal battery pack. The wrong battery pack could cause serious damage or a fire. The GT-521 must be sent to a service center where a factory qualified person will change and properly dispose of the battery pack.

When the battery is low the GT-521 will sound a long beep. There is no way to measure the battery pack condition or capacity directly on the GT-521. Another indication of low battery is if the pump fails to start when the **<START>** key is pressed.

To charge the battery pack, connect the AC power cord from the AC to DC converter module to an AC power outlet. The module is universal and will work with power line

voltages of 100 to 240 volts, 50 to 60 Hz. Take the plug on the end of the cord coming from the converter module and plug it into the charger-input socket on the side of the GT-521 just below the power switch. To fully charge a discharged battery pack may take up to 15 hours.

The battery pack inside the GT-521 when fully charged will power the GT-521 for about five hours of continuous sampling. Under normal intermittent or manual operation however, there is considerably less battery drain and up to 10 hours of use is possible.

GT-521 is to be used powered by its battery pack on a daily basis, connect the charger after each day of usage. It will not damage the battery pack to leave it connected to the charger for long periods.

When the GT-521 is always used in an area where AC power is available. Leave the charger connected to the GT-521.

If the GT-521 is to be stored charge the battery pack. Storing a discharged NiCd battery for any length of time will degrade its performance.

6.4. Zero Test

False counts caused by air leaks or spurious noise will cause errors, especially when sampling relatively clean aerosols. A zero count test is easy to do. Attach a .2 µ hepa filter to the GT-521 inlet nozzle. The hepa filter removes 99.99% of all particles .3 µ and larger. The filter must be large enough that it does not create a restriction and load down the small vacuum pump inside the GT-521. Since the air passing through the GT-521 is now virtually particle free, the output should be zero. Select the .3 µ range on the GT-521 and take a one-minute sample. The result of the one-minute sample should be less than 1 actual count.

6.5. Flow Rate Test

Testing the flowrate is an easy procedure but it requires a flowmeter that is ±3% accurate at .1-cfm. The flowmeter must be non-loading. The vacuum pump inside the GT-521 can be easily loaded down by a small restriction. Most hot wire and differential pressure types of flowmeters are non-loading.

To test the flowrate, connect a flow meter to the sample inlet nozzle of the GT-521 using a short piece of flexible 1/8 " ID tubing, Tygon tubing is a good choice. Turn on the GT-521 and note the flowmeter reading. The flowrate should be .1-cfm ±5%. The flowrate can be adjusted by a trimpot located in the lower of the two access holes in the left side of the GT-521 case. Use the small screwdriver that came with the GT-521 to make the adjustment. Turn the adjustment pot clockwise to increase the flow and counter-clockwise to decrease the flow.

7. Troubleshooting

WARNING: The covers on this instrument should not be removed or opened for servicing, calibration or any other purpose except by a factory authorized person. To do so may result in exposure to invisible laser radiation that can cause blindness.

A factory-authorized person should do replacement of the sensor, vacuum pump, filter or any component inside the GT-521.

Symptom	**Possible Cause**	**Correction**
Does not turn on, no display	1. Low battery 2. Defective Battery	1. Charge battery 10 hrs 2. Send to service center
Display turns on but pump does not	1. Low Battery 2. Defective pump	1. Charge battery 10 hrs 2. Send to service center
Keypad functions do not work	Loose connector or defective component inside	Send to service center
Sample result remains at zero after sampling	1. Pump stopped 2. Laser diode bad	1. Send to service center 2. Send to service center
Sample result is lower than normal	1. Flowrate is low 2. Debris may be stuck in the inlet nozzle and blocking the beam 3. Contaminated optics in sensor	1. Check flowrate 2. Blow into nozzle with a can of 'Aero Duster' Do not put any object down into nozzle 3. Send to service center
Sample result is higher than normal	1. Air leak in sensor 2. Noisy laser	1. Send to service center 2. Send to service center
Battery pack does not hold a charge	1. Defective or worn out battery pack 2. Defective power cords 3. Defective charger module or chords	1. Send to service center 2. Check with an ohmmeter 3. Contact your distributor to get another charger

8. Specifications

Measuring principle	Particle counter, light scatter
Light Source	Laser Diode, 30 mW, 780 nm
Accuracy	±10%, to calibration aerosol
Sensitivity	.3μ = 2 to 1 peak to valley (JIS), 2 to 1 S/N
Concentration limit	3,000,000 particles per cubic foot
Flow rate	0.1-cfm, 2.831-lpm
Particle Size Selection	0.3 to 5.0μ pgm. in 0.1μ steps in two channels
Sample Time Selection	Programmable, 6 to 999 seconds
Display	16 character x 4 line LCD
Keyboard	7 key membrane
Communication	RS232, RS485
Power	6 V NiCd battery pack
Charger	AC to DC module, 9 V, 2200 mA.
Operating Temperature	0° to 50° C
Storage Temperature	-20° C to +60° C
Size	6.5”L x 4”W x 2.13”H
Weight	.737 kg, 26 ounces
Supplied accessories	Battery charger / AC adapter, serial cable, Isokinetic probe, screw driver, Operation Manuals, GT-COMM software
Optional accessories	Zero test filter