BT-637
MANUAL

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BT-637 Manual

Technical Support

Should you require support, please consult your printed documentation to resolve your problem. If you are still experiencing difficulty, you may contact a Technical Service representative during normal business hours—7:30 a.m. to 4:00 p.m. Pacific Standard Time, Monday through Friday.

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	Grants Pass, OR 97526

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 BT-637 is a portable airborne particle counter with a small stable footprint. This allows you to move it around and set it down rather than holding it in your hand while sampling. The large character backlit LCD display provides easy viewing from distances up to 3 meters.

Other key features include:
- Copy data to USB memory stick
- Internal long life pump for continuous operation
- Internal battery pack for portable operation (8 hours continuous)
- 6 particle sizes (0.3, 0.5, 0.7, 1.0, 2.0, 5.0 μm)
- 2 Favorite sizes (including count alarm limits and analog output)
- Serial communications (USB, RS232, RS485)

2. Setup

Setup for the BT-637 is very simple since most features are integrated into the unit. The following sections cover unpacking, layout and performing a test run to verify operation.

2.1. Unpacking

When unpacking the BT-637 and accessories, inspect the carton for obvious damage. If the carton is damaged notify the carrier. Unpack everything and make a visual inspection of the BT-637 components. The BT-637 is shipped with the items shown on the following pages. The first page shows the standard equipment shipped with the BT-637 and the next page shows the optional equipment which can be purchased with the BT-637. If any of the equipment is missing, contact the supplier immediately.

ATTENTION:
The included USB driver CD must be installed before connecting the BT-637 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.
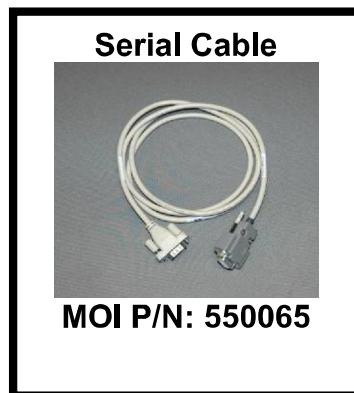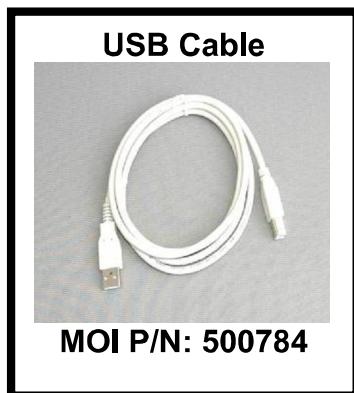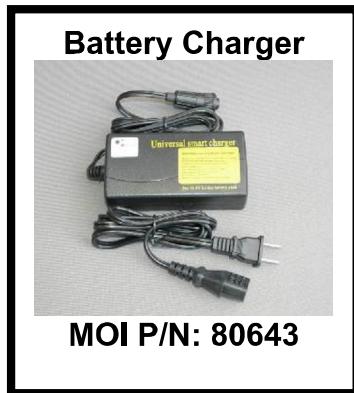
To install USB drivers:
Insert the USB Drivers CD. The install program should run automatically and display the screen below. If an AutoPlay pop-up window appears, select "Run AutoRun.exe". Finally, select "USB Drivers" to start the install process.

BT-637 Standard Equipment

BT-637

MOI P/N: BT-637

Iso-Kinetic Inlet

MOI P/N: G3110

Battery Charger

MOI P/N: 80643

Zero Particulate Filter

MOI P/N: G3111

BT-637 Manual

MOI P/N: BT-637-9800

USB Cable

MOI P/N: 500784

Serial Cable

MOI P/N: 550065

Calibration Certificate

MOI P/N: BT-637-9600

USB Drivers CD

MOI P/N: 80328

Comet Software CD

MOI P/N: 80248

Printer

MOI P/N: G3115

Temperature & Humidity Probe
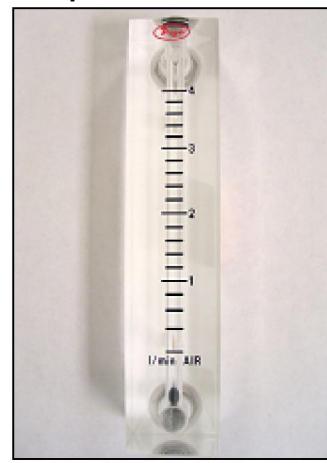
MOI P/N: G3120

BT-637
Optional
Equipment

Dwyer™ Ball Flow Meter

MOI P/N: 9801

2.2.   Layout

The following figure shows the layout of the BT-637 and provides a description of the components.

