

Liquitrac[®] Scanning Threshold Particle Counter (TPC)

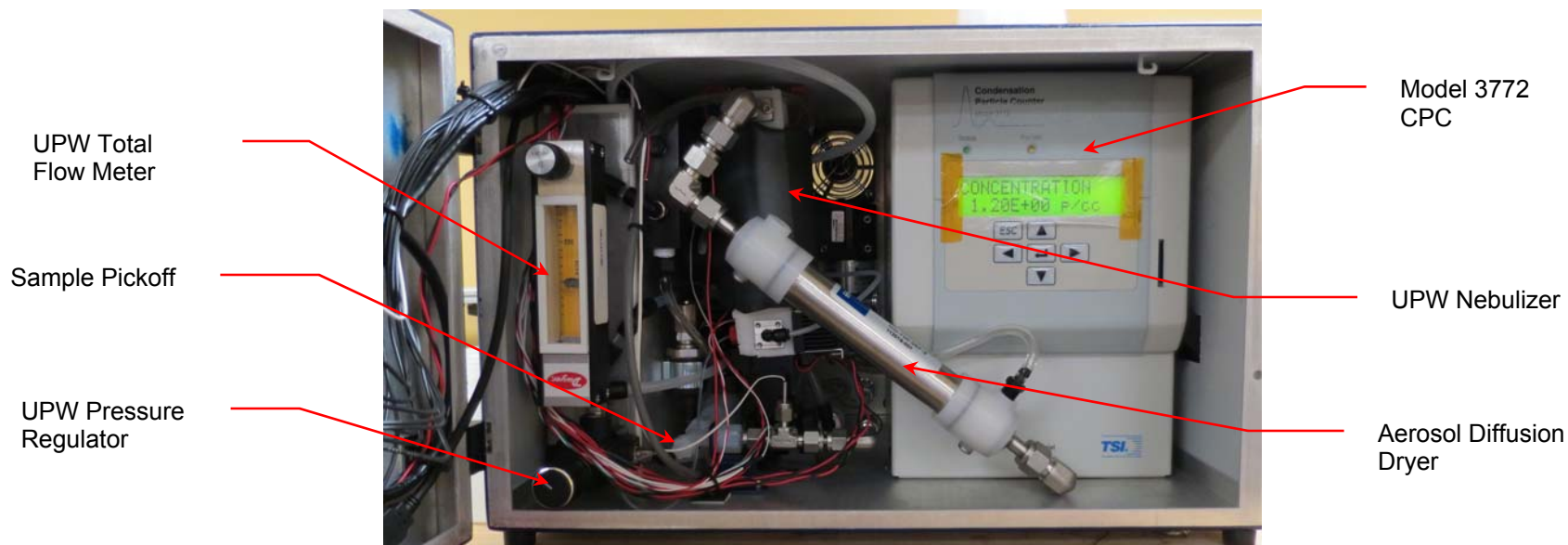
Model 9010: Quick Start Guide

System Overview

The LiquiTrak Model 9010 Scanning Threshold Particle Counter (ScanningTPC) measures the size distribution of particles suspended in ultrapure water (UPW). Particle size is measured ex situ with the particles dispersed in a gas (aerosol). To create the aerosol, UPW is sprayed into a fine mist (nebulized) and the mist is then dried to form an aerosol composed of particles that were present in the UPW and particles formed by previously Dissolved Non-volatile Residue (DNVR). The particle concentration in the aerosol is measured by a Condensation Particle Counter (CPC) where the only particles counted are those larger than a set threshold size. A size distribution is obtained by stepping through different threshold diameters. The influence of the DNVR on the true particle size and the overall distribution is mitigated by limiting the size of the droplets (larger droplets contain more residue and therefore cause a thicker particle coating or larger residue-based aerosol particles).

The Scanning TPC consists of a UPW Nebulizer and a Model 3772 CPC. UPW flows to the instrument at 100 ml/min (adjusted by the total flow meter valve) and is regulated to 14 psi (adjusted by the UPW pressure regulator). The UPW is sampled by the Nebulizer at 1-2 ml/min. The majority of the nebulizer sample is removed from the gas and is sent to waste. The nebulizer sample waste flow is monitored by a droplet counter. The UPW sample that remains in the gas phase is heated to promote evaporation of the water as well as sublimation of semi-volatile components. The aerosol is then passed through a diffusion dryer that uses a semi-permeable membrane to remove water vapor from the sample and is measured by the CPC. The threshold diameter of the CPC as well as the measured concentration is controlled and logged by a programmable logic controller (PLC) on the front panel of the instrument. The liquid particle concentration is calculated by multiplying the CPC concentration by a factory calibrated inspection volume scale factor.

Internal components are shown in the illustration below.



This Quick Start Guide is intended to be used for quick reference only.

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Warnings

- The Scanning TPC contains components that can expose you to high voltage and or heat if the instrument covers are removed. **Do not operate the equipment without the covers in place.**
- To prevent electric shocks, ensure that all electrical outlets are grounded.
- The aerosol particles created by the nebulizer may pose a health risk if inhaled. If not connected to other instrumentation, vent the aerosol output to a fume hood.

