

BRECHTEL

Instrument Manual

PRE-HUMIDIFIER 3110



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1 Changes

Change Description	Page	Date	Authorized By:
First Draft	N/A	9/12/2017	FJB

2 Unpacking

Each Brechtel Manufacturing Pre-Humidifier is inspected and tested in-house at Brechtel Manufacturing to ensure out of the box operation upon delivery. Prior to opening, inspect the packaging container and ShockWatch impact indicator.

Carefully open the package and inspect the instrument and accessories for broken parts, scratches, dents or other signs of damage incurred during shipping.

Notify BMI within 2 days of receiving package if the shock indicator (Fig 1) has activated and/or of any other visible damage

Verify the contents of the shipment with the unpacking instructions, which are enclosed inside the packaging and available as a PDF file.

Retain all shipping packaging, foam inserts and cushions to ensure a safe delivery should the instrument need to be returned.



Figure 1: The black lines in the bottom image indicates the package has experiences an impact.

3 Pre-Humidifier Overview

The Brechtel Manufacturing Pre-Humidifier is a simple device designed to bring a particle sample flow to a known relative humidity. The Pre-Humidifier can be implemented as a component of a suite of instruments, in particular the Model 3100 HTDMA, to explore the humidity dependence of particle size, efflorescence, deliquescence, and other properties. The unit is typically operated by controlling mixing dry and water saturated air flows inside a small metal box containing 24 inches of nafion tubing. The sample flow is drawn through the instrument by a user supplied vacuum and the RH of the flow near the sample exit can be read using the display on the chassis front panel. By changing the ratio of wet and dry air flows, the RH of the flow can be changed.

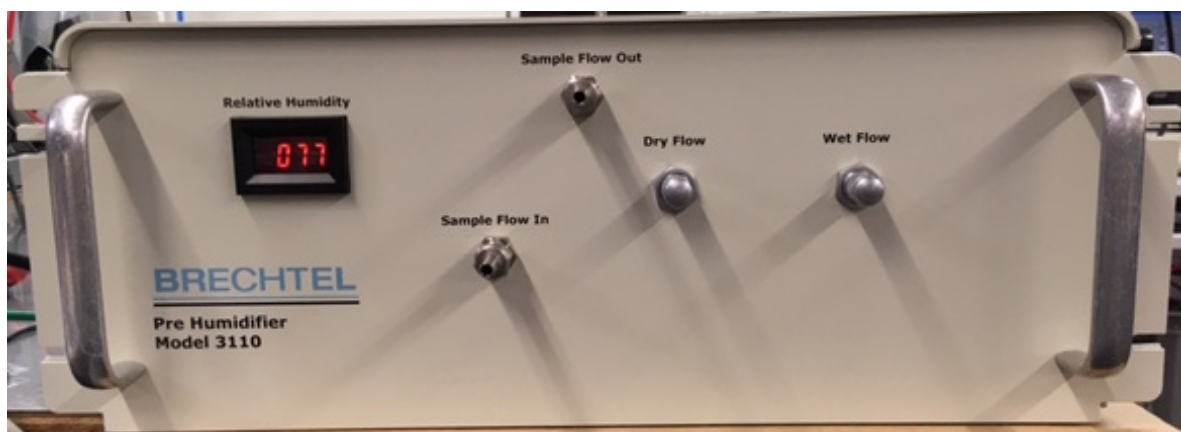


Figure 2: Front view of the Pre-Humidifier chassis.

The data from aerosol humidification studies are used to understand the air quality, climate and human health impacts of aerosols. The unit can also be used in a routine air-monitoring mode at urban and remote field sites to continuously measure the ambient aerosol efflorescence and deliquescence cycles as part of the BMI HTDMA.

4 Installation

The Brechtel Manufacturing Pre-Humidifier is operational out of the box with only minimal additional assembly. Attach the water bottle mounting bracket to the rear panel of the chassis and fill the water bottle with distilled water. Insert the vent tube into the hole in the top of the water bottle to allow proper water filling. Connect the water bottle supply tube to the 'Water Fill' panel mount connector on the rear panel so water flows into the chassis. The sections below describe how to configure the Pre-Humidifier for your specific environment.



Figure 3: View of the Pre-Humidifier Water Fill Bottle mounted to rear panel of chassis.

4.1 Power Connections

Power is supplied to the back panel of the Pre-Humidifier from a 100-240VAC supply. The unit automatically adjusts to the input AC voltage.

4.2 Instrument Rack Mounts

The Brechtel Manufacturing Pre-Humidifier is able to mount into a 19 inch instrument rack using the built-in rackmount ears on each side of the chassis.

4.3 Compressed Air Connection

The push-lock fitting on the rear of the Pre-Humidifier and is used to supply clean compressed air at between 5 and 15 psig during operation. The fitting accepts 1/4" outside diameter tubing. The total air flow rate

required varies depending on desired RH set points but typically is less than 5 lpm. A filter inside the chassis removes particles from the compressed air flow before the needle valves.



