

# Controlling Humidity Above Ambient with the CIRAS-3 Portable Photosynthesis System

Often, the desired environment for photosynthesis measurements is for the leaf cuvette to be controlled to ambient humidity conditions outside the cuvette. If instead, it is desired to have the leaf cuvette humidity above ambient, it can be accomplished easily and safely by adding moisture-holding foam around the equilibrator element on the outside of the CIRAS-3 enclosure as shown below.

A humidity equilibrator is part of the Air Supply absorber assembly. Its normal function is to bring the gas stream back to ambient humidity after passing through the sodalime CO<sub>2</sub> absorber column which always adds humidity to the ambient gas as it removes CO<sub>2</sub>. By surrounding the equilibrator with saturated foam, paper towels, or even a kitchen sponge, the gas can be brought close to the saturation vapor pressure. Then, any of the CIRAS-3 control modes will work to control the humidity to any desired level.

Bare Equilibrator: RH = 29.2%

With Saturated Foam: RH = 89.0%



Measured Data		Humidity/Humidity Ratio		Temperature/Pressure		Flow		Turbidity		Operations	
CO <sub>2</sub>	H <sub>2</sub> O	PARi	Tamb	CI	A	Flow	Turb	Flow	Turb	Record	Z-Diff Bal
400.4	9.2	0	25.0	0.1	-0.1	300	none	4.78	0.0	Settings	Help
CO <sub>2</sub> A	H <sub>2</sub> O <sub>A</sub>	PAR <sub>A</sub>	T <sub>amb</sub>	CI	A	Flow	Turb	Flow	Turb	Controls	
400.6	9.3	11	25.0	1	0.0	300	none	4.78	0.0	Toggle View	
CO <sub>2</sub> B	H <sub>2</sub> O <sub>B</sub>	RH%	Leaf	WV	WUE	Flow	Turb	Flow	Turb	Record	
400.2	0.2	0.1	29.2	2.1	-5.0	300	none	4.78	0.0	Z-Diff Bal	
CO <sub>2</sub>	H <sub>2</sub> O	PARi	Flow	Turb	Flow	Turb	Flow	Turb	Flow	Help	
400	100	0	300	none	4.78	0.0	0.0	0.0	0.0		
H <sub>2</sub> O <sub>r</sub>	PARi										
9.2	0										
H <sub>2</sub> O <sub>a</sub>	PAR <sub>e</sub>										
9.3	11										
H <sub>2</sub> O <sub>d</sub>	RH%										
0.1	29.2										

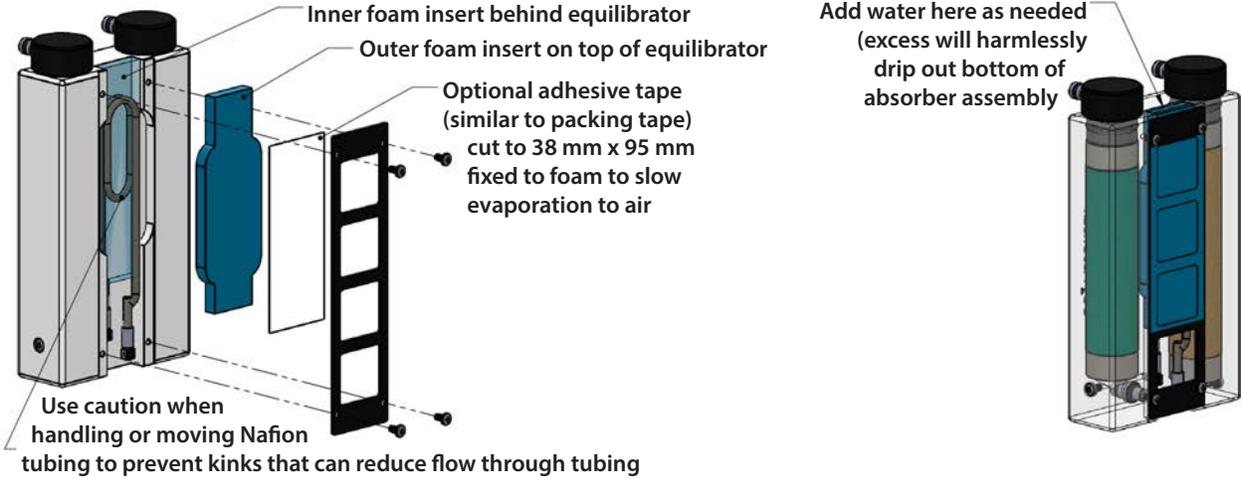
Ambient air in a dry ambient condition

Measured Data		Humidity/Humidity Ratio		Temperature/Pressure		Flow		Turbidity		Operations	
CO <sub>2</sub>	H <sub>2</sub> O	PARi	Tamb	CI	A	Flow	Turb	Flow	Turb	Record	Z-Diff Bal
400.2	33.8	0	25.4	0.2	-1.1	300	none	4.78	0.0	Settings	Help
CO <sub>2</sub> A	H <sub>2</sub> O <sub>A</sub>	PAR <sub>A</sub>	T <sub>amb</sub>	CI	A	Flow	Turb	Flow	Turb	Controls	
402.1	28.9	12	25.4	0	0.0	300	none	4.78	0.0	Toggle View	
CO <sub>2</sub> B	H <sub>2</sub> O <sub>B</sub>	RH%	Leaf	WV	WUE	Flow	Turb	Flow	Turb	Record	
400	-4.9	89.0	24.4	0.2	0.0	300	none	4.78	0.0	Z-Diff Bal	
CO <sub>2</sub>	H <sub>2</sub> O	PARi	Flow	Turb	Flow	Turb	Flow	Turb	Flow	Help	
400	100	0	300	none	4.78	0.0	0.0	0.0	0.0		
H <sub>2</sub> O <sub>r</sub>	PARi										
33.8	0										
H <sub>2</sub> O <sub>a</sub>	PAR <sub>e</sub>										
28.9	12										
H <sub>2</sub> O <sub>d</sub>	RH%										
-4.9	89.0										

