User Guide

Extech Instruments

Heavy Duty Vibration Meter

Model 407860
Introduction

Congratulations on your purchase of the Extech 407860 Vibration Meter. The Model 407860 measures vibration levels in industrial machinery. Misalignment, poor balancing, structural compromises, and other factors can cause unwanted vibration increases. The Model 407860 has a frequency sensitivity that meets ISO-2954 and offers Displacement, Velocity and Acceleration features. This meter is shipped fully tested and calibrated and, with proper use, will provide years of reliable service.

Meter Description

1. Probe connector
2. RS-232 Connector
3. LCD Display
4. Function switches and pushbuttons
5. Probe
6. Magnetic base
7. Protective rubber meter jacket
8. Battery compartment (on rear)

Meter LCD Display
**Meter Operation**

**Connecting the Probe**

1. Note that this meter accepts only the supplied vibration probe.
2. Plug the BNC connector end of the probe cable onto the BNC connector at the top of the meter.
3. The probe can then be connected to the tested machinery in three ways.
   a. Attach the magnetic end of the probe to a ferrous material on the equipment under test as shown in the accompanying diagram.

![Diagram](image1)

b. Manually hold the probe in place against the equipment under test as shown.

![Diagram](image2)

c. Unscrew the magnet from the probe end (as shown in the diagram) and use the threaded mount to connect to a screw, bolt, or stud on the equipment under test.

![Diagram](image3)

**POWER button and Auto Power OFF feature**

1. Press the **POWER** button to turn the meter ON. If the meter does not turn on, check the 9V battery.
2. To turn the meter off, press and hold the **POWER** button until the meter beeps.
3. The meter is equipped with an Automatic Power OFF utility that conserves battery life. If the meter is left inactive for 10 minutes it will automatically turn off.
   **Note:** Automatic Power OFF utility is disabled in the RECORD mode.

**FUNCTION button**

Press the **FUNCTION** button to select RMS, PEAK or MAX-HOLD.

1. **RMS** - Typical selection for vibration measurements
2. **PEAK** – For measurement of the peak value. Not available in the Displacement mode.
3. **MAX_HOLD** – Holds and displays the maximum value. The display will update only when a new maximum is measured. Not available in the Displacement mode.
**UNIT button**

Press this button to select the measurement units desired.

Press and hold this button for > 5 seconds to switch from metric to imperial units.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Metric Units</th>
<th>Imperial Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration</td>
<td>m/s², G</td>
<td>Ft/s²</td>
</tr>
<tr>
<td>Velocity</td>
<td>mm/s, cm/s</td>
<td>Inch/s</td>
</tr>
<tr>
<td>Displacement</td>
<td>mm</td>
<td>inch</td>
</tr>
</tbody>
</table>

**HOLD button**

Press this button to freeze the measured value in the display. HOLD will appear in the display. Press the button again to return to normal operation.

**REC button**

Use this feature to record the maximum and minimum measured values.

1. Press the REC button to begin recording. The REC symbol will appear on the display.
2. Press the REC button again to display the MAX recorded value. Both the REC and MAX symbols will appear on the display.
3. Press the REC button again to display the MIN recorded value. Both the REC and MIN symbols will appear on the display.
4. Press and hold the REC button for >2 seconds to exit the REC mode.

**ZERO Adjustment**

The meter may not indicate zero (or may indicate within a few digits of zero) with no signal applied to the meter (no vibration). Although this is usually not a problem, this procedure will bring the meter within a few digits of zero and improve measurement precision.

1. Connect the vibration sensor to the meter.
2. Turn the meter on and set the function to ACC and RMS.
3. Make sure the vibration sensor is perfectly still (no vibration).
4. Press and hold the HOLD button for > 5 seconds to allow the display to reach the zero value.
Datalogging

The internal datalogger memory can hold up to 500 readings. Readings can be logged manually, with a button press, or automatically at a programmed sample rate.

Sample Rate

The sample rate can be set to 0 (manual), 1, 2, 5, 10, 30, 60, 600, 1800 or 3600 seconds.

1. With the meter OFF, Press and hold the HOLD and REC buttons.
2. Press the POWER button.
3. When the display shows the sample rate, release the HOLD & REC buttons.
4. Use the UNIT button to select the desired sample rate.
5. Press the REC button to save the selection. The meter will sound three tones indicating that the sample rate was successfully stored.
6. Follow the Auto or Manual Datalogging procedures in the next section.
7. To return to normal operation, simply cycle the meter’s power.

Auto Data Logging

1. Set the desired sample rate as described (do not select ‘0’).
2. Turn the meter off and back on.
3. Press the REC button to enter the datalogging function. The REC symbol will appear in the display (upper left-hand corner).
4. Press the LOGGER button to start logging data. The display will briefly indicate the sample rate and the REC indicator will flash
5. An audible tone will sound each time a reading is stored.
6. Press the LOGGER button to pause/resume datalogging.
7. Press and hold the REC button > 2 seconds to exit the datalogging mode.

