GT-521S
MANUAL

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GT-521S Manual

Technical Support

This manual is structured by customer feedback to provide the required information for setup, operation, testing, maintaining, and troubleshooting your GT-521S. Should you still require support after consulting your printed documentation, we encourage you to contact one of our expert Technical Service representatives during normal business hours of 7:00 a.m. to 4:00 p.m. Pacific Time, Monday through Friday. In addition, technical information and service bulletins are often posted on our website. Please contact us and obtain a Return Authorization (RA) number before sending any equipment back to the factory. This allows us to track and schedule service work and to expedite customer service. Please have your instrument serial number available when contacting the manufacturer.

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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.

Table of Contents

1.   Introduction

The GT-521S is a full–featured, two-channel, battery operated, handheld particle counter. The two count channels can be configured to factory calibrated standard sizes or user defined custom sizes. It also has two alarm limits and various communication options. This instrument can store up to 8,000 sample events including data from the optional temperature / relative humidity probe (PN G3120). Sample history events can be viewed on the LCD display, printed on the optional printer (PN G3115) and downloaded to a computer.

2.   Setup

The following sections cover unpacking, layout and performing a test run to verify operation.

2.1.   Unpacking

Unpack and inspect the contents of the shipping container. Standard items (included) are shown in Figure 1 – Standard Accessories. Optional accessories are shown in Figure 2 – Optional Accessories. Contact the supplier if any items are missing. Any damages incurred during shipping are the responsibility of the carrier. If any damage to the shipment is noticed before unpacking, a claim must be filed with the commercial carrier immediately. You should follow any special unpacking instructions provided by the carrier as you then carefully remove all items from the containers and inspect each component. It is recommended to document and photograph all damaged packages and items before, during, and after unpacking them. Contact Met One Instruments (see the Technical Support section at the beginning of this manual) to arrange for any replacement items needed.

ATTENTION:
The included USB drivers must be installed before connecting the GT-521S USB port to your computer. If the supplied drivers are not installed first, Windows may install generic drivers that are not compatible with this product.

To install USB drivers:
Insert the Comet CD. The install program should run automatically and display the screen below. If an AutoPlay pop-up window appears, select "Run AutoRun.exe". Finally, select "USB Drivers" to start the install process.

Users using a 32 bit system should install the USB 32 bit drivers. Users using a 64 bit system should install the USB 64 bit drivers.

MET ONE INSTRUMENTS, INC.

Install Comet

Comet Install Guide

USB Instructions

USB Drivers 64 Bit

USB Drivers 32 Bit

Ethernet Instructions

Ethernet Config

Ethernet Drivers®

Adobe Acrobat®

Comet

Version 1.2.13
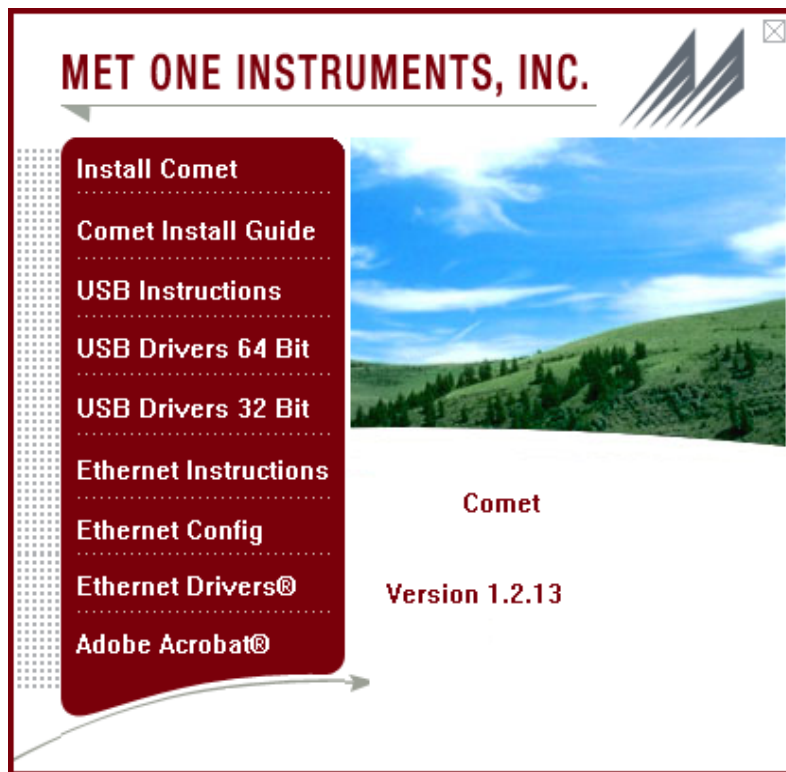
GT-521S Standard Equipment

GT-521S
PN GT-521S

Manual
PN GT-521S-9800

Comet Software CD
PN 80248

Calibration Certificate
PN GT-521S-9600

Battery Charger
PN 390031

Power Cord
PN 400113

ISO-Kinetic Probe
PN G3110

Zero Count Filter
PN G3111

Carrying Case
PN 8517

USB Cable
PN 500787

Figure 1 – Standard Accessories

Printer
PN G3115

Flow Meter
PN 9801

Serial Cable
PN 3228

T/RH Probe
PN G3120

Figure 2 – Optional Accessories

2.2. Layout

The following figure shows the layout of the GT-521S and provides a description of each of the components.

