550 N. University Ave.
Carbondale, IL 62901 USA
+1.618.529.7423
info@emriver.com
emriver.com

Emflume1 Use and Care Manual

Table of Contents

550 N. University Ave.
Carbondale, IL 62901 USA
+1.618.529.7423
info@emriver.com
emriver.com

1 Introduction

This manual describes the safe use of your Emflume1 river processes model. It is crucial to follow safety rules and instructions provided in this manual. Operating the model without assembling and supporting it properly could be dangerous.

You must read, understand, and abide by all the instructions and warnings in this manual to avoid damage to the model or personal injuries. Updates to this manual and other support for the Emflume1 can be found at http://www.emriver.com or lrrd.blogspot.com. Please contact us for additional support if your question cannot be answered online.

1.1 Basic specifications

- Small and portable; fits on a desktop for hands-on interaction
- Efficient (requires only 110 watts) and quiet ducted propeller design
- Dry weight: 65 pounds (29 kg)
- Recirculates up to 6 gallons (23 liters) of water (and media)
- Working area: 3.7” W x 6”D x 22”L (95mm x 152mm x 559mm)
- Reservoir: 5.8” W x 7.5”D x 37”L (147mm x 190mm x 940mm)
- Allows the working section to tilt over 4% of slope in positive or negative direction

1.2 Included materials

- Use and Care Manual
- 15 pounds (6.8 kg) Emriver color-coded modeling sediment
- Pitot tube
- Hydraulic shapes
    - Assorted weirs and culverts
    - Additional materials for custom hydraulic shapes

550 N. University Ave.
Carbondale, IL 62901 USA
+1.618.529.7423
info@emriver.com
emriver.com

2 Safety

YOU MUST READ AND UNDERSTAND THESE WARNINGS BEFORE USING THE EMFLUME1

- NEVER use any lithic materials in the Emflume1. Lithic media, e.g. quartz sand, will destroy the Emflume1. Use only the plastic modeling media provided with the Emflume1. NEVER use alcohol-based solvents or cleaners, including Windex. Use only mild soap/detergents and water to clean the walls.
- Use only water in the Emflume1. Small amounts of water-diluted food coloring may be used. Do not use any other liquids, especially flammable liquids.
- Never run the motor without water in the reservoir. Running the shaft dry will destroy the Emflume1.
- Keep debris out of the propeller; small nuts, bolts, etc. can damage it if ingested. Immediately stop the motor and retrieve any such objects dropped into the flume.
- Do not reach into the propeller shaft or the intake duct while the Emflume1 is turned on. Moving parts can cause serious physical injury.
- Be sure that foam inserts used in the flume are the correct width. They should be wide enough to stay in place from friction, but not so wide that they stress and crack the flume walls (see page 9 for further instruction). Width varies depending on the density of the material used. Only use soft closed-cell foam to make inserts for the flume. Do not insert any rigid material into the flume working section.
- Check all hardware and fittings on the Emflume1 before each use to be sure they are secure.
- Always set the Emflume1 on a level surface.
- Never fill the Emflume1 reservoir with more than 6 gallons (23 liters) of water.
- Use only the parts provided with the Emflume1. Be certain to connect the power supply to a properly grounded outlet. Always use the Ground Fault Circuit Interrupter provided with your Emflume1 (applies to USA customers only).
- The Emflume1 should only be used for its intended purpose as stated herein.
- If any part of the Emflume1 is damaged, if you have doubts about the electrical or structural safety of the model, or you do not understand these instructions, do not use this flume.

550 N. University Ave.
Carbondale, IL 62901 USA
+1.618.529.7423
info@emriver.com
emriver.com

3 Emflume1 Major Components and their Functions

Major components of the Emflume1 are depicted in Figure 3-1 below. Knowing each part and understanding of their functions is crucial to utilize and take care the Emflume1.