Materials and Site Requirements

Check that you have the following tools, equipment, and site requirements before you begin. Refer to the relevant user manuals for instructions about the fluidic fittings.

- Unrestricted air flow around the system components.
- Access to a suitable drain for receiving waste water.
- Cleaned, dried compressed air, or nitrogen at 50-60 psi.
- UPW supply: water pressure 30-50 psi (100 ml/min).
- An electrical power supply with 2 outlets, 115VAC to 230VAC.
- If internal pump is not used, a vacuum source which can connect to a ¼ outside diameter (OD) port fitting at 1 SLPM, < 350 mmHg.
- A ¼ in (OD) Teflon PFA tube, flared and fitted with a Flaretek nut, used to deliver high purity water at 30-50 psig, 100 ml/min.
- A ½ -inch (OD) plastic tube fitted with a Swagelok nut, used to drain waste water from the nebulizer.
- A ¼ -inch (OD) plastic tube fitted with a Swagelok nut, used to provide compressed, dry air/nitrogen.
- A 9/16 adjustable wrench.
- PFA tubing flaring tool, tube gripper, tube cutter, and heat gun.

Note: No tubing is supplied to connect the ScanningTPC to your air or water supplies.

Installation

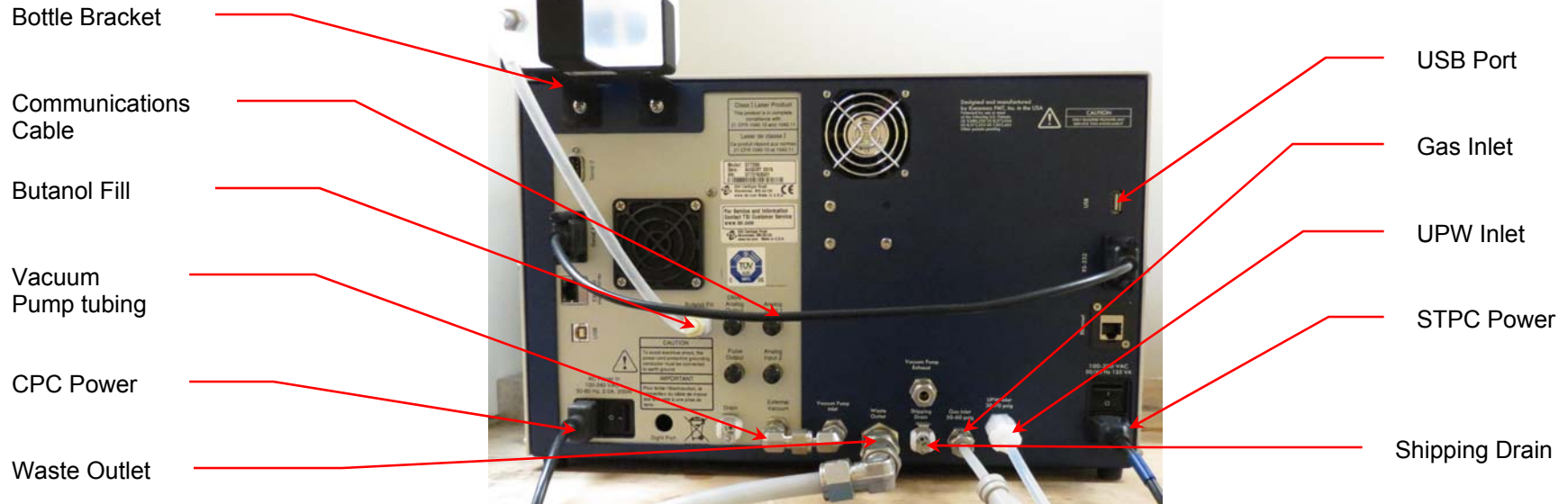
Refer to the photograph on the following page for the correct configuration of connections on the back panel.

1. Install the n-butyl alcohol bottle bracket to the rear panel using a Phillips screwdriver.
2. Connect the CPC communications cable.
3. If using the internal pump, verify the CPC vacuum tubing is in place.
4. Connect the **UPW Inlet** to your UPW supply.
5. Connect the **Gas Inlet** to your gas supply.
6. Connect the **Waste Outlet** to a drain tube and place the tube in an appropriate drain. Note: The drain tubing should pitch downwards and vent to atmosphere.
7. Add n-butyl alcohol to the bottle and connect to the **Butanol Fill** inlet.
8. Connect one power cable to the CPC power receptacle and one to the ScanningTPC power receptacle. Turn on both switches.
9. Turn on your gas supply.
10. Wait thirty minutes and then turn on your UPW supply.



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Installation (continued)



Operation

Status

Press **F1** on the front panel to see the instrument status. White values are within the preferred range; red values are outside the preferred range, yellow values indicate the settings are changing.

