

ParticleView V19

Real-Time Particle Characterization



METTLER TOLEDO

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For updates, webinars, and the latest documents: <http://community.autochem.mt.com>

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1 Introduction

This manual covers specific safety and quality information relating to the ParticleView™ V19 with PVM® (Particle Vision Measurement) technology. The ParticleView V19 system includes the probe and an interface unit.

ParticleView V19 with PVM technology is a probe-based instrument that visualizes particles and particle mechanisms in real time. High resolution images are continuously captured under a wide range of process conditions without the need for sampling or manual offline analysis. A process trend, sensitive to changes in particle size and concentration, is automatically combined with the most relevant images. As a result, scientists are provided with a straightforward and reliable method to ensure comprehensive process understanding is acquired with every experiment.

www.mt.com/ParticleView V19

2 Intended Use

The system includes a lighting system (laser diodes), an imaging system, a camera, PCBs, and a powered USB extender. The probe back end is rated to 4X and IP65 for protection when dust, humidity, and wet conditions are present.

The system may only be used in safe locations. ParticleView V19 is not certified for use in hazardous locations.

3 Technical Data

System certifications	CE/NRTL-C Approved, Class 1 Laser Device, Compliant with 21CFR1040.10 and 1040.11 and IEC 60825-1; IP65 and 4X (probe only)
Functional specifications	
Method of Measurement	Particle Vision Measurement (PVM [®])
Field of view	1300 μm x 890 μm (\pm 50 μm)
Optical resolution	> 2 μm
Image resolution	1500 x 1024 pixels
Illumination	8 pulsed laser diodes (4 front; 4 back)

Table 1. System certifications and functional specifications

Probe Specifications

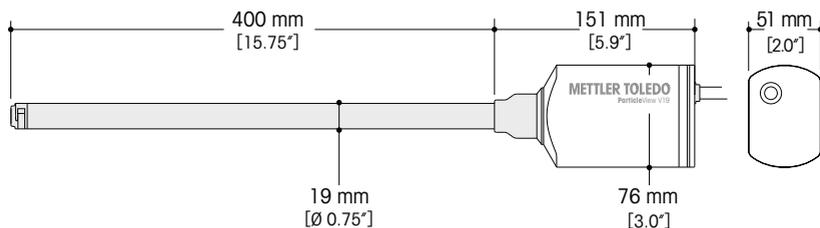


Figure 1. Probe dimensions

Wetted materials of construction	
Probe tip	Alloy C22
Probe window	Sapphire, TM [Thermo-Mechanical press-fit] (standard, no o-rings)
Probe back end	Aluminum, anodized and powder coated
Probe cable (exterior)	PVC, 80 °C Flame Retardant VW-1
Cover (flexible mounting)	Delrin
Clamp-on Reflector	Alloy C22 and PTFE
Environmental	
Operating temperature range *	-80 to 120 °C
Operating pressure range	0 to 10 barg [0 to 145 psig], standard Up to 100 barg [1450 psig], custom
Humidity range (probe back end)	0 to 95% RH
Ingress protection	IP65 and 4X
Installation	
Weight (approximate), Probe, interface unit and cables	1.45 kg [3.20 lb]

* **Note:** Probe operating temperatures below the dew point temperature of the environment require purge air, described on page 11.

Table 2. Probe specifications

Interface Unit Specifications

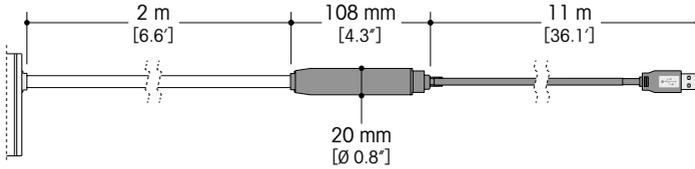


Figure 2. Interface unit dimensions (with powered USB extender)