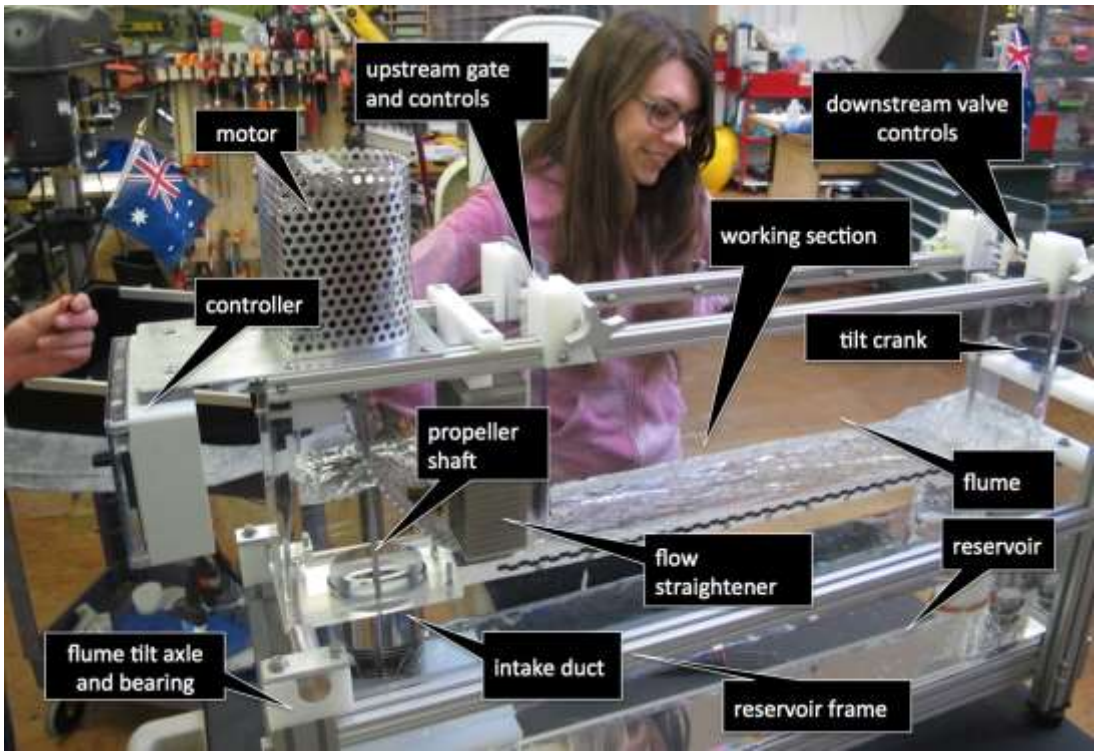

Figure 3-1 Major components of the Emflume1.

3.1 Structural support

The aluminum reservoir frame supports the reservoir and the working section of the flume (Figure 3-2).

Figure 3-2 Aluminum reservoir frame

3.2 Slope control

At the upstream end, two plastic bearings support a large axle that allows the flume to tilt. At the flume's downstream end, the tilt crank is connected to an Acme screw; this is how the flume's slope is controlled. A scale on the downstream end of the support frame shows the slope in degree and percent (Figure 3-3).

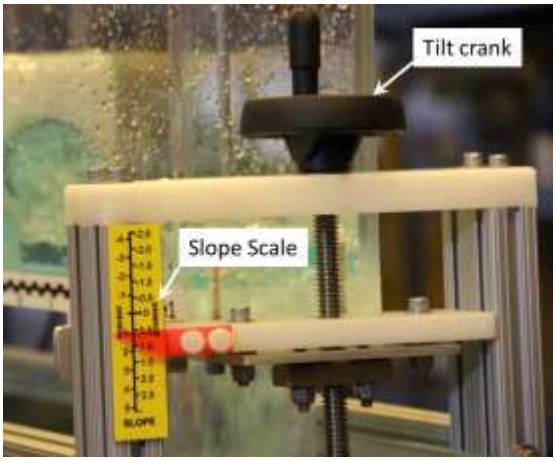

Figure 3-3 Slope control features

3.3 Flow control

A 24-volt switching power supply powers the Emflume1, which plugs into the controller at the upstream end of the flume. The controller plugs into the motor. The controller controls the speed of the motor, and thus, the flow rate in the flume (Figure 3-4).

