

Particle Counter

1020



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Safety Notice

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

Faultless and safe operation of the product presupposes proper transportation, storage, erection and installation as well as careful operation and maintenance. The seller of this equipment cannot foresee all possible modes of operation in which the user may attempt to utilize this instrumentation.

The user assumes all liability associated with the use of this instrumentation. The seller further disclaims any responsibility for consequential damages.

NOTICE



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



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

There are no user serviceable parts located inside the cover of this device.

Do not attempt to remove the cover of this product. Failure to comply with this instruction could cause accidental exposure to laser radiation. This system contains a laser operating at 785 nm. This wavelength is invisible to the naked eye and can cause damage to the eye if directly exposed. A protective housing protects the unit. To avoid the possibility of accidental exposure, always power down the system any time service or repair work is being performed.

Repair should only be attempted by manufacturer trained service personnel.

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1. Safety

1.1 Safety Indicators

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

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

A WARNING indicates a hazard to you and calls attention to a procedure that if not correctly followed could result in injury or even death. Do not proceed beyond a warning without understanding the hazard.

2. Setting Up

2.1 Unpacking

When you unpack the TPI 1020 and accessories, inspect the carton for obvious damage. If the carton is damaged notify the carrier. Unpack everything and make a visual inspection.

You should have the following:

1. TPI 1020 Hand Held Particle Counter
2. 100-240 VAC to 8.4 VDC Lithium Ion Smart Charger w/ power cord
3. Operation Manual
4. TPI 1020 Calibration Certificate

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

2.2 Familiarization



Item	Description
Charging Jack	Plug lithium ion charger module into jack to charge the batteries.
Iso-kinetic Inlet	Reduces count errors due to mismatched sample flow velocity.
Flow Adjust	Adjusts the flow rate of the unit (Section 5.4)
USB Port (not shown, on reverse side)	For future software updates

2.3 Test Run

The battery pack inside the TPI 1020 should be charged for 2.5 hours prior to use (WARNING: see section 5.3 - Battery Pack for instructions and safety).

Press the <START/STOP> button to turn the unit on. The Main screen will appear.



Main Screen

Press the <SELECT> button to display the Select screen when the unit is not sampling. Here the SIZE and VOLUME settings can be changed.



Select Screen

Initially the edit cursor is placed at the beginning of the SIZE setting. Press <SELECT> to cycle through the five size selections. Select 0.3u for this test.

The edit cursor will move to the VOLUME setting after 3 seconds if no buttons are pressed. Press <SELECT> to toggle the volume setting. Select CF (cubic feet) for this test.

The Main screen will be displayed after 3 seconds if no buttons are pressed.

Press the <START/STOP> button to begin a sample. You should hear the internal vacuum pump start running. After 3 seconds, (subsequent readings every 3 seconds) a number will appear on the display representing the number of particles per cubic foot larger than 0.3um. A progress bar will fill in left to right as the one minute sample is running.



Sample Screen

If the sample was taken in a relatively clean area, the count may be 200,000 or lower, whereas in a dusty area it may be as high as 3,000,000. The TPI 1020 will continue to take 19 more 3 second samples. The results from the 20 samples are then averaged and displayed.

This finishes the test run. Always remember to turn the power off when not in use to conserve battery power. Hold the <START/STOP> button for at least 2 seconds then release the key when POWER DOWN is displayed to shut down the unit.

The TPI 1020 will also self-power off after 5 minutes of no activity.

The TPI 1020 is now checked out and ready for use, however, you should read the rest of this manual to better understand how to use and maintain this instrument.

3. TPI 1020 Overview

3.1 Description

The TPI 1020 is designed to be a small, easy to use and completely portable hand-held particle counter that can provide fast and accurate measurement of particulate contamination in particles per cubic foot (or liter). The TPI 1020 has 5 selectable size ranges of 0.3, 0.5, 1, 2, and 5 micron.

The TPI 1020 contains a laser diode based sensor, Lithium Ion battery pack, vacuum pump, microprocessor electronics, LCD display and user input keys all in one small package. The accuracy of the TPI 1020 is certified according to ASTM and JIS standards and comparable to larger more expensive bench top particle counters. The fast 3-second response of the TPI 1020 makes it especially useful for troubleshooting contamination problems and tracing contamination leaks to the source.

The laser diode based sensor inside the TPI 1020 utilizes a specially designed elliptical mirror for high light collection efficiency and improved signal to noise. Precision optics collimate the laser beam into a thin, very intense beam resulting in increased signal and a high concentration limit of 3,000,000 particles per cubic foot. This high concentration limit allows the TPI 1020 to be used for indoor and outdoor aerosol particulate measurement.