Environmental			
Operating humidity range	0 to 95%		
Operating temperature range	0 to 40 °C		
General			
Material of construction	Aluminum, anodized		
Ingress protection	Designed to IP40		
Power (via USB 3.0 on control PC)	+5 VDC, 1.0 A (maximum)		
Power (USB powered extender)	100-240 VAC (auto-switching), 50/60 Hz, 0.3 A		
Communication			
USB cable, Fixed	1 m,	11 m	13 m (total)
USB cable, Extender (powered)	10 m, Type A, male and female		
Cable length (Probe to interface unit)	2 m		
Purge (optional)			
Air inlet on interface unit	3.18 mm [1/8 in], quick-connect		
Air tubing (supplied)	1.8 m [6 ft] of 3.18 mm [1/8 in] dia.		
Adapter, tubing to purge controller, (supplied)	6 mm to 1/8 in		

Table 3. Interface unit specifications

Site preparation for the METTLER TOLEDO ParticleView V19 system is the end user's responsibility. The following should be considered to ensure successful installation of the ParticleView V19:

Power Requirements

Verify that a power outlet is accessible in the area of intended use for the ParticleView V19. ParticleView V19 systems power and communication specifications are via the USB port on the control computer. A powered USB extender is part of the system.

Area of Intended Use

The area of intended use must provide adequate space to manipulate the probe and cable to avoid kinks in the cable. The probe back end should be located with access at eye level to view LEDs. The USB cables provide 13 meters [42.7 feet] of distance between the probe back end and the control computer.

The ParticleView V19 system is designed for indoor use. The probe back end and interface unit contain sensitive electronic components, including a precision camera that should be protected from severe environmental conditions. Direct, intense sunlight can raise the internal temperatures above operating specifications. Refer to section 3 (Technical Data) for the temperature and humidity specifications of the system along with size and weight specifications.

Air/Gas Requirements (if applicable)

To prevent condensation when operating below the dew point of the environment, ParticleView V19 probes require a source of clean, dry, and pressure-regulated instrument air or inert gas. The quality of the air or gas supply must meet the specifications of the American National Standards Institute/Instrument Society of America (ANSI/ISA) S7.0.01-1996 Quality Standard for Instrument Air. Air/gas must:

- Have a dew point at least 10 °C [50 °F] lower than the minimum temperature to which any part of the system will be exposed.
- Contain less than 1 ppm total oil or hydrocarbons
- Contain less than 1 ppm particulates at a maximum size of 3 microns
- Be free of any corrosive contaminants and flammable or toxic gases.

Air supply pressure, maximum	3.4 barg [50 psig]
Operating pressure, normal	2.0 barg [30 psig]
Operating flow rate, starting one (1) hour before use	0.5 SLPM [0.02 SCFM]

Table 4. Probe air/gas specification

4 Safety Information



The CE Mark applies only to unmodified instruments as supplied by Mettler-Toledo AutoChem, Inc. Modifications may require on-site testing for compliance verification. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



Caution—Read all safety warnings before installing or operating this equipment. Failure to follow the instructions and caution/warning statements could result in personal injury and/or product damage that could void the warranty.



Caution—Do not attempt to disconnect the ParticleView V19 probe fixed cable from the interface unit. Doing so will cause permanent damage to the probe and will void the warranty.



Caution—There are no user-serviceable parts in the system. Contact a METTLER TOLEDO Field Service Engineer (FSE) for all service needs.



WARNING—This equipment is approved for indoor use only.

Table 5. Safety cautions and warnings

Laser Classification

All standard-model ParticleView V19 instruments are in compliance with the U. S. Department of Health and Human Services (DHHS) Radiation Performance and in accordance with International Standards.