Figure 3 – GT-521S Layout

Component	Description
Power Switch	Switch that turns the GT-521S on or off. Slide up (towards inlet nozzle) to turn on and slide down to turn off.
Charging Jack	Input jack for the battery charger. This connection charges the internal battery pack and provides continuous operating power for the unit.
USB Port	For USB serial communication
Serial Port	For serial communication (RS-232 or RS-485).
T/RH Connector	Mating connector for the optional external Temperature/RH sensor.
Inlet Nozzle	Ambient air inlet nozzle. Connect isokinetic probe to reduce turbulence in the air sample.

2.3. Default Settings

The GT-521S comes with the user settings configured as follows.

Parameter	Value
Sizes	0.3 µm and 0.5 µm
Sample Location	1
Samples	Single
Sample Time	60 seconds
Sample Hold Time	0 seconds
Volume (concentration)	CF (particles/ft^3)
Count Mode	Normal (cumulative)
Temperature Units	C
Baud Rate	9600
Serial Mode	RS-232
Alarm Limits	Disabled

2.4. Initial Operation

Before operating the GT-521S for the first time, it is recommended that the unit be fully charged. Information regarding charging the battery is found in section 6 of this manual.

Complete the following steps to verify proper operation.
1. Slide the power switch up to turn on power.
2. Observe the Startup Screen for 2 seconds then the Operate Screen (Section 4.2).
3. Press Start / Stop key. The GT-521S will sample for 1 minute and stop.
4. Observe the counts on the display.
5. The unit is ready for use

3. User Interface

The GT-521S user interface is composed of a 7 button keypad and a LCD display. The following table describes keypad functionality. Note, some keys have more than one function.

Key	Description
START STOP	• Starts or stops a sample. • Starts the unit printing when in the Print Data Screen. • Recalls the selected data when in the Recall Data Screen.
MENU ESC	• Loads the Menu Screen when not editing a field. • Loads the Operate Screen when in the Menu Screen. • Cancels editing a field and return the field to the original value.
ENTER	• Loads the screen associated with menu item. • Begins editing of the selected item. • Stops editing a field and saves the changed value.
△ ▽	• Navigates up/down when not editing (Menu). • Modifies field when editing.
◁ ▷	• Navigates right / left • Move through history buffer (Operate screen)
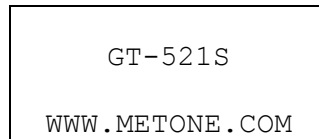
4.   Operation

The following sections cover the basic operation.

4.1.   Power Up

GT-521S power is controlled by a slide switch located on the right hand side of the unit. Move the power switch to the on position (towards the top of the case) to power up the unit.

The first screen shown on power up is the Startup Screen (Figure 4). This screen displays the product type and company website for 2 seconds before loading the Operate Screen.
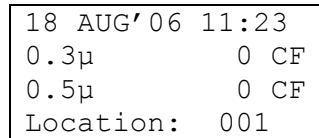
```
       GT-521S

   WWW.METONE.COM
```

Figure 4 – Startup Screen

4.2.   Operate Screen

The Operate Screen displays the date/time, sample status, current sample data and previous sample data. Figure 5 shows the Operate Screen.

```
18 AUG'06 11:23
0.3µ          0 CF
0.5µ          0 CF
Location:  001
```

Figure 5 – Operate Screen w/o Temp/RH

The top line of the Operate Screen shows date and time or status/alarm messages depending upon the machine status. Lines 2 and 3 display the two count channels. Line 4 displays the location number or optional Temp/RH data. Use the up/down arrows to alternate between Location number and Temp/RH when the optional G3120 probe is attached.

Particle count units are user selectable. The selections include: Total counts (TC), particles per liter (/L), particles per cubic foot (CF) and particles per cubic meter (M3). Ambient temperature can be displayed in units of Celsius (ºC) or Fahrenheit (ºF). Both unit settings are discussed in section 5.2.4.

4.2.1. Sampling

The Operate Screen displays current sample information when the unit is sampling (real time data). Concentration values (/L, CF, M3) are time dependent so these values may fluctuate early in the sample; however, after several seconds the measurement will stabilize. Longer samples (e.g. 60 seconds) will improve concentration measurement accuracy. Figure 6 shows the Operate Screen while sampling.

```
COUNTING...   52
0.3μ   29,780 CF
0.5μ    1,400 CF
Location:  001
```

Figure 6 – Operate Screen Sampling

4.2.2. Sample Status

The top line of the Operate Screen displays the status of the GT-521S while the unit is sampling. The following table shows the various status messages:

Status	Description
STARTING…	GT-521S is starting the sample and is waiting for the count system to initialize.
HOLDING…	GT-521S is taking multiple samples and is waiting for the hold time to finish.
STOPPING…	GT-521S is stopping the sample and is waiting for the count system to stop.
COUNTING… 10	GT-521S is sampling. The time remaining is displayed on the far right.

