

STANDARD OPERATING PROCEDURE
Instructions for the Sigma 910 Flow Meter

KEY WORDS

Water velocity, discharge, water depth, data logger, calibration

APPROVALS

APPROVED BY: **Original signed by:** _____ DATE: **6/26/08**
Kean S. Goh, Ph.D.
Environmental Monitoring Branch Management

APPROVED BY: _____ DATE: **6/20/08**
Sheryl Gill
Environmental Monitoring Branch Staff Scientist

APPROVED BY: _____ DATE: **6/30/08**
Carissa Ganapathy
Environmental Monitoring Branch Quality Assurance Officer

PREPARED BY: _____ DATE: **6/20/08**
Matt Goehring
Scientific Aid

Environmental Monitoring Branch organization and personnel, such as management, senior scientist, quality assurance officer, project leader, etc., are defined and discussed in [SOP ADMN002.01](#).

STANDARD OPERATING PROCEDURE Instructions for the Sigma 910 Flow Meter

1.0 INTRODUCTION

1.1 Purpose

This document provides instructions for the installation, programming, calibration and data retrieval of the Sigma 910 Area/Velocity Flow Meter (Figure 1). The 910 Flow Meter measures water velocity and depth in both portable and permanent applications. It can also calculate surface water flow rates in channels of known cross sectional area. These instructions are intended for a 910 Flow Meter equipped with a Submerged Area/Velocity Sensor (Figure 2).



Figure 1. Sigma 910 Flow Meter



Figure 2. Submerged Area/Velocity Sensor

1.2 Definitions

- 1.2.1 Baude rate: data/signal transmission speed between flow meter and PC.
- 1.2.2 COM port: serial port on PC through which data is transmitted.
- 1.2.3 Flow: velocity x cross sectional area, often expressed in units of gallons per minute (gpm), cubic feet per second (cfs), or cubic meters per second (m^3/s).

2.0 MATERIALS

- 2.1 Sigma 910 Flow Meter (Figure 1)
- 2.2 Submerged Area/Velocity sensor (Figure 2)
- 2.3 6 V dc alkaline battery
- 2.4 Desiccant

STANDARD OPERATING PROCEDURE
Instructions for the Sigma 910 Flow Meter

- 2.5 Appropriate mounting apparatus
- 2.6 Programming and data retrieval software (InSight® or Vision®)
- 2.7 RS-232 serial port to PC connection cable (if using a PC to retrieve data)
- 2.8 Data Transfer Unit (DTU) (if not using a PC to retrieve data)

3.0 PROCEDURES

3.1 InSight® Data Analysis Software Installation

- 3.1.1 Insert installation CD and follow Installation Wizard.
- 3.1.2 For the most recent version of the Insight software, go to Hach® company website (www.hach.com).
- 3.1.3 Select “**Downloads**” under “**Information Central**”.
- 3.1.4 Select “**Software Downloads**”.
- 3.1.5 Select “**Flow and Sampling Products Software Downloads**”.
- 3.1.6 Select “**InSight 5.10.5 Software**” or most current version.
- 3.1.7 Follow Installation Wizard to complete installation.

3.2 Battery Installation

- 3.2.1 Unscrew the end of flow meter opposite of interface connectors and install a 6 V dc alkaline battery (Figure 3).



Figure 3. Battery compartment

STANDARD OPERATING PROCEDURE
Instructions for the Sigma 910 Flow Meter

- 3.2.2 Check desiccant. ***Before Calibration/installation you must remove the red plastic cap from the sensor desiccant cartridge.
- 3.2.3 Flow meter desiccant (in battery compartment): if desiccant in tube is pink, replace with cartridge or remove pink beads and replace with blue beads (Figure 4).
- 3.2.4 Sensor desiccant (attached to sensor cable): If pink, remove fill plug and remove desiccant beads and refill with blue (dry) beads and replace cap (Figure 5).



Figure 4. Sensor desiccant



Figure 5. Flow meter desiccant

- 3.3 **Mounting the 910 Flow Meter** ***Before use, insert port/vent plug (Figure 6) into top of the flow meter using 7/16" wrench (Figure 7).