THE ParticleView V19 IS A CLASS 1 LASER PRODUCT COMPLIANT WITH
DHHS 21 CFR 1040.10 AND 1040.11
EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE 50, DATED JUNE 24, 2007.
THE ParticleView V19 IS A CLASS 1 LASER PRODUCT COMPLIANT WITH IEC 60825-1

Laser de Classe 1

Conforme à la norme 21 CFR 1040.10 et 1040.11

À l'exception des écarts conformément à l'avis Laser 50 en date du 24 Juin 2004
et conforme à la norme IEC 60825-1

5 Supplementary Documentation

An electronic ParticleView V19 Hardware Documentation Portfolio, shipped with the instrument, includes the following documents in addition to this manual:

- QuickRef: "Positioning the ParticleTrack or ParticleView Probe" (MK-PB-0050-AC)
- QuickRef: "Using the PSC Purge Controller" (MK-PB-0120-AC)

Please refer to the iC PVM user assistance for software documentation.

Check the <http://community.autochem.mt.com> site for the latest portfolio.

6 Product Installation

ParticleView V19 system installation involves connection of the USB power and communication between the interface unit and the control PC. If the optional purge controller is purchased for applications where the operating environment temperature is below dew point, a third connection to instrument-quality air is also required on the interface unit. The system connections are completed by a METTLER TOLEDO qualified Field Service Engineer. Details on the system connections are provided below should the system be relocated following the initial installation.

Due to the complex nature of multi-phase flow, proper installation is very important for successful application of inline particle and droplet measurement techniques. Installation and mounting of probe-based instruments for particle characterization should consider multiple factors including:

- Existing or planned laboratory or process equipment
- Expected ranges of process variables such as temperature, pressure, flow rates, and/or flow patterns
- Expected range of particle/droplet size and concentration
- Probe location and orientation as shown in [Figure 3](#).

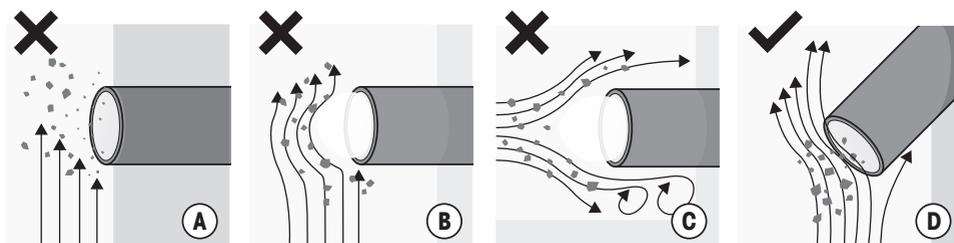


Figure 3. Implementation of a ParticleView instrument: (A) flush with wall of vessel or pipeline; (B) inserted tangentially to process flow; (C) inserted perpendicular to process flow at an elbow; and (D) inserted at optimal angle (45°) relative to process flow.

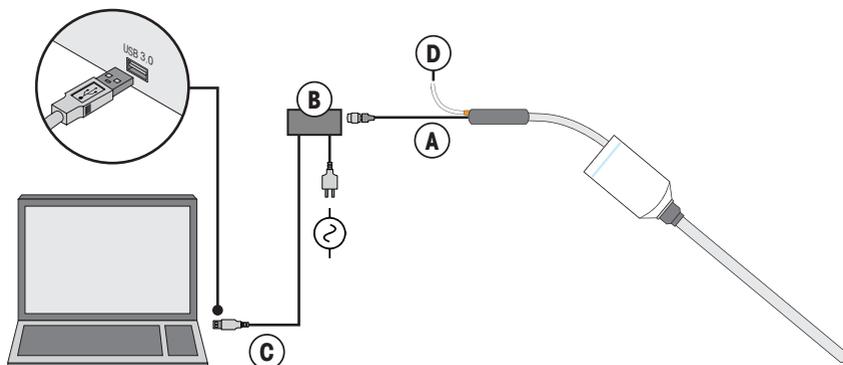


Figure 4. Instrument connections: (A) Fixed USB cable (B) Powered USB extension cable—power and communications; (C) USB to computer; (D) Air/inert gas (if applicable)

Connect USB Power and Communications (A, B, C)

The supplied power cable (B) provides power and communication to the probe.