Manual Data Logging

1. Set the sample rate to ‘0’ as described earlier.
2. Turn the meter off and back on.
3. Press the REC to enter the datalogging function. The REC symbol will appear in the display flashing.
4. Press the LOGGER button. The display will briefly indicate the ‘0’ sample rate.
5. Press LOGGER again to log one data point. The REC indicator will flash and an audible tone will sound. Repeat this step to store the desired number of readings.
6. Press and hold the REC button > 2 seconds to exit the datalogging mode.

Clearing Memory

1. With the meter OFF, Press and hold the HOLD and REC buttons.
2. Press the POWER button.
3. When the display shows the sample rate, release the HOLD and REC buttons.
4. Press and hold the REC button for > 5 seconds. The display will indicate 0 when the memory is clear.
5. Cycle the meter power to return to normal operation.
Memory Full Indication
The meter produces a continuous tone when the internal memory has been filled to capacity (500 readings). The data can be viewed, cleared, or downloaded to a PC.

Viewing Stored Data
1. With the meter OFF, Press and hold the HOLD and REC buttons.
2. Press the POWER button.
3. When the display indicates the existing sample rate, release the HOLD and REC buttons.
4. The HOLD and the FUNCTION buttons are used to scroll through the stored data. When either button is pressed, the data reference number will briefly appear and then the reading for the given memory location will be displayed. The HOLD button increments the data location number and the FUNCTION button decrements the data location number.

PC Interface
The meter is equipped with an RS-232 serial data port (located at the top of the meter next to the probe input jack). This interface was designed to operate with the 407001A Extech software package which includes two programs and the required meter to pc cable.
1. **407001A - Extech Data Acquisition Software**: This software allows the user the meter to a PC and view readings in real-time as they are taken (this software does not download the contents of the meter’s memory to the PC)
2. **DL2005 - Datalogger Download Software**: This software allows the user to download the contents of the meter’s memory to the PC

Download Stored Data to PC (requires DL2005 software)
The SEND button is used to send the contents of the meter’s internal datalogger memory to the PC via the optional DL2005 software.
1. Connect the RS-232 cable to the PC
2. Install and run the DL2005 datalogging software.
3. With HOLD and REC not selected press and hold the SEND button for > 2 seconds. “232” (flashing) will appear in the display.
4. Press the SEND button again and the data will be sent to the meter’s RS-232 port and onto the connected PC.
5. Press the ESC button to return to normal operation.
Battery Replacement

When the 9V battery weakens, the + – indicator appears on the LCD. Follow these steps to replace the battery:

1. Turn the meter OFF.
2. Remove the probe and the RS-232 cable from the meter.
3. Remove the protective rubber jacket that encases the meter by stretching it over the bottom of the meter.
4. Open the battery compartment (located on the lower back of the meter) with a flat head screwdriver or coin.
5. Replace the 9V battery, replace the compartment cover, and affix the rubber jacket.
Specifications

General Specifications

Display
3-1/2 digit LCD with bar-graph

Frequency range
10Hz to 1KHz (frequency sensitivity meets ISO-2954)

Sampling time
One (1) second approx.

Data output
Isolated serial RS-232 PC Interface

Data Hold
Freezes displayed reading

Min/Max Memory
Meter stores highest and lowest readings for later recall

Data Logger
Store up to 500 readings

Data logger Sample Time
0 (manual), 1, 2, 5, 10, 30, 60, 600, 1800 and 3600 sec.

Pickup thread size
10-32 UNF

Auto Power OFF
Meter automatically shuts off after 10 minutes of inactivity

Low battery indication
Battery symbol appears on the LCD

Power supply
9V Battery

Power consumption
8mA DC approx.

Operating Temperature
32 to 122°F (0 to 50°C)

Operating Humidity
Less than 80% RH

Dimensions
Meter: 7.1 x 2.8 x 1.3" (180 x 72 x 32mm)
Probe: 0.75" (18mm) diameter x 1.6" (40mm)

Weight
Meter: Approx. 0.5 lbs (230g)
Probe with magnetic base: 0.24 lbs (110g)

Functions, Units, Ranges, and Accuracy

<table>
<thead>
<tr>
<th>Acceleration (RMS or Peak)</th>
<th>Unit</th>
<th>Range</th>
<th>Accuracy (% of reading)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m/s²</td>
<td>0.5 to 199.9m/s²</td>
<td>±(5% + 2 digits)</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>0.05 to 20.39G</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ft/s²</td>
<td>2 to 656ft/s²</td>
<td>±(5% + 2 digits)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calibration point: 50 m/s² @ 160Hz</td>
<td></td>
</tr>
<tr>
<td>Velocity (RMS or Peak)</td>
<td>mm/s</td>
<td>0.5 to 199.9mm/s</td>
<td>±(5% + 2 digits)</td>
</tr>
<tr>
<td></td>
<td>cm/s</td>
<td>0.05 to 19.99cm/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in/s</td>
<td>0.02 to 7.87in/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calibration point: 50mm/s @ 160Hz</td>
<td></td>
</tr>
<tr>
<td>Displacement (peak to peak)</td>
<td>mm</td>
<td>1.999mm</td>
<td>±(5% + 2 digits)</td>
</tr>
<tr>
<td></td>
<td>inch</td>
<td>0.078in</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calibration point: 0.141mm @ 160Hz</td>
<td></td>
</tr>
</tbody>
</table>

