

HOBO® Plug Load Logger (UX120-018) Manual



The HOBOWare Plug Load logger is designed to monitor energy consumption of AC-powered plug in loads. This compact device can be used as a power meter with its built-in LCD for real-time energy monitoring or as a data logger that can record up to 1.4 million measurements for analysis. With the ability to view or log true RMS voltage (V), true RMS current (A), active power (W), active energy (Wh), apparent power (VA), and power factor (PF), the HOBOWare Plug Load logger provides you with an accurate log of your energy consumption of plug loads. Using HOBOWare®, you can also easily configure the logger to calculate minimum, maximum, and average statistics during logging at a fixed sampling rate of 16.67 mS. To download HOBOWare, visit www.onsetcomp.com/hoboware-free-download.

Specifications

RMS Voltage	Accuracy	0.5% up to 14 Amp continuous; up to 1.0% over 14 Amp when equipment being monitored is at 100% duty cycle
	Resolution	10 mV
RMS Current	Accuracy	0.5% up to 14 Amp continuous; up to 1.0% over 14 Amp when equipment being monitored is at 100% duty cycle
	Resolution	0.1 mA
Active Power	Accuracy	0.5% up to 14 Amp continuous; up to 1.0% over 14 Amp when equipment being monitored is at 100% duty cycle
	Resolution	10 mW down to 1 Watt loads at 120 V AC
Active Energy	Accuracy	0.5% up to 14 Amp continuous; up to 1.0% over 14 Amp when equipment being monitored is at 100% duty cycle
	Resolution	10 mVA
Power Factor	Accuracy	±0.02
	Resolution	0.01 PF
Drift		Up to 0.5% typical within 1 year
Operating Environment		Logging: 5° to 40°C (41° to 104°F); 0 to 95% RH (non-condensing), up to 2,000 m (6,562 ft) altitude
Operating Modes		Meter or logging when launched with HOBOWare
Logging Rate		1 second to 18 hours, 12 minutes, 15 seconds
Statistics Sampling Rate		60 Hz or 16.67 mS single-cycle
Memory Modes		Wrap when full or stop when full
Start Modes		Immediate, push button, date & time, or next interval
Stop Modes		When memory full, push button, or date & time
Restart Mode		Push button
Time Accuracy		±1 minute per month at 25°C (77°F), see Plot A
Power Source		Line-powered with 0.92 m (3 ft) AC power cord or two AAA 1.5 V alkaline batteries, user replaceable
Battery Life		2 years with line power; 6 months battery only (no line power) with logging rate of 1 minute or greater operating at 25°C (77°F)
Memory		4 MB (1.4 million measurements, maximum)
Download Type		USB 2.0 interface
Full Memory Download Time		Approximately 1.5 minutes
LCD		LCD is visible from 0° to 50°C (32° to 122°F); the LCD may react slowly or go blank in temperatures outside this range
Size		13.97 x 7.62 x 4.75 cm (5.5 x 3 x 1.87 in.)
Weight		230.8 g (8.14 oz)
Ratings		IP50; UL Listed; UL Listed to Canadian safety standards
Standard(s) for Safety		UL 61010-1 & CAN/CSA-C22.2 No. 61010-1 ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE – Part 1: General Requirements
Calibration		This device has been calibrated using equipment that has been tested in accordance with ANSI C12.20 0.5%.

HOBOWare Plug Load Logger

UX120-018

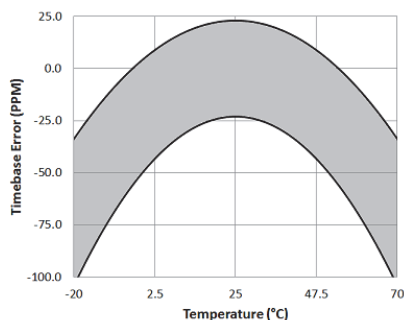
Included Item:

- AC power cord

Required Items:

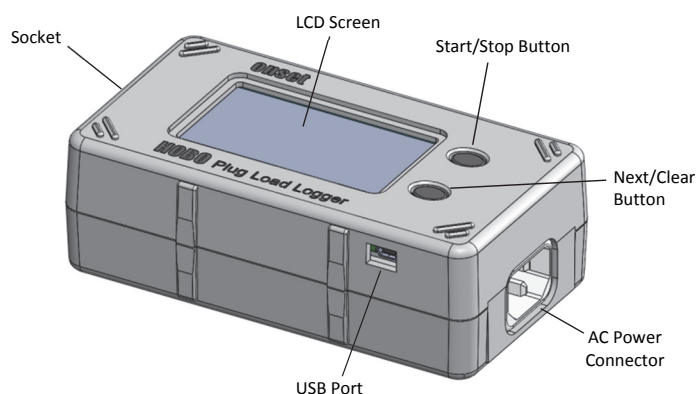
- HOBOWare 3.7 or later
- USB cable (included with software)

Specifications (continued)



Plot A: Time Accuracy

Logger Components and Operation



Start/Stop Button: When in logging mode, press this button for 3 seconds to start or stop logging data, or to resume logging at the next even interval. This requires configuring the logger in HOBOWare with a push button start or stop, and with “Resume logging on next button push” selected (see *Setting up the Logger to Record Data*). You can also press this button for 1 second to record an internal event during logging (see *Recording Internal Logger Events*) or to turn the LCD screen on if the option to turn off the LCD has been enabled (see *Setting up the Logger to Record Data*).

Next/Clear Button: When in meter mode, press this button for 1 second to switch between screens to view the current power draw and a cumulative count of watt-hours (see *Using the Logger as a Power Meter*). You can also press and hold this button for 3 seconds to reset the watt-hours counter. When in logging mode, press this button for 1 second to see current values on all configured channels and cycle through any enabled statistics or press and hold this button for 3 seconds to reset the statistics on the LCD screen only (see *Statistics Logging*).

AC Power Connector: Plug the AC power adapter into this connector and then plug the logger into an outlet.

USB Port: Use this port to connect the logger to the computer via USB cable for launching and reading out (see *Setting up the Logger to Record Data and Reading Out the Logger*).

Socket: Plug the power cord for the load you want to monitor into the socket on the left side of the logger (not visible in the diagram).

LCD Screen: The logger is equipped with an LCD screen that can be used in both meter and logging mode. This example shows all symbols illuminated on the LCD screen followed by definitions of each symbol in the table.



LCD Symbol	Description
	The battery indicator shows the approximate battery power remaining.
START	The logger is waiting to be launched. Press and hold the Start/Stop button for 3 seconds to launch the logger.
STOP	The logger has been launched with push button stop enabled; press and hold the Start/Stop button for 3 seconds to stop the logger. Note: If you also launched the logger with a push button start, this symbol will not appear on the display for 30 seconds.
LINE	A device is connected to the AC line.
NEXT	This shows which button to press to switch to the next screen when in meter mode or to cycle through the enabled channels and statistics when in logging mode.
CLEAR	When the logger is in meter mode, press and hold this button for 3 seconds to reset the watt-hour counter (see <i>Using the Logger as a Power Meter</i>). The watt-hour counter cannot be cleared when the logger is in logging mode. When the logger is in logging mode, press and hold this button for 3 seconds to reset the statistics shown on the LCD screen only (see <i>Statistics Logging</i>).
MEM USED 	The logger has been configured to stop logging when memory fills. The memory bar indicates the approximate space remaining in the logger to record data. When first launched, all five segments in the bar will be empty. In this example, the logger memory is almost full (only one segment in the memory bar is empty).
MEM USED 	The logger has been configured to never stop logging (wrapping). The logger will continue recording data indefinitely, with newest data overwriting the oldest data. When first launched, all five segments in the memory bar will be empty. In this example, the memory is full (all five segments are filled in) and new data is now overwriting the oldest data. This will continue until the logger is stopped or the battery runs out.
	This shows which screen is currently in view on the logger; in this example, the first screen is displayed. RMS voltage, RMS current, active power, and active energy are displayed on the first screen while apparent power and power factor are shown on the second screen (all measurements