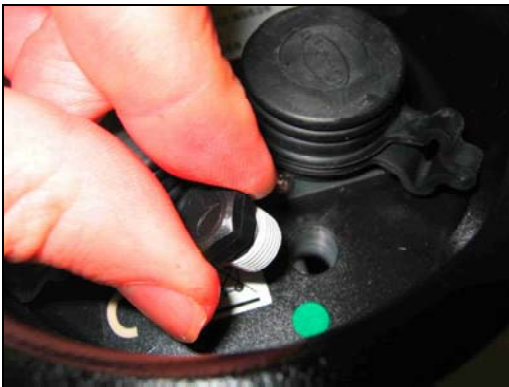


Figure 6. Port/Vent plug



Figure 7. Port/Vent installation

STANDARD OPERATING PROCEDURE Instructions for the Sigma 910 Flow Meter

- 3.3.1 Mount with connector terminals face down and battery side face up.
- 3.3.2 Unused connectors should remain covered with protective caps to avoid corrosion.
- 3.3.3 Attach sensor desiccant container, with accompanying cable, to the handle of flow meter to prevent strain on sensor cable.



Figure 8. Strain relief cable

- 3.3.4 Make sure the flow meter and attached sensor desiccant container are mounted/secured above potential high flow levels.
- ### 3.4 Connecting the Sensors to the 910 Flow Meter
- 3.4.1 Plug Area/Velocity Sensor (Figure 9) into Velocity receptor A (Figure 10). Make sure to align receptacle pins on connector and receptor. Secure connection by screwing cap on until snug.

STANDARD OPERATING PROCEDURE Instructions for the Sigma 910 Flow Meter



Figure 9. Velocity Receptor A



Figure 10. Area/Velocity sensor

3.5 Mounting the Sensors

- 3.5.1 Decide on how to mount the sensor in pipe, weir, etc. See [Section 6.0](#) Study-Specific Decisions for more information.
- 3.5.2 Mount the sensor with angled side facing into the direction of the flow (Figure 11).



Figure 11. Sensor orientation

- 3.5.3 Mount sensor at lowest part of channel to ensure it registers the lowest flows.

3.6 Programming: Connect PC to 910 Flow Meter

- 3.6.1 Open the Insight Data Analysis program (**Start**→**Programs**→**Hach**→**Insight**→**Insight**).
- 3.6.2 From the "**Connect**" drop down menu, select **RS232** → **flow meter**.

STANDARD OPERATING PROCEDURE Instructions for the Sigma 910 Flow Meter

- 3.6.3 Enter the appropriate baud rate (**19,200**) and COM port.
- 3.6.4 Connect flow meter to PC using RS232 cable and click **OK**. A Connected to Sigma 910 screen should appear (Figure 11).

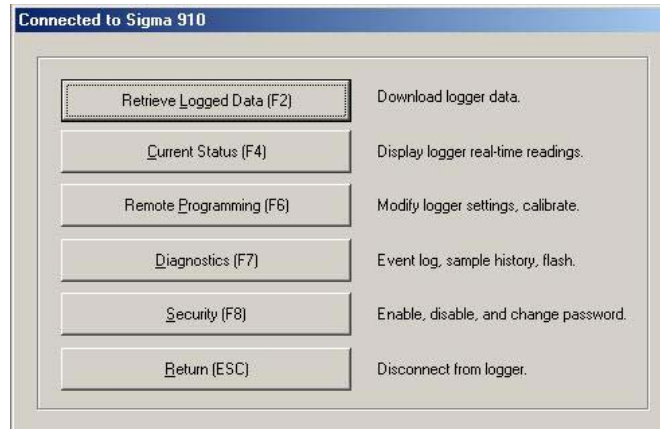


Figure 11. Connected to Sigma 910 screen

3.7 Programming: Setting the Date and Time ***Make sure all previous data is downloaded prior to this step as all data will be erased following this step.

- 3.7.1 From the connected to Sigma 910 screen, click **Remote Programming** to view the Remote Programming Screen (Figure 12).