Status Indicators

UPW Pressure: Pressure downstream of the internal pressure regulator. Nominally set to 14 psi. This value can be adjusted using the UPW Pressure Regulator behind the instrument front panel. Note: Adjusting the UPW pressure changes the total flow into the instrument.

UPW Temperature: Temperature of the total UPW flow, measured downstream of the nebulizer sample pickoff.

UPW Nebulizer Flow: Waste flow from the nebulizer. This value is calculated by multiplying the drop rate by the factory calibrated drop volume.

Nebulizer Gas Pressure: Pressure at the gas manifold that supplies the nebulizer.

Nebulizer Temperature: Temperature reading of the nebulizer, nominally controlled to 22°C.

Status Indicators (continued)

CPC Concentration: Aerosol particle concentration read from the Model 3772 CPC.

Evaporator Temperature: Temperature reading of the aerosol exiting the heated evaporator section. Nominally controlled to 60°C.

Condenser Temperature: Temperature in the CPC growth region. Read from the Model 3772 CPC.

Colloid Particle Concentration: Liquid particle concentration, calculated using CPC concentration.

Pause Remaining: Remaining time for the pause between switching size channels.

Sample Remaining: Remaining time for a measurement on a given channel. Updates every minute.

CPC Status indicates any Model 3722 CPC faults. **Vacuum Fault** and **Butanol Low** are indicated on the screen. When **Fault** is displayed – reference the Model 3722 Operation and Service Manual for more information.

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Operation (continued)

Settings

Press **F2** on the front panel to see the instrument settings. The nebulizer temperature is set to 22°C and the evaporator temperature is set to 60°C.

Settings

Evaporator Temperature: The Evaporator Temp is set to 60°C.

Nebulizer Temperature: The nebulizer temperature is set to 22°C.

State and Size: The ScanningTPC counts 10, 15, and 20 nm particles.

When the State for a specific particle Size is Enabled, that particle size is counted. If the State is Disabled, that size particle is not counted. Press the button to toggle between the two states. Selects the scanned size channels.

Cond temp: CPC growth section control temp (sets the threshold diameter).

Pause Time: Remaining time for the pause as the instrument switches size channels.

Sample Time: Time the CPC measures particle concentration at the specified size channel.

Pump On/Off: Turns the internal vacuum pump on/off.

Additional Settings: Jumps to additional settings screen.

Set Date/Time: Allows you to set the date and time.

Configure Network: Allows you to configure the network connection.

Update Firmware: Allows you to update the firmware when a new version is received from Kanomax FMT, Inc.

Managing Data

Press **F3** on the front panel to manage data.

Data logging on: Must be on to log concentration and temperature data to internal memory.

Plotting on: Must be on to see data displayed on graphs.

Manage microSD Card Data: Manage data stored on internal card.

Manage USB Stored Data: Manage data on USB Flash drive.

Copy Data to USB: Insert a USB Flash drive into the USB port. Press **F3 > C**

Data to USB. Wait 10 secs before removing the USB jump drive.

Graph

Press **F4** on the front panel to see a trend graph displaying liquid particle concentration. (Plotting must be turned on in the Managing Data screen.)

Shutting Down and Shipping

1. Disconnect the n-butyl alcohol fitting from the **Butanol Fill** port on the back panel and then remove the bottle and bracket.
2. Run the STPC on UPW until particle count = 0 (12 hours). If UPW is not available, disconnect the Aerosol Diffusion Dryer from the CPC inlet. Reinstall after drying is complete. Turn off UPW supply.
3. Connect the provided CDA/N₂ Adapter Fitting to the UPW Inlet. Apply 30 psi of air/nitrogen for 2 hours. Note: The main air/nitrogen supply must remain connected during this step.
4. Plug the provided drain bottle into the **Shipping Drain** port and allow any water remaining in the nebulizer to drain.
5. Disconnect air/nitrogen and UPW supplies.
6. Disconnect communication cables.
7. Turn off power.
8. Replace all caps. Place in original packing and ship.

Troubleshooting

Status screen displays CPC Status **Vacuum Fault** message.

- Hold your finger lightly against the Vacuum Pump Exhaust port on the back panel to check that there is a flow.
- Check that the vacuum pump tubing is not kinked.
- Tighten (but do not over-tighten) the Swagelok fittings on the vacuum pump ports on the back panel.

Status screen displays CPC Status **Butanol low** message.

- Refill the bottle.

Status screen displays CPC Status **Fault** message.

Unlock and open the cabinet door.

- On the CPC display, use the ▼▲ arrows to select STATUS. Press Enter. Scroll through the status values and note any with an exclamation (!) mark. Refer to the Model 3772 User Manual for troubleshooting instructions for any noted faults.

System button displays **Release system key** warning message if you press and hold it down. After three seconds the controller enters a low-level firmware update mode for the display screen. Once this mode has been activated you must power-cycle the ScanningTPC to resume normal operation or you will lose configuration data. **Do not** press the System button unless you are instructed to do so by Kanomax FMT, Inc.