4.2.3. Sample History

Sample history (previous data) can be viewed on the Operate Screen when the unit is stopped (not sampling). To view sample history, press Enter or ◄ from the Operate Screen. The unit will display the last sample event (newest record) and display "←" in the upper right corner of the display (see Figure 7) to indicate history data, and displays the date and time stamp when the sample was collected. Press ◄ or ► to move through sample history one record at a time (◄ displays older events, ► displays newer events). Press the Enter key at any time to return to the Operate Screen. Press Start at any time to start a new sample.

```
18 AUG'06 11:23←
0.3μ        0 CF
0.5μ        0 CF
Location:  001
```

Figure 7 – History Screen

4.2.4. Warning / Error Messages

The GT-521S displays warning/error messages on the top line of the Operate Screen. These messages alternate with the normal header. The following table lists the warning/error messages:

Display Message	Description
<COUNT ALARM>	Count alarm. The count is $\geq$ the alarm limit.
LOW BATTERY!	Low battery warning. Less than 15 minutes of normal operation remaining.
SENSOR ERROR!	Particle sensor error.

4.3.   Sample Related Functions

The following sub-sections cover sample related functions.

4.3.1. Starting/Stopping

To start or stop a sample, press the START/STOP key. A sample event can be manually started or stopped from either the Operate Screen or the menu.

4.3.2. Real-Time Serial Output

GT-521S provides real-time output on the serial port at the end of each sample. The format of the output is controlled by the report type setting (section 5.8.1).

4.3.3. Samples

The Samples setting controls the number of samples to take. Repeat configures the unit for continuous sampling. Single configures the unit for a single sample. 2-999 configures the unit for a number of samples. Samples are discussed in section 5.2.

4.3.4. Sample Time

The sample time determines the amount of time that counts are accumulated. The length of the sample is user settable from 1 – 9999 seconds and is discussed in section 5.2.

4.3.5. Hold Time

The hold time is used when Samples is set for more than one sample. The hold time represents the time from the completion of the last sample to the start of the next sample. The hold time is user settable from 0 – 9999 seconds and is discussed in section 5.2.

4.3.6. Count Mode

The count mode is used to set whether counts are displayed as Cumulative (normal) or Differential. When in differential mode, the volume units will be preceded with the delta character $\triangle$. Count mode is discussed in more detail in section 5.3.

```
COUNTING...    58
0.3µ  29,780 ΔCF
0.5µ   1,400 ΔCF
Location:  001
```

Figure 8 – Differential Counts

4.3.7. Sample Timing

The following figures depict the sample timing sequence for both single and multiple samples. Figure 9 shows the timing for single samples. Figure 10 shows the timing for multiple samples.

Start Time | Sample Time | Stop Time

Figure 9 – Single Sample
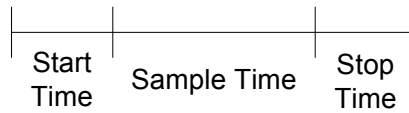
Start Time | Sample Time | Hold Time | Sample Time | Stop Time

Figure 10 – Multiple Samples

5. Menu Selections

The Menu is accessible by pressing the Menu key on the Operate Screen. The table below shows the menu items. Press ▲ or ▼ to navigate to a menu item then press Enter to display a screen where you can view or change item setting(s).

Menu Item	Description
SAMPLE SETUP	View / change location number, sample time, hold time and samples.
SETTINGS	View / change volume (count units), ºC / ºF and Count mode (Normal or Difference)
RECALL DATA	Recall sample history based on time
PRINT DATA	Print stored data based on a time range.
MEMORY	View memory usage and clear memory.
COUNT ALARMS	Set count alarm limits for 2 particle sizes
SERIAL	Set output report type, baud rate and serial output mode
SET FLOW	Adjust the sample flow rate
SET SIZES	Set particle sizes
SET CLOCK	Set the date and time.
SET CONTRAST	Adjust the display contrast.
ABOUT	Display firmware version and serial number.

5.1. Edit Menu Items

To change settings, press Menu to display the main menu, press ▲ or ▼ to navigate to the desired item and press Enter to display the item view/edit screen.

To edit pick list items (e.g. Settings Temp – C/F), press ▲ or ▼ to navigate to the item. Press Enter to select the item. Press ▲ or ▼ to change the setting. Press ENTER to save the setting or ESC to cancel and return to the previous value.

To edit numeric values (e.g. Count Alarms - Alarm Limit), press ▲ or ▼ to navigate to the item. Press Enter to select the item. Press ▲ or ▼ to increment or decrement a value. Press ◄ or ► to select the next digit. Press ENTER to save the value or ESC to cancel and return to the previous value.

5.2. Sample Setup Screen

Figure 11 shows the Sample Setup Screen. The four parameters are covered in the following sections.

```
LOCATION:      001
SAMPLE TIME: 0060
HOLD TIME:   0000
SAMPLES:   SINGLE
```

Figure 11 – Sample Setup Screen

5.2.1. Location Number

The location number is used to assign a unique number to a location or area. This important field is included in sample data records (display, printer and serial output).

5.2.2. Sample Time

The sample time determines the amount of time that counts are accumulated while the pump is running. The length of the sample is user settable from 1 – 9999 seconds.