1. Connect one end of the powered USB extension cable (B) to the fixed USB cable (A) on the ParticleView V19 interface unit (Figure 4).
2. Plug the extension cable into a power outlet. (Use of a surge protector power strip is recommended.)
3. Plug the opposite end of the USB extension cable (C) into a USB 3.0 port on the control computer. Assuming the computer is powered ON, the LED indicator on the probe back end illuminates solid blue.

Optional: Connect Air Supply (D)

When operating below the dew point temperature of the environment, purge air is required. The Purge Controller should be used to regulate the purge air flow.

1. Clean/purge all air lines and tubes before connecting to the ParticleView V19 instrument.
2. Connect the air supply to the air inlet on the purge controller (D in Figure 4). The required tubing from the air supply to the Purge Controller is user-supplied (6.35 mm [1/4-inch], rated for 120 psig, may be made of polypropylene, PVC, or nylon).
3. Connect the adapter (6 mm to 1/8 inch, supplied with the Purge Controller) to the outlet on the Purge Controller. On the outlet of the adapter (not shown), connect the supplied 3.18 mm [1/8 inch] purge tubing to the ParticleView V19 interface unit quick-connect purge inlet.
4. Adjust the purge controller pressure and set it to the pre-purge flow rate for one hour (Table 4). After the one hour pre-purge, the system is ready to run an experiment.
5. Refer to the quick reference guide for further details—"QuickRef-Using the PSC Purge Controller" (MK-PB-0120-AC).



Figure 5. Purge Controller



Figure 6. Purge exhaust

Note: The exhaust hole for the purge air is located next to the purge inlet on the interface unit (Figure 6). Take care during installation and cleaning of the system to ensure the exhaust hole is not blocked or submerged in liquid.

7 Flexible Probe Mounting Options

A common laboratory configuration is a ParticleView V19 probe mounted in a METTLER TOLEDO EasyMax™ or OptiMax™ workstation.

Lab-joint adapters are manufactured from PTFE (polytetrafluoroethylene) with O-ring seals, and are designed for the installation of ParticleView V19 probes in a range of standard laboratory glass joints on round bottomed flasks or jacketed lab reactors.

ParticleView V19 probes include the Flexible Mounting System that enables the easy attachment of industry-standard flange adapters and fittings, without permanent modification of the probe. Length reducers are an option for use with flange adapters and other flexible mounting kits to provide a practical means of decreasing the probe wetted length when a shorter insertion depth is required. This innovative design from METTLER TOLEDO allows probes with this feature to be easily moved from one installation point to another at a lower overall cost.

All installation requirements should be discussed with your METTLER TOLEDO Technology and Applications Consultant.

8 Operating Instructions

During system installation, a trained METTLER TOLEDO engineer makes all system connections and verifies the system is ready for use.

1. If required, start the pre-purge.
2. Power ON the iC PVM computer and verify the ParticleView V19 powered USB cable is connected to a USB 3.0 port on the control computer.
The ParticleView V19 is powered via the USB connection. After connected, the instrument LED will be solid blue.
3.  Launch the iC PVM software.
After launching iC PVM, the instrument LED will be pulsing green.
4. Observe the indicator LEDs on the back end of the ParticleView V19 for an indication of the system status.

Indicators	Color	LED State	Status
Power	Solid Blue	ON	Instrument is powered.
Communication	Pulsing Green	ON	Instrument is communicating with the iC PVM software and collecting images.
Error	Pulsing Red	ON	Software or hardware error. Refer to "Errors" on page 16

Table 6. ParticleView V19 LEDs

5. Once iC PVM software is launched, the probe motorized focus will automatically adjust to the home position (set to the window at the factory). A user is immediately presented with a live image.
6. Clean the probe window, install the Clamp-On Reflector, if required, and install the probe in the process to be monitored.

9 Best Practices for Routine Operation

Ensure Reliable Instrument Performance

- Follow preventative maintenance guidelines for your ParticleView instrument.
- Check probe window cleanliness as part of routine SOP.