Figure 4: Rear view of the Pre-Humidifier chassis.

4.4 Sample Flow Connections

The 1/4" sample inlet and outlet fittings are made from stainless steel. Connect to the inlet and outlet fittings using electrically conductive tubing. The Pre-Humidifier is optimized to humidify sample flow rates less than 1 lpm, the higher the sample flow rate, the lower maximum RH that can be reached.

4.5 Humidification Control System

The RH control system is completely contained within the chassis and requires no user installation. Ensure the water bottle is full so water is provided to the unit.

5 Pre-Humidifier Operation

5.1 Operation Overview

Two manual needle valves are provided on the front panel to control the dry and wet air flow rates that mix together to create the desired sample flow RH. The wet flow is created using a 36" long nafion tube submerged in a water bath maintained at 40°C. Dry compressed air enters the nafion tube in the water bath and becomes saturated with water vapor.

When attempting high RH operation, be sure to tightly close the Dry Flow valve to limit the amount of dry flow supplied to the sample humidifier.

The saturated air flow from the wet bath is mixed with a dry air flow and the mixed flow is delivered to a second box housing another 24" coil of nafion. The particle sample flow is passed through the 24" long nafion. By manually adjusting the ratio of dry and wet air flow rates, different RH values can be attained. Because of the nature of the nafion tubing, the system is relatively slow response, be sure to wait several minutes after making changes to the air flow rates to determine the change in RH. An RH sensor monitors the RH of the sample flow just before the exit port on the front panel. The RH sensor reading is displayed on the front panel.

Warning: Operating the Pre-Humidifier at RH above 80% over long periods of time (days) can possibly result in water condensation inside the sample flow nafion box. To operate under dry conditions, dry air flow may be required for a substantial amount of time to evaporate any liquid condensate.

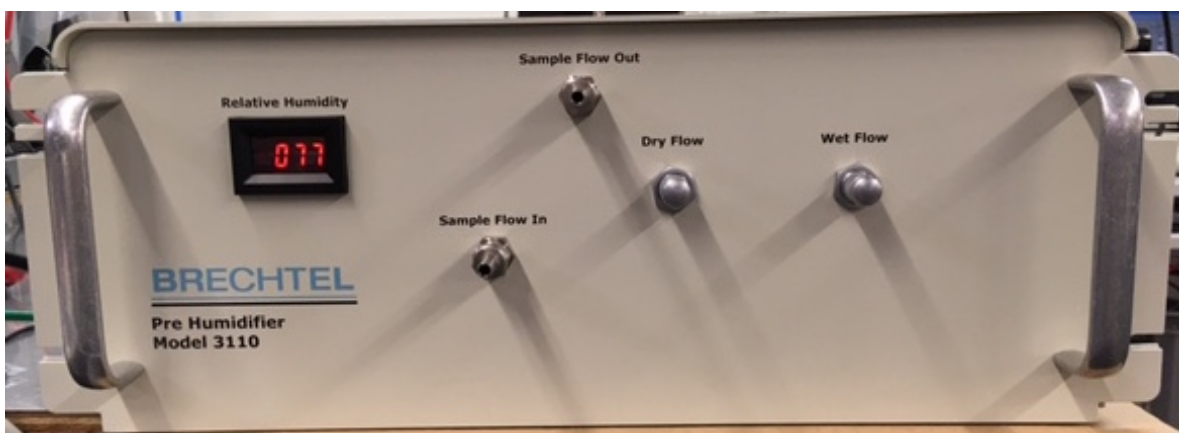


Figure 5: Front view of the Pre-Humidifier chassis.

Connect your aerosol instrument to the sample flow out port of the Pre-Humidifier. In the case of the Brechtel Model 3100 HTDMA, the Pre-Humidifier is installed between the SEMS and HSEMS so that the dry monodisperse flow from the SEMS, after the MCPC flow splitter, is attached to the Pre-Humidifier sample flow in port. The sample flow out port of the Pre-Humidifier is connected to the HSEMS sample flow in port. The RH setting of the Pre-Humidifier can be manually entered into the HSEMS AutoScheduler software. Adding the Pre-Humidifier to the HTDMA allows particle efflorescence studies to be conducted by exposing the dry SEMS-selected particles to a high RH in the Pre-Humidifier and then exposing the sample flow to a lower RH in the HSEMS.

6 Pre-Humidifier Specifications

Relative Humidity

Description	MIN	MAX	UNIT
Sample Flow	0.1	2.0	lpm
RH	20	90	%
Response Time	1	10	minutes

Power

Description	MIN	MAX	UNIT
Voltage Input	100	240	VAC
Power Input		10	Watts

Physical Dimensions

Description	MIN	UNIT
Width	19	in
Depth	12	in
Height	7	in
Weight	19	lb

7 Appendix