Washington State Department of Ecology

Environmental Assessment Program

Standard Operating Procedure for Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment.

Version 2.0

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Please note that the Washington State Department of Ecology's Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by the Department of Ecology.

Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Rev number	Summary of changes	Sections	Reviser(s)
6/ 2016	2.0	Updated equipment brand to WaterLOG, added latest models of equipment in use, updated methods to match latest equipment firmware, added network drive and internet hyperlinks, updated and clarified appendices	1.1, 2.1, 6, 7.1, 10, appendices	Bookter
7/14/2016	2.0	Minor editorial	various	Hopkins/Kammin

Environmental Assessment Program

Standard Operating Procedure for Basic Use and Maintenance of WaterLOG Data Loggers and Peripheral Equipment.

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for Operation of WaterLOG Data Loggers and Peripheral Equipment.

2.0 Applicability

2.1 This procedure is to be followed during Freshwater Monitoring Unit (FMU) stream gaging station visits where WaterLOG Data Loggers and Peripheral Equipment are used. WaterLOG H-350XL®, H-500XL®, and H-522+® are the most common type of data loggers the FMU utilizes in their Data Collection Platforms (DCP's) for stream flow gaging. DCP's that have WaterLOG equipment may also use an H-222SE®, H-222®, or H-2221® GOES radio and a gas bubbler (H-355® or H-3553®). (H-355® bubblers are only compatible with H-350XL® data loggers).
Note: Xylem Inc. acquired Design Analysis in 2009 and rebranded all Design Analysis equipment to the WaterLOG name. FMU utilizes some equipment made by and labeled Design Analysis.

3.0 Definitions

3.1 FMU – Freshwater Monitoring Unit
3.2 GOES – Geostationary Operational Environmental Satellites
3.3 LED – Light Emitting Diode
3.4 PCMCIA or IDE/ATAPI flash card – Industry standard for downloading station data.
3.5 USB or flash drive – Newer industry standard for downloading station data.
3.6 NESDIS – National Environmental Satellite, Data, and Information Service
3.7 NOAA – National Oceanographic and Atmospheric Administration
3.8 USGS – United States Geological Survey
3.9 DCP – Data Collection Platform
3.10 LRGS – Local Readout Ground Station
3.11 EDDN – Emergency Data Distribution Network

4.0 Personnel Qualifications/Responsibilities

4.1 Personnel referencing this document should have at minimum a basic understanding of how data loggers, telemetry radios, and SDI-12 type sensors and equipment operate. In addition, an understanding of general FMU policies and procedures. Experience working in areas with difficult terrain and carrying heavy equipment is also beneficial. No special certifications are required for users of this equipment.

5.0 Equipment, Reagents, and Supplies

5.1 PCMCIA IDE/ATAPI Type Flash Card or adapter card for PDA use and logger downloading.

5.2 USB / Flash Drive for logger downloading.

5.3 Personal Flotation Device (PFD) — Approved PFDs are required for all personnel working in or near bodies of water.

5.4 Station Padlock Keys

5.5 Write in the Rain field notebook with preprinted station visit stream gage notes (Appendix D).

5.6 Hand tools – a tool box for minor repairs and parts replacement is required on all field trips.

5.7 Appropriate desiccant for application. (loose, whole replacement desiccant chamber, or in packet form depending on type of equipment)

5.8 Emery Paper / Small wire brush (for cleaning battery terminals)

5.9 Multi-meter (for verification of battery voltage)

5.10 Spare 12 volt 80 amp hour (Ah) batteries may be needed. Determine station voltage via GOES archive data and decide if replacement batteries will be necessary for the stations you will be visiting.

6.0 Summary of Procedure

6.1 Trip Preparation

6.1.1 Before you prepare to embark you must check all station transmissions in the GOES archive to determine battery voltages at each station and how many batteries to pack.
H:\hydron\Telemetry_Data\telemetery_archive\GOES_Archive
Pick up a station priority list and ratings from the Basin Lead or Principal Investigator (P.I.) for the WRIA's you plan to visit.

6.1.2 Prepare a field/float plan before embarking, which can be found on the Ecology SharePoint site.

6.1.3 Load all necessary equipment needed for you field excursion. (Appendix C)

6.2 Upon Arrival at Station

6.2.1 Visually inspect exterior of station house and equipment for damage, wear, or any hazards that may cause personal harm (e.g. bees, wasps, poisonous plants, etc.).

6.2.2 Using FMU keys open station house and inspect the station interior as described above, taking care to avoid hazards.

6.2.3 Visually verify that power is being supplied to the logger via the **BATTERY INDICATOR/MONITOR LED or POWER LED** located on the front face of the logger.