Ensure Measurement Sensitivity by Optimizing Probe Location and Positioning

- Probe should be positioned in the process where it can obtain maximum sensitivity to changes in particle or droplet system.
- Probe must be oriented to ensure particle system flows optimally across the probe window surface.
- Probe tip must remain fully immersed to provide measurements of the particle/droplet system.
- Probe location is more critical under the following conditions:
 - Lower Rheology
 - Larger median particle dimension
 - Greater deviation between average particle shape and a sphere (more irregular particles or particle structures).
- Probe location is less critical under the following conditions:
 - Smaller difference between particle density compared to carrying solution density.
 - Higher solids concentration (or higher dispersed phase in liquids)
 - Smaller median particle dimension.
 - Smaller deviation between average particle shape and a sphere (fewer irregular particles or particle structures)

Monitor Particle Systems Reliably

- Use iC PVM as the reliable SOP for routine monitoring of particle and droplet systems in the laboratory and scale-up processes.
- Use iC PVM for further improvement and optimization of templates to be used in application-specific SOPs.

Develop a Standard Operating Procedure (SOP)

- Select or create an appropriate iC PVM template for each given application. A well-designed template will simplify the startup procedure and ensure consistent operation in each experiment.
- Define the default lighting scheme (Front or Back lighting). The factory default lighting scheme is Front lighting, which provides a “backscattered” image. In Back lighting mode, a “trans illuminated” image is provided. For Back lighting, it is recommended that the Clamp-On Reflector is used.
- Set the desired focus position. A new home position can be defined. The factory default home position is at the window. Each time an experiment is started, the probe will return to the set home position.
- Optimize the measurement interval to ensure robust repeatable measurement and to maximize sensitivity to dynamic changes in the particle system.

Save Experiment Settings as a Template—Make sure to select the right template for a specific particle or droplet system.

Check Probe Window Cleanliness—The probe window must be clean before mounting in particle or droplet system.

10 Troubleshooting

Refer to the following table and investigate the possible cause to see if the error persists. Otherwise, please contact the AutoChem [Market Support Group](#) for assistance.

NOTE: In iC PVM software, the error appears in the LIVE Experiment Toolbar and is logged in the System Events and Log page (FILE menu > Info). The control software LIVE tab and LIVE experiment toolbar change to red when an error occurs.

Tips

If this happens—	Do this—
<p>iC PVM software is unable to connect to the V19 instrument</p> <p>Probe LED flashes red. Allow a few moments for system to reestablish communications. If issues continue...</p>	<ol style="list-style-type: none"> 1. Shut down computer. 2. Disconnect V19 USB cable. 3. Reconnect V19 USB cable (verify connection to USB 3.0 port) 4. Start control computer and launch iC PVM software.
<p>Condensation is forming inside probe window</p> <p>If probe is inserted in a particle/droplet system with processing conditions below the dew point temperature, the optional Purge Controller must be used.</p> <p>NOTE: A 'High Relative Humidity' warning appears in software.</p>	<ol style="list-style-type: none"> 1. Ensure inlet air supply is according to specifications before using instrument. 2. Run the purge for at least an hour before using the system.
<p>HOME focus position is not at the window</p>	<ol style="list-style-type: none"> 1. Start an experiment in iC PVM. 2. From the LIVE ribbon Focus group, adjust the motorized focus to be at the window using a fingerprint or Kimwipe® as a reference. 3. Set this to be the HOME position.
<p>Probe LED is flashing red</p> <p>Could indicate:</p> <ul style="list-style-type: none"> • Loss of communication with iC PVM. • USB powered extender cable has become disconnected from power source (or fixed USB has become disconnected extender cable.) • Laser fuse blown • Laser power supply blown • Bad focus motor 	<ol style="list-style-type: none"> 1. Check iC PVM for reported instrument fault (FILE > Instrument) 2. If fault is loss of communication, check USB connection (A in this table) 3. Reconnect power supply to the powered USB extension cable. 4. Allow a few moments for the system to reestablish communication (bright blue LED, followed by flashing green). <p>If issue continues, please contact METTLER TOLEDO Service.</p>

