HOBO® 4-Channel Pulse Input Data Logger (UX120-017x) Manual

onset
HOBO® Data Loggers

The HOBO 4-Channel Pulse Input data logger records electronic pulses and mechanical or electrical contact closures from external sensing devices. Using HOBOware®, you can easily configure each of its four channels to monitor and record pulse, event, state, or runtime data in a wide variety of applications, including tracking building energy consumption, monitoring mechanical equipment, and recording water and gas flow rates. Plus, when combined with the E50B2 Energy & Power Meter (T-VER-E50B2), this logger provides extensive power and energy monitoring capabilities. There are two models of the HOBO 4-Channel Pulse Input data logger: the UX120-017 stores more than 500,000 measurements while the UX120-017M holds more than 4,000,000 measurements.

Specifications

Inputs

External Contact Input	Electronic solid state switch closure or logic driven digital signals to 24 V
Maximum Pulse Frequency	120 Hz
Maximum State, Event, Runtime Frequency	1 Hz
Bits	4–32 bits depending on pulse rate and logging interval
Maximum Pulses Per Interval	7,863,960 (using maximum logging rate)
Driven Logic Signal	Input Low: ≤ 0.4 V; Input High: 3 to 24 V
Absolute Maximum Rating	Maximum Voltage: 25 V DC Minimum Voltage: -0.3 V DC
Solid State Switch Closure	Input Low: < 10 KΩ; Input High: > 500 KΩ
Internal Weak Pull-Up	100 KΩ
Input Impedance	Solid state switch closure: 100 KΩ pull up; Driven signal: 4.5 KΩ
Minimum Pulse Width	Contact closure duration: 500 uS; Driven logic signal: 100 uS
Lockout Time	0 to 1 second in 100 ms steps
Edge Detection	Falling edge, Schmitt Trigger buffer
Preferred Switch State	Normally open or Logic "1" state

Logging

Resolution	Pulse: 1 pulse, Runtime: 1 second, State and Event: 1 State or Event
Logging Rate	1 second to 18 hours, 12 minutes, 15 seconds
Time Accuracy	±1 minute per month at 25°C (77°F) (see Plot A on next page)
Battery Life	1 year, typical with logging intervals greater than 1 minute and normally open contacts
Battery Type	Two AA alkaline or lithium batteries

Memory

Memory	UX120-017: 520,192 measurements (assumes 8-bit) UX120-017M: 4,124,672 measurements (assumes 8-bit)
Download Type	USB 2.0 interface
Download Time	30 seconds for UX120-017, 1.5 minutes for UX120-017M

Physical

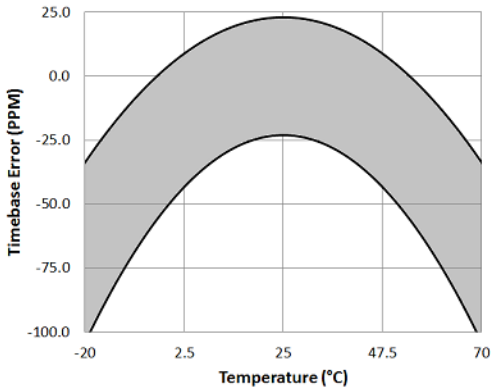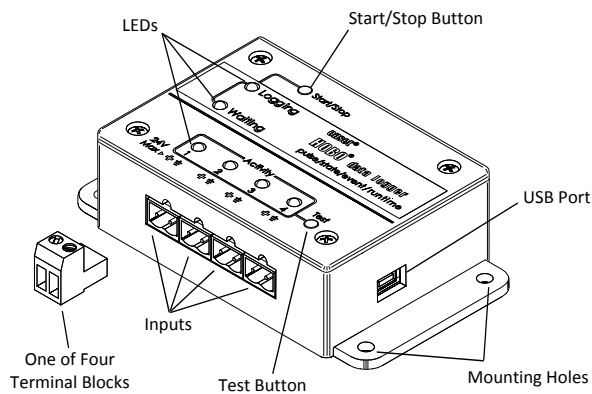|	
Operating Range	Logging: -40° to 70°C (-40° to 158°F); 0 to 95% RH (non-condensing) Launch/Readout: 0° to 50°C (32° to 122°F) per USB specification
Weight	149 g (5.26 oz)
Size	11.4 x 6.3 x 3.3 cm (4.5 x 2.5 x 1.3 inches)
Environmental Rating	IP50
CE	The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).