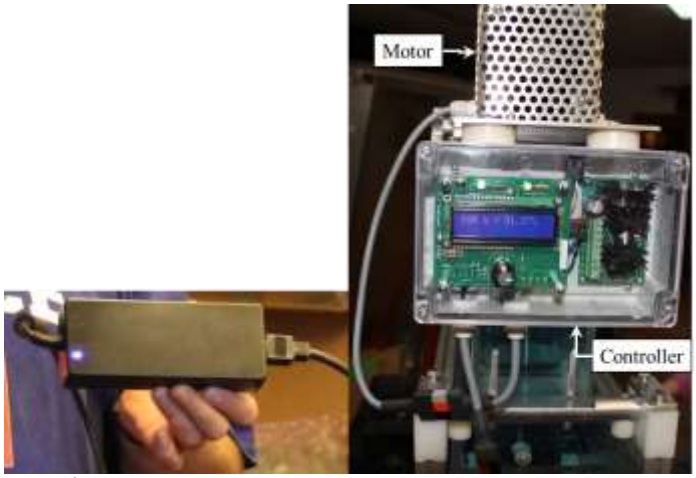

Figure 3-4 Power supply adapter, flow controller and motor

The controller takes 24-volts DC current and produces a square wave. Turning the knob on the controller varies speed from zero to maximum, which is about 2,500 rpm. The LCD readout on the controller provides the PWM value of the square wave, roughly analogous to percent of total power.

550 N. University Ave.
Carbondale, IL 62901 USA
+1.618.529.7423
info@emriver.com
emriver.com

The motor drives the propeller shaft (also pictured in Figure 3-5). The propeller pumps water from the reservoir upward through the intake duct and flow straightener, and into the flume working section.

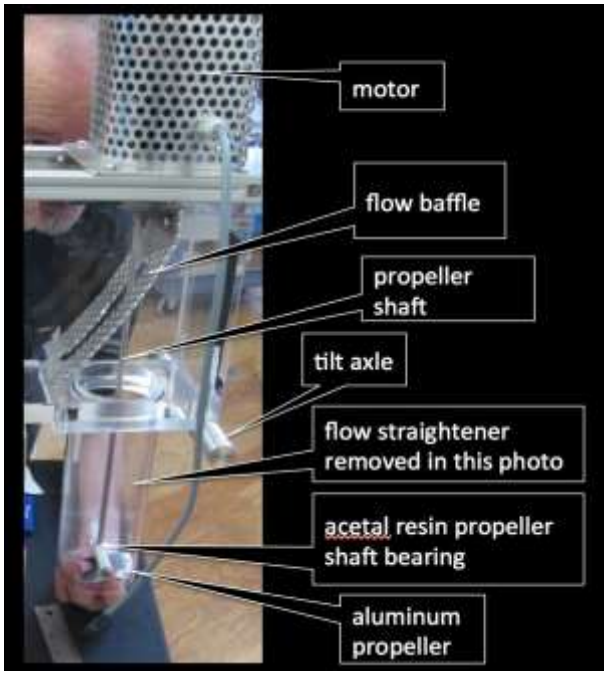

Figure 3-5 Emflume1 motor and ducted propeller (The working section is shown removed from the reservoir, and the duct flow straightener is removed for clarity).

An acetal plastic bearing holds the propeller shaft. Water lubricates and cools the bearing. ***Never run the motor without water in the reservoir.***

3.4 Flow Straightener

The flow straightener in the intake duct prevents vortices from forming in the duct from the propeller's rotation. As flow leaves the duct, the intake baffle reduces turbulence. Flow then travels through another flow straightener and the upstream control gate (Figure 3-6).

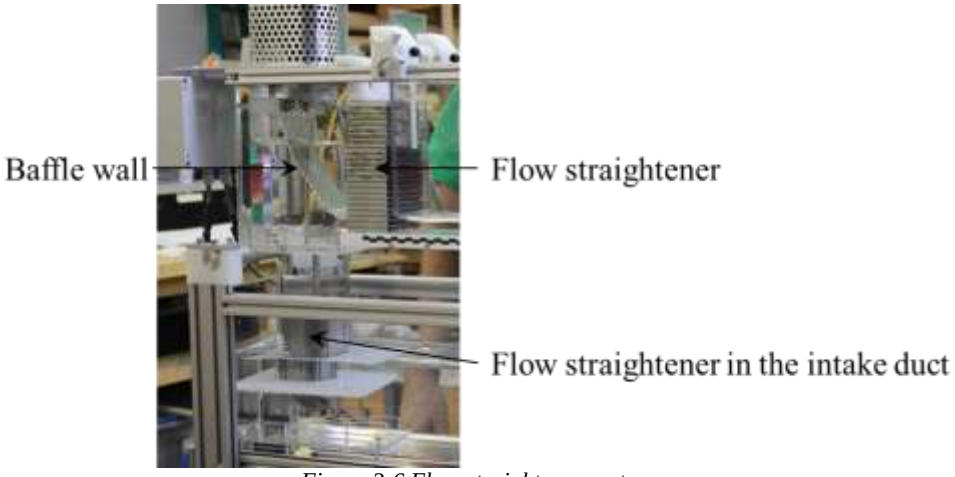

Figure 3-6 Flow straightener system

550 N. University Ave.
Carbondale, IL 62901 USA
+1.618.529.7423
info@emriver.com
emriver.com

3.5 Control gates/valves

The upstream control gate is used to restrict flow as necessary to produce desired conditions in the working section of the flume.