LCD Symbol	Description
	are shown in meter mode; only enabled measurements are shown in logging mode).
METER	The logger is operating in meter mode and not logging data (see <i>Using the Logger as a Power Meter</i>).
LOGGING	The logger is currently logging (see <i>Setting up the Logger to Record Data</i>).
max min	These symbols show the maximum and minimum values for a specific measurement type (average statistics are not displayed). When the logger is in logging mode, press the Next/Clear button for 1 second to cycle through each of the available statistics for enabled measurements. Press and hold the Next/Clear button for 3 seconds to clear these values on the LCD screen only (see <i>Statistics Logging</i>).
	This is an example reading for RMS voltage. It is located in the upper left quadrant of screen 1.
	This is an example reading for RMS current. It is located in the upper right quadrant of screen 1.
	This is an example reading for active power. It is located in the lower left quadrant of screen 1.
	This is an example reading for the active energy cumulative counter. It is located in the lower right quadrant of screen 1. The units are Wh or kWh depending on the running total in the counter. Press and hold the Next/Clear button for 3 seconds to reset the counter (if in logging mode, this resets the LCD screen only).
	This is an example reading for apparent power. It is located in the upper left quadrant of screen 2.
	This is an example reading for power factor. It is located in the upper right quadrant of screen 2. The power factor is automatically set to zero for loads less than 1 watt.
	The logger has been configured to start logging on a particular date/time. The display will count down in days, hours, minutes, and seconds until logging begins. In this example, 5 minutes and 38 seconds remain until logging will begin.
LoAd	The launch settings are being loaded onto the logger from HOBOWare. Do not disconnect the USB cable during this process.
Err	An error occurred while loading the launch configurations onto the logger from HOBOWare. Make sure the USB cable is connected to both the logger and the computer and try launching again.
Stop	The logger has been stopped with HOBOWare or because the memory is full.

Notes:

- When the logger is in meter mode, it must be plugged in for the LCD to be illuminated.
- You can disable the LCD screen when logging. Select “Turn LCD off” when setting up the logger (see *Setting up the Logger to Record Data*). When this option is enabled, you can still temporarily view the LCD screen by pushing the Start/Stop button for 1 second. The LCD will then remain on for 10 minutes.
- The LCD screen refreshes every second while logging regardless of the logging interval selected in HOBOWare.

- When the logger has stopped logging, the LCD screen will remain on until the logger is offloaded to a computer (unless launched with the “Turn LCD off” option). If the logger has been offloaded and then unplugged from the line voltage, the LCD screen will turn off for a few seconds. Once the logger has been offloaded and disconnected from the computer, the LCD will turn off automatically after 2 hours. The LCD will turn back on the next time the logger is connected to the computer.

Logger Measurements

You can view or log the following measurements with this logger:

- RMS Voltage (V).** RMS is root mean square. True RMS is the real or effective value of AC voltage for a circuit.
- RMS Current (A).** True RMS is the real or effective value of current for a circuit.
- Active Power (W).** The capacity of the circuit for performing work in a particular time (also known as real power).
- Active Energy (Wh or kWh).** A watt-hour (Wh) is a unit of energy equivalent to one watt (1 W) of power expended for one hour (1 h) of time. kWh is a unit of energy equal to 1,000 watt-hours. **Note:** The first logged data point for active energy measurements is 0 (when the logger is operating in logging mode).
- Apparent Power (VA).** The product of the current and voltage of the circuit.
- Power Factor (PF).** The ratio of the active or real power flowing to the load to the apparent power in the circuit. It is a dimensionless number between 0 and 1.

See *Using the Logger as a Power Meter* for instructions on viewing these measurements on the LCD screen when the logger is in meter mode. See *Setting up the Logger to Record Data* for details on how to configure these measurements for logging.

Using the Logger as a Power Meter

The HOBOW Plug Load logger can operate in either meter mode or logging mode. When in meter mode, the logger functions as a power meter in which you monitor all available measurements for a connected device on the logger LCD without logging any data. When in logging mode, the logger can record data at an interval you select as described in *Setting up the Logger to Record Data*.

To operate the logger as a power meter, connect the AC power cord to the logger and plug it into a wall outlet with the AC adapter. Plug the load you want to monitor into the logger. METER will appear on the LCD to indicate the logger is in meter mode. **Note:** If the logger was previously in logging mode, you must first read out the logger before switching to meter mode. See *Reading Out the Logger* for details.

Press the Next/Clear button to switch between the two meter mode screens. The first screen shows RMS voltage, RMS current, active power, and active energy for the connected device; the second screen shows apparent power and power factor. All measurement values are updated every second. For active energy, the LCD shows a running total of watt-hours

consumed by the connected device in the lower right quadrant of screen 1. Press and hold the Next/Clear button for 3 seconds to clear the active energy total and restart the counter.

Unplug the load when you are done monitoring it. No data is saved in the logger when operating in meter mode.

