



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-F203

HOBO Water Level Pressure Transducers

Standard Operating Procedure

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1. Purpose

This SOP describes the deployment, data retrieval, and barometric compensation of Onset HOBO water level loggers for continuous monitoring of water surface elevation in streams, lakes, wetlands, and groundwater wells (Freeman et al., 2004; Onset Computer Corporation, 2020). Continuous stage records are essential for developing stage-discharge rating curves, characterizing hydrologic response to storms, and documenting seasonal water table fluctuations.

2. Scope

- **Applies to:** Onset HOBO U20, U20L, and MX2001 water level loggers deployed at EA Program surface water and groundwater monitoring sites
- **Does not apply to:** Real-time telemetered stage recorders; acoustic or radar level sensors; staff gauge readings (visual observations recorded in the field notebook)
- **Location:** All EA Program hydrologic monitoring sites

3. Responsibilities

Role	Responsibility
PI / Field Lead	Approve deployment locations and logging intervals
Trained Personnel	Deploy, retrieve, and download loggers per this SOP
New Students	Complete training before independent use

4. Definitions

- **Absolute pressure:** Pressure measured relative to a perfect vacuum; the HOBO U20L measures absolute pressure (water column plus atmospheric), which must be compensated to isolate water-column pressure (Freeman et al., 2004).
- **Barometric compensation:** Post-processing step in HOBOWare that subtracts a concurrent barometric pressure record (from a reference logger deployed in air) from the absolute pressure record to yield true water depth (Onset Computer Corporation, 2021).
- **Datum:** A fixed reference elevation (e.g., NAVD88, local benchmark) to which stage measurements are referenced.
- **Deployment depth:** The vertical distance from the water surface to the sensor face at the time of deployment; used as the initial reference for water-level calculations.
- **HOBO U20L:** Onset Computer Corporation submersible water-level logger recording absolute pressure and temperature at user-defined intervals; rated to a maximum depth of 9 m (model U20L-01) or 4 m (model U20L-04 barometric) (Onset Computer Corporation, 2020).
- **HOBObconnect / HOBOWare:** Onset software (mobile app and desktop, respectively) used to program loggers, download data, apply barometric compensation, and export time-series data (Onset Computer Corporation, 2021).
- **Stage:** Water-surface elevation at a monitoring location, expressed relative to a datum; the primary hydrologic quantity derived from pressure transducer records.

- **Stage-discharge rating curve:** An empirical relationship between stream stage and discharge (Q) at a gauging cross-section; enables conversion of continuous stage records into continuous discharge records (Freeman et al., 2004).
- **Stilling well:** A perforated pipe anchored in the stream or lake bed that protects the logger from direct current, debris, and disturbance while allowing free water exchange.

5. Safety and Hazards

Hazards

- **Physical:** Deployment sites may involve steep banks, slippery surfaces, swift water, or confined spaces (well casings). Work in pairs at all stream and well sites.
- **Drowning:** Do not deploy loggers during high-flow events. Never wade in flows deeper than waist height.
- **Biological:** Waterborne pathogens; ticks and snakes in riparian areas.

5.1. Required PPE

- ☐ Wading boots or chest waders (stream deployments)
- ☐ Closed-toed shoes (well deployments)
- ☐ Nitrile gloves
- ☐ Sun protection (hat, sunscreen)

5.2. Required Training

- [SOP-F001 Field Safety](#)
- Work with a trained partner for all in-stream deployments

6. Instrument Specifications

6.1. HOBO U20L Water Level Logger

Parameter	Value
Measurement principle	Absolute pressure (water + atmosphere)
Pressure range	0–9 m (U20L-01) or 0–4 m barometric (U20L-04)
Accuracy	+/- 0.1% full scale (~0.5 cm water)
Logging interval	1 second to 18 hours (user-configurable)
Memory	~21,700 combined readings
Battery life	~5 years at 1-minute logging
Communication	Optical USB coupler (U20L)

6.2. HOBO MX2001 Water Level Logger

Parameter	Value
Communication	Bluetooth Low Energy; download via HOBOnnect app
Pressure range	0–9 m or 0–4 m models
Other specs	Similar to U20L

6.3. Barometric Reference Logger

Because the water level loggers measure absolute pressure, a companion barometric pressure logger must be deployed above the water surface at or near the site. An Onset HOBO U20L-04 barometric model or HOBO MX barometric logger serves this purpose.

7. Equipment and Materials

Item	Storage	Notes
HOBO U20L or MX2001 loggers	SGM 133	Check battery before deployment
Optical USB coupler (U20L)	SGM 133	For HOBOWare download
HOBOnnect app (MX2001)	Phone	Requires Bluetooth pairing
Stilling well (PVC, 2 in)	SGM 132	With end cap and perforations
Stainless steel cable / line	SGM 131	For securing logger in well
Staff gauge (if not installed)	SGM 131	Painted, graduated to 0.01 m
HOBOWare laptop	SGM 133	Pre-loaded with HOBOWare Pro
GPS unit	SGM 133	See SOP-F006
Field data sheet	SGM 133	

8. Estimated Time

Task	Time
Logger programming (HOBOWare)	10–15 min
Stilling well installation (new)	30–90 min
Logger deployment (existing site)	15–30 min
Data retrieval and export	15–30 min
Barometric compensation (HOBOWare)	15–30 min

9. Procedure

9.1. Logger Programming

1. Connect the logger to HOBOWare using the optical USB coupler or open HOBOnnect via Bluetooth.

2. Select **Launch** (HOBOWare) or **Configure** (HOBOnnect).
3. Set the logging interval appropriate to the project (5 min is typical for hydrologic studies; 15 min for long-term deployment).
4. Enable a delayed start if synchronizing with another logger at the site.
5. Record the logger serial number, launch time, and interval in the field notebook and in the deployment spreadsheet.