The exit duct holds a valve plate controlled by the knobs above it. Raising and lowering this plate controls flow depth and other characteristics in the working section. The two black screws on the gate axle bearings are used to adjust friction on the rod connected to the knobs. Without some friction, the plate may not stay in the up position.

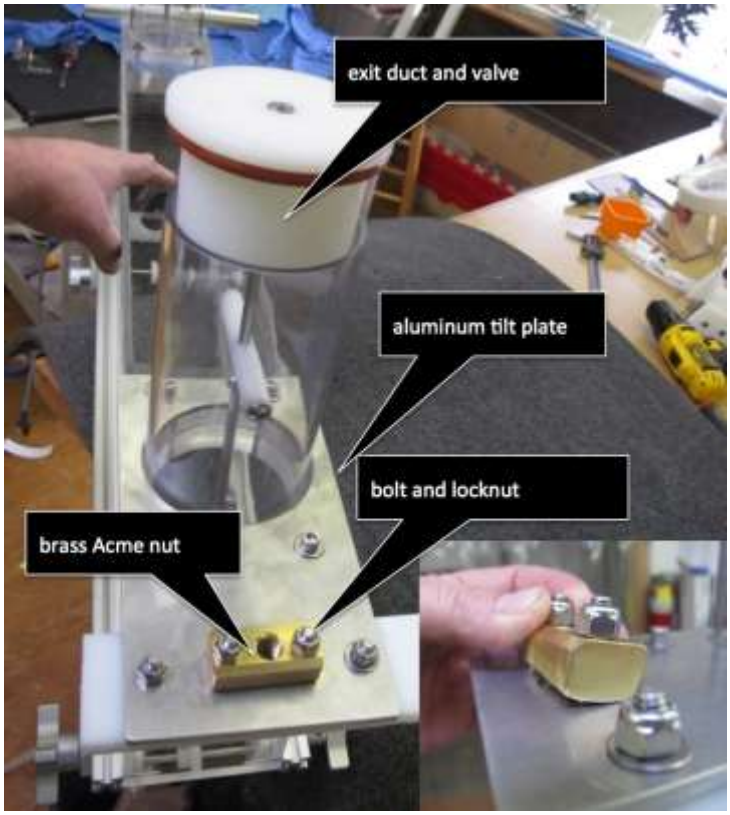

Figure 3-7 Underside of the downstream end of the Emflume1. The brass Acme nut is threaded onto the tilt screw (not shown). ***Do not alter the tightness of the bolts attaching this nut to the aluminum plate. T****hey are secured by locknuts and intentionally left loose to allow for up and down movement of the flume using the tilt crank.*

550 N. University Ave.
Carbondale, IL 62901 USA
+1.618.529.7423
info@emriver.com
emriver.com

4 Setup and Use Instructions

4.1 Fill and drain the reservoir

Fill the reservoir with six gallons of water (water level should be within about 3cm of the reservoir's top). Be sure the drain valve on the underside of the reservoir is in the closed position. The valve is in the closed position when the grey handle is rotated counterclockwise, placing it under the reservoir, parallel to the side of the reservoir frame.

Drain the reservoir by turning the handle on the drain valve a quarter turn clockwise, into the open position. The valve is in open position when the handle is perpendicular to the side of the reservoir frame. A screen in the drain prevents plastic media from leaving the Emflume1 reservoir.

4.1.1 Modeling with plastic media

Use of plastic modeling media in the Emflume1 is optional. To use the media, add small amounts until you get the results you want. You may have to drain some water from the reservoir as the media displaces it, or the reservoir may overflow.

4.2 Power the flume

The Emflume1 is powered by a 24-volt switching power supply. This power supply will automatically shut down if it detects a short circuit. Always use a Ground Fault Circuit Interrupter-equipped outlet to power the flume. The power supply is compatible with wall outlets worldwide. See the label on the power supply for more information.