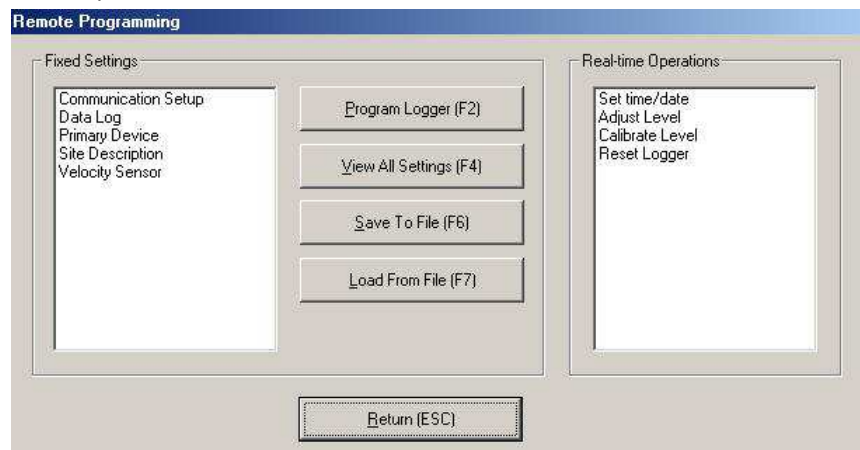


Figure 12. Remote Programming screen

STANDARD OPERATING PROCEDURE

Instructions for the Sigma 910 Flow Meter

- 3.7.2 Double click **Set Time/Date** from the Real Time Operations Menu.
- 3.7.3 Select **Use PC time/date** (if PC's is correct), or select User Entered Time/Date and enter the new logger time/date.
- 3.7.4 Click **Program**.

3.8 Programming: Calibration

- 3.8.1 No Velocity calibration is required.
- 3.8.2 The Depth Sensor must be zeroed during each installation.
 - 3.8.2.1 From the Remote Programming Screen double click **Calibrate Level** from the Real Time Operations Menu.
 - 3.8.2.2 Follow the pop-up commands.
 - 3.8.2.3 Remove the sensor from the water, if necessary, and place on a flat surface and then click **OK**.

3.9 Programming: Site Description Identification

- 3.9.1 From the Remote Programming menu, double click **Site Description** from the Fixed Settings box.
- 3.9.2 Enter a Location and a unique Site ID #. ***A unique Site ID # for each location allows the data to be stored with previously retrieved data from the specified site in the PC database when data is downloaded.
- 3.9.3 From the Remote Programming Screen, click **Program Logger**.

3.10 Programming: Setting Velocity Sensor Priorities

- 3.10.1 From the Remote Programming menu double click **Velocity Sensor** from the Fixed Settings box.
- 3.10.2 Select direction of probe from drop down menu.
- 3.10.3 Upstream (most applications): relatively consistent velocities with low to medium turbulence.

STANDARD OPERATING PROCEDURE

Instructions for the Sigma 910 Flow Meter

- 3.10.4 Downstream: useful when measuring flow downstream of the conversion of multiple flows at a site.
- 3.10.5 Always Positive: in extremely turbulent flows particle deflection can cause negative (upstream) readings. This setting records all values as positive regardless of flow direction.

3.11 Programming: Entering Velocity Cutoff/Velocity Default Values

- 3.11.1 At very low velocities/ clear water, a lack of deflecting particles (turbidity or air bubbles) makes velocity measurements erratic. You may enter a cutoff value that when reached the Default value will be displayed/recorded. You must also enter the Default value.
- 3.11.2 From the Remote Logger screen, click **Program logger**.

3.12 Programming: Setting Data Log Settings

- 3.12.1 From Remote Programming Screen, double click **Data Log** under the Fixed Settings.
- 3.12.2 Select appropriate Memory Mode:
 - 3.12.2.1 Slate: stops logging data when memory full.
 - 3.12.2.2 Wrap: when memory full, writes over oldest reading.
- 3.12.3 Select the appropriate Flow Units.
- 3.12.4 Select the Logging Interval.
- 3.12.5 Select the Totalizing Scaler (scales the total flow units).
- 3.12.6 Select the Total Flow Units (records total flow passing sensor).
- 3.12.7 From the Remote Programming screen, click **Program Logger**.