Setting up the Logger to Record Data

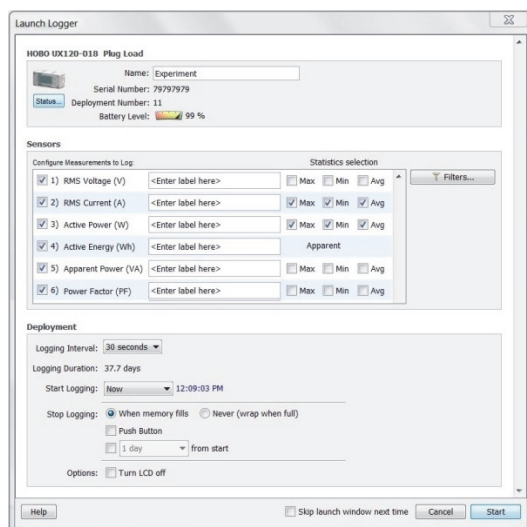
Use HOBOWare to set up the logger to record data and optional statistics. The logger will then operate in logging mode. To operate the logger in meter mode, see *Using the Logger as a Power Meter*.

1. Connect the logger and open the Launch Logger window.

Use the USB cable provided with HOBOWare to connect the logger to a computer. Open HOBOWare and click the Launch icon on the toolbar or select Launch from the Device menu to open the Launch Logger window.

Important: USB 2.0 specifications do not guarantee operation outside the range of 0°C (32°F) to 50°C (122°F).

- 2. Select and configure measurements.** Under Configure Measurements to Log, click the checkbox for the measurement you wish to log. Type a label if desired. Select the Min, Max, and/or Avg checkboxes if you want to log statistics for the selected measurement (not available for Active Energy). Statistics are calculated at a fixed single-cycle sampling rate of 60 Hz or 16.67 mS and the resulting value is recorded at each logging interval (see *Statistics Logging*).



- 3. Configure filters (optional).** Click the Filters button to create additional filtered data series. Any filtered series will be available automatically upon reading out the logger.
- 4. Select the Logging Interval.** Select a logging interval from 1 second to a maximum of 18 hours, 12 minutes, and 15 seconds. The projected logging duration is updated automatically based on the logging interval and measurements selected in step 2. Logging duration is the approximate time it will take to fill the logger memory and is an estimate only; battery life and other factors will affect the deployment.
- 5. Choose when to start logging:**
- **Now.** Logging begins immediately.

- **At Interval.** Logging will begin at the next even interval as determined by the selected logging interval.
- **On Date/Time.** Logging will begin at a date and time you specify.
- **Push Button.** Logging will begin once you press the Start/Stop logging button on the logger for 3 seconds.

6. Choose when to stop logging:

- **When Memory Fills.** Logging will end once the logger memory is full.
- **Never (Wrap When Full).** The logger will continue recording data indefinitely, with newest data overwriting the oldest.
- **Push Button.** Logging will end once you press the Start/Stop logging button on the logger for 3 seconds. Note that if you also choose Push Button to start logging, then you will not be able to stop logging until 30 seconds after logging begins.

If you select the Push Button setting, then you also have the option to select “Allow button restart.” This allows you to stop and then restart logging during the deployment by pushing the Start/Stop button on the logger for 3 seconds.

Important: When “Allow button restart” is selected and you use the Start/Stop button to stop and restart logging, logging will restart on the next even logging interval, not at the time the button was pushed. For example, a logger started logging at 7:00 AM with a logging interval set to 1 hour. If you press the Start/Stop button to stop the logger at 8:45 AM and then press the button again at 10:15 AM, logging will not begin immediately at 10:15 AM. Instead, logging will begin again at 11:00 AM, which is the next even interval time based on your 1-hour logging interval. Therefore, depending on the logging interval, the gap between the time you press the button to resume logging and the time actual logging begins could be significant. The faster the logging interval, the less time will elapse before logging resumes.

- **Specific Stop Time.** Logging will end at a date and time you specify. Note that if you also configure the logger for a Push Button stop and to “Allow button restart,” then the logger will stop logging at the date you select regardless of how many times you stop and restart the logger with the Start/Stop button.