6.2.3.1 The red power light flashes on and off to show that the logger is receiving proper +12V power. If the power source has failed or provides less than +10V, then the power light will stop flashing.

6.2.4 Press the **ON / OFF** Key to access menu options.
Note: If the logger does not respond when you press a key, it may be in the process of measuring. Wait a few seconds and try again. Wait up to two minutes if the logger is connected to a water quality instrument. To save power, the logger display will turn off automatically after **five minutes** of inactivity.

6.2.4.1 Use the arrow keys to scroll down to desired menu options screen. Options include *Sensor Input Setup, Output Options, Data Options, Scan Setup, System Setup, System Status, and Accessory Setup*. Choose the appropriate Menu Option for the desired task. Appendix A describes the specific functions of each menu.

6.2.4.2 **Note:** The various items under each Menu option may vary depending on the Firmware version in each machine. We do not automatically update firmware at each of our stations. However, as equipment is repaired or replaced it will have the latest firmware installed. You may encounter versions from 1.15 up to and including 4.48 as of June 2016.

6.2.5 Record the date, time, stage, water and air temperature readings. Record battery voltage as described in the station visit SOP (Myers, 2009). These data are typically displayed when first powering up the data logger. These readings can also be obtained in the *Data Options* menu under *View Current File* (this data would have been recorded during the last scan). For an instantaneous reading, you may press the **Enter** button or the **Exterior Side** button (this will force a scan which will not be recorded on the data file). Do not force a scan that may interrupt a timed scan, allow a minimum of two minutes before a timed scan.

6.2.6 Data is usually downloaded during scheduled site visits. Downloading the *.NEW* file is done in the *Data Options* menu. Insert USB or PCMCIA card in slot on logger face, scroll down and select *Copy Files*, then select *Copy .New 2 USB* or *Copy .New 2 Card* (depending on the storage media being used). Press **Enter** to download the file. It is NOT necessary to turn scanning off to download. However, be sure to allow plenty of time between scans to avoid interrupting a timed scan. Upon completion you will then be asked to erase the *.NEW* file. Press the **Enter** button to complete that task. Complete data downloads are usually done at or near the end of each water year and erased from logger files to clear all internal data. Scanning and GOES must be turned off to erase all internal data. Erasing the *Int. SD File* does not affect the station configuration files in any way.

6.2.7 Sites that are using water quality probes (e.g. turbidity, dissolved oxygen, nutrient, etc.) to trigger an ISCO® Compositor to collect water samples are typically downloaded when sample bottles are collected (this is determined by the project lead or principal investigator). These stations require all internal data to be completely downloaded and erased more frequently (frequency is determined by project lead) due to the large amount of data recorded in the logger. All internal data is downloaded and erased using the *Copy All 2 USB* and *Erase Int. SD* commands, respectively. See appropriate SOP's for further details on multiple probe use and maintenance.

6.2.8 Check the *System Status* menu. Record current, minimum, maximum battery voltage, and the number of system resets; then reset the status screens. Battery replacement (if needed) will most likely be determined by these readings. The battery replacement procedure is described in Appendix B.

6.2.9 Next open the *System Setup* menu and check the logger time. Logger clock time should be set to Pacific Standard Time (PST). A handheld GPS units, smartphone application, or an atomic watch are recommended for obtaining the correct time. The time is set by pressing the **Enter** button while at the logger time screen, then set the correct time and press **Enter** again to synchronize the corrected time (Appendix A).

6.2.10 Next check GOES Time. If the GOES radio is connected to a GPS antenna, then the GOES Time is automatically synchronized. If the GOES radio is not connected to a GPS antenna, then access the *Output Options* menu. Select from the drop-down menu *GOES Options* and locate the *GOES Time* (Appendix A). *GOES Time* must be set at Greenwich Mean Time (GMT) and must be accurate to the second in order to align satellite transmissions in the appropriately selected fifteen second window. Any deviation from this could result in a failed transmission not only at this site, but potentially at multiple other sites nationwide (NOAA, NESDIS, and USGS also use the GOES satellite system).

6.2.11 In the *Output Options* menu, verify that Logging and Log .NEW are ON. (Loggers with newer firmware may have a WITH headers, WITHOUT headers, or OFF option instead of a specific ON/OFF for the Log .NEW function.)

6.2.12 In *Scan Setup*, verify that the time to next scan is something less than 15 minutes and the time of next scan is correct. Wait until timed scan is complete and verify in the current data file (*Data Options, View Current File)* that the scan was successful and that the data was logged.

6.3 <u>Field troubleshooting and DCP servicing for WaterLOG platforms</u>

6.3.1 A set of quick reference sheets for troubleshooting and performing basic maintenance of WaterLOG DCP's have been appended for easy referencing. Appendix B discusses troubleshooting options and Appendix A references different functional controls and commands for WaterLOG DCP's and peripheral equipment.