3.13 Programming: Flow Level Adjustment (necessary when first installing a sensor at a new location and when ever performing a field visit to an ongoing study location).

- 3.13.1 From the Remote Programming Screen, double click **Adjust Level** from the Real Time Operations to display the current registered level.

STANDARD OPERATING PROCEDURE

Instructions for the Sigma 910 Flow Meter

3.13.2 Independently measure water depth: if in a pipe, measure from top of pipe to water level and subtract from pipe diameter.

3.13.3 If measured value differs from current level then enter the new value and click **OK**.

3.14 Programming: Setting the Primary Device (used to calculate flow from level readings)

3.14.1 From the Remote Programming Screen, double click **Primary Device** under Fixed Settings.

3.14.2 If the displayed Primary Device is incorrect, click **Modify Primary Device** and select the appropriate Primary Device.

3.14.3 Enter appropriate values for the desired Primary Device.

3.14.4 From the Remote Programming Screen, click **Program Logger**.

3.15 Programming: Resetting the 910 Flow Meter (necessary when memory is full or main power loss for more than 3 hours, or installing at a new location) ***All logged data will be permanently erased during this operation. Make sure all data has been downloaded.

3.15.1 From Remote Programming Screen, Double click **Reset Logger** from the Real Time Operations box.

3.15.2 After reset occurs, the message "Logger was successfully programmed" will be displayed.

3.16 Data Retrieval

3.16.1 Connect PC to 910 Flow Meter using the RS232 cable ([see Section 3.6](#) for more details). The Connected to Logger Screen should appear.

3.16.2 Select **Retrieve Logged Data**.

3.16.3 Select **Download All Data** or **Download Since Last Download** and then click **OK**.

3.16.4 A Standard Site File is created in the /InSight/Data directory and a database file is created in the /InSight/Data/Merge directory. ***If the database toolbar is open on the main menu, then the file will

STANDARD OPERATING PROCEDURE Instructions for the Sigma 910 Flow Meter

automatically be merged with existing data from the same logger. You can display the database toolbar by selecting **Site Database** from the Advanced drop down menu.

- 3.16.5 Double check that the download was successful. Click **Open Database tab** in Database menu (Figure 13). Select the appropriate Site ID. Click the **Table tab**. Select **Level** from the Channel drop down menu. Click **OK**. Scroll down to make sure most recent data has been successfully stored. ***If the Database menu is not displayed, click Site Database under Advanced menu.



Figure 13. Database menu

- 3.16.6 From Database menu, click **Export To ASCII**.
- 3.16.7 Select the Site ID and Date range.
- 3.16.8 In the Channels tab, check Ch 5 (battery), Level, Velocity 1, and Flow 1.
- 3.16.9 In the Data tab select the appropriate time frame.
- 3.16.10 Click **create**, then click **OK**.
- 3.16.11 Open Microsoft Excel, and go to the **Data menu**→**Get External Data**→**Import text File**.
- 3.16.12 Select the file to be imported. Data under **Program Files**→**Hach**→**Insight**→**Data**→**Text**→appropriate Site ID.
- 3.16.13 Click **Import**, click **Delimited**, click **Next**, click **Comma**, click **Next**, click **Finish**.

STANDARD OPERATING PROCEDURE Instructions for the Sigma 910 Flow Meter

3.17 Current Status Check

- 3.17.1 From the Connected to Logger screen, click **Current Status**.
- 3.17.2 If Current Status reads “Program Complete”, you must reset the logger. See [Section 3.15](#) for instructions.
- 3.17.3 Note the Battery voltage: When it reads 3.8 volts, the logger has approximately 30 days of logging left.
- 3.17.4 Disconnect the computer from logger and replace protective caps.