5.2.3. Hold Time

The Hold time is the time between samples when sampling more than a single sample. The Hold time is user settable from 0 – 9999 seconds. The pump will remain on during the hold period if the Hold time is 60 seconds or less. If the Hold time is greater than 60 seconds, the pump will stop after each sample, and start a few seconds before the next sample. Hold times greater than 60 seconds will increase pump life.
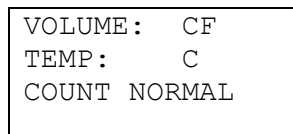
5.2.4. Samples

The samples setting controls the number of samples to take as illustrated below.

Selection	Description
REPEAT	Repeat configures the unit for continuous sampling.
SINGLE	Single configures the unit for a single sample.
002-999	Configures the unit to take N samples.

5.3. Settings Screen

Figure 12 shows the Settings Screen. The four parameters are covered in the sections immediately following.

```
VOLUME:  CF
TEMP:    C
COUNT NORMAL
```

Figure 12 – Settings Screen

5.3.1. Volume

The GT-521S supports total counts (TC), particles per liter (/L), particles per cubic foot (CF), and particles per cubic meter (M3). Particle count information updates while the unit is sampling. Concentration values (/L, CF, M3) are time dependent so these values may fluctuate early in the sample; however, after several seconds the measurement will stabilize. Longer samples (e.g. 60 seconds) will improve concentration measurement accuracy. In total count mode, counts accumulate throughout the sample time.

5.3.2. Temperature

The GT-521S displays temperature in Celsius (C) or Fahrenheit (F).

5.3.3. Count mode

The GT-521S can display counts in two different modes. These are Normal and Differential.

Selection	Description
NORMAL	Displays cumulative counts on the screen and in reports.
DIFFERENCE	Displays differential counts on the screen and in reports.

The Normal mode displays cumulative counts. For a given size the counts represent all particles that size and larger.

The Differential mode displays the number of particles between a given size and the size larger. When in differential mode, the volume units will be preceded the delta character Δ on the screen. For the serial output a lower case 'd' character is displayed in the header.

```
COUNTING...    58
0.3µ    29,780 CF
0.5µ     1,400 CF
Location:  001
```
Figure 13 – Cumulative Counts

```
COUNTING...    58
0.3µ    28,380 ΔCF
0.5µ       790 ΔCF
Location:  001
```
Figure 14 – Differential Counts

5.4.   Recall Data Screen

Stored sample events can be viewed from the Operate Screen but this requires navigating one record at a time to reach a desired record. The Recall Data Screen provides a way to quickly navigate to a record based on time. Figure 15 shows the Recall Data Screen.

```
    RECALL DATA
  01 JAN'00 00:00
```
Figure 15 – Recall Data Screen

To recall data, enter the desired date/time string and select the START/STOP button. The unit will recall the data from the date/time entered (if an exact match is found) or the next most recent data available. The screen shown when the data is recalled is the Operate Screen. The unit will display "←" on the upper right corner of the display to indicate history data. Use ◄ or ► to navigate through the stored sample events.

5.5. Print Data Screen

Stored sample events can be printed through the printer port within a user selected range. To print selected data, select PRINT DATA from the Menu. Figure 16 shows the Print Data Screen.

```
PRINT DATA
LOCATION: 000
 01 JAN'00 00:00
 18 AUG'06 13:23
```

Figure 16 – Print Data Screen

Edit the location and time range to select which sample events to print. The following table describes settings.

Setting	Description
LOCATION	The location ID of the sample events to print. Setting location to 000 prints all locations. Settable from 0 - 999
01 JAN'00	The date/time to begin printing sample events from.
18 AUG'06	The date/time to stop print samples at.

After the print settings have been selected, press the Start/Stop button to begin printing the sample events. Once the Start/Stop button has been pressed the Printing Status Screen is displayed. Figure 17 shows the Printing Status Screen as it would look when finished.

```
PRINTING STATUS
SCANNING...15
PRINTING...10
FINISHED!
```

Figure 17 – Printing Status Screen

Pressing the ESC button cancels the data printing and loads the menu. The format of the print is dependent upon the report type setting (Section 5.8.1)

5.6. Memory Screen

The GT-521S memory is composed of a single file which contains the data from sample events. Every time a sample is completed, the GT-521S stores that data into the memory. The GT-521S memory is circular, meaning when the memory is full, the unit will start overwriting the oldest saved samples with new samples. GT-521S provides the user the ability to view the memory usage as well as clear the memory.

5.6.1. View Available Memory

Memory Screen is used to view available memory or to clear the memory. The Memory Screen is accessed by selecting MEMORY from the menu. Figure 18 shows the Memory Screen.

```
FREE:     100%
SAMPLES: 8000
PRESS ENTER TO
   CLEAR MEMORY!
```
Figure 18 – Memory Screen

FREE shows the percent of space available for data storage. When 0% is displayed, memory is full and the oldest data will be overwritten by new data.

SAMPLES shows the number of samples which can be stored in memory before the memory is full. When 0 is displayed, memory is full and the oldest data will be overwritten.

5.6.2. Clearing Memory

To clear memory, press the ENTER key while viewing the Memory Screen. This will delete all the sample events in memory. A warning screen will be displayed to prevent accidental erasure.

