USER GUIDE

UltraShock

MadgeTech

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ULTRASHOCK

Temperature, Humidity, Pressure and Tri-Axial Shock Data Logger

PRODUCT USER GUIDE

To view the full MadgeTech product line, visit our website at **madgetech.com**.

TABLE OF CONTENTS

2 Product Overview

4 Software Installation Guide

5 Device Operation

8 Product Maintenance

9 Dimensional Drawings

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PRODUCT OVERVIEW

The MadgeTech UltraShock is a 3-axis shock / acceleration data logger with additional channels for temperature, humidity and barometric pressure. Each of the six channels may be made active or inactive as needed. Disabling channels will provide additional storage to the enabled channels.

The UltraShock is specifically designed for documenting dynamic environments such as moving vehicles, trucks, containers, ships, etc. The device is also valuable in characterizing environments such as production and assembly lines of delicate electronics, IC fabrication, communications and computer components.

The UltraShock contains two separate accelerometers to provide high sensitivity and accuracy up to 15g or higher levels of shock monitoring up to 300g. One of three operating ranges must be chosen during setup for a logging session. Those ranges are +/- 15g (low g accelerometer), +/- 100g and +/- 300g (high g accelerometer).

Physical Mounting

The most accurate transfer of shock, vibration and acceleration to the final logged data will occur when the mounting is mechanically rigid. Typically, this would occur when the UltraShock is mounted by two bolts directly to a solid metal, flat surfaced object of significant mass.

For various applications, the rigid “bolted down” mounting may not be optimal or practical. The bottom surface of the UltraShock is precision machined flat. It is possible to mount the unit by the use of a double-sided adhesive material. MadgeTech does not make recommendations of specific materials but several points to consider are:

- Adhesive joint should be as thin as possible
- Adhesive joint must have adequate strength to support the unit under conditions expected in use (temperature, shock, vibration, etc.)
- Adhesive joint material should be as stiff as possible (high durometer)

The stiffness of the mounting material will affect the transfer of shock or vibration to the UltraShock. A soft material will have a tendency to reduce the transfer of high frequencies while a hard material would, in varying degrees, come closer to the fidelity of signal that a bolted down mount would provide.

Orientation of Axes

The illustration to the right shows the directions of the x, y and z axes. They are also laser engraved on the front face of the unit. If an UltraShock is positioned so that any axis points upward, that axis will report a g force of +1 g.

PRODUCT OVERVIEW

LED Indicator Functions

The red and green LEDs on the front of the UltraShock will flash or maintain a static condition to represent operating functions as shown in the table below.

The power up indication is only presented if the battery pack is separated from the front face and replaced. This should be done only during factory service or if directed to do so by a MadgeTech support or repair agent. If it is presented at any other time, there may be a malfunction of the unit.

OPERATING FUNCTION	GREEN LED INDICATOR	RED LED INDICATOR
Power-up Indicator	**Flashes 4 times** Red and green LED indicators alternately and rapidly flash 4 times each at power-up. LED indicators continue to flash for error at power-up.	
Logging Data (without USB connected)	**Flashes every 15 seconds** Indicates normal operation of logger without USB connected and adequate battery charge level.	**Flashes every 15 seconds (maximum)** Indicates low battery charge level.
Logging Data (with USB communication)	**Flashes every 15 seconds** Indicates normal operation of logger with USB connected.	**Flashes every 5 seconds (maximum)** Indicates when logger communication occurs via USB.
Delayed Logging Start	**Flashes every 3 seconds** Red and green LED indicators simultaneously flash every 3 seconds to indicate data logging delayed start is set.	
USB Charging (USB connected)	**Pulses slowly on and off** Indicates when battery is charging via USB connector.	**Flashes every 5 seconds (maximum)** Indicates when logger communication occurs via USB.
Battery Charged (USB connected)	**On** Indicates when battery is fully charged when connected to USB.	**Flashes every 5 seconds (maximum)** Indicates when logger communication occurs via USB.
Battery Charging Fault (USB connected)	**Off**	**On 2 seconds then off 2 seconds** Indicates when there is a battery charging fault and continues to flash until fault is cleared.
Logger Off	**Off** Red and green LED indicators are off when logger is off and USB not connected.	