HOBO 4-Channel Pulse Input Data Logger

Models: UX120-017
         UX120-017M

Included Items:

- 4 Mounting screws
- 2 Magnets
- Hook & loop tape
- 4 Terminal block connectors

Required Items:

- HOBOware Pro 3.2 or later
- USB cable (included with software)

Accessories:

- Additional terminal blocks (A-UX120-TERM-BLOCK)
- Lithium batteries (HWSB-LI)

Additional sensors and accessories available at www.onsetcomp.com.

Specifications (continued)

Plot A: Time Accuracy

Logger Components and Operation

Start/Stop Button: Press this button for 3 seconds to start or stop logging data. This requires configuring the logger in HOBOware with a Button Start and/or a Button Stop (see *Setting up the Logger*). You can also press this button for 1 second to record an internal event (see *Recording Internal Logger Events*).

LEDs: There are three types of LEDs on the logger to indicate logger operation: Logging, Waiting, and Activity. Note that all LEDs will blink when the logger is initially powered (i.e. when the batteries are installed).

LED	Description
Logging (green)	Blinks every 2 seconds when the logger is recording data. Disable this LED by selecting the Turn Off LEDs option in HOBOware.
Waiting (orange)	Blinks every 2 seconds when awaiting a start because the logger was configured with Start At Interval, Delayed Start, or Button Start settings in HOBOware.
Activity (red)	There is one Activity LED per input channel. Press the Test button to activate all four Activity LEDs for 10 minutes to determine the state of the four input channels. When the logger is recording data, the Activity LED for the corresponding channel will blink at every pulse signal. **Note:** If you press the Test button during logging, then the Activity LED will remain illuminated for any channel that has not been configured to record data.

Inputs: There are 4 input channels to connect the logger to external sensors/devices.

Terminal Blocks: There are 4 terminal blocks included with the logger to plug into the inputs for connecting devices.

Test Button: Press this button to activate the Activity Lights for 10 minutes to test for contact resistance or voltage signal in any of the four input channels (see the LED table).

Mounting Holes: There are four mounting holes, two on each side, that you can use to mount the logger to a surface (see *Mounting the Logger*).

USB Port: This is the port used to connect the logger to the computer or the HOBO U-Shuttle via USB cable (see *Setting up the Logger* and *Reading Out the Logger*).

Setting Up the Logger

Use HOBOware Pro to set up the logger, including selecting the start and stop logging options, configuring the input channels for specific sensor types, and entering scaling factors. It may be helpful to set up the logger with a Delayed Start or a Button Start first and then bring it to the location where you will mount it to connect the external sensors/devices and test the connections before logging begins.

1. **Connect the logger and open the Launch window**. To connect the logger to a computer, plug the small end of the USB cable into the side of the logger and the large end into a USB port on the computer. Click the Launch icon on the HOBOware toolbar or select Launch from the Device menu.

> **Important:** USB specifications do not guarantee operation outside this range of 0°C (32°F) to 50°C (122°F).

2. **Select Sensor Type.** Each of the input channels can be configured to log the following:

- **Pulse.** This records the number of pulse signals per logging interval (the logger records a pulse signal when the input transitions to the logic low). There are built-in scaling factors you can select for supported devices and sensors, or you can set your own scaling when you select raw pulse counts. You can also adjust the maximum pulse frequency and lockout time as necessary.

- **State.** This records how long an event lasts by storing the date and time when the state of the signal or switch changes (logic state high to low or low to high). The logger checks every second for a state change, but will only record a time-stamped value when the state change occurs. One state change to the next represents the event duration.

- **Event.** This records the date and time when a connected relay switch or logic low transition occurs (the logger records an event when the input transitions to the logic low). This is useful if you need to know when an event occurred, but do not need to know the duration of the event. You can also adjust the lockout time to debounce switches.