Inlet Nozzle

Temp/RH Connector

Display

Keyboard

USB Drive

COUNTING... 10
0.3µ 1,325,724 CF
0.5µ   266,232 CF
0.7µ   98,532 CF

Met One Instruments   Benchtop Particle Counter BT-637

Power

Charger Jack

RS-232   USB   GB A G2G1

RS232   USB I/O   RS485   Analog Out
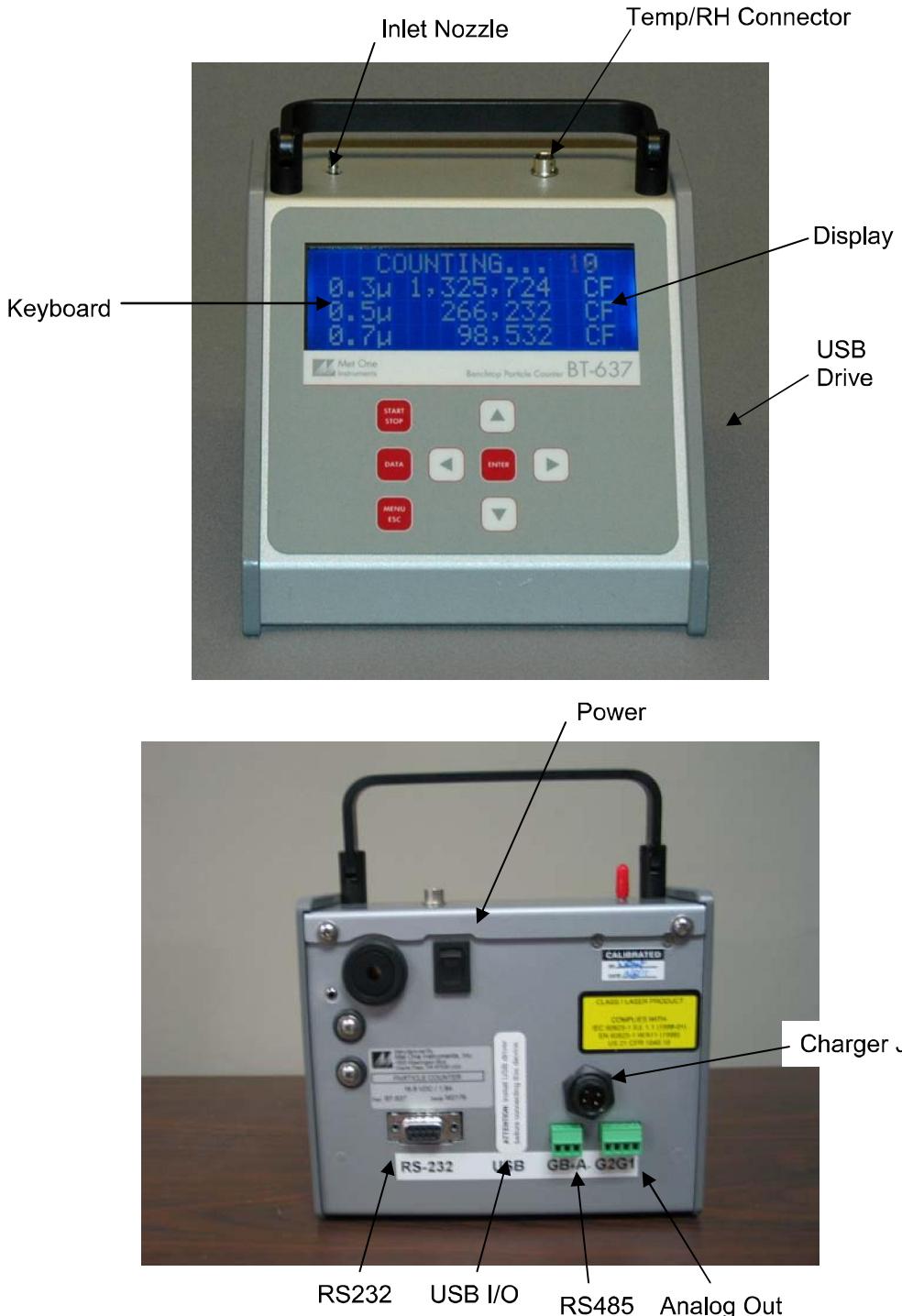
Figure 1 – BT-637 Layout

Component	Description
Display	4X20 character LCD display (backlit)
Keyboard	8 key membrane keypad
Power Switch	Switch that turns the BT-637 on or off (up for on and down for off).
Charger Jack	Input jack for external battery charger. This jack charges the internal batteries and provides continuous operating power for the unit.
Inlet Nozzle	Nozzle through which air sampling occurs. Under normal operation an iso-kinetic probe is connected to the nozzle. When performing a zero count a zero filter is connected.
Temp/RH Connector	Mating connector for the optional external Temperature/RH sensor.
USB I/O	USB communication port
USB Drive	Export sample data to USB memory stick
RS-232 Serial Port	Connection used for serial communication
RS-485 Serial Port	Connection used for long distances (4,000 feet) or multi-drop (32 units)
Analog out	Two analog output channels (0-5V = 0 – FS Counts). FS (Full Scale) is settable from 0 to 9,999,999 counts.

2.3.   Default Settings

The BT-637 comes with the sample settings and unit settings set to the following default values.

Parameter	Value
Sample Location	1
Sample Mode	Manual
Sample Time	60 seconds
Sample Hold Time	0 seconds
Count Units	CF
Temperature Units	C
Baud Rate	9600
Serial Output	RS-232

2.4.   Initial Operation

Before operating the BT-637 for the first time, it is recommended that the unit be fully charged. Information regarding charging the battery is found in Section 8.1 of this manual.

3. User Interface

The BT-637 user interface is composed of an 8 button keypad and a LCD display. The following sections provide an overview of the keypad and menu systems, which will be referenced throughout the document.

3.1. Keypad

The BT-637 keypad is composed of 8 buttons as shown in **Figure 2**
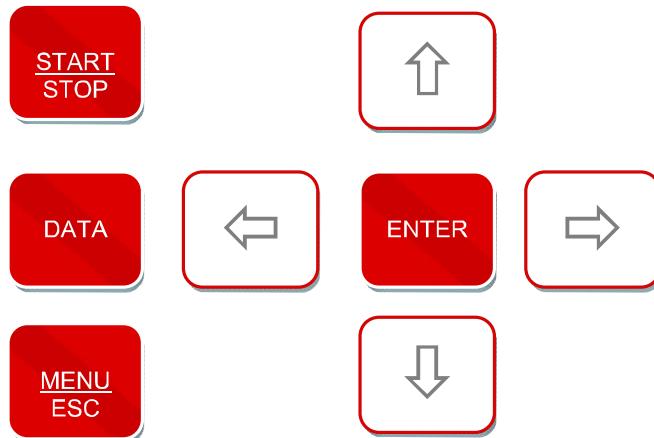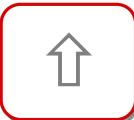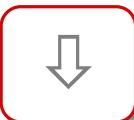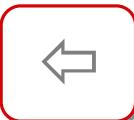
Figure 2 – BT-637 Keypad

The following table provides a description of how each button is used in the operation of the unit.

Key	Description
START STOP	• Starts or stops the unit sampling (Operate or Main Menu Screen). • Starts USB data transfer (Copy to USB Drive Screen). • Starts printing data (Print Data Screen). • Recalls the selected data (Recall Data Screen).
DATA	• Loads the Data Menu Screen.
MENU ESC	• Loads the Main Menu Screen. • Loads the Operate Screen when in the Main Menu Screen. • Stops editing a field and returns the field to the original value before editing began.

ENTER	• Loads the screen associated with menu item. • Begins editing of the selected item in a screen when not already editing. • Stops editing a field and saves the changed value.
⇧	• Navigates up when not editing. • Modifies field when editing.
⇩	• Navigates down when not editing. • Modifies field when editing.
⇦	• Navigates left
⇨	• Navigates right

4.   Operation

The primary function of BT-637 is to sample, store and retrieve data. All other operations of the unit are derived from this basic purpose. The following sections cover the basic operation of BT-637.

4.1.   Power Up

The BT-637 power is controlled by a switch located on the back of the unit. To power up the unit move the switch to the on position (up). The following sections describe the screen sequence on power up.

4.1.1. Startup Screen

The first screen shown on power up is the Startup Screen.   The Startup Screen displays the product type and company website for approximately 3 seconds before loading the Operate Screen. Figure 3 shows the Startup Screen.