3.18 Maintenance

- 3.18.1 Cleaning the Flow Meter: Use warm water and mild detergent.
- 3.18.2 Storage: Remove 6V battery from Flow Meter for prolonged storage.
- 3.18.3 Problems with O-Ring Gaskets on Flow Meter: O-Rings maintain watertight seal on end caps. If damaged replace immediately.
- 3.18.4 Replacing Meter and Sensor Desiccant: See [Sections 3.2.3 and 3.2.4](#) for instructions.
- 3.18.5 Cleaning the Sensor
 - 3.18.5.1 Soak sensor in soapy water (dish detergent, window cleaner, Isopropyl Alcohol).
 - 3.18.5.2 Remove the protective cover with screwdriver.
 - 3.18.5.3 Gently swirl sensor in soapy water and use a spray bottle to remove larger deposits.
 - 3.18.5.4 Clean the protective cover and gasket.
 - 3.18.5.5 Reassemble the sensor.
- 3.18.6 Hydrophobic Filter Replacement (prevents water from entering sensor desiccant tube). It only needs replacement after accidental submersion in water or exposure to excessive moisture.

STANDARD OPERATING PROCEDURE Instructions for the Sigma 910 Flow Meter

- 3.18.6.1 Remove the tube that connects the desiccant canister to the sensor cable and unscrew the plastic hex head from canister (Figure 14).



Figure 14. Hydrophobic filter replacement

- 3.18.6.2 Remove the old filter and any Teflon tape remnants.
- 3.18.6.3 Apply 2 turns of Teflon tape to the threads of the plastic hex head.
- 3.18.6.4 Place new filter, smooth side down, over hole and thread hex head back into canister. ***Filter should rotate with hex head as it is screwed in. If not, it is torn. Start over with new filter.

4.0 REMEDIAL ACTION IN CASE OF MALFUNCTION

- 4.1 If random increase/decrease in flow or level occurs, level data are absent but velocity data correct, or silt has deposited between transducer and protective cover, try cleaning the sensor. See [Section 3.18.5](#).
- 4.2 If cleaning the sensor doesn't fix the problem or any other malfunction occurs call Hach® tech support 1-800-635-1230. Please have model and serial numbers, purchase order number and invoice number.

5.0 SAFETY

- 5.1 If installing a flow meter in confined spaces make sure all persons assisting in the installation, maintenance and data collection have confined space certification.
- 5.2 Follow the safety procedures outlined in the [Field Health and Safety Manual](#).

STANDARD OPERATING PROCEDURE
Instructions for the Sigma 910 Flow Meter

6.0 STUDY-SPECIFIC DECISIONS

6.1 Sensor Installation in Pipes

- 6.1.1 Use either pipe size specific mounting ring, or mounting band. These come pre-drilled with holes for direct mounting of the sensor.
- 6.1.2 If using mounting ring or band, route the sensor cable along the ring/band edge with zip ties to prevent debris collection.
- 6.1.3 Another alternative is to permanently bolt a mounting plate to the bottom of the pipe and attach the sensor to the plate.
- 6.1.4 With either set-up, make sure sensor is at bottom most point of the channel.
- 6.1.5 Avoid locating sensor near obstacles/inflow junctions that create turbulence that may alter sensor readings. Recommended 2-4 pipe diameters distance downstream from obstacles.
- 6.1.6 Avoid slow velocity sites with high levels of silt deposition.
- 6.1.7 Locate sensor as far into pipe as possible to avoid drawdown effects towards the end of the pipe.
 - 6.1.7.1 Recommended > 10x the max expected water level upstream of outfall.
 - 6.1.7.2 Recommended > 10x the max expected water level up/downstream of any vertical drop in channel floor.
 - 6.1.7.3 Recommended > 10x the max expected water level up/downstream of turns and junctions within the pipe.

6.2 Securing Sensor to Flume or Weir

- 6.2.1 Attach sensor to bottom most point.
- 6.2.2 Drill holes in the appropriate site to secure the sensor or attach sensor via a Submerged AV mounting plate that can be bolted to the device.

STANDARD OPERATING PROCEDURE
Instructions for the Sigma 910 Flow Meter

7.0 REFERENCES

1. Hach[®] Company. 2005. Sigma Flow Meter Models 910 & 920.
2. Hach[®] Company. 2005. Submerged Area/Velocity Sensor.
3. Manufacturer:

Hach[®] Company
P.O. Box 389
Loveland, Colorado, 80539-0389
1-800-635-1230