Pairing Digital Flow Sensors with the Hach AS950 Automatic Sampler

By Jim Caruso, Application Development Manager, Hach

Introduction

When the Hach® AS950 Automatic Sampler launched in 2015, we were excited to offer the option to connect digital flow sensors to the controller. Digital flow sensors can be used for collecting flow proportional samples, as well as triggering the start or end of sampling programs with setpoint conditions. The flow sensors that the AS950 is compatible with are the US9001 downlooking ultrasonic sensor,[1] and the submerged pressure area velocity (sub-AV) sensor.

Benefits of digital flow sensors:

- Collect samples that better represent your flow stream with the ability to automatically adjust the volume per sample or the interval between samples proportionally to flow.
- Start sample programs based on flow parameter setpoints like high level or flow.
- One instrument in a compact package – ideal for tight installation locations like manholes.
- One power source – one battery or one power supply.
- Lower cost to purchase compared to separate flow and sampler instruments.
- All your data in one file – sample data and flow data together for streamlined report generation.

Hach AS950 Portable Sampler

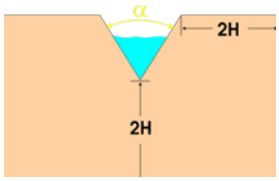


Figure 1: V-notch weir

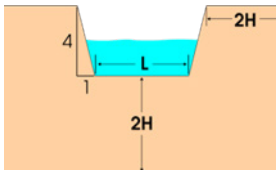


Figure 2: Trapezoidal weir

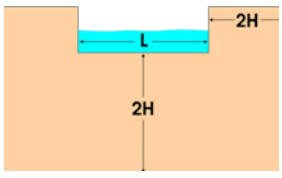


Figure 3: Rectangular weir

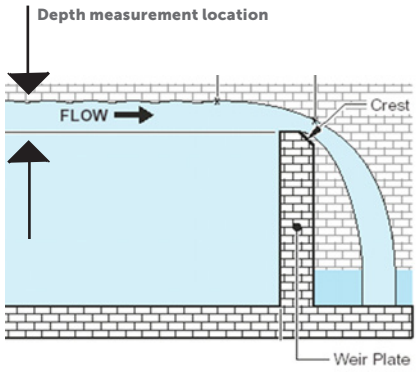


Figure 4: Weir side view

Application scenarios

To select the best flow sensor for the application, we need to know some specifics about the installation location. Flow can be broken down into two categories: closed pipe (pressurized), and open channel (free flowing, gravity driven). Hach offers sensors for open channel flow (we can sample from both). The open channel category can be broken down into three sub-categories: hydraulic structure (flumes and weirs), mathematical (Manning's Equation), and area velocity (AV).

Weirs

A known head (depth) to discharge relationship has been determined for each weir geometry and therefore only the measurement of the head above the crest needs be collected to determine flow.

[1] *US9001B ballast and US9003 in-pipe also available*

Flumes

A known head (depth) to discharge relationship has been determined for each flume type and size, and therefore only the measurement of the head in the appropriate location needs to be collected to determine flow.

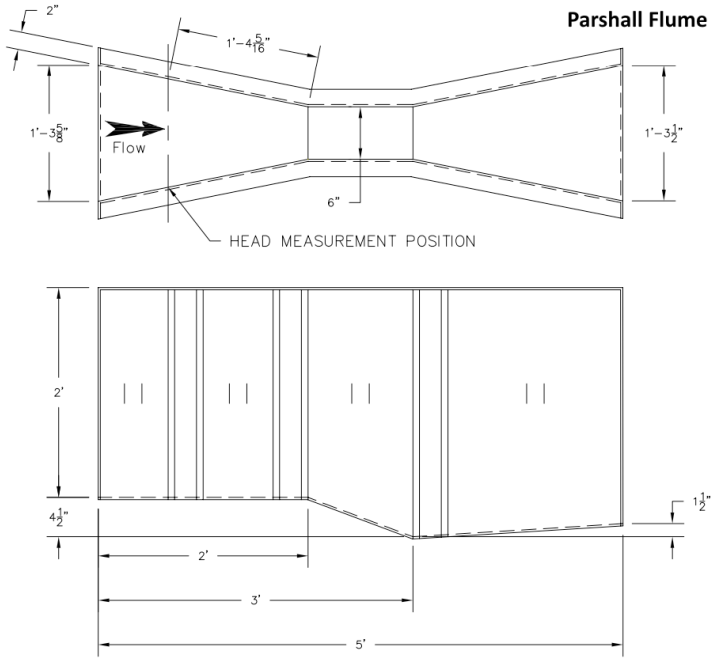


Figure 5: Parshall flume

Parshall flume installation

Manning's Equation

- The Manning Equation is a method of estimating flow rates in open channel flow applications that exhibit good hydraulic characteristics (laminar flow) and where surcharge is not likely.
- Flow rates are calculated using a level input to determine wetted area.
- Slope and the "roughness coefficient" are constants specific to each application.