7.0 Records Management

7.1 After collection of downloaded data you must transfer the collected data to the appropriate Principal Investigator or Basin Lead. Upload the collected files to the temporary flow folder found at: H:\FLOWS\Projects\TEMPFLOW. It is also customary to send an e-mail to the Basin Lead indicating that you have finished your field excursion and have collected data for them. Then turn in any field forms and notes to the appropriate PI or Basin Lead at their desk following your return from the field.

8.0 Quality Control and Quality Assurance Section

8.1 Routine inspections and repair (or notification of need for repair) is necessary to ensure quality of collected data. It is up to you to be thorough with your observations and quick with your repairs or notifications otherwise loss of data or station failure may occur.

9.0 Safety

9.1 All field staff must understand and comply with the Environmental Assessment Program (EAP) safety manual (2015).

9.2 All field staff must also possess the proper, up to date safety equipment approved by the FMU safety officer and understand its complete operation.

10.0 References

10.1 Design Analysis Associates, Inc. 2007. WaterLOG® Series Owner's Manual Revision: 1.17. Models (H-350XL and H-500XL). Design Analysis Assoc. Inc., 75 West 100 South, Logan, UT 84321 USA.

10.2 YSI/ Xylem – WaterLOG. XL Series User Manual version 2.14. Models H-350XL, H-500XL, H-522+, and H-522). D41-02 0615. Document available at: http://www.waterlog.com/media/pdfs/xl-series-user-manual-(d41-02-0615).pdf

10.3 Butkus, Steven. 2005. Quality Assurance Monitoring Plan – Stream Flow Gaging Network. Environmental Assessment Program, Washington State Department of Ecology. Publication No. 05-03-204. Document available at: https://fortress.wa.gov/ecy/publications/SummaryPages/0503204.html

10.4 Environmental Assessment Program. 2015. Environmental Assessment Program Safety Manual.

10.5 Myers, Jason. 2009. Standard Operating Procedure for Stream Hydrology Site Visits. Environmental Assessment Program, Washington State Department of Ecology. Document available at: www.ecy.wa.gov/programs/eap/quality.html

10.6 Shedd, James R. 2009. Standard Operating Procedure for Measuring and Calculating Discharge. Environmental Assessment Program, Washington State Department of Ecology. Document available at: www.ecy.wa.gov/programs/eap/quality.html

11.0 Appendices

Appendix A

Basic Menu Options

Menu Tree for XL Series Loggers can be accessed in the WaterLOG Resource Library under Manuals: www.waterlog.com/resource-library.

The latest Menu Tree for the XL Series Loggers (v4.45) can be accessed here: www.waterlog.com/media/pdfs/menu-tree-vs-4-45.pdf

Sensor Input setup: Can be used to program analog, digital or SDI Sensors. It is commonly used to set stage for bubbler systems and pressure transducers.

Output Options: Used to configure or change Logging and GOES options.

Data Options: Used for viewing logged values and downloading both the .NEW files and data files to the USB drive or PCMCIA card. This option can then be used to erase files after downloads are completed.

Scan Setup: This is used for turning scanning on and off, adjusting scan rate, and verifying scanning is at the correct time (typically scanning is set at 15 minute intervals).

System Setup: This is used to set date, logger time (PST), station ID, syncing GOES time when applicable, system configuration options, function options (e.g. temperature probe setup), basic setup (e.g. language interpreter for user defined programs outside of the normal use of data logger), and firmware updates. Use of most other system setup functions is not necessary.

System Status: This screen shows current station battery voltage, minimum and maximum voltage, and system resets. In addition, status screens are reset in *System Status* and should be reset at each visit. The logger firmware version is available in this menu.

Accessory Setup: Used to control accessories (e.g. H3553® and H355® Gas Bubbler systems). The *Gas Purge Setup* is for control of the H355® Gas Bubblers. The other options are for control of H3553® Gas Bubblers.

NOTE: The various items under each Menu option may vary depending on the Firmware version in each machine. We do not automatically update firmware; however as equipment is repaired or replaced it will have the latest firmware installed. You may encounter versions from 1.15 through 4.48 as of June of 2016.

Peripheral Equipment

WaterLOG Manuals: www.waterlog.com/resource-library

GOES Radios:

FMU stream gage stations may use WaterLOG H-222SE®, H-222®, H-2221® radios or an H-522+ ® data logger with a built in GOES radio to transmit data via the GOES satellite network. It is vital to maintain an accurate GOES time. If GOES time drifts, then station transmissions may be lost and/or interfere with other station transmissions.