Emflume1 system connectors are color-coded. Snap the color-coded Anderson connectors together to connect power. Connect the Emflume1 motor and the flow controller via the black, orange and gray connectors. Connect the power supply and the flow controller via the black and red plastic connectors. If you ordered a velocimeter, connect it to the controller via the purple, blue and white connectors.

4.3 Flow controller

The flow controller controls speed of the motor, and thus the flow rate in the flume. The controller takes 24-volts DC current and produces a square wave.

Turning the knob varies speed from zero to maximum, about 2,500 rpm. The motor is very powerful and is able to produce flow greater than the flume can handle, so please be careful when adjusting flow.

The LCD readout on the controller gives the PWM value of the square wave, roughly analogous to percent of total power.

Pushing the control knob at any time shuts the motor off.

550 N. University Ave.
Carbondale, IL 62901 USA
+1.618.529.7423
info@emriver.com
emriver.com

4.4 Upstream control gate

The upstream control gate is used to restrict flow as necessary to produce desired conditions in the working section of the flume. The gate can be used to restrict flow and produce shallow, high velocity, critical flow conditions, especially at higher flow rates. Turn the aluminum knobs above the gate to adjust its height.

Don't lower the upstream control gate fully. Lowering it fully may create overflow and flood the Emflume1.

4.5 Working section and Inserts

Various inserts can be used in the working section of the flume to study fluid mechanics and sediment transport. Some inserts are provided with the Emflume1, including a sharp-crested weir, flat-topped weir, and a weir (or bridge crossing) with a culvert through it.

A precut section of closed-cell foam is also included with the Emflume1. Use a bandsaw or any other cutting tool to cut the foam into any shape you would like.

Foam inserts must be the correct width. This width will depend on the density of the material, and you will have to experiment a bit. They should be just wide enough for friction to hold them in place, but not so wide that they stress the sides of the flume. If shapes are too wide, they will crack the walls of the flume. The precut shapes included with your Emflume1 will give you an idea of how tightly inserts should fit.

Only use soft closed-cell foam to make inserts for the flume. Do not insert any rigid material into the flume working section.

4.6 Exit duct and control valve

The exit duct holds a valve plate controlled by the small aluminum knobs above it. Raising and lowering this valve plate controls flow depth and velocity in the working section of the flume.

The two black screws on the gate axle bearings are used to adjust friction on the rod connected to the knobs. Some friction is needed to hold the valve plate in the up position as there is considerable downward force when flow is high. Use a screwdriver to tighten the screws if the axle slips.

4.7 Adjust slope

Turn the black crank at the downstream end of the flume to adjust the slope of the working section of the flume. A scale on the end of the support frame shows the slope.

This scale should be calibrated when your Emflume1 arrives, but it can be adjusted or recalibrated. To calibrate the slope scale, center the bubble in the spirit level, and gently slide the scale so that it reads zero.

550 N. University Ave.
Carbondale, IL 62901 USA
+1.618.529.7423
info@emriver.com
emriver.com

4.8 Drain and store the Emflume1

Drain the reservoir after each use! A biofilm will form inside if you don't, and the life of metal parts will be shortened. These biofilms can be persistent, ugly, and very difficult to remove. Do not leave standing water in the flume. NEVER use alcohol-based solvents or cleaners, including Windex. Use only mild soap/detergents and water to clean the walls.

For cleaning and maintenance, the working section of the flume can be tilted to one side or removed completely for easier access to the reservoir.

To tilt the working section to one side without removing it completely, remove the thumbscrews (See Figure 4-1) on the tilt axle bearings, and turn the aluminum plates aside to free the tilt axle. Flip the working section toward the downstream end of the flume.

Figure 4-1 upstream thumb screw and downstream tilt

Removing the flume from the reservoir and frame completely requires two people.

Remove the tilt control knob by turning it counterclockwise until it is freed from the tilt nut. Lift it out, being careful to retain the bearing that the knob normally sits on.

Remove the thumbscrews on the tilt axle bearings, and turn the aluminum plates 180 degrees to free the tilt axle. Lift up the tilt axle end of the flume a few inches. Then move the flume sideways a few inches, towards the tilt axle end. You may then lift the flume up and away from the reservoir and frame. Carefully place the flume on several layers of towels or other soft material.