PRODUCT OVERVIEW

Humidity

The UltraShock utilizes polymer type humidity sensor and a high-tech Gore® vent material at the entrance holes to the internal temperature and humidity sensor chamber. The vent equalizes pressure, reduces condensation and also blocks entry of liquids and other contaminants.

If the unit has been exposed to very high levels of humidity for extended time, it will return to normal measurement accuracy by storing it in normal room humidity (approximately 50% RH) conditions for several days.

Temperature

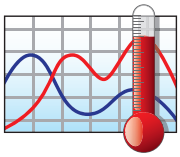
The UltraShock utilizes a silicon temperature sensor and is calibrated for accuracy. When measuring humidity and temperature, in addition to shock, please note that there will be a delay in response time to humidity and temperature measurements as the UltraShock processes shock events before other parameters.

Pressure

The UltraShock pressure sensor is designed to measure barometric pressure from very low altitudes to those altitudes found in aircraft, up to high altitude balloons. While specified to 300 mbar, it will continue to report data to 100 mbar. This equates to approximately 53,000 feet.

The pressure sensor is contained within the same sealed chamber as the temperature and humidity sensors and is also protected by the Gore® vent.

SOFTWARE INSTALLATION



MadgeTech 4 Software

The MadgeTech 4 Software makes the process of downloading and reviewing data quick and easy, and is free to download from the MadgeTech website.

1. Download the MadgeTech 4 Software on a Windows PC by going to **madgetech.com**.
2. Locate and unzip the downloaded file (typically you can do this by right clicking on the file and selecting **Extract**).
3. Open the **MTInstaller.exe** file.
4. You will be prompted to select a language, then follow the instructions provided in the MadgeTech 4 Setup Wizard to finish the MadgeTech 4 Software installation.

DEVICE OPERATION

Connecting and Starting the Data Logger

1. Once the software is installed and running, plug the interface cable into the data logger.
2. Connect the USB end of the interface cable into an open USB port on the computer.
3. The device will appear in the Connected Devices list, highlight the desired data logger.
4. For most applications, select Custom Start from the menu bar and choose the desired start method, reading rate and other parameters appropriate for the data logging application and click Start. (Quick Start applies the most recent custom start options, Batch Start is used for managing multiple loggers at once, Real Time Start stores the dataset as it records while connected to the logger.)
5. The status of the device will change to Running or Waiting to Start, depending upon your start method.
6. Disconnect the data logger from the interface cable and place it in the environment to measure.

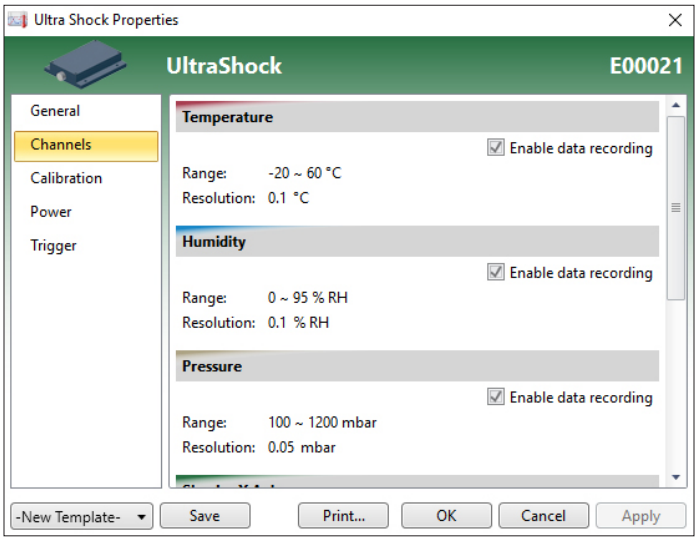
Note: *The device will stop recording data when the end of memory is reached or the device is stopped. At this point the device cannot be restarted until it has been re-armed by the computer.*

Downloading Data from a Data Logger

1. Connect the logger to the interface cable.
2. Highlight the data logger in the Connected Devices list. Click **Stop** on the menu bar.
3. Once the data logger is stopped, with the logger highlighted, click **Download**. You will be prompted to name your report.
4. Downloading will offload and save all the recorded data to the PC.