9.2. Stream Deployment (Stilling Well)

1. Choose a stable bank location away from direct turbulence but representative of the cross-section stage.
2. Install the stilling well (2-inch PVC with perforations) vertically with the bottom anchored and the top above expected high-water level. Ensure the perforations face upstream and downstream.
3. Lower the logger into the stilling well and secure it with stainless steel wire or cable tie. The logger should hang freely.
4. Record the deployment elevation:
 - Distance from the top of the stilling well to the water surface and to the logger sensor
 - Staff gauge reading (if installed)
 - GPS coordinates per [SOP-F006](#)
5. Deploy the barometric reference logger nearby, above the high-water line, in a shaded and ventilated location (e.g., inside a radiation shield attached to a tree or post). Do not seal it in an airtight container.
6. Photograph the deployment.

9.3. Well Deployment

1. Remove the well cap and measure depth to water using an e-tape. Record the measurement.
2. Lower the logger into the well on stainless steel cable or braided fishing line. Position below the lowest expected water level but above the well screen bottom.
3. Secure the suspension cable to the well cap or casing.
4. Record the logger depth below the top of casing (TOC) and the TOC elevation if surveyed.
5. Replace the well cap.
6. Deploy the barometric reference logger at the wellhead or nearby.

9.4. Data Retrieval

Retrieve data at intervals appropriate for the project (typically monthly or quarterly).

U20L (optical coupler):

1. Remove the logger from the stilling well.
2. Attach the optical USB coupler and connect to the laptop.
3. In HOBOWare, select **Readout**. The logger continues recording after readout.
4. Return the logger to its deployment position.

MX2001 (Bluetooth):

1. Open the HOBObconnect app on a smartphone within ~30 m line of sight.
2. Select the logger and tap **Readout**.
3. The logger does not need to be removed from the water.

9.5. Barometric Compensation

1. In HOBOWare, open the water level logger file and the barometric reference logger file.
2. Select **Data Assistant > Barometric Compensation**.
3. Specify the reference water level: enter a staff gauge reading or a known water surface elevation at a specific date and time.
4. HOBOWare subtracts the barometric pressure from the absolute pressure to yield the water column height.
5. Export the compensated data as **.csv**.
6. Save using the convention: **YYYY-MM-DD_SiteID_waterlevel_compensated.csv**.
7. Commit data to the project repository per [SOP-L801](#).

10. Quality Control

- Verify that the barometric logger file overlaps the full duration of the water level record. Gaps in barometric data prevent compensation.
- Compare the compensated stage at the download visit against a simultaneous staff gauge reading. Acceptable agreement is within 1 cm.
- Flag and investigate any sudden offsets or drift in the compensated record (may indicate logger movement, sedimentation, or battery failure).

11. Data Management

1. Save all raw logger files (**.hobo**) to **data/raw/loggers/** in the project repository.
2. Save compensated **.csv** files to **data/processed/stage/**.
3. Commit all files per [SOP-L801](#).

12. References

- Freeman, L. A., Carpenter, M. C., Rosenberry, D. O., Rousseau, J. P., Unger, R., & McLean, J. S. (2004). *Use of submersible pressure transducers in water-resources investigations* (Techniques of Water-Resources Investigations Book 8, Chapter A3). U.S. Geological Survey. <https://pubs.usgs.gov/twri/twri8a3/>
- Onset Computer Corporation. (2020). *HOBOWare U20L water level logger user's manual*. https://www.onsetcomp.com/files/manual_pdfs/14366-F-MAN-U20L.pdf
- Onset Computer Corporation. (2021). *HOBOWare user's guide*. https://www.onsetcomp.com/files/manual_pdfs/10246-K-MAN-HOBOWare.pdf

13. Related SOPs

SOP	Title	Relationship
F001	Field Safety	Required prerequisite
F006	GPS and Site Navigation	Deployment coordinates
F007	Field Decontamination	Between-site cleaning
F301	Stream Discharge Measurement	Stage-discharge rating curves
F303	Groundwater Sampling	Well deployment context
L801	RStudio and GitHub	Data version control

14. Training Record

Before deploying water level loggers independently, personnel must:

1. Read this SOP in full
2. Demonstrate logger programming (launch, interval, delayed start) using HOBOWare or HOBObconnect
3. Participate in a supervised stream or well deployment
4. Demonstrate barometric compensation in HOBOWare and export of compensated data
5. Be signed off by the PI or field lead