The majority of FMU stream gage stations use a GPS antenna to synchronize the GOES time. These dome shaped antennas are generally mounted to the GOES antenna (Yagi or Omni models). If a station has a GPS antenna, then the GOES time cannot be adjusted (it is automatically synchronized via GPS). If the GOES time is inaccurate on a station with a GPS antenna, then the radio and/or GPS antenna should be replaced and repaired.

Some FMU stream gage stations have not been upgraded to incorporate a GPS antenna. For stations without GPS, always check the GOES time. If the GOES time is inaccurate, then adjust the GOES time using the following procedure. If you turn off power to a station without a GPS (e.g. change battery), then the GOES time will be cleared and need to be reset.

For all FMU stream gage stations, Logger Time is set to Pacific Standard Time (PST) and GOES Time is set to Greenwich Mean Time (GMT).
Note: GMT = PST +8 hours and GMT = Pacific Daylight Time (PDT) + 7 hours.

GOES Time Adjustment Procedure

Using the WaterLOG data logger:

1. Turn GOES Off: Go to *Output Options* → *GOES Options* → *GOES Mode [On]*
   a. Press **Enter**
   b. Scroll to Off
   c. Press **Enter**
2. Adjust Time: Go to *Output Options* → *GOES Options* → *GOES Time [HH:MM:SS]*
   a. Press **Enter**
   b. Adjust time to a time one minute in the future
   c. Wait for GOES time to match the correct time
   (Use an atomic watch, GPS, or smartphone application to determine an accurate time.)
   d. Press **Enter** when the time is synchronized
3. Turn GOES On: Go to *Output Options* → *GOES Options* → *GOES Mode [Off]*
   a. Press **Enter**
   b. Scroll to On
   c. Press **Enter**

Note: Always check that **Scanning is ON** and **GOES is Timed** before you leave a station. The logger will state the Scanning and GOES statuses when powered off.

Gas Bubbler (H355® and H3553®):

WaterLOG H355® manual: www.waterlog.com/media/pdfs/h-3551t-manual-small.pdf.
WaterLOG H3553® manual: www.waterlog.com/media/pdfs/h-3553t-user-manual-(d44-03-1115).pdf.

FMU stream gage stations use both H355® and H3553® gas bubbler systems to measure water elevation (i.e. stage). These bubblers use a pump and compressor to draw in ambient air, compress it, and pump the air into the stream to measure relative stream stage.

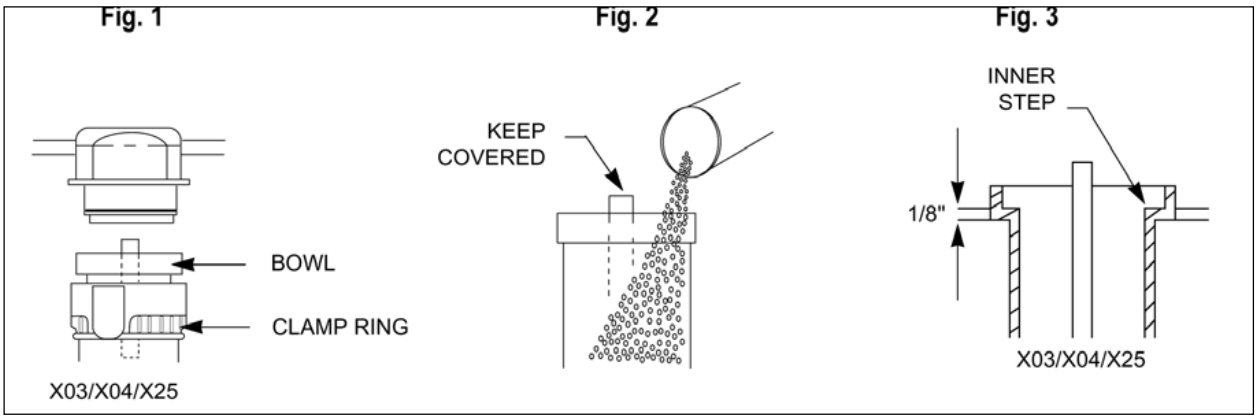
The H3553® gas bubbler can be used with any of the FMU data loggers (H350XL®, H500XL®, or H522+ ®). The H355® gas bubbler is specifically designed for use with the H350XL® data logger. Bubble rate, purging, and timed purge settings are located and adjusted in the *Accessory* setup menu (see Appendix B).

The H355® and H3553® both utilizes a clear plastic desiccant chamber to remove moisture from the system. The desiccant should be replaced as needed. It is easiest to change desiccant at the shop and to take fresh desiccant chambers into the field for any necessary replacements. The following procedure describes how to replace and recharge saturated desiccant.

