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Standard Operating Procedures for:

Operation and Maintenance of the Teledyne ISCO 6712 Portable Sampler and Water Quality Monitoring Station

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Table of Contents

1.0 Introduction

1.1 Scope of the method

1.1.1 Method - This document details the procedure for operation and maintenance of the Teledyne ISCO 6712 Portable Sampler (PS) and water quality monitoring station.

1.1.2 Purpose - The PS is a battery powered water sampling instrument that uses a peristaltic pump for purposes of storm water collection. If the project requires hydrologic monitoring, the PS may be equipped with a rain gage and level logger. When deploying the level logger, the sampler should be placed in an area where a stage vs. discharge relationship can be determined such as at, weirs, detention basins, stormwater pipes, and well-defined channels.

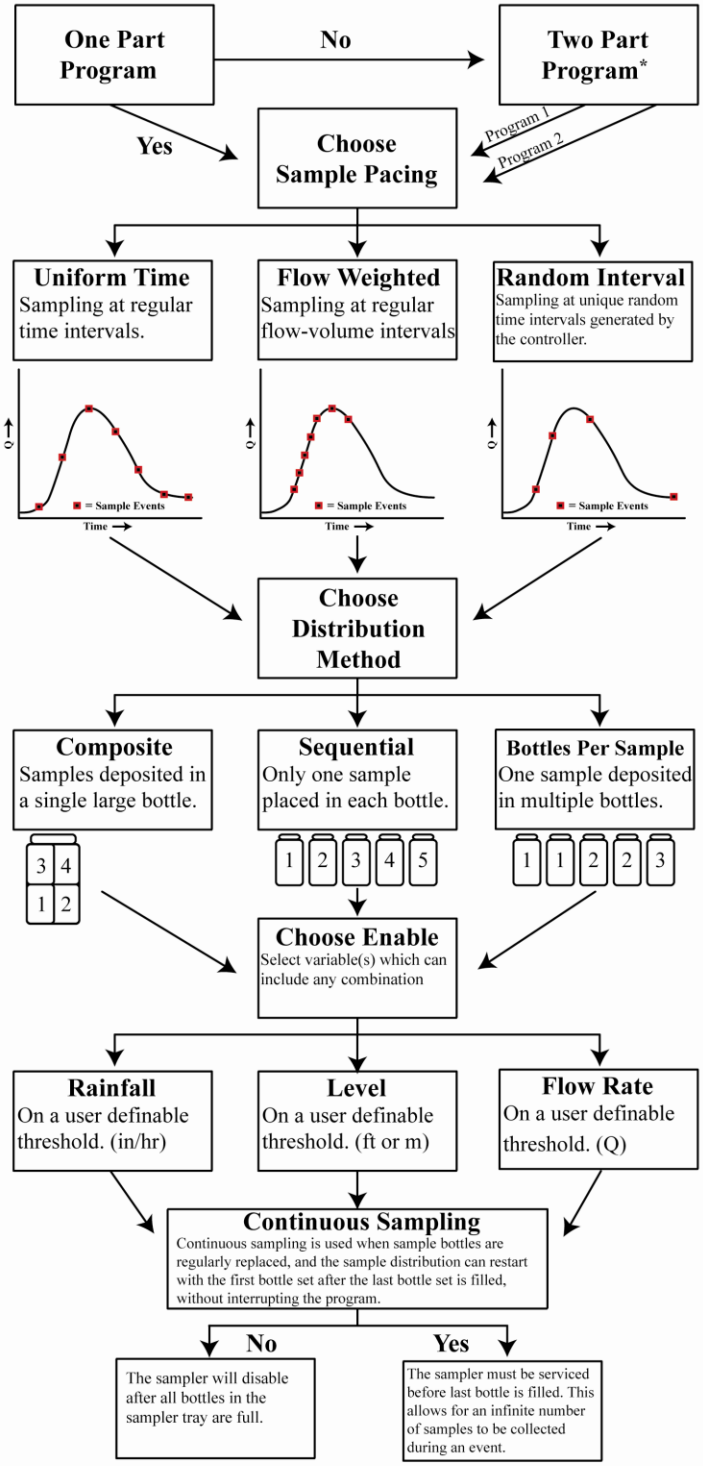
1.1.3 Sample Pacing – The pacing method determines how often a sample will be collected during a storm event and is selected based on specific project goals. Sample pacing can be time-weighted, flow-weighted, or random interval. *Time-weighted pacing* samples at user-defined time intervals that can be at equal intervals or spread throughout the storm event. *Flow-weighted pacing* samples at user-defined flow intervals. *Random interval pacing* samples at unique intervals generated by the controller. See the PS Installation and Operations Guide (Teledyne 2006) for more information on sample pacing.

