PASPort

Flow Rate Sensor

PS-2130

Sensor Specifications:	
Sensor Range:	Flow Rate: 0.3 to 13 ft./sec. Temperature: -3° to 42°C
Accuracy:	0.1 ft./sec
Pulse frequency:	8.62 pulses/linear foot
Unit options:	meters/sec; feet/sec; total pulses
Probe length:	3 to 7 ft. with telescoping tube (Probe is 7 feet when fully expanded.)
Minimum depth:	1.5 in. (3.8 cm)

Flow Rate Quick Start

The PS-2130 Flow Rate Sensor measures the flow rate and temperature of moving water.

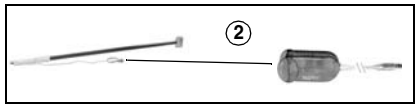
Additional Equipment Needed

- PASPORT™ interface (Xplorer, Power Link, etc.) with USB-compatible computer
- EZscreen or DataStudio® software (version 1.9 or later)

Equipment Setup

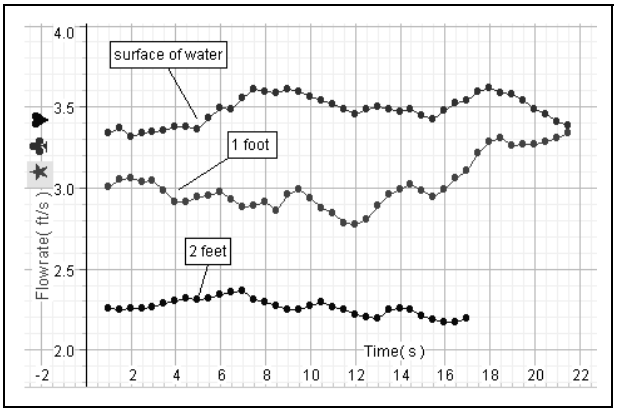
① Connect the PASPORT interface to a USB port on your computer or to a USB hub.

② Connect the Flow Rate Sensor to the PASPORT interface. (If using an Xplorer in the classroom, connect the Xplorer cable to your computer.)



③ The software launches when it detects a PASPORT sensor. Launch DataStudio.

Measuring the Velocity (Flow Rate) of Water in a Stream



DataStudio/DS Lite Tasks:	Procedure (Optional):
View the flow rate measurement:	In the Data list, drag the **Flow Rate icon** ( ) to an open display.
Change measurement units:	Click the **Setup** button (Setup) to open the PASPORT Experiment Setup window. Scroll to the Flow Rate box, and click in the box of the units you wish to change.
Scale to fit the data:	Click the **Scale-to-Fit** ( ) button on the Graph display.
Change the sample rate:	In the PASPORT Setup window, scroll to the Flow Rate box. Click on the down arrow to select the desired unit. Click the **Plus/Minus** buttons to increase/decrease the value.
View data statistics:	On the Graph display toolbar, click the **Statistics** button (Σ) to view the minimum, maximum, and mean. Use the pull-down menu to turn statistics on or off.

Activity: Measuring Flow Rate and Temperature in a Stream

Equipment required: Flow Rate Sensor (PS-2130), PS-2000 Xplorer, pad of paper, pencil

Note: The Flow Rate Sensor is factory calibrated and is not set up for user calibration. The propeller produces 2 pulses per revolution. In DataStudio, you can simultaneously view flow rate and temperature.

1. Plug the Flow Rate Sensor into a PASPORT Xplorer. (**Note:** Ensure the Xplorer has functional batteries.)
2. Insert the propeller housing about 2 inches below the water of a moving stream. Hold the propeller housing steady.
3. On the Xplorer, click the **Start** button to take a reading.
4. On a piece of paper, draw a diagram of the stream and shoreline. On the stream diagram, mark the point where you took the measurement. Next to the point, record the flow rate and temperature readings displayed on Xplorer.
5. Repeat steps 2-4 at several locations and/or depths in a stream or creek: **a)** near the shore at 0.5 foot **b)** midstream at 0.5 foot **c)** midstream at 1 foot **d)** midstream at 2 feet **e)** midstream at 3 feet.
6. Compare the flow rate and temperature at the different locations. Is the flow rate higher midstream or near the shore? What effect might depth have on the flow rate and temperature?