BT-637

WWW.METONE.COM

Figure 3 – Startup Screen

4.2. Operate Screen

The Operate Screen displays the sample status, current sample data and previous sample data. Figure 4 shows the Operate Screen (the top line remains fixed, the remaining lines scroll).

```
15 AUG'10 11:23 L001
  0.3μ              0  CF
  0.5μ              0  CF
  0.7μ              0  CF
  1.0μ              0  CF
  2.0μ              0  CF
  5.0μ              0  CF
```
Figure 4 – Operate Screen

The top line of the Operate Screen is reserved for the normal header (date, time and location) or status / alarm messages depending upon the machine status. The top line always remains the same while the other 3 lines scroll to display the full list. The first 6 scrollable items are the count channels, which show either the current or previous count values. Temp and RH will follow the count lines if the RH/Temp probe is connected as shown in Figure 5.

```
18 AUG'06 11:23 L001
  0.3μ              0  CF
  0.5μ              0  CF
  0.7μ              0  CF
  1.0μ              0  CF
  2.0μ              0  CF
  5.0μ              0  CF
  Temp   24°C RH   40 %
```
Figure 5 – Operate Screen w/ RH/Temp

The Operate Screen normally displays 6 particle sizes however the BT-637 also offers a Favorites mode which configures the unit to display and print any two of the six standard sizes (see Section 4.2.1).

Particle counts units are user selectable. The selections include: Total counts (TC), particles per cubic foot (CF), and particles per liters (/L). Ambient temperature can be displayed in units of Celsius (C) or Fahrenheit (F). Both unit settings are discussed in Section 5.2.

4.2.1. Favorites

The Favorites setting eliminates the need to scroll the display when monitoring two non-adjacent sizes (see Section 5.3). The Favorites setting configures the display and printer for two sizes however the BT-637 still counts and buffers all six particle sizes. Sample data for all six channels is available via the serial port (Section 7) or by viewing count history on the display (Section 4.2.5). Figure 6 shows the Favorites Operate Screen. Figure 7 shows the Favorites Operate Screen with RH/Temp probe attached.

```
18 AUG'06 11:23 L001
  0.3µ            0   CF
  5.0µ            0   CF
```
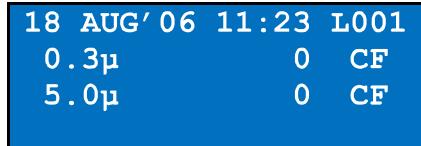
Figure 6 – Favorites Operate Screen

```
18 AUG'06 11:23 L001
  0.3µ            0   CF
  5.0µ            0   CF
  Temp   24°C RH   40 %
```

Figure 7 – Favorites Operate Screen w/ RH/Temp

4.2.2. Sampling

When the unit is sampling, the Operate Screen displays the current sample information. All of the scroll fields are as described in Section 4.2 and are real-time values as long as the unit is sampling. Total counts (TC) and concentration values (CF, /L) will update while the unit is sampling. Concentration values (CF, /L) 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 8 shows the Operate Screen while sampling with RH/Temp probe connected.

```
COUNTING... 58    L001
  0.3µ     29,780   CF
  0.5µ      1,400   CF
  TEMP   24°C RH    40%
```

Figure 8 – Operate Screen (Sampling)

4.2.3. Sample Status

The top line of the Operate Screen displays the status of the BT-637 while the unit is sampling. The following table shows the various status messages and their meaning:
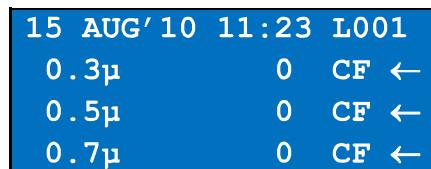
Status	Description
STARTING…	BT-637 is starting the sample and is waiting for the count system to initialize.
COUNTING… 58	BT-637 is sampling. The time remaining is displayed to the far right.
HOLDING…10	BT-637 is in auto mode and is waiting for the hold time to finish. The time remaining is displayed to the far right.

4.2.4. Non-Sampling

When the unit is not sampling (stopped), the Operate Screen displays real time information (the last sample, or zero counts if no samples were taken). The Operate screen is also used to view sample history information (see Sample History below).

4.2.5. Sample History

To navigate and view previous data (history), use the left and right arrow keys. History information can be easily identified by left arrows on the right side of the display (see Figure 9). Pressing the left arrow key shows older events while pressing the right arrow key shows newer events. Each press of an arrow key moves 1 record in the associated direction. When the oldest record has been reached, pressing the left arrow key will not change the current record being viewed. When the newest record has been reached, pressing the right arrow key will cause the Operate Screen to display real time information. Pressing the Enter key at any time causes the Operate Screen to display real time information. Sample history will display 2 channels in Favorites mode. To view other channels, change the Favorites sizes or disable Favorites mode (Section 5.3) before you view history.

```
15 AUG'10 11:23 L001
 0.3µ          0  CF ←
 0.5µ          0  CF ←
 0.7µ          0  CF ←
```
Figure 9 – History Screen

4.2.6. Warnings / Errors

The BT-637 has internal diagnostics to monitor critical functions such as low battery, sample flow rate and the optical engine (Sensor).

The low battery warning occurs when the battery capacity drops below ~5%. When a low battery warning occurs, the Operate Screen displays the low battery warning on the top line of the Operate Screen. This warning alternates with the normal text displayed. The low battery warning is displayed whether the unit is sampling or not sampling. Figure 10 shows the Operate Screen with the low battery warning on the top line.

```
       Low Battery!
  0.3µ             0   CF
  0.5µ             0   CF
  0.7µ             0   CF
```

Figure 10 – Operate Screen Low Battery

A flow error will be reported when the sample flow rate is not within +/- 10% of the nominal 0.1 CFM flow rate. Figure 11 shows the Operate Screen with a flow error.

```
       FLOW ERROR!
  0.3µ             0   CF
  0.5µ             0   CF
  0.7µ             0   CF
```

Figure 11 – Operate Screen Flow Error

A sensor error is reported when the BT-637 detects a problem in the optical engine (sensor). Figure 12 shows a sensor error.

```
       SENSOR ERROR!
  0.3µ             0   CF
  0.5µ             0   CF
  0.7µ             0   CF
```

Figure 12 – Operate Screen Sensor Error

4.3. Sampling

The following sub-sections cover BT-637 sample related functions.

4.3.1. Starting/Stopping

A sample can be manually started or stopped from either the Operate Screen or the menu. To start or stop a sample from either of these screens press the START/STOP key on the keypad. Starting or stopping a sample from the menu will load the Operate Screen.

Depending upon the current sample mode of the BT-637; the sample will either run a single sample or continually run samples. If the BT-637 is set to continually run samples, the unit will continue to sample until the unit is stopped. BT-637 sample modes are discussed in Section 4.3.3.

4.3.2. Real-Time Output

BT-637 provides real-time output on the serial port at the end of each sample. The format of the output is controlled by the Serial Output setting (Section 5.2). Section 7.3 covers real-time output in greater depth.