1.1.4 Sample Distribution – The sampling method determines how a sample will be collected and is based on specific project goals. Sample distribution can be composite samples, sequential samples, bottles per sample. *Composite sampling* is when all samples are deposited in a single large bottle. *Sequential sampling* is when samples are deposited into individual bottles. *Bottles per sample* distribution is more flexible where one or more samples can be deposited in a single bottle.

1.1.5 Continuous Sampling Option - The continuous sampling option can be used to collect sample without interrupting the program. Continuous sampling fills all of the bottles and restarts at the first bottle. Continuous sampling can only be used if sample bottles are regularly replaced to prevent sample mixing.

1.2 Sampling Method Flow Chart

Programming the Teledyne ISCO 6712 Portable Sampler



* A two-part program is a sampling program that divides the bottles into two groups, filling each group according to the separate pacing, distribution, sampler enable, pause and resume settings.

2.0 Definitions

All definitions unless otherwise stated are from the Teledyne ISCO 6712 Portable Sampler Installation and Operation Guide (Teledyne, 2006).

2.1 Portable Sampler

2.1.1 Adjustable Distributor Arm: A single distributor arm adjusts quickly to fit all bottle kits.

2.1.2 Controller: Contains control panel, memory storage, and a rechargeable desiccant to prevent moisture damage to the electronics, pump, and distributor system.

2.1.3 Liquid Detector**:** Detects liquid in the pump tubing.

2.1.4 Peristaltic Pump**:** A type of pump that uses flexible tubing in a circular pump casing where rollers compress the external circumference of the pipe to draw liquid from the liquid source. Because the rollers compress the tubing it is essential to replace the pump tubing at regular intervals.

2.1.5 Pump Tubing**:** Specialized tubing used in the peristaltic pump.

2.1.6 Submerged Probe**:** Provides flow-pacing, real-time level, flow rate, and total flow.

2.1.7 Suction Line**:** Can be 3-99 feet in length. Suction line runs from the liquid source to the pump.

2.1.8 Sampler Housing**:** A lockable enclosure that houses the PS to prevent damage.

2.1.9 Strainer**:** A stainless steel fitting at the intake end of the pump tubing that prevents large objects from entering.

2.2 Programming

2.2.1 Auto Suction Head**:** The hydraulic head is automatically determined.

2.2.2 Continuous Sampling: When sample bottles are regularly replaced, the sample distribution can restart with the first bottle set after the last bottle set is filled, without interrupting the program.

2.2.3 Disable**:** The program has stopped. The sampler is no longer active.

2.2.4 Distribution Methods:

*Composite***:** Samples deposited in a single large bottle.

*Sequential***:** Only one sample placed in each bottle.

Bottles Per Sample: One sample deposited in multiple bottles.

2.2.5 Delayed Start**:** Starts the sampling program after a user-definable delay of 1-999 minutes.

2.2.6 Enable: The start of the sampler program. The program is actively running.

2.2.7 Fixed Suction Head**:** A user-definable measurement of the hydraulic head.

2.2.8 Start Immediately**:** Starts the sampling program immediately.

2.2.9 Sample Pacing

*Uniform Time Pacing***:** sampling at regular time intervals.

*Flow Pacing***:** sampling at regular flow-volume intervals.

Random Interval Pacing: sampling at unique random time intervals generated by the controller.

2.2.10 Suction Line Rinse**:** The sampler will rinse the suction line automatically. Once liquid is detected in the pump, the pump will reverse and purge the suction line.

2.2.11 Sampling Retries**:** The sampler will continue to retry to detect liquid until a successful sample has been retrieved or maximum number of retries was attempted.

2.2.12 One Part Program**:** uses all of the bottles in the sampler tray (if sampling is enabled) for the defined program.

2.2.13 Two Part Program: a sampling program that divides the bottles into two group, filling each group according to the separate pacing, distribution, sampler enable, pause and resume settings.

2.3 Hydrology

2.3.1 Hydrograph**:** A graphical representation of the flow rate of a stream with respect to time (Ward and Trimble 2004).

2.3.2 Weir**: S**tructures constructed across a stream to control, measure, or divert flow. Types of weirs include; rectangular, trapezoidal, sharp or broad-crested, and triangular cross section (Ward and Trimble 2004).