Enabling and Disabling of Channels

1. Connect the logger to the interface cable.
2. Highlight the data logger in the Connected Devices list.
3. Click **Properties** or right click the logger in the list and select **Properties**.
4. Select **Channels** in the Properties list.
5. Check or uncheck **Enable data recording** for each channel you want to enable or disable.



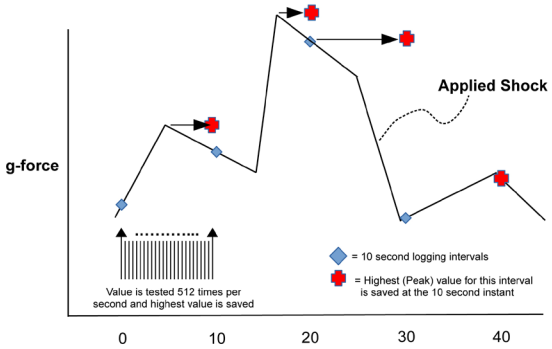
DEVICE OPERATION

Logging Mode - Peak vs. Instantaneous

When **Custom Start** is selected in the MadgeTech 4 Software, the user is presented with a range of logging time intervals or actual recording rates (sampling rates). For all but the two highest recording rates, the user will also have a choice of Peak vs. Instantaneous capture.

PEAK

Regardless of the logging interval, the accelerometers will internally sample at 512Hz. At the logging interval (for example, 30 seconds), the Peak value found in the previous logging interval is stored.

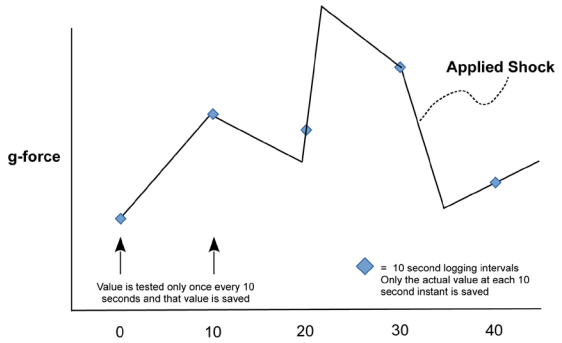


Using **Peak** mode = excellent information capture, shorter battery life

The red markers show the peak value for the interval which will be stored.

INSTANTANEOUS

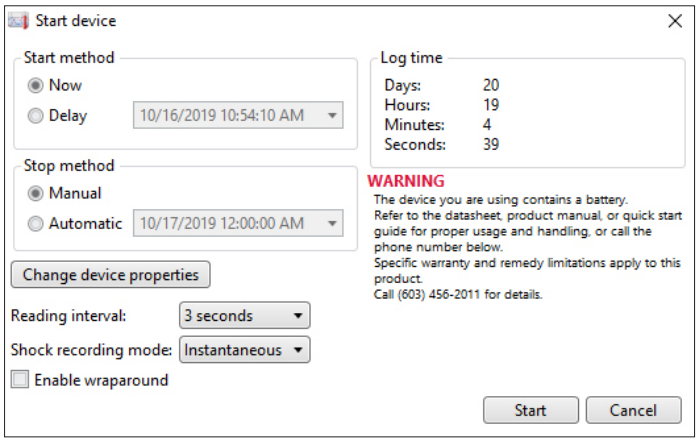
The accelerometers will only sample data at the logging rate. For instance, if a 30 second logging rate was selected, then only a single data point is captured at each 30 second instant.



Using **Instantaneous** mode = much information lost, longer battery life

The potential to lose valuable data can be seen. This, of course, is very dependent on the applied shock duration and wave shape. It's possible for a significant shock event to occur and not even be visible in the data for the Instantaneous mode.