$$Flow = \frac{1.0}{n} * \frac{A^{\frac{5}{3}} S^{\frac{1}{2}}}{P^{\frac{2}{3}}}$$

Key
Flow = flow rate
A = cross sectional area
P = perimeter
N = roughness coefficient
S = slope

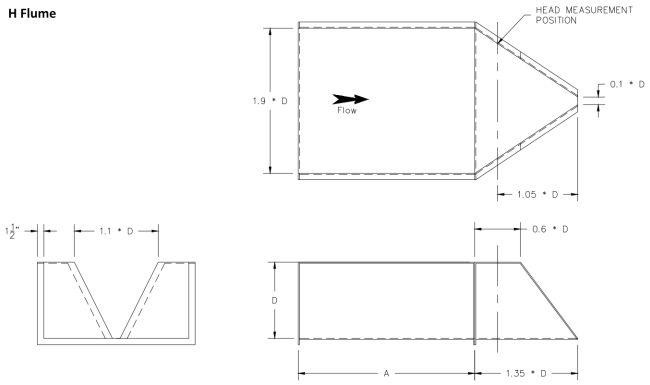


Figure 6: H-flume

Best sensor for flumes, weirs, and Manning's Equation

The Hach US9001 downlooking ultrasonic sensor includes:

- A non-contacting sensor; which means no sensor fouling and reduced maintenance.
- Zero-drift ultrasonic technology.
- A LED status indicator that confirms proper operation.

Hach US9001 sensor installed in manhole and measuring the depth of the flow going into an insertion flume

It is common to find a flume at the ifluent to a treatment plant. The US9001 ultrasonic sensor is perfectly suited for these applications:

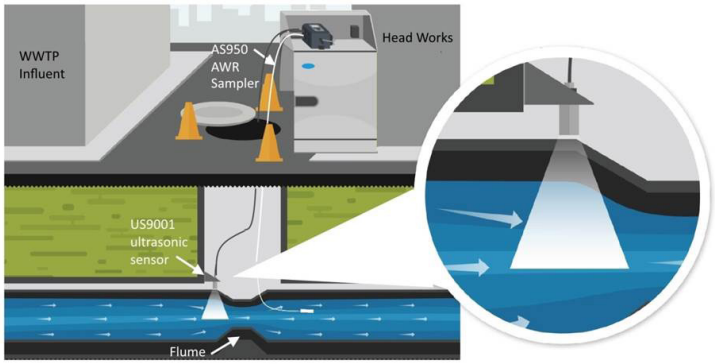


Figure 7: Treatment plant influent

A weir is often present at the effluent. The US9001 ultrasonic sensor is ideal for these applications:

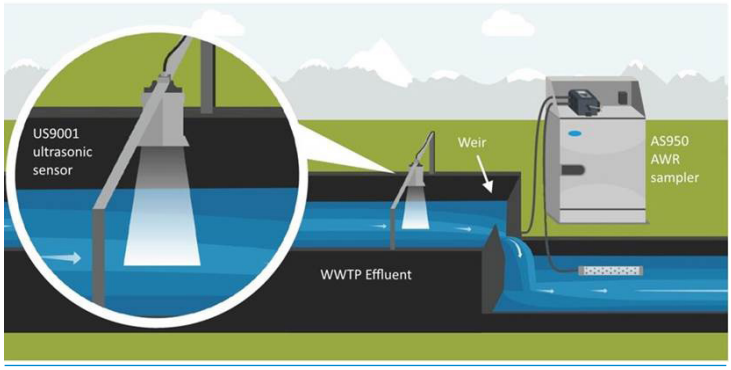


Figure 8: Treatment plant effluent

Overflow weirs are another suitable application for the US9001:

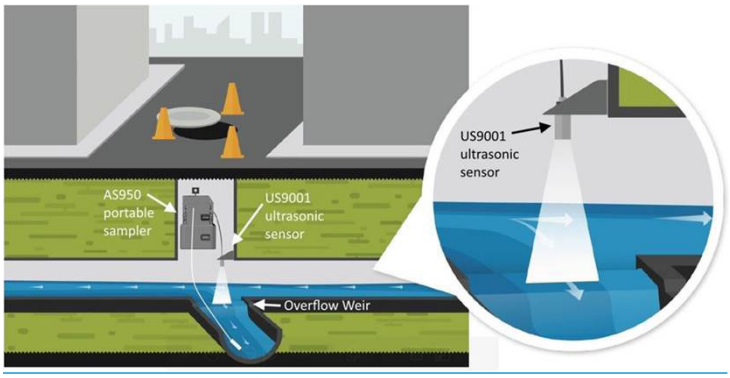
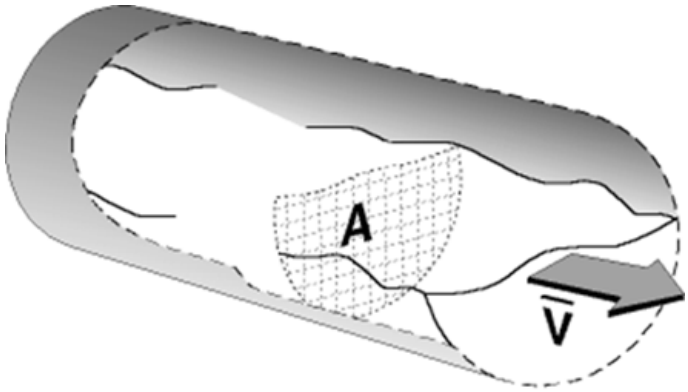