3.0 Equipment and Supplies

3.1 Installation

3.1.1 Stainless steel inlet strainer

3.1.2 Stainless steel mounting plate

3.1.3 Pressure transducer or submergible probe

3.1.4 Housing for sampler

3.1.5 Mounting hardware for securing tubing, strainer, pressure transducer, and sampler housing

3.1.6 Ultraviolet (UV) rated PVC tubing, fittings, and glue.

3.1.7 Lock for security

3.1.8 Pre-cleaned suction intake tubing and hose clamps

4.0 Installation

4.1 Site Location

4.1.1 Sampler Location - The PS should be placed on a level surface at an elevation above the maximum flood height (Figure 1).

4.1.2 Sampler Protection - The PS should be placed in an enclose housing to protect sampler from the elements (Figure 1).

4.1.3 Flow Sensor and Strainer - The strainer and flow sensor should be secured to the bottom of the open channel, detention basin, or pipe by securing the stainless steel mounting plate. Zip ties are used to secure the strainer to the mounting plate. The pressure transducer is fastened to the mounting plate via a small screw in mounting plate (Figure 2).

Figure 1. Monitoring Station and Sampler Installation. Monitoring station has been installed on a concrete slab above the pipe outlet.

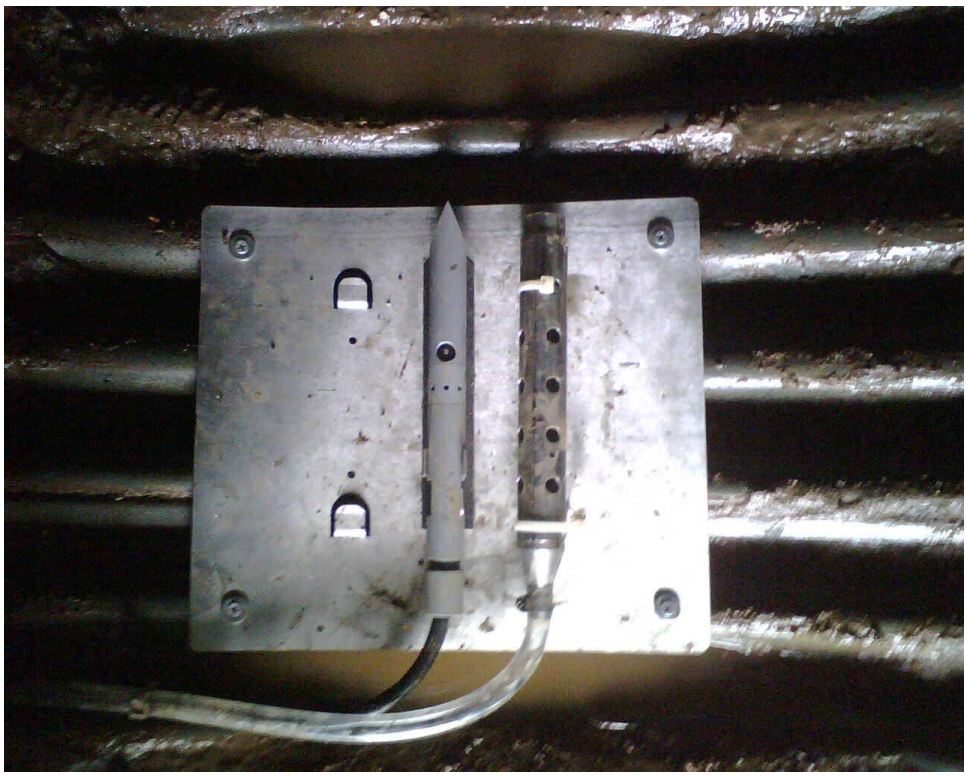


Figure 2. Pressure Transducer and Strainer Installation. Mounting plate with pressure transducer and sample tubing intake installed in the invert of a corrugated metal pipe.

4.1.4 Tubing and Sensor Cables - Suction tubing can be 3-99 feet in length and should be encased by ultraviolet (UV) rated PVC pipe if installation is permanent. The flow sensor has a 30 ft cable that should also be encased by UV rated PVC pipe for protection from debris and sunlight (Figure 3).

4.1.5 Rain Gage - The rain gage must be mounted within 25 feet of the sampler housing. The rain gage must be level and free of any obstruction to obtain accurate readings (Figure 3).