- **Runtime.** This records the number of state changes that happen over a period of time. The logger checks the state of the line once a second. At the end of each logging

interval, the logger records how many seconds the line was in the logic low state.

3. Choose the logging interval, from 1 second to a maximum of 18 hours, 12 minutes, and 15 seconds (available for Pulse or Runtime logging only).

4. Choose when to start logging:

   - **Now.** Logging begins immediately.

   - **At Interval.** Logging will begin at the next even interval.

   - **Push Button.** Logging will begin once you press the Start/Stop logging button for 3 seconds.

   - **On Date/Time.** Logging will begin at a date and time you specify.

5. Choose when to stop logging:

   - **When Memory Fills.** Logging will end once the logger memory is full.

   - **Never (wrapping).** The logger will record data indefinitely, with newest data overwriting the oldest.

   - **Push Button.** Logging will end once you press the Start/Stop logging button for 3 seconds. **Note:** If you also configured a Push Button start, then you must wait 5 minutes after logging begins before you can use the button to stop logging.

   - **Specific Stop Date.** Logging will end at a date and time you specify.

6. Select any other logging options as desired and finish the launch configuration. Depending on the start type, verify that the logging or waiting LED is blinking.

Connecting Sensors, Transducers, or Instruments to the Logger

You can connect the logger to an external sensing device using the four input channels. To connect a device to the logger:

1. Follow the instructions and wiring diagrams in the user manual for the device.

2. Connect the device to the terminal block as directed in the device instructions.

3. Plug in the terminal block into one of the four inputs (labeled 1 through 4).

4. Press the Test button as needed to activate the Activity LEDs and check whether the logger reads the pulse signal.

5. Configure logger launch settings if you have not already.

Notes:

- Be sure that all devices are connected before logging begins. Any sensors/devices attached after logging begins will not record accurate data.

- If connecting an E50B2 Energy & Power Meter (T-VER-E50B2), you have the option to use the default meter settings or your own custom settings.

- If any channels have been configured to record raw pulse counts or events in HOBOware, there is also an option to specify lockout time. This can prevent false readings from mechanical contact/closure bouncing. For more information on setting lockout time, see the HOBOware Help.

Determining Logging Duration for Event/State Data

The logger's storage capacity and logging duration varies depending on several factors, including logging interval, number of channels configured, and the type of data being recorded. This table estimates the logging duration based on recording event or state changes on one input channel with logging set to stop when the memory is full. To estimate logging duration for multiple event or state channels, divide the logging duration by the number of active channels. If you want to know exactly how long the logger will run, use pulse or runtime modes.

Time Between Events	Approximate Total Data Points	Approximate Logging Duration (1 Year Battery Life)	Logger Part Number
1 to 15 seconds	346,795	4 to 60 days	UX120-017
	2,749,781	32 days to 1.3 years	UX120-017M
16 seconds to 4.2 minutes	260,096	48 days to 2.1 years	UX120-017
	2,062,336	1 to 16.6 years	UX120-017M
4.3 to 68.2 minutes	208,077	1.6 to 27 years	UX120-017
	1,649,869	13 to 214 years	UX120-017M
68.3 minutes to 18.2 hours	173,397	22.5 to 360 years	UX120-017
	1,374,891	17.8 to 285 decades	UX120-017M

Notes:

- Typical battery life is 1 year.

- The logger can record battery voltage data in an additional channel. This is disabled by default. Recording battery voltage reduces storage capacity and is generally not used except for troubleshooting.

Setting Maximum Pulse Frequency

When recording raw pulse counts, the logger dynamically adjusts its memory usage from 4 to 32 bits instead of a typical fixed width. This results in the ability to store more data using less space, which in turn extends logging duration. The default pulse rate is 120 Hz, which is also the maximum. You can adjust this rate in HOBOware (see the HOBOware Help for details). Decreasing the rate will increase logging duration. The following table shows examples of how pulse rate and logging interval affect logging duration.