Note: Accuracy stated from 80 to 160Hz @ 23 ± 5°C
Warranty

EXTECH INSTRUMENTS CORPORATION warrants this instrument to be free of defects in parts and workmanship for one year from date of shipment (a six month limited warranty applies to sensors and cables). If it should become necessary to return the instrument for service during or beyond the warranty period, contact the Customer Service Department at (781) 890-7440 ext. 210 for authorization or visit our website www.extech.com for contact information. A Return Authorization (RA) number must be issued before any product is returned to Extech. The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. Extech specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. Extech’s total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

Calibration and Repair Services

Extech offers repair and calibration services for the products we sell. Extech also provides NIST certification for most products. Call the Customer Care Department for information on calibration services available for this product. Extech recommends that annual calibrations be performed to verify meter performance and accuracy.

Support line (781) 890-7440
Technical Support: Extension 200; E-mail: support@extech.com
Repair & Returns: Extension 210; E-mail: repair@extech.com

Product specifications subject to change without notice
For the latest version of this User’s Guide, Software updates, and other up-to-the-minute product information, visit our website: www.extech.com
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## Appendix A: Machinery Classification

When evaluating machinery and equipment it is useful to know their classification range and group type. There are four machine groups and classification ranges recognized internationally (ISO 2372 and VDI 2056). The limits for vibration severity (mm/s) are shown in the Tables below:

### GROUP K – Small Machinery up to 15KW (for example, production motors)

<table>
<thead>
<tr>
<th>Testing Status</th>
<th>Vibration Severity (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0 to 0.71</td>
</tr>
<tr>
<td>Acceptable</td>
<td>0.72 to 1.80</td>
</tr>
<tr>
<td>Permissible</td>
<td>1.81 to 4.5</td>
</tr>
<tr>
<td>Dangerous</td>
<td>Greater than 4.5</td>
</tr>
</tbody>
</table>

### GROUP M – Medium-sized Machinery up to 75KW (for example, electrical motors without special foundations)

<table>
<thead>
<tr>
<th>Testing Status</th>
<th>Vibration Severity (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0.00 to 1.12</td>
</tr>
<tr>
<td>Acceptable</td>
<td>1.13 to 2.80</td>
</tr>
<tr>
<td>Permissible</td>
<td>2.81 to 7.10</td>
</tr>
<tr>
<td>Dangerous</td>
<td>Greater than 7.10</td>
</tr>
</tbody>
</table>

### GROUP G – Large Machinery on Heavy Foundations

<table>
<thead>
<tr>
<th>Testing Status</th>
<th>Vibration Severity (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0.00 to 1.80</td>
</tr>
<tr>
<td>Acceptable</td>
<td>1.81 to 4.50</td>
</tr>
<tr>
<td>Permissible</td>
<td>4.51 to 11.20</td>
</tr>
<tr>
<td>Dangerous</td>
<td>Greater than 11.20</td>
</tr>
</tbody>
</table>

### GROUP T – Large Turbo Machinery on Special Foundations

<table>
<thead>
<tr>
<th>Testing Status</th>
<th>Vibration Severity (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0 to 2.80</td>
</tr>
<tr>
<td>Acceptable</td>
<td>2.81 to 7.10</td>
</tr>
<tr>
<td>Permissible</td>
<td>7.11 to 18.00</td>
</tr>
<tr>
<td>Dangerous</td>
<td>Greater than 18.00</td>
</tr>
</tbody>
</table>
Appendix B: Relative Sensitivity Table (ISO 2954)

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Relative sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal value</td>
</tr>
<tr>
<td>10</td>
<td>1.0</td>
</tr>
<tr>
<td>20</td>
<td>1.0</td>
</tr>
<tr>
<td>40</td>
<td>1.0</td>
</tr>
<tr>
<td>80</td>
<td>1.0</td>
</tr>
<tr>
<td>160</td>
<td>1.0</td>
</tr>
<tr>
<td>500</td>
<td>1.0</td>
</tr>
<tr>
<td>1000</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Appendix C: Glossary

Vibration: Vibration is an oscillation or repetitive motion of an object around an equilibrium position.

Displacement: Displacement is the peak-to-peak distance from a reference position, or equilibrium point, of an object under test.

Peak to Peak Amplitude: Peak –to-peak amplitude is the displacement of an object (see above). It can be thought of as the distance from the maximum positive deviation point to the maximum negative deviation point with respect to an object’s equilibrium position.

Velocity: Velocity is the rate of change of displacement. Velocity is measured in inches/second (mm/second) units.

Acceleration: Acceleration is the rate of change of velocity. Units of measure for Acceleration is feet per second squared (meters per second squared)

Peak Amplitude: Maximum deviation of an object from its equilibrium position.

RMS: Root Mean Square Amplitude (RMS) is the square root of the average of the squared values of a waveform. The RMS amplitude of vibration is 0.707 times the peak amplitude value. The RMS value of a vibration signal is an important measure of its amplitude.