Figure 3. Monitoring Station Installation

5.0 Data Collection

5.1.1 Data Records - The PS can be programmed to record rainfall, level, and time when storm water samples are collected when appropriate. Refer to the PS installation and operation guide to determine appropriate programming for specific projects (see sampling methods flow chart).

5.1.2 Recording Rainfall - The rain gage records rainfall at 1/100th of inch increments and records the total amount per unit time. The length of time between records should be based on specific project goals. The

longest interval between recordings should be 15 minutes. Rainfall rate should be recorded at the same interval as the water level reading.

5.1.3 Recording Water Level - The flow probe module records the level or stage of water above the flow sensor at pre-determined time intervals. The length of time between records should be based on specific project goals, but the longest interval between recordings should be 15 minutes. Water level should be recorded at the same interval as the rainfall records.

5.1.4 Sample Number and Time - The number of samples collected is determined by the rainfall amounts and the time interval selected between sampling events.

6.0 Storm Water Runoff Monitoring

6.1 Before the storm event

6.1.1 Deployment - The PS can be deployed immediately before a storm event or serviced at regular intervals. Regardless, the PS needs to be serviced before a storm event to ensure proper functionality. Routine site visits will be necessary for all sampling methods.

6.1.2 Servicing the PS - For complete hydrologic data sets the PS can be deployed continuously for recording rainfall rates and sampling when predefined criteria are met. The PS will require regular servicing of battery packs and clean bottles. The sampler must also be serviced within 24 hours following a rain event to collect any samples and replace full sample bottles with clean bottles (Figures 4-5).

6.1.3 Deployment Checklist - Routine steps in PS servicing before a storm event:

- The PS will require charged Nickel-Cadmium battery.
- 24, 1 Liter or 1 composite 10 Liter clean bottle(s) for sampler tray. (Refer to bottle washing SOP for Nutrient analysis)

- When deploying the PS at the sample site the tubing should be checked to make sure there are no clogs or foreign debris.

- The strainer should also be inspected for foreign debris. Clean as necessary to remove dirt or other debris from the strainer.

- Check the rain gauge to be sure it is level and the funnel remains open from debris.

- Attach the rain gauge, level logger (if deployed), and pump tubing to the PS.

- Remove the cap(s) from the bottles in the sampler tray.

- Start the PS program.

Figure 4. Collection of 24, 1 L sample bottles in the sample tray.

Figure 5. Samples collected from the PS show the change in suspended solids throughout the storm event.

6.2 After the storm event

6.2.1 Retrieving Samples - If running a continuous sampling program the PS will require replacement of clean sample bottles before the last bottle in the sample tray fills. For non-continuous sampling the PS will require service within 24 hours of the sample collection. If the sampler will not remain in the field the program can be stopped and caps replaced on the bottles. The bottles and sampler can then be disconnected from the rain gauge, pump tubing, and level logger and transported back to the lab. Data can be transferred to the laptop in the field or back in the lab.

6.2.2 Sample Report - Data can be viewed in the field using the following procedure (Figure 6-7)

6.2.2.1 Select the **Stop** button

6.2.2.2 Select **Sampling Report** and the sampler begins displaying the report data

6.2.2.3 To advance manually through the report, stop the automatic display by pressing **Stop** once

6.2.2.4 Then, use the arrow keys to move manually through the report

6.2.2.5 Return to the main menu by pressing **Stop** twice

7.0 Maintenance

7.1 Routine Maintenance

7.1.1 Maintenance Schedule - The samplers will need to be checked weekly for proper functionality.

7.1.2 Rain Gage - The rain gauge must be cleaned each time the PS is serviced. Check that the funnel remains open from debris. The rain gauge also needs to be leveled each time the PS is serviced to ensure accurate readings.

7.1.3 Pump - Inspect the pump tube for wear. The pump tube must be replaced every 100,000 pump counts. Figures 8-9 illustrate the procedure for changing the pump tubing. More information about recommended service intervals and changing the pump tubing can be found in the PS installation and operation guide (Figure 8-9).

7.1.4 Humidity Indicator - The internal desiccant box must be periodically monitored, and if the numbers on the front of the controller turn pink the internal desiccant must be changed. If the external desiccant tube turns pink it is an indicator that the desiccant must be replaced with fresh (blue) desiccant. See PS installation and operation guide for instructions on reusing desiccant (Teledyne 2006).