<u>Desiccant Replacement Procedure</u>

The desiccant used is a loose granulated, silicone based, color changing material. The color changes from blue to pink as it becomes saturated with moisture. The desiccant is recharged (pink → blue) using the drying chamber at the Environmental Assessment Program's Operation Center.

1. Loosen the clamp ring and remove the desiccant chamber from the top housing.
2. Pour out expired desiccant into a suitable container to be dried and re-used.
3. Cover the opening of the metal center air tube of the desiccant chamber with your finger.
4. Pour fresh desiccant carefully into the plastic chamber (fill to within ½ inch of the inner step).
5. Wipe the inner shoulder of the plastic chamber free of desiccant.
   (If this surface is not clear and clean, then the cap will not re-fit into place.)
6. Replace bowl, bowl guard, and clamp ring onto unit. Be sure clamp ring has securely locked into place.



Figs. 1,2,3 © Courtesy of Design Analysis Associates, INC. 2009

H-310® Pressure Transducer:

WaterLOG H310® Manual: www.waterlog.com/media/pdfs/h-310-manual-v2-7.pdf

Some FMU stream gage stations use WaterLOG H310® submersible pressure transducers to measure water elevation (i.e. stage) and temperature. The H310® communicates with the data logger via SDI-12, a digital communication method.

Each unit is packaged with a predetermined length of polyethylene vented cable. The technician installing the instrument must determine if the length of cable is adequate for their specific installation.

The H310® utilizes three small desiccant packs contained in a dry air connection box. The desiccant packs contain a color indicator. When the indicator strip on the pack is blue, then the desiccant packs are dry and ready for deployment. If the indicator strip is pink, then the desiccant packs need to be removed and replaced with dry (blue) packs.

The instrument and cables should be protected from direct sunlight (including the polyethylene cable). The pressure transducer must not be allowed to freeze as this will damage the pressure membrane making the unit inoperable.

Stage is adjusted for the H310® in the *Sensor Input Setup* menu. Go to *Sensor Input Setup* → *H-310 Setup* → *H310 Stage [XX.XXX]*.

For further information on setup, wiring, configuration and operation of this instrument refer to the owner's manual.

Figure 4 – WaterLOG H310 Pressure Transducer (*photo courtesy of Design Analysis Inc.*)

Appendix B

Basic and Minor Troubleshooting of DA DCP Units.

This reference page can be useful for identifying servicing issues that may arise while performing routine site visits at WaterLOG Data Collection Platform (DCP) sites. It is however, not a substitute for the operators' manual or a trained service professional. Care should be taken when attempting troubleshooting to avoid personal injury and to not damage or alter the DCP. If it appears that the DCP requires advanced maintenance, refer to the basin lead or service technician for assistance.

1.1 Problem: Logger will not power up/display on screen.

Follow these instructions in the order they appear to properly diagnose and repair the DCP.

Possible cause/solution:

a. Check battery voltage at the battery terminals using a multi-meter. If voltage is less than 11.0V, replace battery. (Refer to the following sections for more details on battery changing).

b. If battery is ok: Check voltage where battery leads attach to the DCP at the terminal strip with a multi-meter. If no voltage is read, check and replace fuse if broken or burned out.

c. Verify the connections at logger and at battery terminals are good and verify voltage at the green wiring block which presses into the base of the data logger.

d. If voltage is OK, as a last resort, detach, then re-attach the green block from the logger, this may trigger a logger restart causing the logger to reboot.

Note: Stations with multiple peripheral sensors (e.g. turbidity, dissolved oxygen, nitrate, etc.) may require the extra sensors to be detached and re-attached one at a time to correct a non-display problem or to isolate a problem sensor. This should only be performed by a trained service technician.

1.2 *Replace Battery:*

Use caution around the bubbler communication plug (Figure 5). If necessary, disconnect plug to limit potential damage when replacing battery.

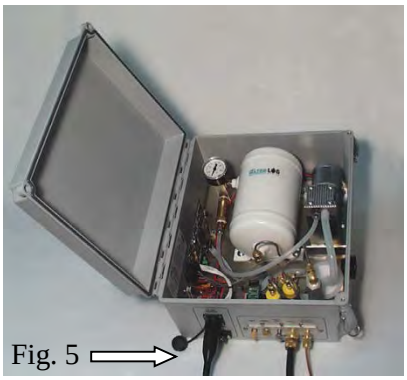


Fig. 5

a. Power down station using circuit breakers.
b. Disconnect old battery.
c. If corrosion is present, clean new battery terminals and power leads (use wire brush or emery paper).
d. Install new battery.
e. Attach power leads.
f. Spray corrosion inhibitor on battery terminals.

g. Power up station using circuit breakers.
h. If an inline fuse is present (rare), inspect the fuse for damage to the internal filament (Figure 6).
i. Replace fuse, if necessary.
j. Check logger time and GOES time.
k. If needed, adjust time (see Time Adjustment procedure above).
l. Check that Scanning is ON and GOES is TIMED.