5.7.   Count Alarms Screen

Configure count alarm limits for two particle sizes. To disable count alarms, select OFF in the field next to the COUNT ALARM header. The alarm for a specific particle size can be disabled by setting the alarm value to zero. The alarm is active when the count is equal to or greater than the alarm limit. The maximum alarm limit value is 9,999,999. Figure 19 shows the Count Alarm Screen.

Alarm values do not change with the count units setting (TC, /L, CF, M3). In other words, a value of 1,000 will alarm at 1,000 counts or 1,000 particles per liter or 1,000 particles per cubic foot depending on the count unit setting.

```
COUNT ALARMS OFF
SIZE ALARM LIMIT
 0.3    00000000
 0.5    00000000
```
Figure 19 – Set Alarms Screen

5.7.1. Alarm Analog Output

Along with the two channel alarms mentioned in section 5.7, there is also an alarm level analog output for each channel. The analog output is always active and it is not tied to the alarm logic being on or off. The table below shows the analog output levels for each alarm. The analog out is available on the DB-9 Serial connector on the right side of the instrument. See section 7.1 for details.

Channel	Alarm Type	Analog Output
Channel 1	No Alarm	0.00 V
Channel 1	Hi Alarm	5.00 V
Channel 2	No Alarm	0.00 V
Channel 2	Hi Alarm	5.00 V

5.8. Serial

Configure the serial port settings.

```
REPORT:  CSV
BAUD:    9600
SERIAL:  RS-232
```

Figure 20 – Serial Screen

5.8.1. Report Type

The Report setting determines the output format for the Serial Port. The choices are NONE, CSV and PRINTER.

When set to NONE, the unit will not automatically output the reading at the end of a sample to the Serial Port. CSV is a Comma Separated Values output format suitable for importing into a spreadsheet. PRINTER is the same format as the screen and optional external printer.

Note: When using the optional external printer, set the report type to PRINTER.

5.8.2. Baud

Use the Baud Rate selection to set the serial communications baud rate. GT-521S communicates at baud rates from 300 – 38400. The default baud rate is 9600.

5.8.3. Serial Output Mode

The Serial Output Mode setting controls the behavior of the GT-521S serial output. The modes are RS-232 and RS-485. The following table lists the Serial Output settings and describes their meanings.

Serial Setting	Description
RS-232	RS-232/USB serial communication with CSV style output. Records automatically transmitted after each sample.
RS-485	RS-485 communication with CSV style output.

5.9. Set Flow Screen

The GT-521S has a factory calibrated flow rate of 0.1 CFM (2.83 LPM). Use the following procedure to adjust the flow rate when a periodic flow rate check (Section 8.3) indicates a flow rate error greater than ± 5%.

1. Connect a reference flow meter to the inlet fitting on the top of the unit. (PN 9801)

2. Access the Set Flow Screen (Figure 21) by pressing Menu then select Set Flow. The pump will start automatically when you enter the Set Flow Screen and stop when you leave the screen.

3. Press ◄ or ► to obtain a reading of 0.1 CFM (2.83 LPM) ± 5% on the reference flow meter.

4. Press Enter to save the setting or ESC to cancel the change.
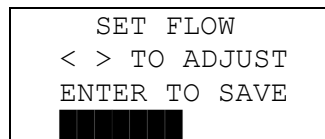
```
        SET FLOW
    < > TO ADJUST
    ENTER TO SAVE
    ███████
```
Figure 21 – Set Flow Screen

5.10. Set Sizes Screen

The GT-521S has factory calibrated particle sizes (for example, 0.3, 0.5, 1.0, 5.0 and 10 µm). These standard sizes will support most applications and provide the best size accuracy (± 10%). This unit also supports custom sizes. These sizes are configured using the Set Sizes Screen (Figure 22). Custom sizes are interpolated using the standard size calibration curve. Therefore, the size accuracy for custom sizes is somewhat reduced (± 15%).

```
      SET SIZES
    CH1:    00.3µ
    CH2:    00.5µ
```
Figure 22 – Set Sizes Screen

The unit sorts sizes from small to large after each size change. Duplicate sizes are not allowed. Any attempt to set the two sizes to the same value will result in a "DUPLICATE SIZES!" warning message.

5.11. Set Clock Screen

To set the date and time select SET CLOCK from the menu. Figure 23 shows the Set Clock Screen and the following table describes the date / time formats.

```
       SET CLOCK
DATE: 18 AUG'06
TIME: 11:25:36
```

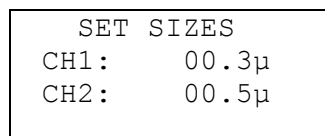**Figure 23 – Set Clock Screen**

Date / Time Formats		
Date	dd mmm'yy	dd=day, mmm=month, yy=year
Time	hh:mm:ss	hh=hours, mm=minutes, ss=seconds

5.12. Set Contrast Screen

Press ◄ or ► to improve display quality. Press Enter to save the setting or ESC to cancel the change. Figure 24 shows the Set Contrast Screen.

```
SET CONTRAST
< > TO ADJUST
ENTER TO SAVE

■■■■■■■
```