7.1.5 Batteries - The battery packs must be fully charged and replaced when the PS is serviced.

7.1.6 Flow Sensor and Intake - Be sure to clean debris and dirt on and around the flow sensor and strainer each time the sampler is serviced.

7.1.7 Tubing - The suction tube must be periodically cleaned to prevent build up of debris. The suction line can be cleaned by pumping a weak acid (HCl) through the line and then rinsing with DI water.

7.2 Maintenance Checklist

- ☐ Inspect the pump tube for wear. Replace if necessary.
- ☐ Clean the pump tubing housing.
- ☐ Clean the bottles, suction line, strainer, and pump tube.
- ☐ Check the humidity indicator.
- ☐ Check the controller's internal battery status and replace the battery every five years

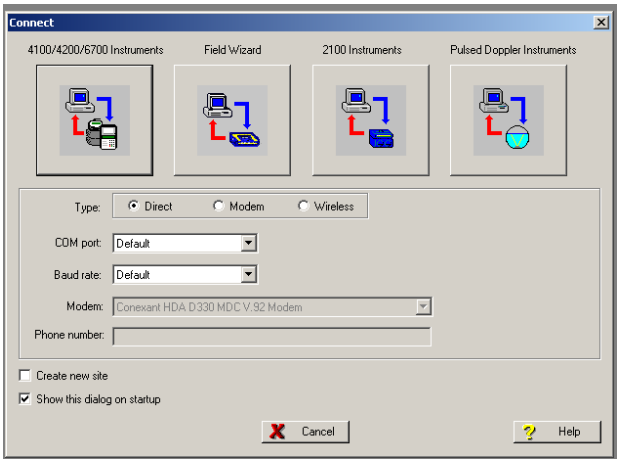
7.3 Downloading Data

7.3.1 The data should be periodically downloaded from the PS.

7.3.2 To download the data connect the PS to a laptop (with the Flowlink® software installed) via the USB cord.

7.3.3 Open the Flowlink® software 

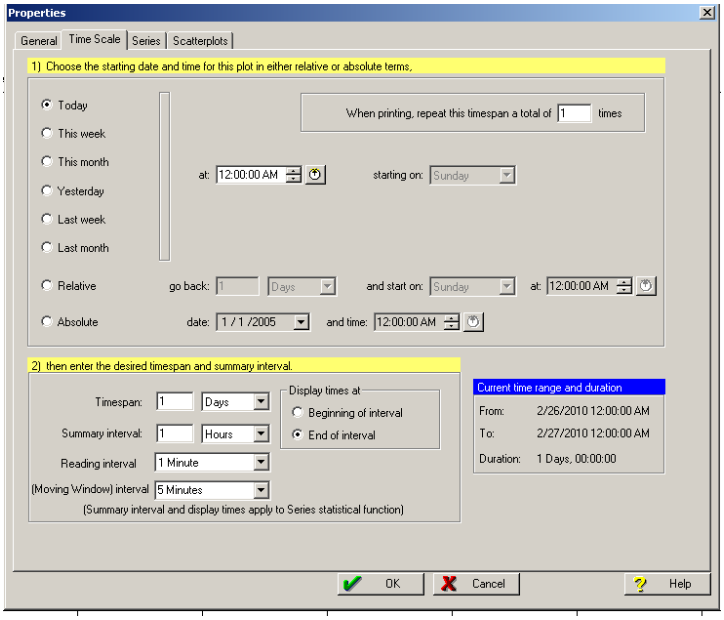
and click the "connect" button to PS icon (below). Make sure the proper USB port is listed under the port drop down box.



7.3.4 Click download (F8) data.

7.3.5 Click create new graph.

7.3.6 Charts can then be produced from the data. To display the data for a specific sample event click the properties icon () and define the sampling period.



7.3.7 Change the units in the graph by clicking the series tab on the properties window and then select proper units.

7.3.8 Switch from graph view to table view by clicking the  icon. The data can then be exported a spread sheet via a .CSV file for further processing.

7.3.8.1 To export the data click the File→ export and define where the file is to be saved.

8.0 Health and Safety

8.1 Working Outdoors

Wear appropriate clothing for working outdoors in changing weather conditions including protection from noxious plants and sunburn. Use insect repellent for protection from biting insects.

8.2 Water Bourne Illness

Field staff should protect themselves from water borne illness by avoiding touching eyes, nose and mouth. Be sure to wash with bacteria disinfectant soap and water after wading in streams. This is particularly important for streams that drain intense agricultural areas, sewage treatment plant effluents, or other pollution sources.

9.0 References

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