3.2 Applications

- " Controlled Environments
- " Indoor Air Quality Studies
- " Process Control
- " HVAC Applications
- " Filter Testing
- " Laboratory Environments
- " Manufacturing Environments
- " Emissions Sourcing

3.3 Certifications and Compliance

- " CE Certified
- " NIST traceable calibration in accordance with JIS B 9921 and ASTM F328 and ASTM F649
- " In accordance with ISO 14644-1:1999(E) and ISO 14644-2:2000(E)

4. Operation

4.1 Iso-kinetic Sampling

The TPI 1020 comes with an iso-kinetic inlet nozzle. The iso-kinetic inlet helps reduce count errors related to the sample flow velocity and the aerodynamics of small particles. When taking a sample of typical indoor or outdoor aerosols the opening of the iso-kinetic inlet should always face upward. The TPI 1020 can be held in your hand or placed on a flat surface with its display facing towards you.

When sampling in an area having constant airflow, such as a clean room, duct, vent or the downstream side of a filter, always face the opening of the iso-kinetic inlet into the air flow. The sampling height will affect the TPI 1020 particle count reading. Taking a sample near the floor can give results several times higher than a sample taken at eye level.

When using the TPI 1020 to find the source of a contamination problem, be aware that not all contamination problems are continuous, some are the result of a short-term event or burst of particles. Locating the source will require taking a number of samples in the same spot.

4.2 Taking a Sample

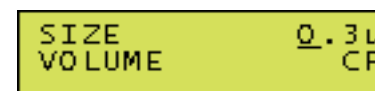
CAUTION: Never sample smoke, paint spray, oil mist, reactive, or pressurized gasses to avoid damaging the sensor optics.

Press the <START/STOP> button to turn the unit on. The Main screen will appear. The particle counter will automatically display the size and volume settings last used.



Main Screen

Press the <SELECT> button to display the Select screen when the unit is not sampling. Here the SIZE and VOLUME settings can be changed.



Select Screen

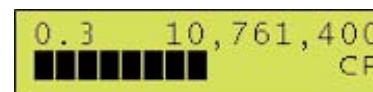
Initially the edit cursor is placed at the beginning of the SIZE setting. Press <SELECT> to cycle through the five size selections. Select size range of interest.

When you select a particle size, you are setting a lower size limit for the counter in the TPI 1020. The TPI 1020 will count $\frac{1}{2}$ of the particles of the selected size when a sample is taken, and all particles larger than the selected size. This type of counting is defined as cumulative counting.

The edit cursor will move to the VOLUME setting after 3 seconds of no button presses. Press <SELECT> to toggle the volume setting between CF (cubic feet per minute) and LPM (liters per minute). Select the volume units desired.

The Main screen will be displayed after 3 seconds of no button presses.

After selecting the desired particle size and volume, press the <START/STOP> button to begin a one minute sample. You should hear the internal vacuum pump start running. After 3 seconds, (subsequent readings every 3 seconds) a number will appear on the display representing the number of particles per cubic foot (or liter). A progress bar will fill in left to right as the one minute sample is running.



Sample Screen (set for 0.3u and cubic feet)

The results from the 20 3-second samples are then averaged and displayed. The display will hold the average result until the start key is pressed to take another sample or until the unit is switched off. The <START/STOP> key is used to stop a sample at anytime. Any data accumulated is lost when the <STOP> key is pushed.

5. Maintenance

5.1 Service Schedule

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

Sensor, vacuum pump and filter replacement requires access to the inside of the TPI 1020 and a factory-authorized person must do this. Contact Test products international for service information.

Calibrating particle sensors like the one in the TPI 1020 requires specialized equipment and a skilled technician. The sensor in the TPI 1020 should be calibrated on a yearly basis.

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5.2 Service Schedule Table

Item To Service	Frequency	Done By
Flow rate test	Monthly	Customer or Factory Service
Inspect pump	Yearly	Factory service only
Test battery pack	Yearly	Factory service only
Calibrate Sensor	Yearly	Factory service only

5.3 Battery Pack

WARNING: There are no user serviceable components inside the TPI 1020. Do not attempt to change the internal battery pack. The wrong battery pack could cause serious damage, a fire, or explosion. The TPI 1020 should be sent to a service center where a factory qualified person would change and properly dispose of the battery pack.

This device contains Lithium Ion battery technology and should only be charged with the supplied 8.4 VDC Lithium Ion Smart Charger unit. Never connect a power source greater than 8.4 VDC to this device.