Table 7. Common troubleshooting tips

FAQs

FAQ	Answer
Can I install ParticleView V19 in a hazardous location (ATEX, IECEx)?	No, the ParticleView V19 system is not certified for operation in potentially explosive atmospheres.
Can ParticleView V19 be used in a non-lab environment?	ParticleView V19 is 4X and IP65 rated, has a temperature and pressure range, along with flexible mounting options that make it suitable for use in many non-laboratory environments. ParticleView V19 is not ATEX or Class I Div 1 rated, so cannot be used in such environments.
Where do I find product documentation?	<ul style="list-style-type: none"> • A Hardware Documentation Portfolio ships with the instrument and is installed on the desktop of the control computer during initial installation. • An iC PVM software online Help system is embedded in the software. • Check the AutoChem Customer Community website for the latest product documentation.
How does focusing work?	ParticleView V19 has a motorized focus and the focal point is adjustable in the iC PVM software. There is no micrometer visible at the head of the probe—everything is internal and software controlled.
Does the probe need purging at low temperatures?	Yes. Just like other probe-based instruments, ParticleView V19 should be purged at temperatures below the dew point of the atmosphere in which the probe is located (refer to page 7).
What's the maximum distance from probe back end to control computer?	13 meters, with powered USB Extender.
Are different magnification options available?	No
How many lasers?	There are eight (8) lasers in total—four (4) Front lighting and four (4) Back lighting.
Is there an RE Reflector attachment like the one for the PVM V819?	Yes, but it has a new design, without threads. The new Reflector clamps on to make installation easier and it is included with the system.

Table 8. Common FAQs

Errors

Error Message	V19 LED	iC PVM LIVE toolbar	Description	Possible Cause
Instrument off-line	OFF	RED	<ul style="list-style-type: none"> Power to probe is lost. 	<ul style="list-style-type: none"> Check connection between the instrument fixed USB cable and the powered USB extension. Verify the power supply is connected to the powered USB extension cable and the wall outlet. If error does not clear after a few moments, disconnect and reconnect the instrument to the PC USB 3.0 port. Wait for the bright blue LED on the probe back end. Then, restart iC PVM and wait for the LED to pulse green.
Instrument off-line	RED (pulsing)	RED	<ul style="list-style-type: none"> Communication between instrument and control software is lost. Hardware watchdog timer can no longer communicate with iC PVM. USB powered extension cable has become disconnected from the power source. 	<ul style="list-style-type: none"> Check connection between powered USB extender and the control computer. If error does not clear after a few moments, disconnect and reconnect the instrument to the PC USB 3.0 port. Wait for the bright blue LED. Then, restart iC PVM and wait for the LED to pulse green.
	RED (pulsing)		<ul style="list-style-type: none"> iC PVM has stopped unexpectedly. 	<ul style="list-style-type: none"> Using Windows 'Task Manager > Processes,' shut down the iCPVM.exe process. Disconnect and reconnect the instrument to the control computer. Restart iC PVM and wait for the pulsing green LED on the probe back end.

Table 9. Troubleshooting errors

Warnings

Warning Message	V19 LED	iC PVM LIVE toolbar	Description	Possible Cause/Action
Power Supply	RED (pulsing)	Green	<ul style="list-style-type: none"> • Power to laser board is lost. • Warning displays in software. • No interruption to image collection; but ALL images will be BLACK (no light). 	Contact METTLER TOLEDO Service
Fuse blown			<ul style="list-style-type: none"> • Fuse blown on the laser board resulting in power loss. • Warning displays in software. • No interruption to image collection, but ALL images will be BLACK (no light). 	
Focus motor			<ul style="list-style-type: none"> • Motor cannot find its zero position. This can occur: <ul style="list-style-type: none"> - During instrument power up - When user sets motor to 'Go to Zero' in iC PVM • No interruption to image collection; but image quality may be compromised if image cannot be focused. 	