Figure 9: Combined sewer overflow (CSO)

Area velocity

- When no hydraulic structure (weir or flume) is present, site hydraulics are less than optimal, and/or the possibility of surcharge exists, area velocity (AV) is the preferred method of flow measurement.
- The Continuity Equation simply stated is:

  Flow Rate = wetted area x average velocity



$Q = \overline{V} \times A$

Q = Flow
$\overline{V}$ = Average Velocity
A = Area

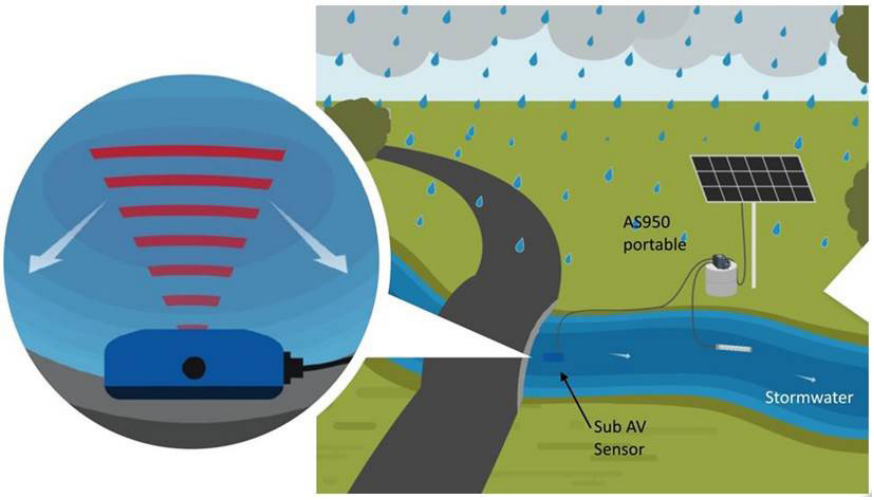
Best sensor for area velocity

The Hach AV9000/Sub AV sensor:

- Has a proven accurate and reliable area velocity method.
- Can verify that the sensor is performing accurately before you leave the site.
- Has bi-directional velocity.
- Includes advanced digital signal processing, providing great performance in difficult hydraulics.

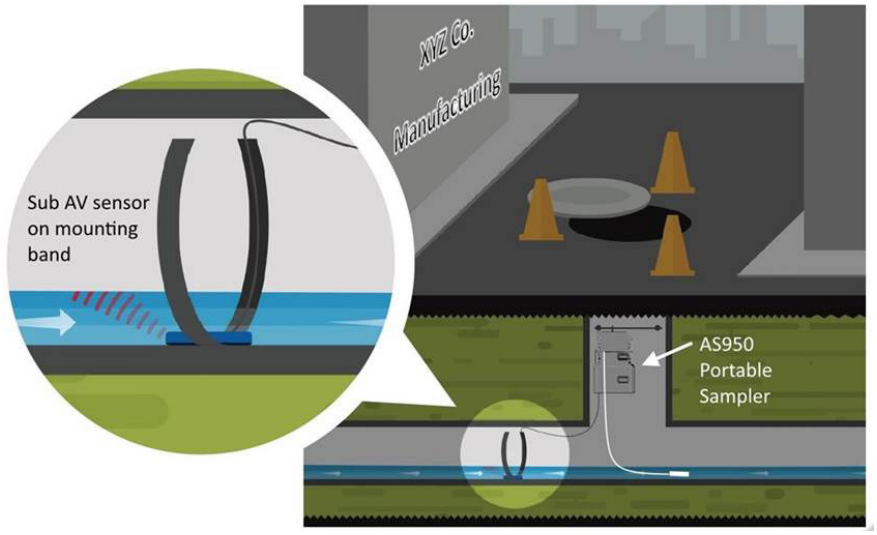
Hach sub AV sensor being installed in stormwater pipeline

A sub AV sensor installed in a dry stormwater drainage culvert signals the sampler to take a sample during a storm and paces the sampler for flow proportional samples:



Stormwater

Measuring the effluent flow at an industrial site helps determine loading for comparison to NPDES permit limits:



Industrial waste / NPDES permit monitoring

How to order

To properly configure your Hach AS950 for flow, you will need the sensor port option, flow sensor, and sensor mounting hardware.

Please contact your local salesperson for more information or visit www.hach.com.

HACH World Headquarters: Loveland, Colorado USA

United States:	800-227-4224 tel	970-669-2932 fax	orders@hach.com
Outside United States:	970-669-3050 tel	970-461-3939 fax	int@hach.com

hach.com

HACH®
Be Right™

DOC043.53.30345.Apr16