Figure 24 – Set Contrast

5.13. About Screen

Figure 25 shows the About Screen. The About Screen shows the firmware version and programmable logic versions on the second line. Press ▲ or ▼ to toggle between the two version numbers.

```
    GT-521S
  80203 R0.1.0


  www.metone.com
```

Figure 25 – About Screen

6.   Charging the Battery

> **Caution:**
> **The provided battery charger is designed to work safely with this device. Do not attempt to connect any other charger or adapter to this device. Doing so may result in equipment damage.**

To charge the battery, connect the battery charger to an AC power outlet and the DC barrel connector to the socket on the right side of the GT-521S. The battery charger is universal and will work with power line voltages of 100 to 240 volts, 50 to 60 Hz. A discharged battery pack will take approximately 2.5 hours to fully charge.

When fully charged the battery inside the GT-521S will power the unit for about 6 hours of continuous sampling. Under normal operation, the battery will power the unit for about 24 hours. For continuous operation, operate the unit with the battery charger attached. Charge the battery before storing the GT-521S. Storing a discharged battery will degrade its performance.

7.   Serial Communications

GT-521S provides serial communications via the USB and DB-9 connectors located on the right hand side of the unit. The following sections discuss the various serial communications available with GT-521S.

ATTENTION:

The included USB drivers must be installed before connecting the GT-521S USB port to your computer. If the supplied drivers are not installed first, Windows may install generic drivers that are not compatible with this product.

To install USB drivers:

Insert the Comet CD. The install program should run automatically and display the screen below. If an AutoPlay pop-up window appears, select "Run AutoRun.exe". Finally, select "USB Drivers" to start the install process.

Users using a 32 bit system should install the USB 32bit drivers. Users using a 64 bit system should install the USB 64 bit drivers.
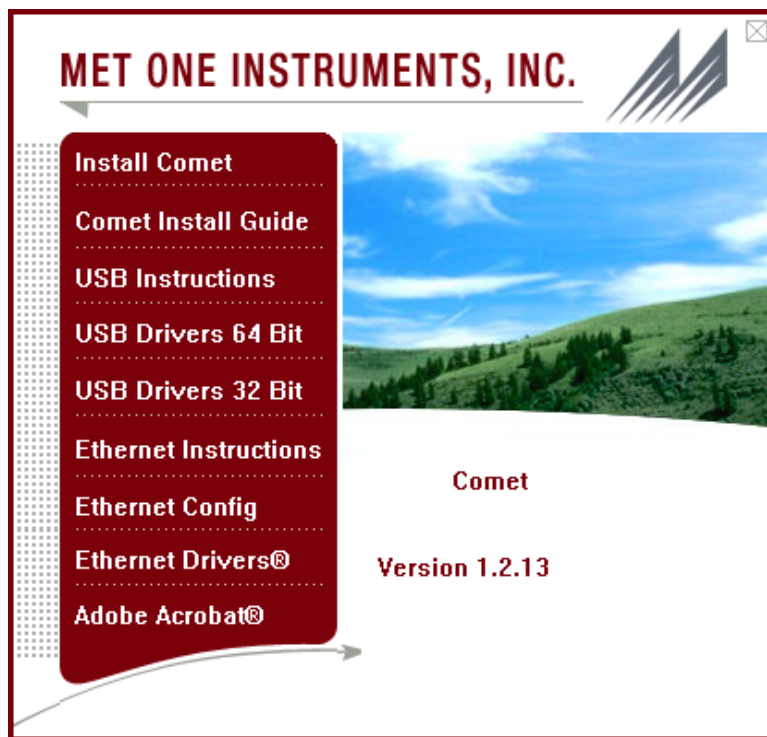
WARNING:

The optional RS-232 serial cable (PN 3228) is custom built to function with the GT-521S. The use of any other serial cable can cause damage!

7.1. Serial Interface

The serial interface to the GT-521S is a standard 9 pin (DB-9) connector. It is located on the right hand side of the instrument as shown below.

Communication with the GT-521S through the RS-232 DB-9 port requires a custom serial cable (PN3228). 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	Communication Type
1	Not Used	
2	TX	RS-232
3	RX	RS-232
4	Not Used	
5	Ground	RS-232 & RS-485
6	Analog Out 1	DAC
7	Analog Out 2	DAC
8	A+	RS-485
9	B-	RS-485
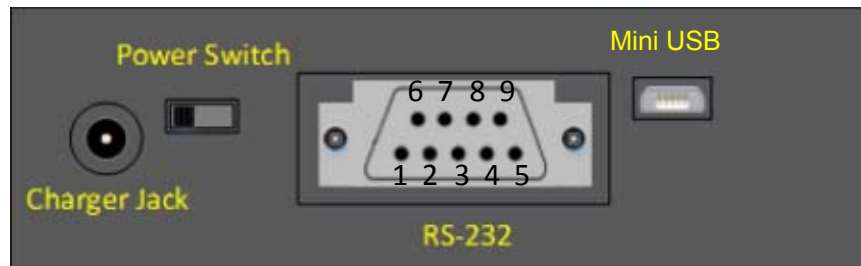
7.2. Commands

GT-521S provides serial commands for accessing stored data and settings. They are not case sensitive and are terminated by a carriage return. These commands are all available via the USB, RS-232 and RS-485 hardware interfaces. The serial settings (baud rate, parity and stop bits) in the counter must match the serial settings in the computer for proper communication regardless of the hardware interface type.