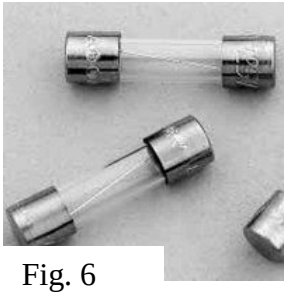


Fig. 6

1.3 <u>Problem:</u> Still no display on DCP.

<u>Possible solution:</u>

The logger may need repair or replacement. Contact the principal investigator, basin lead or supervisor and report the problem. Do not attempt any further troubleshooting as this may damage instrumentation and void the warranties.

2. <u>Telemetry Transmission Problems</u>: Not receiving transmissions from station in the mainframe.

This is can be a complicated problem. The following lists some possible causes, but the best approach is to inform your service technician of the problem.

<u>Probable causes/solutions:</u>

a. Cause: GOES mode set to OFF. Solution: Turn GOES Mode ON.

b. Cause: Scanning OFF. Solution: Turn Scanning ON.

c. Cause: Low battery voltage. Solution: Replace battery.

d. Cause: GOES time inaccurate. Solution: Set GOES time to correct time (see Appendix A).

e. Cause: Incorrect data sets transmitted. Solution: Set correct data sets to be transmitted. (Transmission frequency = **3-hour, Data Sets = 1**. Transmission frequency = **1-hour, Data Sets = 2**.**)**

f. Cause: Damaged GOES antenna. Solution: Replace GOES antenna.

g. Cause: Misaligned GOES antenna. Solution: Align GOES antenna to appropriate compass bearing and vertical angle. Ensure antenna is not pointed at any obstructions (e.g. building, tree trunks, etc.).

h. Cause: Other GOES transmission interference. Solution: Check GOES transmission drift on address before and after station address and fix problem station transmission.

i. Cause: Power loss to radio unit. Solution: Use multi-meter to track voltage loss and repair issue.

GOES Radio Operation can be checked by sending Random Transmissions and verifying the transmission using the LRGS or EDDN field message retrieval website (http://eddn.usgs.gov/).

GOES Radio Test – Random Transmission Procedure

Using the WaterLOG data logger:

1. Send Random Transmission:
   a. Go to *Output Options* → *GOES Options* → *Random Options* → *RR Channel [000]*
   b. Ensure correct Random Channel is selected
   c. Go to *Output Options* → *GOES Options* → *Random Options* → *RR Data Options* →
   d. Select a minimum of three source options (e.g. Date, Time, Stage)
   e. Go to *Output Options* → *GOES Options* → *Random Options* → *Transmit RR Data?*
   f. Press **Enter** (If radio transmission is successful, then "Transmission OK" will be displayed. This means the radio unit sent a transmission, not that the signal was sent from the antenna.)

2. Check for the transmission in EDDN:
   a. Go to EDDN Field Test (http://eddn.usgs.gov/fieldtest.html).
   b. Input DCP address (e.g. 3004C67A) and number of hours to review (max = 72 hours).
   c. Press **Enter**
   d. Check for the presence of the recently sent random transmission.
   The transmissions shown on EDDN are in pseudo binary code. For a guide to translating the transmission code, refer to **page 137** in the XL Logger Manual (www.waterlog.com/media/pdfs/xl-series-user-manual-(d41-02-0615).pdf).

3. If the **random transmission is not shown in EDDN**, then there is a transmission problem locally. Contact your service technician.

4. If the **random transmission is shown in EDDN but does not appear on the station webpage**, then there is an issue with the DECODES system. Contact your IT technician.

3. Download Problems:

3.1 Problem: Station will not download to card or card error is displayed.

Possible causes/solutions:

a. Cause: Faulty PCMIA card or USB flash drive. Solution: Replace portable storage media.

b. Cause: Logger internal data card corrupted. Solution: Replace DCP and attempt data retrieval from faulty logger at shop.

c. Cause: No *.NEW* file. Due to internal data erased from logger (e.g. new logger, end of water year download/erase, etc.) and no fresh *.NEW* was started. Solution: Download internal data, but do not erase. Now start a *.NEW* file.

3.2 Problem: Current data not displaying on Current Data File.

Probable causes/solutions:

a. Cause: Scanning OFF. Solution: Turn Scanning ON.

b. Cause: Fresh *.NEW* file (will show NOW NOW NOW). Solution: Wait, the current file should fill with data after the next scan.

c. Cause: No *.NEW* file started. Solution: Start a *.NEW* file and wait for next scan to see data.

d. Cause: Forced scan interrupted a timed scan. Solution: Do not force a scan within 3 minutes of a timed scan.

e. Cause: Time to next scan wrong (MUST be less than 15 minutes). Solution: Turn Scanning OFF and back ON (should reset logger and Scan clock). Verify logger time is correct.

f. Cause: Next scan time is wrong. Solution: Turn Scanning OFF and back ON (should reset logger and Scan clock). Verify logger time is correct.