Logging Interval	Pulse Rate (Hz)	Number of Bits Required	Approximate Total Data Points	Approximate Logging Duration
1 minute	4	8	520,192	361 days
1 minute	50	12	346,795	240 days
1 minute	120	16	260,096	180 days

Reading Out the Logger

There are two options for reading out the logger: connect it to the computer with a USB cable and read out it with HOBOware, or connect it to a HOBO U-Shuttle (U-DT-1, firmware version 1.14m030 or higher) and then offload the datafiles from the

U-Shuttle to HOBOware. Refer to the HOBOware Help for more details.

## Recording Internal Logger Events

The logger records several internal events to help track logger operation and status. These events, which are unrelated to state and event logging, include the following:

Internal Event Name	Definition
Host Connected	The logger was connected to the computer.
Started	The Start/Stop button was pressed to begin logging.
Stopped	The logger received a command to stop recording data (from HOBOware or by pushing the Start/Stop button).
Button Up/Button Down	The Start/Stop button was pressed for 1 second.
Safe Shutdown	The battery level is 1.8 V; the logger shut down.

Mounting the Logger

There are three ways to mount the logger using the materials included:

- Screw the logger to a surface with a Phillips-head screwdriver and the four mounting screws, using the following dimensions.
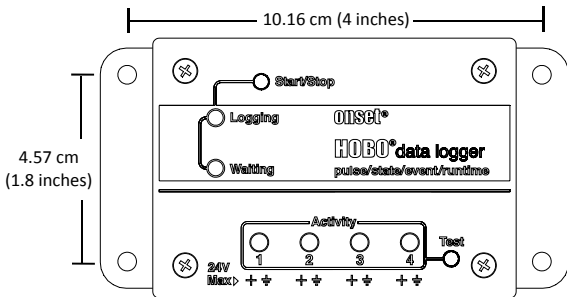
- Attach the two magnets to the back of the logger and then place the logger on a magnetic surface.

- Use the hook-and-loop tape to affix the logger to a surface.

Protecting the Logger

The logger is designed for indoor use and can be permanently damaged by corrosion if it gets wet. Protect it from condensation. If it gets wet, remove the battery immediately and dry the circuit board. It is possible to dry the logger with a hair dryer before reinstalling the battery. Do not let the board get too hot. You should be able to comfortably hold the board in your hand while drying it.

Note: Static electricity may cause the logger to stop logging. The logger has been tested to 4 KV, but avoid electrostatic

discharge by grounding yourself to protect the logger. For more information, search for "static discharge" in the FAQ section on onsetcomp.com.

Battery Information

The logger is shipped with two AA alkaline batteries. You can also use 1.5 V AA lithium batteries when deploying the logger in cold environments. Expected battery life varies based on the temperature where the logger is deployed and the frequency (the logging interval and the rate of state changes and/or events) at which the logger is recording data. A new battery typically lasts one year with logging intervals greater than one minute and when the input signals are normally open or in the high logic state. Deployments in extremely cold or hot temperatures, logging intervals faster than one minute, or continuously closed contacts may reduce battery life.

The logger can also be powered through the USB cable connected to the computer. This allows you to read out the logger when the remaining battery voltage is too low for it to continue logging. Connect the logger to the computer, click the Readout button on the toolbar, and save the data as prompted. Replace the batteries before launching the logger again.

To replace the batteries:

1. Disconnect the logger from the computer.

2. Unscrew the logger case using a Philips-head screwdriver.

3. Carefully remove the two batteries.

4. Insert two new AA batteries (alkaline or lithium) observing polarity. When batteries are inserted correctly, all LEDs blink briefly.

5. Carefully realign the logger case and re-fasten the screws.

⚠ **WARNING:** Do not cut open, incinerate, heat above 85°C (185°F), or recharge the lithium batteries. The batteries may explode if the logger is exposed to extreme heat or conditions that could damage or destroy the battery cases. Do not dispose of the logger or batteries in fire. Do not expose the contents of the batteries to water. Dispose of the batteries according to local regulations for lithium batteries.

HOBOware provides the option of recording the current battery voltage at each logging interval, which is disabled by default. Recording battery life at each logging interval takes up memory and therefore reduces logging duration. It is recommended you only record battery voltage for diagnostic purposes.