- 7. Choose whether to keep the LCD on or off.** By default, the LCD will always remain on while logging. If you select the “Turn LCD off” checkbox, the LCD will not show the current readings, status, or other information while the logger is logging. You will, however, be able to temporarily turn the LCD screen on by pressing the Start/Stop button for 1 second if you select this option.
- 8. Click the Start button to launch the logger.** Note that the Start button text changes in the Launch Logger window based on the Start Logging selection. Disconnect the logger from the computer. Plug in the load you want to monitor to the logger. LOGGING will appear on the LCD to indicate the logger is in logging mode. After logging begins, you can read out the logger at any time (see *Reading Out the Logger*).

Statistics Logging

If the logger is in logging mode and maximum, minimum, or average statistics are enabled for any measurements, the logger will record the statistics at each logging interval. Statistics are calculated based on a fixed single-cycle sampling rate of 60 Hz or 16.67 mS. This can result in up to three additional series per measurement that record the following information at each logging interval:

- The maximum, or highest, sampled value,
- The minimum, or lowest, sampled value, and
- An average of all sampled values.

For example, a logger is configured with all six measurement types enabled as well as maximum, minimum, and average statistics for RMS current only. The logging interval is set to 1 minute. Once logging begins, the logger will record the actual readings for all six measurement types every minute. In addition, the logger will take sample readings for RMS current every 16.67 mS and temporarily store them in memory. The logger will then calculate the maximum, minimum, and average using the 3,600 samples for RMS current gathered over the previous 1-minute period and will log the resulting values. When reading out the logger, this would result in nine data series: six series for the six enabled measurement types plus three series for the RMS current statistics (maximum, minimum, and average).

While the logger is logging, press the Next/Clear button on the logger for 1 second to cycle through the maximum and minimum statistics (if enabled) for each configured measurement type. Average statistics are not displayed on the LCD screen. The statistics for a particular measurement type appear in the same quadrant on the LCD screen. Continuing with the previous example in which all six measurement types are enabled in addition to the maximum, minimum, and average statistics for RMS current, you can view the latest reading for RMS current in the upper right quadrant in screen 1 on the LCD. If you then press the Next/Clear button for 1 second, the LCD switches to show the most recent RMS current maximum value in the same upper right quadrant. Press the button again to view the minimum value in the same quadrant. Pressing the Next/Clear button a third time will then switch the LCD to screen 2.

The minimum and maximum values displayed on the LCD screen are based on the entire logging period by default; they are not the same as the values recorded at each logging interval. Although both the logged statistics and the statistics shown on the LCD screen are calculated at the 16.67 mS fixed sampling rate, the logged statistics are based only on the samples taken in between each logging interval. Meanwhile, the statistics shown on the LCD screen are based on all the samples taken since the logger started logging. You can reset the starting point used to determine the minimum and maximum values on the LCD screen only by pressing and holding the Next/Clear button for 3 seconds while viewing statistics. The statistics displayed on the LCD screen will no longer be based on the entire logging deployment, but instead will restart at the time the button was pressed. This allows you to monitor the minimum and maximum values for a set period of time period rather than the entire deployment. This will not affect the statistics being logged; all enabled statistics will continue to be recorded at each logging interval.

Reading Out the Logger

To read out a logger that has been logging data, connect it to the computer with a USB cable. In HOBOWare, select Readout from the Device menu. You can then save the data, plot it, and export it for further analysis. Refer to the HOBOWare Help for details.

Note: If the logger was operating in logging mode and you want to switch to meter mode, you must read it out first.

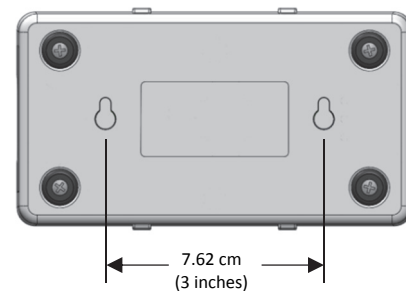
Recording Internal Logger Events

When the logger is in logging mode, the logger records the following internal events to track logger operation and status. You can plot these events in HOBOWare after reading out the logger and opening the data file.

Internal Event Name	Definition
Host Connected	The logger was connected to the computer via USB cable.
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).
Start/Stop Button Up; Start/Stop Button Down	The Start/Stop button was pressed for 1 second.
Line Loss	No power is detected on the line.
Line Restore	Power has been restored to the line.
Safe Shutdown	The battery level dropped below 1.85 V; the logger performs a safe shutdown.