The following table lists the available commands:

Command	Description
Settings (must match computer settings): • Baud Rate = 9600 (default, see Section 5.8.2 to change this) • Parity = None • Stop Bits = 1	
Command	**Description**
?,H	Displays the help menu
1	Returns the unit's settings information
2	Returns all available records from the data file
3	Returns all records since last '2' or '3' command.
4 n	Returns the last n records. If n is omitted this returns the last record.
D	Date (mm/dd/yy) Set Date
T	Time (hh:MM:ss) Set Time
C	Clear data
S	Start a sample
E	End a sample
ST	Sample Time
RV	Show software revision.
ID	Set/Get the Location ID. Range 1-999.
FAx	Alarm Limit setting where x=1 or 2 for Alarm 1 or 2.
SE	Serial Mode (0=RS-232, 1=RS-485)
SF	Alarms on/off where 0=Off, 1=On
SH	Set Hold Time in seconds
SN	Set Number of Samples (0=Repeat, 1=Single, 2-999=N samples)
SR	Set Report Mode (0=NONE, 1=CSV, 2=Printer)
SS	Read serial number
CU	Count Units (0=CF, 1=/L, 2=TC, 3=M3)
TU	Temperature Units (0=C, 1=F)
RZ	Returns Channel Size information.
DT	Sets Date/Time without user interaction (mm-dd-yy hh:MM:ss)
OP	Operational Status. S=Stop, R=Running, H=Hold.
CS	Set Channel Sizes (2 Channel Sizes) CS sz1 sz2
CM	Set Count Mode 0=Normal, 1=Difference

7.3. Real Time Output

The real time output occurs when the unit finishes a sample. The output format is either a comma separated value (CSV) or a printer style depending on the Report Type setting (see section 5.8.1).

7.4. Comma Separated Value (CSV)

CSV Header (Note 1):

Time,Size1,Count1(CF),Size2,Count2(CF),AT(C),RH(%),Location,Seconds, Status

If differential Mode:

Time,Size1,Count1(dCF),Size2,Count2(dCF),AT(C),RH(%),Location,Seconds, Status

CSV Example Record:

2017-03-23 09:21:29,00.3,00084140,00.5,00008680,+022,033,001,0060,000,*03414

Note: If COUNT is set to NORMAL data will be reported as cumulative counts. If COUNT is set to DIFFERENCE data will be reported as differential counts regardless of setting when data was collected.

CSV Fields			
Field	**Parameter**	**Example Value**	**Notes**
1	Date and Time	2017-03-23 09:21:29	
2	Channel 1 Size	00.3	
3	Channel 1 Count (TC, /L, CF, M3)	00084140	Note 2
4	Channel 2 Size	00.5	
5	Channel 2 Count (TC, /L, CF, M3)	00008680	Note 2
6	Temperature (C,F)	+022	Note 2 & Note 3
7	RH (%)	033	Note 3
8	Location	001	
9	Sample Time (0-9999 seconds)	0060	
10	Status Bits (see below)	000	Note 5
11	Check sum	*03414	

Status Bits		
Bit	**Value**	**Condition**
	0	OK (no alarms or errors)
0	1	Count alarm size 1
1	2	Count alarm size 2
2	4	Not used
3	8	Not used
4	16	Low battery
5	32	Sensor error
6	64	Not used
7	128	Not used

Notes (for table above):

1. CSV header included for multiple record transfers like All Data (2) or New Data (3) or last n data (4 n).
2. Units determined by product setting.
3. Temperature and RH will be null (,,) if Temp/RH probe is not attached
4. Alarm sizes will be null (,,) if alarms are disabled.
5. Status bits combinations are possible. For example, 17 (00010001B) = Low Battery and Size 1 alarm.

7.5. Printer Format

The printer output format is 9 lines by 26 characters (including T/RH if attached).

8. Maintenance

Due to the nature of the instrument, there are no customer serviceable components in the GT-521S. The case of the GT-521S should never be removed or opened for any reason. **Opening or removing the case of the GT-521S voids the warranty and may result in exposure to laser radiation, which can cause eye injury.**

8.1. Service Schedule

Although there are no customer serviceable components in the GT-521S, there are service items which ensure the proper operation of the instrument. The table below shows the service schedule for the GT-521S.

Time Period	Item	Manual Section
Weekly	Zero Count Test	8.2
Monthly	Flow Rate Test	8.3
Yearly	Annual Calibration	8.4

8.2. Zero Count Test

Air leaks or debris in the particle sensor can cause false counts which may result in significant count errors when sampling in clean environments. Perform the following zero count test weekly to ensure proper operation:

1. Attach zero count filter to the inlet nozzle (PN G3111).
2. Configure the unit as follows: Samples = SINGLE, Sample Time = 60 seconds, Volume = Total Count (TC)
3. Start and complete a sample.
4. The smallest particle size should have a count <= 1.