When the battery is low enough to need charging, a "Battery Low" message is displayed on the display and the pump will not turn on when the <START/STOP> key is pushed.

To charge the battery pack, plug the 8.4 VDC Lithium Ion Smart Charger unit into an AC power outlet. The module is universal and will work with power line voltages of 100 to 240 volts, 50 to 60 Hz. Take the barrel connector on the end of the cord coming from the Charger module and plug it into the charger input socket on the side of the TPI 1020 (See section 2.2 Familiarization). To fully charge a discharged battery pack should take around 2.5 hours.

NOTE: After the batteries are completely charged, the smart charger will stop charging. The next time it is used, it must be disconnected from AC power, and then reconnected to the AC outlet to restart the charge cycle.

The battery pack inside the TPI 1020 when fully charged will power the TPI 1020 for about 12 hours of continuous use. Under normal intermittent or manual operation however, there is considerably less battery drain and up to 30 hours of use is possible.

If the TPI 1020 is to be used powered by its battery pack on a daily basis, connect the charger after every few days of usage, or as needed.

5.4 Flow Rate Test

The sample flow rate of 0.1cfm (2.83 lpm) is set at the factory. However, wear from continued use can degrade the motor and vacuum pump. Variation in the flow rate will reduce the accuracy of the instrument.

A flow calibration kit is available separately that includes everything needed to test and adjust the flow rate. It includes a flow meter, inlet adaptor, and flow adjustment tool.

Testing the flow rate is an easy procedure. It requires a flow meter that is 3% accurate at 0.1cfm. The flow meter must be non-loading (low restriction). The tiny vacuum pump inside the 80340 can be easily loaded down by even a small restriction. Most hot wire and differential pressure types of flow meters are non-loading.

To test the flow rate, connect the flow meter to the inlet nozzle of the TPI 1020. Turn on the TPI 1020, start a sample, and note the flow meter reading. The flow rate should be 0.10cfm (2.83 lpm) \pm 5%.

If the flow is not within this tolerance, it can be adjusted by a trim pot located in an access hole in the side of the TPI 1020 case (See section 2.2 Familiarization). Use the flow adjustment tool that comes with the flow calibration kit to make the adjustment. Turn the adjustment pot clockwise to increase the flow and counter-clockwise to decrease the flow.

6. Troubleshooting

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

A factory-authorized person should perform replacement of the sensor, vacuum pump, filter or any component inside the TPI 1020.

Symptom	Possible Cause	Correction
Does not turn on, no display	1. Low battery 2. Defective battery	1. Charge battery 2.5 hours 2. Send to service center
Display turns on but pump does not	1. Low battery 2. Defective pump	1. Charge battery 2.5 hours 2. Send to service center
Keypad functions do not work	Loose connector or defective component inside	Send to service center
Sample result remains at zero after sampling	1. Pump stopped 2. Laser diode bad	1. Send to service center 2. Send to service center
Sample result is lower than normal	1. Flow rate is low 2. Something may be stuck in the inlet nozzle and blocking the beam 3. Contaminated optics in sensor	1. Check flow rate 2. Blow into nozzle with can of "Aero Duster" 3. Send to service center
Sample result is higher than normal	1. Air leak in sensor 2. Noisy laser	1. Send to service center 2. Send to service center
Battery pack does not hold a charge	1. Defective or worn out battery pack 2. Defective power cords 3. Defective charger module or cords	1. Send to service center 2. Check with an Ohmmeter 3. Contact your distributor to get another charger

7. Specifications

Measuring Principle	Particle counter, light scatter
Light Source	Laser diode, 30mW, 780nm
Measurement Ranges	0.3, 0.5, 1, 2, 5 micron ranges
Accuracy	+/-10%, to calibration aerosol
Sensitivity	0.3um
Concentration Limit	3,000,000 particles per cubic foot (105,900 particles/L)
Measurement Time	3 second updates, 1 minute total
Flow Rate	0.10cfm (2.83lpm)
Display	2 line by 16 character LCD
Power	7.2V lithium ion self contained battery pack. Provides 30 hours of typical intermittent operation, up to 12 hours continuous use
Charger	AC to DC module intelligent lithium ion charger, 100-240VAC input to 8.4VDC @1500mA typical output. Charge time is 2.5 hours typical.
Operating Temperature	0 to 50C
Storage Temperature	-20 to 60C
Size	6.75" H x 3.75" W x 2.0" D (17.2cm H x 9.5cm W x 5.1cm D)
Weight	1.31 lb (21 oz) (0.60 kg)
Supplied Accessories	Operation manual, lithium ion smart charger w/ power cord

Notes:

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