Mounting the Logger

You can mount the logger using the two features shown below. The dimensions are as follows:



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 the message FAIL CLK appears on the LCD screen, there was a failure with the internal logger clock possibly due to condensation. Remove line power before touching device. Remove the batteries immediately and dry the circuit board.

Note: Static electricity may cause the logger to stop logging.

The logger has been tested to 8 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.

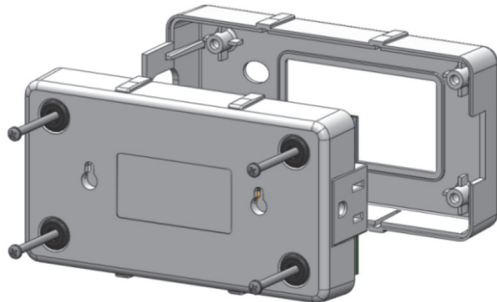
Battery Information

The logger requires two user-replaceable AAA 1.5 V alkaline batteries to operate in logging mode (an AC power cord is required to operate in meter mode). Expected battery life varies based on the ambient temperature where the logger is deployed, the logging interval, frequency of offloading to the computer, number of measurements that are active, if statistics are being logged, and battery performance. New batteries typically last 2 years when the logger is line powered. If the logger is running on battery power only (i.e. not plugged into AC power), projected battery life is 6 months with logging intervals greater than 1 minute. Deployments in extremely cold or hot temperatures or a logging interval faster than 1 minute can impact battery life. Estimates are not guaranteed due to uncertainties in initial battery conditions and operating environment.

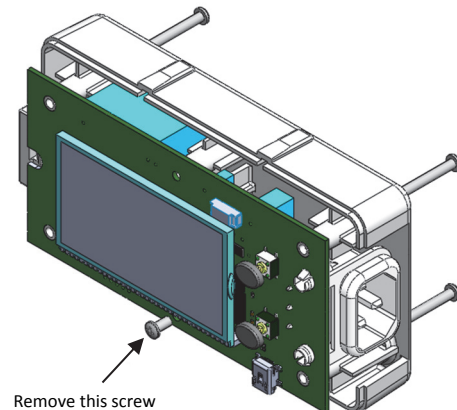
HOBOWare provides the option of recording the current battery voltage at each logging interval, which is disabled by default. Recording battery life at each logging interval takes up memory and therefore reduces logging duration. It is recommended you only record battery voltage for diagnostic purposes.

To install or replace the batteries:

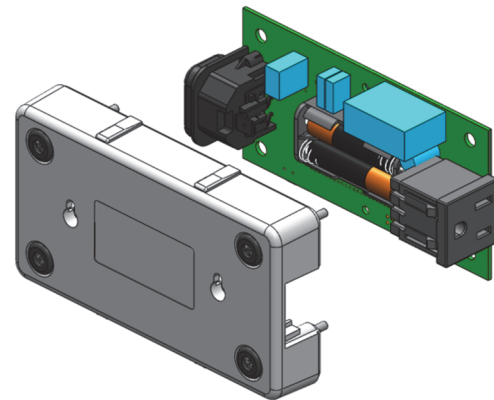
1. Remove the four screws on the back of the logger to detach the front of the logger housing.



2. Remove the bottom screw on the circuit board inside the logger housing. Carefully lift the circuit board out of the case.



3. On the underside of the circuit board, insert two new batteries observing polarity. Do not unplug or adjust the green grounding wire.



4. Carefully place the circuit board back in the case and screw it back in.
5. Place the front of the logger housing back onto the case and screw it together using the four longer screws.

UL Rating

- The UX120-018 logger is intended for use on 15 AMP circuits with a working voltage of 120V AC $\pm 10\%$ at 50/60Hz and a max power of 1800W.
- Indoor use only.
- Insulation category 2.
- The UX120-018 logger may be cleaned with a soft cloth; do not use any liquids to clean the device.

⚠ WARNING: Never open or replace batteries while the logger is plugged into the mains. Always disconnect supply cord from the device before servicing replaceable batteries. The UX120-018 logger is not repairable in the field and if it fails to operate properly, the device must be returned to Onset for repairs. If the UX120-018 logger is used in any manner not specified in this manual, protection will be compromised.

Always use detachable mains cable supplied with device or equivalent.

During deployment, do not position the device such that the mains cable cannot be easily accessed.