4. **Incorrect Stage or Excessive Bounce**:

Probable causes/solutions:

The following may be possible causes for stage fluctuation:

Slant Pipe or Terminal End Damage
The slant pipe may have moved, been damaged, or may have not been tightly secured. Inspect, document, and report any damages and any shifted or worn out anchoring devices to the principle investigator or basin lead as soon as you can.

Orifice Line Leaks

a. When present, leaks are usually found at the orifice line (O-line) connection fitting on the bottom of the gas bubbler (H355® or H3553®) on the DCP platform. This connection can loosen due to station vibration or expansion/contraction from varying temperatures.

   Test the fitting for leaks by spraying the fitting connection with SNOOP or another type of appropriate leak detection solution. If a leak is confirmed or suspected, then re-tighten the brass compression nut ***slightly***. This may alleviate the problem. Be cautious, over tightening may damage the bubbler unit. If there is sufficient length to the O-line, then cut off a small length of O-line and install a new compression fitting.

b. The O-line/terminal end may have been damaged, obstructed or plugged causing a leak in the system. Purging the line may be a simple solution to incorrect stage readings (see procedure below). Be sure to verify that the communication wire from logger to gas bubbler has not been disconnected or damaged.

Station repairs may have required the slant pipe to be moved or reconfigured and secured in a different location, making it necessary to adjust stage. Contact the principle investigator or basin lead and verify that a stage adjustment is needed before attempting. Stage adjustment is accomplished in the *Sensor Input Setup* menu (see procedure below). You must manually determine stage via the PGI and then set the logger to match.

Excessive Stage Bounce
Bounce may occur due to certain water conditions (e.g. terminal end located in a riffle) and may be minimized by adjusting the stage scan averaging time from 001 up to 010 seconds. The majority of FMU stream gage stations have the averaging time set to 010 seconds. It is not recommended, except under extreme conditions and with prior principle investigator or basin lead approval, to set averaging higher than 010 seconds.

A bubble chamber attached to the terminal end may help to control or alleviate stage bounce problems. (The bubble rate is typically set at 50-60 BPM unless a bubble chamber is installed and then it is set at 30 BPM). A bubble line test may be done to test the o-line for any noise issues and to test stability. Refer to the operators' manual for correct procedures regarding this option.

Purge Bubbler – H522+ Logger / H3553 Bubbler

The H3553® gas bubbler settings are located in Accessory Setup at the bottom of the XL Menu Tree. There is a place to set stage in Accessory Setup. **Do not set stage in Accessory Setup.** It may result in erroneous stage readings.

Using the WaterLOG data logger:

1. Go to *Accessory Setup → H3553 at adrs [1] → Purge H3553 <1> ?*
2. Press **Enter**

The bubbler will build pressure and then purge the orifice line. This will take approximately 30 seconds. Watch the terminal end for bubbles to confirm a successful purge.

Set Stage – H522+ Logger / H3553 Bubbler

There are actually three methods to set the stage offset in the H522+ keypad menu tree. There is a chance of overlapping stage offsets if stage is set in more than one location. **Be careful to only use the following method when setting stage, to limit the chance of offset errors.**

The H3553® gas bubbler is an SDI-12 sensor. For our stations, the H3553® is set to SDI address 1. This allows for stations with other SDI-12 sensors (e.g. water quality sensors).

SDI Extended Command Procedure:

1. Check Communication with the H3553® Bubbler
   a. Go to *Sensor Input Setup → SDI Transparent → SDI-12 Test Adrs [0]*
   b. Press **Enter**
   c. Select **1**
   d. Press **Enter**
   e. Go to *Sensor Input Setup → SDI Transparent →Send ID Cmd?*
   f. Press **Enter**

   If connected to the H3553, the sensor model and serial number will appear on screen.

2. Set Current Stage (SCS)
   I. Enter Extended Command
      a. Go to *Sensor Input Setup → SDI Transparent → Ext Cmd [00]*
      b. Press **Enter**
      c. Enter **1XSCSX.XX** (where X.XX is the desired stage height)

d. Press **Enter**

An "!" will be added to the end of the above command.

II. Send Extended Command

a. Go to *Sensor Input Setup* → *SDI Transparent* → *Send Extended Cmd?*

b. Press **Enter**

The screen will read 10171, or similar response, acknowledging the sent command.