1. Connect the logger to the interface cable.
2. Highlight the data logger in the Connected Devices list.
3. Click **Custom Start**.
4. Choose the **Start method**—Now or Delay (select date and time).
5. Choose the **Stop method**—Manual or Automatic (select date and time).
6. Select the **Reading interval**.
7. Select the **Shock recording mode** (if applicable)—Instantaneous or Peak



NOTE: When switching USB connections from a PC, laptop or power adapter, users can expect a 2 minute delay.

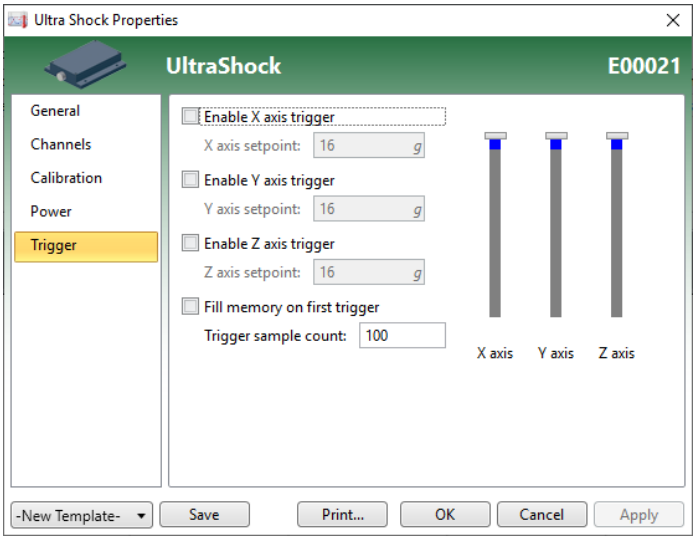
DEVICE OPERATION

Trigger Mode and Post Trigger Storage

The UltraShock allows the user to enter a shock value which will trigger the storage of data. In general, consider the use of a trigger as primarily a means of saving storage space by saving only data which is above a certain value.

To change a trigger in the MadgeTech 4 Software:

1. Click **Properties** or right click the device in the Connected Devices list.
2. Click to enable/disable triggers for the X, Y and Z axis and set trigger points. Trigger setpoints are absolute values.
3. You may also choose between filling all of memory after a trigger or storing only a fixed number of samples after a trigger.



For example, if the option to fill memory is selected, then after the first trigger, all of available memory will be filled at the selected logging rate. This will consume the remainder of available storage space for the selected channel.

If instead, a value of 100 is entered for “trigger sample count”, then a total of 100 data points will be stored once a trigger occurs. These 100 samples are acquired at the selected logging rate.

The trigger sample count should be chosen carefully because it may gather data points for which we have no interest. For instance, if 100 were entered and the logging rate were 30 seconds, then 100 data points would be gathered over a 3,000 second interval. There may be very little relevant information to a shock event which triggered the logging process.

While the use of a trigger has a significant effect on data storage, it has virtually no impact on battery life.

Battery Life

The UltraShock battery life is highly dependent on the mode of operation which has been selected for the device. Referring to the Peak and Instantaneous mode discussion, along with the Trigger discussion, the following table presents typical battery life, all at 25 °C, for various applications of the product. At 0 °C, life will be approximately 30% less. At 60 °C, a slight improvement may be seen but is generally masked by increased self-discharge of the battery.

SETUP CONDITIONS	COMMENT	BATTERY LIFE (DAYS)
All channels, 30s logging	Peak	25
All channels, 30s logging	Instantaneous	29
All channels, 1024Hz		24
All channels, 512Hz		24
Temperature, RH, Pressure	No Shock	> 120
Triggered vs. Non-triggered		No difference (but major storage differences)

DEVICE OPERATION

Storage and Data Transfer

The UltraShock contains 8 Megabytes of storage space. This space provides for 598,893 data points for each channel, with all 6 channels active.

If fewer channels are used, the active channels recover and utilize the unused storage space.

For instance, if only temperature were being logged, there would be adequate storage space for around 4,000,000 data points.

The following table present several examples of storage capacity, measured in days, for various applications of the product.