Figure 1: Taking Flow Rate Measurements from a Stream

Flow Rate Sensor Safety Tips

WARNING: When using the Flow Rate Sensor outdoors, follow standard water and outdoor safety precautions. The Flow Rate Sensor is recommended for use in streams (avoid rivers or turbulent waters). Always inform students of potential hazardous conditions in the area. Do not use the sensor in high winds, adverse weather or avalanche conditions, near potential land or mudslides, or when standing on unstable ground. Before using the sensor, survey the area. When inserting the Flow Rate Sensor into water, stand on stable ground. Keep the Flow Rate Sensor away from water that has lots of debris or potential obstacles. If the propeller or sensor becomes lodged in a high velocity current or near a drop off, do not attempt to remove the sensor. In high risk situations, only allow a water patrol officer or public safety official to remove the sensor.

Measuring Flow Rate

Note: Before taking measurements, please read the "Flow Rate Sensor Safety Tips" and "Flow Rate Sensor Usage Tips" on this card."

1. Plug the cable of the Flow Rate Sensor into a PASPORT Xplorer or other PASPORT interface (if using the sensor in the classroom).
2. (Optional): Insert the handle of the Flow Rate Sensor into a body of water. Using the measurement markings on the handle, record the depth of the water (in meters).
3. In Xplorer, select the units (ft./second or meters/second).
4. To begin recording the flow rate and temperature, push the **Start** button on the Xplorer (or other PASPORT interface).

Using the Flow Rate Sensor to Determine Total Water Output

Use the equation, *output = average flow rate x area* to determine the total water output in a stream bed.

Procedure:

1. With a measuring tape or other device, measure the width of the stream bed. Record the stream width (in meters) on a piece of paper.
2. With the Flow Sensor measurement scale, take depth measurements (in meters) at equally spaced intervals across the stream. (For an accurate depth measurement, submerge the sensor until the propeller housing rests on the bottom of the stream bed.) Keep the pole vertical. Record each depth measurement on a piece of paper.
3. With the Flow Rate Sensor connected to a PASPORT interface, take a flow rate measurement (in m/s) for each of the intervals. (Be sure to take a separate data run for each measurement.)
4. Use the results obtained to calculate the total water output.

Flow Rate Sensor Usage Tips

- Always hold the pole vertical and keep the propeller in the direction of the current flow, facing upstream.
- For higher water velocities (around 1 m/s), a sample rate of 5 samples/second is recommended.
- When taking a reading, keep the handle steady.
- If the flow rate reading suddenly fall to zero midstream, check the propeller for debris. When sand or other particles become lodged in the propeller, the propeller stops turning and the reading drops to zero.
- Erratic readings may occur with turbulent water flow. If measuring from a stream or creek, keep the housing in a stable position, away from rocks and turbulence. If measuring in low depths, you can rest the housing on the stream bed for a more stable reading.
- Do not connect the propeller housing to pipes or other tubing.
- Store the sensor in a dry environment to avoid corrosion. If necessary, periodically lubricate the propeller with silicon oil.
- If using the Flow Rate Sensor from a boat, tether the boat. Boat movement may interfere with an accurate flow rate measurement.

Suggested Flow Rate Applications

- Measuring flow rate and temperature at different depths in a stream or creek
- Comparing the characteristics of different streams
- Determining sediment transport for a stream or other body of water
- Measuring flow rate from a dam

Estimating Total Water Output:

1. Calculate the cross-sectional area of the stream: Multiply each interval width by each depth you measured to calculate the area for each interval; then add the areas for each of the intervals to obtain the total cross-sectional area of the stream. (Note: The more intervals you use, the closer your approximation of the area will be to the actual area.)
2. Connect the PASPORT Xplorer to your computer. Open DataStudio and retrieve your flow rate data for each of the intervals. Average the flow rate recorded for each of the intervals.
3. To determine the total water output for a given flow rate, multiply the *average flow rate by the total cross-sectional area* of the stream bed.

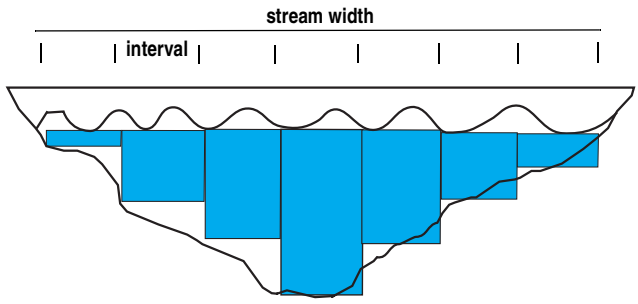


Figure 2: Measuring the cross-sectional area of a stream bed