Warnings (continued)

Warning Message	V19 LED	iC PVM LIVE toolbar	Description	Possible Cause/Action
High pressure	GREEN (pulsing)	Green	<ul style="list-style-type: none"> • Pressure sensor in probe back end has reached 15 psig. • No interruption to image collection in iC PVM. 	<ul style="list-style-type: none"> • Verify inlet purge pressure and flow do not exceed specifications. • Ensure probe exhaust hole is not blocked (Figure 6). • If problem persists, contact METTLER TOLEDO service
High temperature			<ul style="list-style-type: none"> • Temperature sensor in probe back end has approached the 50 °C limit. Software communicates a warning at 50 °C. • No interruption to image collection, but image quality may be compromised as higher temperatures increase camera noise. 	<ul style="list-style-type: none"> • Verify environment temperature is not exceeding specifications (40 °C) • If problem persists, contact METTLER TOLEDO service.
High relative humidity			<ul style="list-style-type: none"> • Relative Humidity sensor in probe back end has approached 96% limit. Software communicates a warning at 80%. • No interruption to image collection, but image quality may be compromised as humidity can result in condensation inside probe. 	<ul style="list-style-type: none"> • Verify the purge is supplying clean, dry instrument air or Nitrogen per specifications (page 7). • Verify the inlet purge pressure and operating flow rate are set per specifications.

Table 10. Troubleshooting warnings

11 Product Maintenance

METTLER TOLEDO warrants its products against defects in materials and workmanship for twelve months from the date of installation or fifteen months from the date of shipment, whichever comes first. For details, please refer to the warranty provided with the instrument. For assistance, please email AutoChemCustomerCare@mt.com.

It is recommended that you retain the original packing materials if you need to return the ParticleTrack system. If factory service is required, your METTLER TOLEDO service engineer will issue you a Return Material Authorization (RMA) form.

There are no user-serviceable parts inside a ParticleView V19. Contact your METTLER TOLEDO Field Service Engineer for all service needs.

Schedule the following maintenance tasks:

- Clean the probe window periodically. To clean the outside window, use a medium such as water, alcohol, or acetone to clear the surface. A fine, abrasive polishing compound may be used to remove stubborn stains (0.3 micron alumina, used to polish optical surfaces is recommended). After cleaning, use a dry, clean Kimwipe® to remove cleaning solution. Probe window cleanliness can be verified in the software.
- Ensure the air/gas supply meets required standards, when using the optional purge.
- The ParticleView V19 system is designed for indoor use, so the base unit and probe back end can only be wiped clean. The wetted portion of the probe tip can be cleaned with solvent such as ethanol, IPA, or soap and water.

METTLER TOLEDO has offices around the world. Contact the Mettler-Toledo AutoChem, Inc., headquarters in the USA for technical support or service. To arrange for specific application assistance from a METTLER TOLEDO Technology and Applications Consultant, or for assistance, contact CustomerCare through the toll-free number on [page 2](#).

Recommended Maintenance

A qualified METTLER TOLEDO Field Service Engineer should perform regular Preventive Maintenance (PM) on the system. [Table 11](#) show the normal life expectancy of several component parts. Use this information for planning potential cost of ownership.

Replacement Interval	Part
Annually (included in annual PM)	Focus Motor
	Bearings
	Probe O-ring

Table 11. Replaceable parts

Relocation, Shipment, or Storage

To prevent and minimize damage to the ParticleView V19, follow the instructions below to prepare the system for relocation, shipment, or storage.

1. Close the iC PVM software application and shutdown the computer according to normal operating procedures.
2. Disconnect the power, communications, and air (if applicable) from the interface unit.
3. Disconnect the USB cable from the control computer.
4. Store the system and all components in the factory-supplied box.

12 Disposal



Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment.

If you have any questions please contact the responsible authority or the distributor from which you purchased this device.

Thank you for your contribution to environmental protection.

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