SETUP CONDITIONS	COMMENT	DAYS OF LOGGING (1)
All channels, 30s logging	Peak or Instantaneous	204
Temperature, humidity, 30s logging		683
3-axis shock, 128Hz, instantaneous	No Trigger	2.84 hours
3-axis shock, 128Hz, instantaneous	With Trigger	Many (2)

1. In many cases, the storage space exceeds the battery capacity. In such cases, external power would need to be provided to the UltraShock.

2. When logging at a sampling rate (not time) of 128Hz, for example, only 2.84 hours of storage is available without using triggered operation. If trigger is enabled, all storage space is available and is only used for the duration of the triggered shock events, plus a post-event buffer which is user programmable.

PRODUCT MAINTENANCE

Battery Charging and Care

The UltraShock battery does not require any periodic maintenance. It should be charged as needed. If the unit will not be used for a while, leaving the battery in a 50% state of charge is considered beneficial to battery longevity. Using the MadgeTech provided charger is recommended to maintain charging time.

The battery is a Lithium Ion two cell pack. Please note the safe handling and storage recommendations in the specifications section.

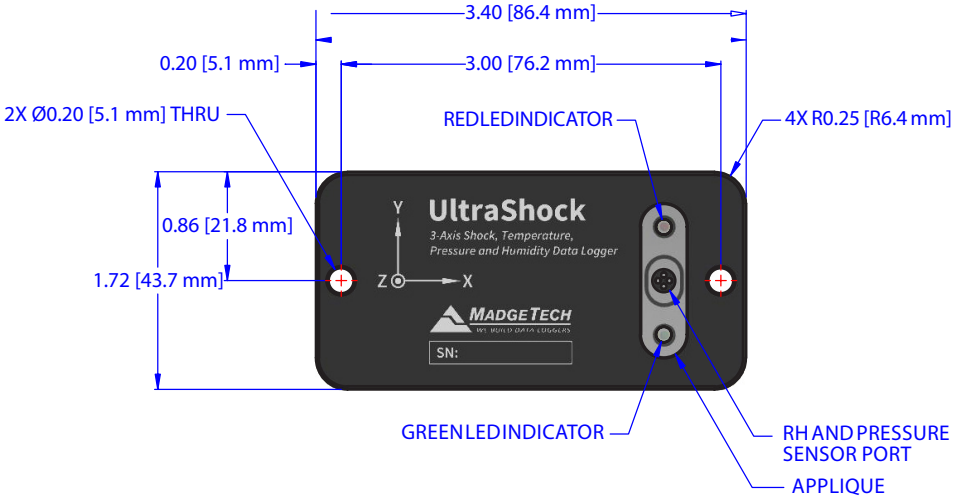
Inspection

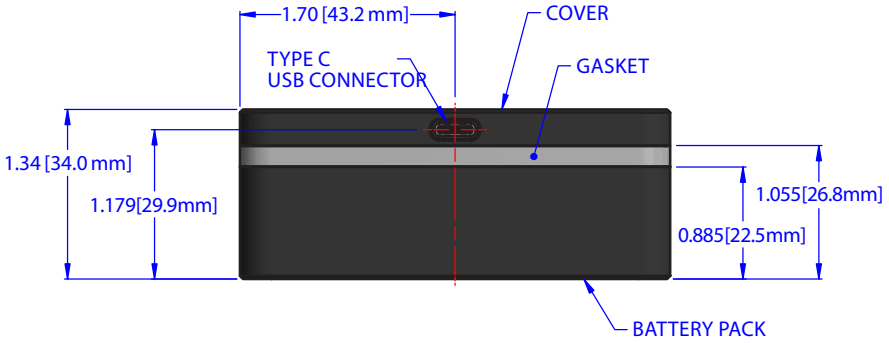
The UltraShock may be inspected visually for any signs of damage, especially to the gray gasket or to the USB jack. If damage is found, visit **madgetech.com** to return the unit to MadgeTech for repair.

Recalibration

Recalibration is recommended annually. To send devices back for calibration, visit **madgetech.com**.

DIMENSIONAL DRAWINGS





FRONT VIEW

BACK VIEW (BOTTOM)

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DOC-1363036-00 REV 4 2020.08.12