4.3.3. Sample Mode

The sample mode controls single sample or continuous sampling. The Manual setting configures the unit for a single sample. The Auto setting configures the unit for continuous sampling. See sections 4.3.6 and 5.1.2

4.3.4. 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 – 999 seconds and is discussed in sections 4.3.6 and 5.1.3.

4.3.5. Sample Hold Time

The sample hold time is used when the sample mode is set to auto (continuous sample). The sample hold time represents the time from the completion of the last sample to the start of the next sample. The hold time could also be considered the amount of time between samples when no sampling is occurring. The sample hold time is user settable from 0 – 999 seconds and is discussed in sections 4.3.6 and 5.1.4.

4.3.6. Sample Timing

The following figures depict the sample timing sequence for both manual and auto sampling modes. Figure shows the timing for manual sample mode.

Figure 13 – Manual Mode Sample

Figure shows the timing for auto sample mode.
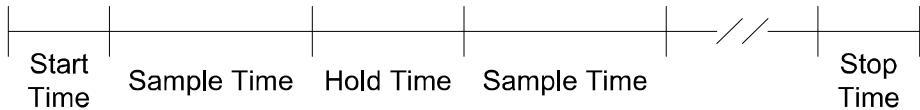
Figure 14 – Auto Mode Sample

5.   Main Menu

The BT-637 main menu provides access to core functions of the BT-637 and is accessible by pressing the Menu key on the Operate Screen. **Figure 15** shows the BT-637 main menu (4 lines visible at a time on unit).


```
SAMPLE SETUP
SETTINGS
FAVORITES
SET CLOCK
CALIBRATE FLOW
ABOUT
```

Figure 15 – BT-637 Main Menu

Menu Item	Description
SAMPLE SETUP	Loads the Sample Setup Screen where sample specific settings can be modified. See Section 5
SETTINGS	Loads the Settings Screen where BT-637 settings can be modified. See Section 5.2
FAVORITES	Configure two favorite size channels including alarm limits and analog output scaling. See Section 0
SET CLOCK	Loads the Set Clock Screen where the date and time can be set. See Section 5.4
CALIBRATE FLOW	Loads the Calibrate Flow Screen. See Section 5.5
ABOUT	Loads the About Screen where BT-637 version information can be viewed. See Section 5.6

5.1. Sample Setup

Select SAMPLE SETUP from the menu to access the Sample Setup screen. Figure 16 shows the Sample Setup Screen.

```
LOCATION:     001
SAMPLE MODE: MANUAL
SAMPLE TIME: 060
HOLD TIME:    000
```

Figure 16 – Sample Setup Screen

5.1.1. 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).

5.1.2. Sample Mode

The sample mode controls single sample or continuous sampling as illustrated below.

Selection	Description
MANUAL	The Manual setting configures the unit for a single sample.
AUTO	The Auto setting configures the unit for continuous sampling.

5.1.3. 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 – 999 seconds and is discussed in Section 4.3.4.

5.1.4. Sample Hold Time

The sample hold time is used when the sample mode is set to auto (continuous sample). The sample hold time represents the time from the completion of the last sample to the start of the next sample. The hold time could also be considered the amount of time between samples when no sampling is occurring. The sample hold time is user settable from 0 – 999 seconds and is discussed in Section 4.3.5.

5.2. Settings Screen

To access the BT-637 settings screen select SETTINGS from the menu. Figure 17 shows the Settings Screen.

```
COUNT UNITS: CF
TEMPERATURE: °C
BAUD RATE:   9600
SERIAL OUT:  RS-232
```

Figure 17 – Settings Screen

5.2.1. Count Units

The BT-637 supports total counts (TC), particles per cubic foot (CF), and particles per liter (/L). Particle count information updates while the unit is sampling. Concentration values (CF, /L) 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.

5.2.2. Temperature

The BT-637 displays temperature in Celsius (C) or Fahrenheit (F).

5.2.3. Baud Rate

Use the Baud Rate selection to set the serial communications baud rate. BT-637 communicates at baud rates from 300 – 38400.

5.2.4. Serial Output

The Serial Output setting controls the behavior of the BT-637 serial output. The modes are RS232, RS485 or Printer (see Section 7 for serial communication protocol). The following table lists the Serial Output settings and describes their meanings.

Serial Output Setting	Description
RS232	RS232/USB communication with CSV style output. Records automatically transmitted after each sample.
RS485	RS485 communication with CSV style output.
PRINT	RS232 communication with printer style output. Records automatically transmitted after each sample.

5.3.   Favorites Screen

The Favorites mode eliminates the need to scroll the display when monitoring two non-adjacent sizes. The Favorites mode also provides count alarm limits and analog output scaling for the Favorites (2 count channels). The Favorites mode controls the display (real time and history) and printer format. The CSV serial output includes all 6 sizes. Figure 18 shows the Favorites screen.

```
FAVORITES ON
SIZE ALARM    A-SCALE
 0.3 0500000 0500000
 5.0 0500000 0500000
```
Figure 18 – Favorites

Access the Favorites Screen by pressing the Menu then selecting Favorites. Use the Up/Down arrows to move the cursor to the selection. Press enter then use the Up/Down arrows to change the setting. For alarm limit and analog scaling, use the Right/Left arrows to move to the next digit. Press Enter to save the setting.

5.3.1. Favorites Mode On/Off

Enables or disables Favorites mode.
- On = Enabled (2 channel operation)
- Off = Disabled (6 channel operation)

5.3.2. Favorites Sizes (SIZE)

Select 2 of the 6 standard sizes. Favorite 1 is above Favorite 2 (0.3 μm in Figure 18).

5.3.3. Favorites Alarm Limits (ALARM)

Favorites count alarm limit. A zero (0) value disables the count alarm. The alarm is active when the count is equal to or greater than the alarm limit.

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

5.3.4. Favorites Analog Output Scaling (A-SCALE)

Favorites analog output scaling (0 – 5 volts = 0 – VALUE). A zero (0) value will configure the analog output for a digital or binary alarm (0 volts = normal, 5 volts = alarm). The alarm limit for this binary mode is configured in Section 5.3.3 above.
    The alarm value does not change with the count units setting (TC, CF, /L). In other words, a value of 1,000 will output 5 volts at 1,000 counts or 1,000 particles per cubic foot or 1,000 particles per liter depending on the count unit setting.