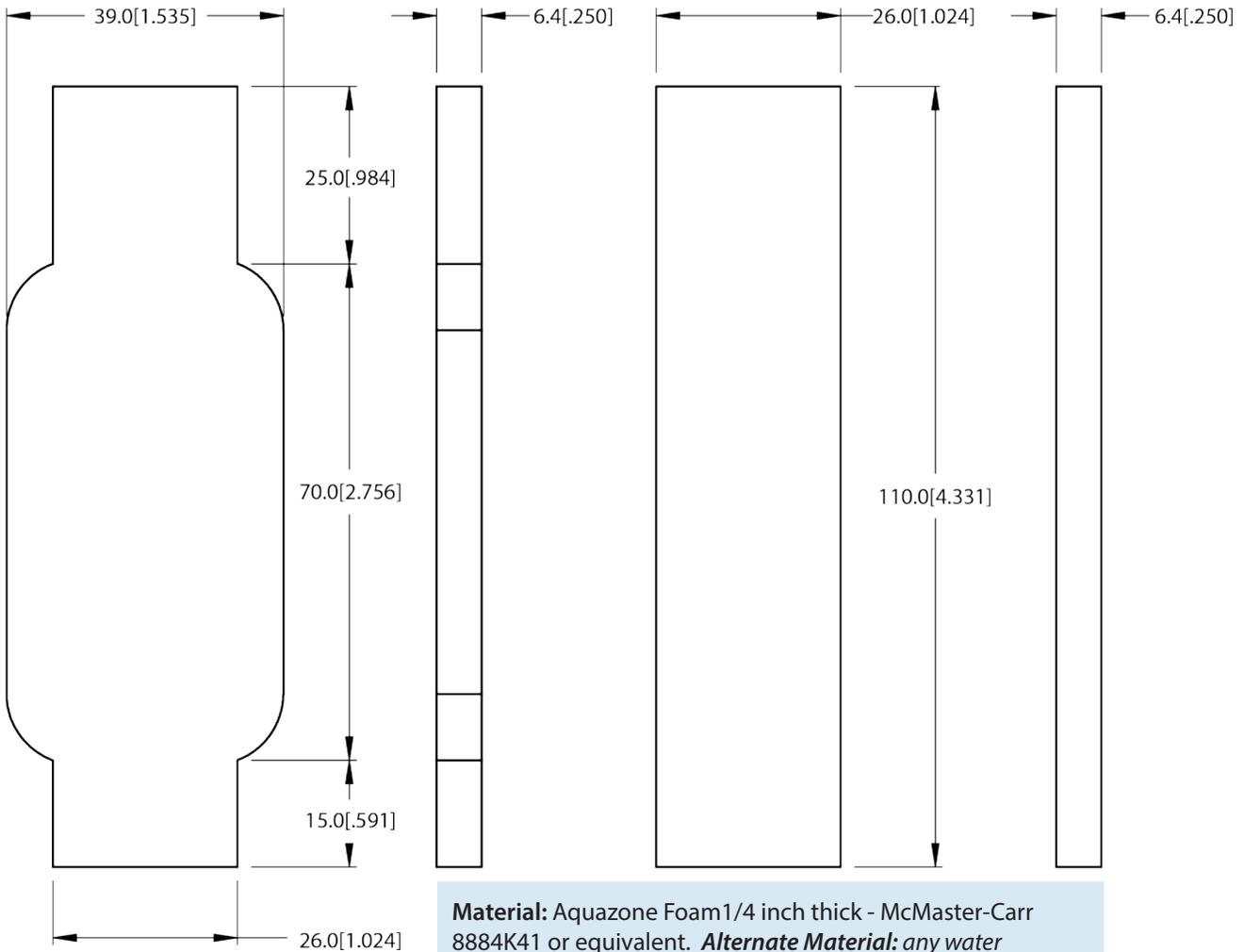
Elevated humidity condition with the equilibrator in saturated foam in the same dry ambient condition

The drawing at the end of this application note shows the size of two foam inserts that can be installed into the absorber assembly and surround the equilibrator Nafion tubing. Liquid water can be added to the top of the equilibrator while the CIRAS-3 is in operation and running. There is no danger of getting liquid water into the CIRAS-3 internals due to the function of the Nafion tubing. Excess water can harmlessly drip out the bottom of the absorber assembly without concern.

## Foam Inserts Assembly into Absorber



## Foam Inserts for Absorber mm[in]



**Material:** Aquazone Foam 1/4 inch thick - McMaster-Carr 8884K41 or equivalent. **Alternate Material:** any water absorbing foam or kitchen sponge.



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