8.3. Flow Rate Test

The flow rate test verifies the sample flow rate is within tolerance. The reference flow meter must be non-loading because the vacuum pump can be loaded down by external restrictions. Met One Instruments sells a suitable flow meter (PN 9801). The flow rate test follows:

1. Connect a ±3% reference flow meter to the sample inlet nozzle.
2. Start a 5 minute sample.
3. The flow meter reading after ~3 minutes should be 0.1 CFM (2.831 LPM) ±5%.
4. Adjust the flow rate if the error is > ±5% (see section 5.8).

8.4. Annual Calibration

The GT-521S should be sent back to Met One Instruments yearly for calibration and inspection. The annual calibration cannot be performed by the customer because this calibration requires proprietary software and equipment and a skilled technician. Met One Instruments maintains a calibration facility for calibrating particle counters according to industry accepted methods such as ISO and NIST. The annual calibration also includes inspection and preventative maintenance to improve product reliability.

8.5. Flash Upgrade

GT-521S is firmware upgradeable via the serial connection using a Met One Instruments flash burn program. Binary files and the flash program must be provided by Met One Instruments.

9. Troubleshooting

The following section covers some common failure symptoms, causes and solutions. It is important to note that there are no customer serviceable components in this product. The GT-521S case should never be removed or opened for any reason. **Opening or removing the case will void the warranty and may result in exposure to laser radiation, which can cause eye injury.**

Symptom	Possible Cause	Solution
Display does not turn on	• Low Battery • Defective Battery	• Charge battery • Send to service center
Pump does not turn on when a sample is started	• Low Battery • Defective pump	• Charge battery • Send to service center
Keypad does not work	• Loose connector • Internal hardware failure	• Send to service center
Sample result is lower than normal	• Flow rate is low • Optics may be contaminated	• Perform flow rate test • Send to service center
Sample result is higher than normal	• Flow rate is high • Air leak in unit • Optics may be contaminated	• Perform flow rate test • Perform zero test • Send to service center
Battery does not hold a charge	• Defective or worn out battery • Defective charger	• Send to service center

10. Specifications

Performance

Particle Size Range	0.3 µm – 10 µm, 2 count channels
Calibrated Sizes	0.3 µm, 0.5 µm, 1.0 µm, 2.0 µm, 5.0 µm and 10 µm
User Size Settings	0.1 µm steps from 0.3 µm - 2.0 µm
	0.5 µm steps from 2.0 µm – 10 µm
Concentration Range	0 – 3,000,000 particles per cubic foot (105,900 particles/L)
Accuracy	± 10% to calibration aerosol
Sensitivity	0.3 µm
Flow Rate	0.1 cfm (2.83 lpm)
Sample Time	Adjustable: 1 to 9999 seconds
Hold Time	Adjustable: 0 to 9999 seconds

Electrical

Light Source	Laser Diode, 90mW, 780 nm
Battery	7.4V Li-ion battery pack.
Battery Life	24 hours Intermittent operation, 6 hours continuous operation
Battery Charge Time	Fully changed in 2.5 hours
AC Adapter/Charger	Li-ion battery charger, 100 – 240 VAC, 50/60Hz
Communications	USB, RS-232 or RS-485
Standards	Meets ISO 21501-4

Interface

Display	16 character x 4 line LCD
Keyboard	7 key membrane type

Physical

Height	6.25" (15.9 cm)
Width	4.00" (10.2 cm)
Depth	2.12" (5.4 cm)
Weight	2.00 lbs (0.91 kg)

Environmental

Operating Temperature	0º C to +50º C
Storage Temperature	-20º C to +60º C

Accessories

Supplied	Operation Manual	
	USB Cable	
	Comet Software	
	AC Adapter / Battery Charger	
	Iso-kinetic Sample Probe	
	Carrying Case	
	Zero Particulate Filter	(PN G3111)
Optional	RH & Temperature Probe	(PN G3120)
	Flow Meter	(PN 9801)
	Portable Printer	(PN G3115)
	Custom Serial Cable	(PN 3228)

11. Warranty / Service

Warranty

Products manufactured by Met One Instruments, Inc. are warranted against defects and workmanship for a period of one (1) year from the ship date.

Any product found to be defective during the warranty period will, at the option of Met One Instruments, Inc., be replaced or repaired. 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 been altered or modified other than by Met One Instruments, Inc. Consumable items such as filters, bearings pumps and batteries are not covered under this warranty.

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

Service

Any product being returned to Met One Instruments, Inc. for service, repair or calibration, including items sent for warranty repair, must be assigned a return authorization (RA) number. Please call (541) 471-7111 or send an email to service@metone.com requesting an RA number and shipping instructions.

All returns must be shipped to the factory, freight pre-paid. Met One Instruments, Inc. will pay the shipping charge to return the product to the end user after repair or replacement of an item covered by warranty.

All instruments sent to the factory for repair or calibration must be free of contamination resulting from sampling chemicals, biological matter, or radioactive materials. Any items received with such contamination will be disposed and the customer will be billed a disposal fee.

Replacement parts or service/repair work performed by Met One Instruments, Inc. are warranted against defects in material and workmanship for a period of ninety (90) days from the date of shipment, under the same conditions as stated above.

REV 2013