Figure 19 shows the analog output connector pin assignments. GND pins are signal ground. A1 and A2 are Analog Output 1 and Analog Output 2 which are associated to Favorite 1 and Favorite 2 respectively (see Section 5.3.2).
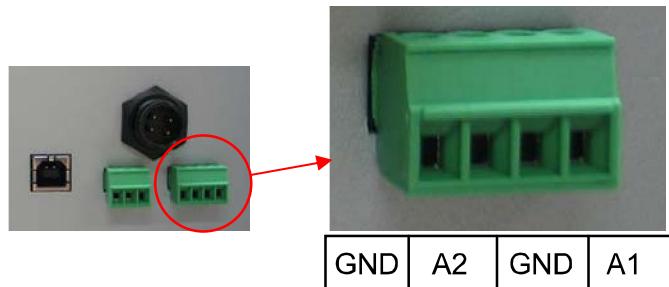
Figure 19 – Analog Output Connector

5.4. Set Clock Screen

To set the date and time select SET CLOCK from the menu. Figure 20 shows the Set Clock Screen.

Figure 20 – Set Clock Screen

The following table lists the date and time settings and their meanings.

Setting	Description
DATE	The date in the following format: dd mmm'yy dd = Day mmm = Month yy = Year
TIME	The time in the following format: HH:MM:ss HH = Hours in 24 hour format MM = Minutes ss = Seconds

5.5. Calibrate Flow Screen

The BT-637 has a factory calibrated flow rate of 0.1 CFM or 2.83 LPM. Under normal circumstances, the integrated flow control system will maintain flow within +/- 5% of this flow rate. Use the following procedure to calibrate the flow rate when a periodic flow rate check (Section 8.2.2) indicates a flow rate error greater than +/- 5%.

1. Connect a flow meter to the inlet fitting on the top of the unit.

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

3. Observe the flow meter reading and enter the value in the Reference Flow field. The BT-637 will calculate a new set point.

4. Wait 60 seconds for the flow system to adjust to the new set point.

5. Observe the flow meter reading. The value should be between 2.76 and 2.9 LPM. If the value is outside this range, go to step 3.

6. Exit the Calibrate Flow screen by pressing the ESC button (the pump will stop).
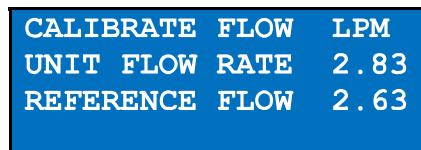
```
CALIBRATE FLOW   LPM
UNIT FLOW RATE   2.83
REFERENCE FLOW   2.63
```
Figure 21 – Calibrate Flow

5.6. Viewing Version Information

To access the version information, select ABOUT from the menu. Figure 22 shows the About Screen with the master version.

```
        BT-637
     80203 R0.1.0
      SN A10000
    www.metone.com
```
Figure 22 – About Screen Master Version

The About Screen shows the model number, firmware versions, serial number, and the company web page. Firmware versions are located on the second line. Use the up or down arrows to cycle through the three firmware versions embedded in the BT-637.

6. Data Management

To access data options (copy data, view available memory, recall data and print data), simply press the Data key to navigate to the Data Screen. Figure 23 shows the Data Screen.
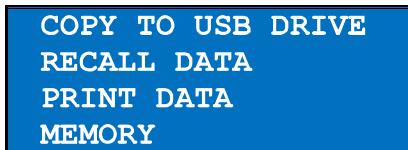
```
COPY TO USB DRIVE
RECALL DATA
PRINT DATA
MEMORY
```
Figure 23 – Data Screen

6.1. Copy to USB Drive

To access the Copy to USB Drive feature, press the Data key then select COPY TO USB DRIVE from the Data menu. Figure 24 shows the Copy Data Screen.
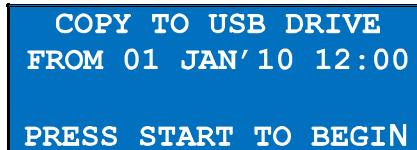
```
 COPY TO USB DRIVE
FROM 01 JAN'10 12:00

PRESS START TO BEGIN
```
Figure 24 – Print Data Screen

The BT-637 will copy all data from the displayed date/time to current time. Initially, the date/time will be the first sample record so all records will be copied. To reduce transfer time, press Enter and change the date/time to a more recent date/time.

Press the Start button to initiate the copy process. Press the ESC button to cancel the copy process and return to the Data menu. The following screen is displayed during the copy process (Figure 25).

```
COPY TO USB STATUS
  COPYING SETTINGS…
   50%  COMPLETE
```
Figure 25 – Printing Status Screen

The following table describes the status messages.

Status	Description
SETTINGS…	Copying settings file
DATA…	Copying data file
FINISHED!	Shown when the copy is complete.

6.2. Recall Data

Select Recall Data to navigate to the Recall Data Screen where you can quickly navigate to a record based on time. Note: Stored sample events can be viewed from the Operate Screen (as described in Section 4.2.5), but this requires navigating one record at a time to reach the desired record. The Recall Data Screen is accessed by selecting RECALL DATA from the data menu. If no sample events are available the screen shown in Figure 26 is displayed. Press the ESC key to exit the No Samples Events Screen.

```
NO SAMPLE EVENTS
   AVAILABLE.
```

Figure 26 – Recall Data Screen (No Data)

Figure 27 shows the Recall Data Screen when there are sample events available.

```
   RECALL DATA
01 JAN'00 00:00
```
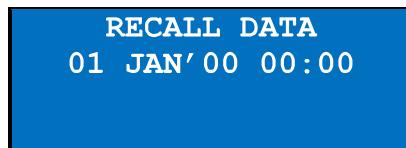
Figure 27 – Recall Data Screen

To recall data, enter the desired date/time string of the data to recall 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 screen reacts in exactly the same manner as described above and it now has the desired data shown.

6.3. Printing Sample Data

Select Print Data to print stored sample events through the printer port within a user selected range. The following sections describe the process of printing sample data.

To access the printing feature of the BT-637, press the Data key then select PRINT DATA from the menu. If no sample events are available the screen shown in Figure 28 is displayed. Press the ESC key to exit the No Samples Events Screen.

```
NO SAMPLE EVENTS
   AVAILABLE.
```
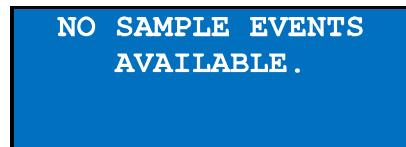
Figure 28 – Print Data Screen (No Data)

Figure 29 shows the Print Data Screen when there are sample events available.

```
PRINT DATA
LOCATION: 000
01 JAN'00 00:00
18 AUG'06 13:23
```
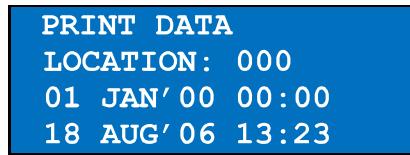
Figure 29 – Print Data Screen

To select which sample events to print, the location and time range must be specified. The following table describes the printing selection 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.