3. Manually Reboot Logger (this will refresh settings and apply the new stage offset)

   In other words, turn Scanning OFF and back ON for a 'soft reboot.'

   a. Go to *Scan Setup* → *Scanning [ON]*

   b. Press **Enter**

   c. Select **OFF**

   d. Press **Enter**, twice

   e. Select **ON**

   "Testing…" will appear for a few seconds and the logger has been rebooted.

4. Check new Stage value

   a. Go to *Stage = X.XX* (status screen at top of menu tree)

   b. Press **Enter**

   c. Check that new Stage value matches desired Stage value.

You can also check the stage offset before and after setting stage to confirm the offset has changed.

5. Check Stage Offset:

   a. Go to *Accessory Setup* → *H3553 at adrs [1]* → *Offset <1> [X.XXX]*

Appendix C

Vehicle and Equipment Checklist

Standard Vehicle Equipment:

This equipment should be present anytime the vehicle is used.

- Cell Phone and Charger

Vehicle Folder containing

- Mileage Logs
- Emergency Information
- Fuel Card
- Maps

Safety Equipment

- First Aid Kit
- MUTCD compliant Safety Vests (2)
- CG Approved PFD (1 per person)
- PFD CO_2 Refill
- Road Cones
- Signs
- Hard Hats (2)
- Orange Strobe

Tools / Other

- Mechanic's Toolbox
- Shovel
- Loppers/Clippers/Machete
- Tire Chains
- 2- 150 ft. Ropes
- Spare Key
- Jack, jack handle, adequate spare
- Flashlight
- Lighter
- Electrical Tool Box
- Pens
- Pencils
- Note Paper
- Flagging Tape
- Orange Spray Paint
- Spare Bucket

Standard Flow Gear

Flow Box:

- Weighted Tape for Tape Down
- Tag Line
- 300 ft. Transect Tape
- Line Clamps
- Swoffer Kit w/ Cables and Fans
- Swoffer Meter
- Bridge Depth Sounding Correction Sheets (2/10, 6/10, 8/10's)
- Survey Pins and Hammer
- Flow Tracker
- Wading rod
- Laser Level
- Stadia Rod
- Thermistor
- Spare Batteries for All Devices
- Battery Chargers
- Discharge Measurement Sheets

Station Visit

- Station Visit Data Flash Card
- Multi-meter
- Logger Menu Flow Chart
- Desiccant
- Station Key
- USGS key
- Other Keys as needed
- Appropriate DCP Batteries

ADCP Gear

- ADCP Unit
- PDA (CHECK BATTERY STATUS)
- SD card for PDA
- Tow Ropes and Carabiners
- ADCP Data Sheet

Bridge Gear (If Needed)

- Lead Flow Weights, all sizes
- Bridge Board
- T-bar
- Reel w/ Swoffer Cable

3-Wheel Crane

- Reel
- Crane Assembly

4-Wheel Crane

- HS Meter Box
- Props
- Meter Body w/Fiber-Fin
- Cleaning Soln.
- Lubricant
- Reel
- Crane Assembly/Boom
- Counterweights
- Wheel Chocks

Personal Equipment

- Water
- Food
- Dry Clothes
- Rain Gear
- Sunscreen
- Gloves
- Waders/Hip Boots
- Up to Date Ratings Sheets
- Maps/Station Directions
- Notebook w/ Extra Data Sheets

Decontamination Equipment

- To Be Determined
-

Appendix D

Washington State Department of Ecology

EAP-FMU Stream Gage Logger Notes

Sta. Name_____

Sta. No. _____ **Party** _____

DATE					
TIME (PST)					
LOGGER					
STAFF					
WIRE WEIGHT					
CHECK BAR					
TAPE DOWN					
CORR. FACTOR					
CORRECTED TD					
TD RP ELEVATION:					
CORRECTED td					
=WS ELEV@TD					
LASER: STADIA ROD READING					
- WATER SURFACE, ROD READING					
= DIFFERENTIAL, LASER TO WATER SFC					
LASER BEAM ELEVATION					
- DIFFERENTIAL					
= STAGE					
WATER TEMP				ELEVATION	READING
THERMISTER			LL RM1		
AIR TEMP			LL RM2		
THERMISTER			LL RM3		

ECY 070-183 (Rev. 7/08)

Batt V _____ Min _____ Max _____

Reset Stats Y/N Batt replaced Y/N

GOES Time OK Y/N

Data downloaded Y/N .NEW file erased Y/N

Desiccant condition _____ Changed Y/N

CSG checked Y/N

HWM _____ ft on stick + Ref Elev _____ ft

= HWM Elev _____ ft. Cleaned Y/N

Added cork Y/N

Remarks: _____
_____
_____
_____
_____