6.3.1. Printing Status

After the print settings have been selected, the Printing Status Screen is displayed. Figure 30 shows the Printing Status Screen as it would look when finished.

```
PRINTING STATUS
SCANNING...15
PRINTING...10
FINISHED!
```
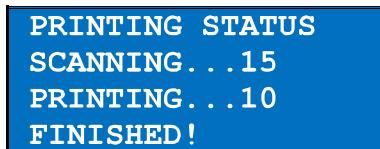
**Figure 30 – Printing Status Screen**

The following table describes the status components of the Printing Status Screen.

Status	Description
Scanning…	Displays how many records have been checked to determine if they meet the print settings.
Printing	Displays how many records have been printed.
Finished!	Is shown when the printing has completed.

Pressing the ESC button cancels the data printing and loads the menu. The format of the print is dependent upon the port setting (Section 5.2).

6.4. Memory

The BT-637 memory is composed of a single file which contains the data from sample events. Every time a sample is completed, the BT-637 stores that data into the memory. The BT-637 memory is circular, meaning when the memory is full, the unit will start overwriting the oldest saved samples with new samples. BT-637 provides the user the ability to view the memory usage as well as clear the memory.

6.4.1. View Memory Usage

The Memory Screen is used to view the amount of data memory available or to clear the memory. The Memory Screen is accessed by pressing the Data key then selecting MEMORY from the Data Menu. Figure 31 shows the Memory Screen.

```
FREE:       100%
SAMPLES:   8000
PRESS  ENTER  TO
 CLEAR  MEMORY!
```
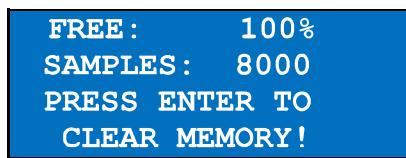
Figure 31 – Memory Screen

The following table lists the Memory Screen items and their description.

Item	Description
FREE	Shows the percentage of memory space which is available for data storage. When 0% is shown the memory is overwriting the oldest data with new data.
SAMPLES	Shows the number of samples which can be stored in memory before the memory is full. When 0% is shown the memory is overwriting the oldest data with new data.

6.4.2. Clearing memory

Clearing the BT-637 memory removes all data from sampled events. To clear the BT-637 memory select the ENTER key while in the Memory Screen. The Memory Caution Screen, as shown in Figure 32, is shown to verify that the memory is to be cleared.

```
PRESS  ENTER  TO
CLEAR  MEMORY!

PRESS  ESC  TO  CANCEL
```
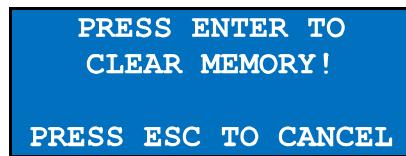
Figure 32 – Memory Caution Screen

7. Serial Communications

BT-637 provides serial communications via USB and DB9 connectors located on the back of the unit. These ports support flash upgrades (field upgrade), serial commands (see Section 7.2) and real-time data output.

7.1. Connection

ATTENTION:
The included USB driver CD must be installed before connecting the BT-637 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 USB Drivers 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.

The baud rate is settable from 300 – 38400 baud (Section 5.2). The rest of the settings (parity and stop bits) are not. For proper communication, set parity to none and stop bits to 1. Also, the BT-637 and the computer must have the same baud rate. The default baud rate for BT-637 is 9600 baud, but once changed the new rate will be the power up default.

The BT-637 supports USB, RS-232 and RS-485 communications. USB and RS-232 are standard PC connections. RS-485 is a two wire, half duplex, differentiating electrical connection which is commonly used for local networks and multi-drop communication links. BT-637 is by default USB/RS-232 and is RS-485 when the serial mode is set to RS485 (Section 5.2).

7.1.1. RS-485 Connection

Figure 33 Figure 33 shows the RS485 connector location and pin assignments.

Figure 34Figure 34 shows a RS-485 network wiring diagram.

| GND | B+ | A- |
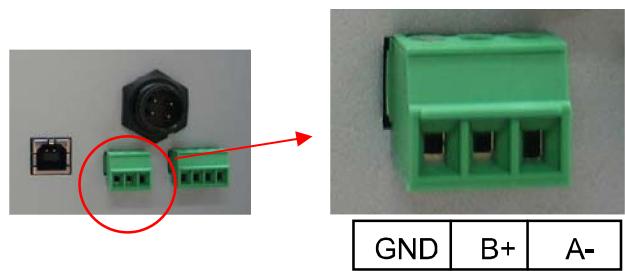
Figure 33 – RS485 Connector
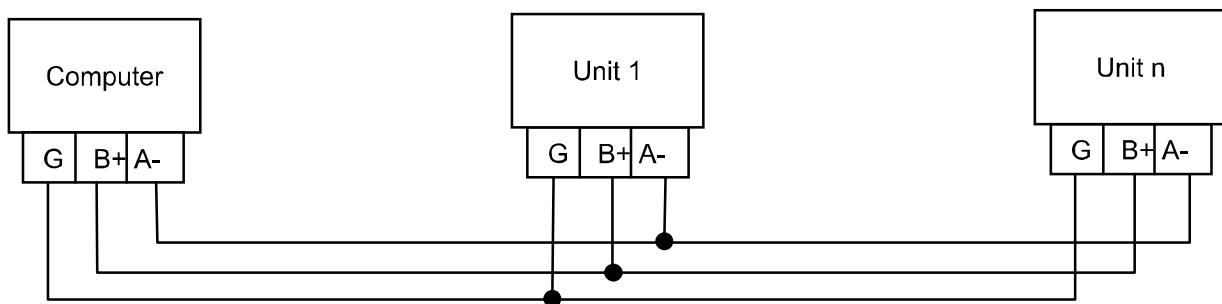
Figure 34 – RS485 Network

7.2. Commands

BT-637 provides a serial command set for remote accessing of stored data and settings. BT-637 is always ready for serial communication and provides a prompt ('>') whenever a carriage return is sent to it. All commands are terminated by a carriage return. Commands which need additional information prompt for the appropriate information. The following table lists the available commands and a description of the command. Commands can be entered in either Upper or Lower Case.

Command	Type	Description
?,H	Help	Displays the following help menu to assist users. ``` ?---------------------------- | BT-637 System Menu | ---------------------------- 1 - Display Settings 2 - Display All Data 3 - Display New Data 4 - Display Last Data D - Set Date T - Set Time C - Clear Memory S - Start Sample E - End Sample ST - Set Sample Time SH - Set Hold Time SM - Set Sample Mode SR - Set Report Mode CU - Set Count Units TU - Set Temp Units ID - Set Location ID SF - Set Favorites Mode FA - Set Favorites Alarm FD - Set Favorites DAC Range FS - Set Favorites Size > ```
1	Settings	Returns the units settings information
2	All data	Returns all available records from the data file. If there is no data nothing will be returned.
3	New data	Returns all records since last '2' or '3' command. All new data is displayed or if there is no new data nothing will be returned.
4	Last data	Returns the last record if just the '4' command is entered. If the command is '4' followed by a space and a number (x), the last x records are returned.

D	Date	If just the command is entered, the current date setting and a prompt to change the date is shown. If the command is followed by a space and a valid date, the unit is set to that date. A valid date is formatted as mm/dd/YY.
T	Time	If just the command is entered, the current time setting and a prompt to change the time is shown. If the command is followed by a space and a valid time, the unit is set to that time. A valid time is formatted as HH:MM.
C	Clear data	Displays a prompt for clearing the stored unit data.
S	Start	Starts a sample
E	End	Ends a sample (abort the sample, no data record)
ST	Sample time	If just the command is entered, the current sample time is displayed. If the command is followed by a space and a number, the sample time is set to that number of seconds.
ID	Location	Set/Get the Location ID. Range 1-999.
FAx	Favorites alarm limit	Favorites Alarm Limit setting where x=1 or 2 for Favorite 1 or 2 respectively.
FDx	Favorites analog scaling	Favorites DAC Range setting where x=1 or 2 for Favorite 1 or 2 respectively.
FSx	Favorites sizes	Favorites Size setting where x=1 or 2 for Favorite 1 or 2 respectively. The setting parameter is followed by a space. 0=0.3u, 1=0.5u, 2=0.7u, 3=1.0u, 4=2.0u, 5=5.0u
SF	Favorites mode	Favorites mode. 0=Off, 1=On
SH	Hold time	If just the command is entered, the current hold time is displayed. If the command is followed by a space and a number, the hold time is set to that number of seconds.
SM	Sample mode	If just the command is entered, the Sample Mode is displayed. If the command is followed by a space and a number, the Sample Mode is set. 0=Manual, 1=Auto
SR	Serial output mode	This command is used for setting the Report Mode for the serial port. 0=RS-232, 1=RS-485, 2=Printer.
CU	Count units	This command is used for setting the Count Units. 0=CF, 1=/L, 2=TC (Total Counts). If just the command is entered, the Volume Mode is displayed, If the command is followed by a space and a number, the Volume Mode is set.

TU	Temperature units	Temperature Units. This command is used for setting the Temperature Units. 0=C, 1=F. If just the command is entered, the Temperature Units are displayed, If the command is followed by a space and a number, the Temperature Units are set.

7.3.   Real Time Output

The real time output of BT-637 occurs when the unit finishes a sample. The output format is either a comma separated value (csv) or a printer style. The following sections show the two format styles.

7.4.   Comma Separated Value (CSV)

CSV Header (Note 1):

Time,0.3(CF),0.5(CF),0.7(CF),1.0(CF),2.0(CF),5.0(CF),AT(C),RH(%),Location,Sample Time,Fav1,Fav2,Status

CSV Example Record:

31-AUG-2010 14:12:21,   154200,   21780,   9560,   6340,   3540,   920, 24, 41, 1, 60,0.3,0.5,0

The format for comma separated value is as follows:

Field	Parameter	Example Value
1	Date and Time	31-AUG-2010 14:12:21
2	0.3μ Count – units determined by unit settings (TC, CF, /L)	154200
3	0.5μ Count – units determined by unit settings (TC, CF, /L)	21780
4	0.7μ Count – units determined by unit settings (TC, CF, /L)	9560
5	1.0μ Count – units determined by unit settings (TC, CF, /L)	6340
6	2.0μ Count – units determined by unit settings (TC, CF, /L)	3540
7	5.0μ Count – units determined by unit settings (TC, CF, /L)	920
8	Temperature – units determined by unit settings (C,F)	24 (Note 2)
9	RH (%)	41 (Note 2)
10	Location	1
11	Sample Time (0-999 seconds)	60
12	Favorite Size #1	0.3 (Note 3)
13	Favorite Size #2	0.5 (Note 3)
14	Status Bits (see below)	0 (Note 4)

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

Notes:
1. CSV header included for multiple record transfers like Display All Data (2) or Display New Data (3)
2. Temperature and RH will be null (,,) if Temp/RH probe is not attached
3. Favorite sizes will be null (,,) if favorites are disabled.
4. Status bits combinations are possible. For example, 11H = Low Battery and Favorite 1 alarm.

7.5. Printer Style

The format for printer style without the RH/Temp probe connected:

```
31-AUG-2010  14:09:26 L001
Sample Time  30
 0.3     156,300   CF
 0.5      18,580   CF
 0.7       7,720   CF
 1.0       4,760   CF
 2.0       2,620   CF
 5.0         620   CF
```

The format for printer style with the RH/Temp probe connected:

```
31-AUG-2010  14:09:26 L001
Sample Time  30
 0.3     156,300   CF
 0.5      18,580   CF
 0.7       7,720   CF
 1.0       4,760   CF
 2.0       2,620   CF
 5.0         620   CF
 Temp  24°C  RH   41%
```

8.   Maintenance

Due to the nature of the instrument, there are no customer serviceable components in the BT-637. The case of the BT-637 should never be removed or opened for any reason. **Opening or removing the case of the BT-637 voids the warranty and may result in exposure to laser radiation, which can cause eye injury.**

8.1.   Charging the Battery

To charge the battery, connect the battery charger module AC power cord to an AC power outlet and the battery charger DC plug to the socket on the back of the GT-637. The universal battery charger will work with power line voltages of 100 to 240 volts, at 50/60 Hz. The battery charger LED indicator will be Red when charging and Green when fully charged. A discharged battery pack will take approximately 3 hours to fully charge.

When fully charged the battery inside the BT-637 will power the unit for about 8 hours of continuous sampling.

There is no need to disconnect the charger between charging cycles because the charger enters a maintenance mode (trickle charge) when the battery is fully charged.

8.2.   Service Schedule

Although there are no customer serviceable components in the BT-637, there are service items which ensure the proper operation of the instrument. Table 1 shows the service schedule for the BT-637.

Time Period	Item	Manual Section
Weekly	Zero Count Test	8.2.1
Monthly	Flow Rate Test	8.2.2
Yearly	Annual Calibration	8.2.3

Table 1 Service Schedule

8.2.1. Zero Count Test

The zero count test determines whether the BT-637 is counting "false counts", which can be caused by air leaks or spurious noise. These "false counts" cause count measurement errors that become especially apparent when sampling relatively clean environments. It is Met One Instruments recommendation that a zero test be performed weekly to ensure optimal counting accuracy. The zero count test is as follows:

1. Attach a filter with a rating of 0.2μm or better to the BT-637 inlet nozzle. The filter must be large enough that it does not create a restriction and load down the small vacuum pump inside the BT-637. One zero particulate filter is supplied with the BT-637 (MOI #G3111).

2. Set the Sample – Op Mode to MANUAL and the Sample – Sample to 060. This ensures that the sample will be one minute long and only occur once.

3. Start and complete a sample.

4. The result of the one minute sample should be less than 1 on the 0.3μm channel.

8.2.2. Flow Rate Test

The flow rate test verifies that the flow rate is within tolerances for proper operation of the instrument. The BT-637 requires that the flow rate be set to 0.1 (cf) or 2.831 (L), which is the flow rate used for volume calculations within the instrument.

The flow rate test requires a flow meter that is ±3% accurate at 0.1 (cf) or 2.831 (L). The flow meter also needs to be of a type which is non-loading, because the vacuum pump inside the BT-637 can be easily loaded down by a small restriction. Met One Instruments sells a flow meter which can be used for the flow rate test (MOI #9801). The flow rate test is as follows:

1. To test the flow rate, connect a flow meter to the sample inlet nozzle of the BT-637 using a short piece of flexible 1/8" ID tubing (Tygon tubing is a good choice).

2. Start a sample on the BT-637 and while the unit is sampling, note the flow meter reading. The flow rate should be 0.1 (cf) or 2.831 (L) ±5%.

3. The flow rate can be adjusted using the front panel (see Section 5.5)

8.2.3. Annual Calibration

The BT-637 should be sent back to Met One Instruments yearly for calibration and inspection. Due to the nature of the instrument the sensor in the BT-637 needs annual calibration that cannot be performed by the customer. Calibrating particle sensors like the one in the BT-637 requires specialized equipment and a skilled technician. Met One Instruments maintains a calibration facility for calibrating particle counters according to industry accepted methods such as ASTM and JIS using NIST traceable standards.

In addition to calibration, the annual calibration allows a skilled technician to inspect the BT-637. This inspection ensures that any preventative maintenance is done before a failure occurs. The annual calibration and inspection process ensures that the BT-637 is operating and will continue to operate properly.

8.3. Flash Upgrade

BT-637 is firmware upgradeable via the serial connection using a Met One Instruments flash burn program. Using this program allows the BT-637 to have new firmware flashed into the unit in the field, without having to disassemble the unit. 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 the BT-637.

The case of the BT-637 should never be removed or opened for any reason. **Opening or removing the case of the BT-637 voids 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 for 2 – 3 hours • Send to service center
Pump does not turn on when a sample is started	• Low Battery • Defective pump	• Charge battery for 2 – 3 hours • Send to service center
Keypad does not work	• Loose connector • Internal hardware failure	• Send to service center
Sample result is zero	• Zero filter is attached • Pump did not run • Internal hardware failure	• Remove zero filter • Send to service center
Sample result is lower than normal	• Flow rate is low • Debris may in unit • Optics may be contaminated	• Perform flow rate test • Send to service center
Sample result is higher than normal	• Air leak in unit • Internal hardware failure	• Perform zero count test • Send to service center
Battery does not hold a charge	• Defective or worn out battery • Defective power cords or connectors • Defective charger	• Send to service center

10. 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

11. Specifications

Measurement Method   Scattered laser light

Performance

Particle Size Range	6 channels – 0.3 µm, 0.5 µm, 0.7 µm, 1.0 µm, 2.0µm and 5.0 µm
Concentration Range	0 – 3,000,000 particles per cubic foot (105,900 particle/L)
Accuracy	± 10% to calibration aerosol
Sensitivity	0.3 µm
Flow Rate	0.1 cfm (2.83 lplm)
Sample Time	Adjustable: 1 to 999 seconds
Hold Time	Adjustable: 0 to 999 seconds

Electrical

Light Source	Laser Diode, 35 mW, 780 nm
Power	12V Li-Ion self-contained battery pack – Provides for 8 hours continuous use. Full recharge approximately 3 hours.
AC Adapter/Charger	AC to DC module, 100 – 240 VAC to 16.8 VDC @ 1.8A
Communications	RS-232 or RS-485
Certifications	Meets or exceeds CE, ISO, ASTM and JIS international certifications.

Interface

Display	20 character x 4 line LCD
Keyboard	8 key membrane type

Physical

Size	Height = 7" (17.7 cm)
	Width = 6.6" (16.8 cm)
	Depth = 6.5" (16.5 cm)
Weight	5.00 lbs – 80 ounces – (2.27 kg)

Environmental

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

Accessories

Supplied	Operation Manual	(MOI #BT-637-9800)
	Serial Cable	(MOI #550065)
	USB Cable	(MOI #500784)
	USB Drivers CD	(MOI #80328)
	Comet Software	(MOI #80248)
	Battery Charger	(MOI #80643)
	Iso-kinetic Sample Probe	(MOI #G3110)
	Zero Particulate Filter	(MOI #G3111)
Optional	RH & Temperature Probe	(MOI #G3120)
	Flow Meter	(MOI #9801)
	Portable Printer	(MOI #G3115)

Declaration of Conformity

CE MARKING

Manufacturers Name: Met One Instruments, Inc.

Manufacturer's Address: Met One Instruments, Inc.
                                1600 NW Washington Blvd
                                Grants Pass, Oregon 97526
                                United States of America
                                Phone: 541-471-7111
                                  FAX: 541-471-7116
                                E-Mail: metone@metone.com

Declares, that the product(s):

Product Names: Particulate Monitor, Aerosol Mass Monitor, Particle
                                Counter

Model Numbers: GT-321, GT-321-1, GT-331, GT-521, BT-637

Product Options: All

Are in compliance with the following documents:

EMC: Emissions: CISPR 11:1990 / EN 61326-1

                                Immunity: EN50082-1 / EN 61326-1

Tom Pottberg
President
April 13, 2007

Met One Instruments, Inc   Regional Sales & Service
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Grants Pass, Oregon 97526   Rowlett, Texas 75088
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Facsimile   541-471-7116   Facsimile   972-412-4716

Warranty

Products manufactured by Met One Instruments, Inc. are warranted against defects in material and workmanship for a period of one (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 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 bearings 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 or merchantability.

Service

Any product being returned to Met One Instruments, Inc. for service, repair or calibration must be assigned a return authorization (RA) number. Please call (541) 471-7111 or (972) 412-4715 for an RA number and shipping instructions.

Products manufactured by Met One Instruments, Inc. that are returned for service, repair or calibration are warranted against defects in material and workmanship for ninety(90) days from date of shipment, under the same conditions as stated above.

9/99