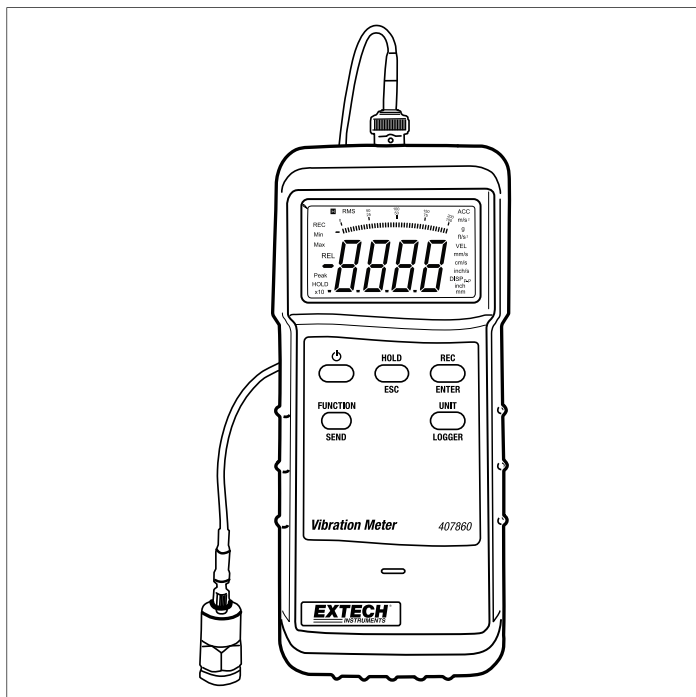


Heavy Duty Vibration Meter 407860



Introduction

Congratulations on your purchase of the Extech 407860 Vibration Meter. The 407860 monitors vibration in machinery, allowing users to detect abnormal vibration that can result from misalignment, poor balancing, and structural compromises.

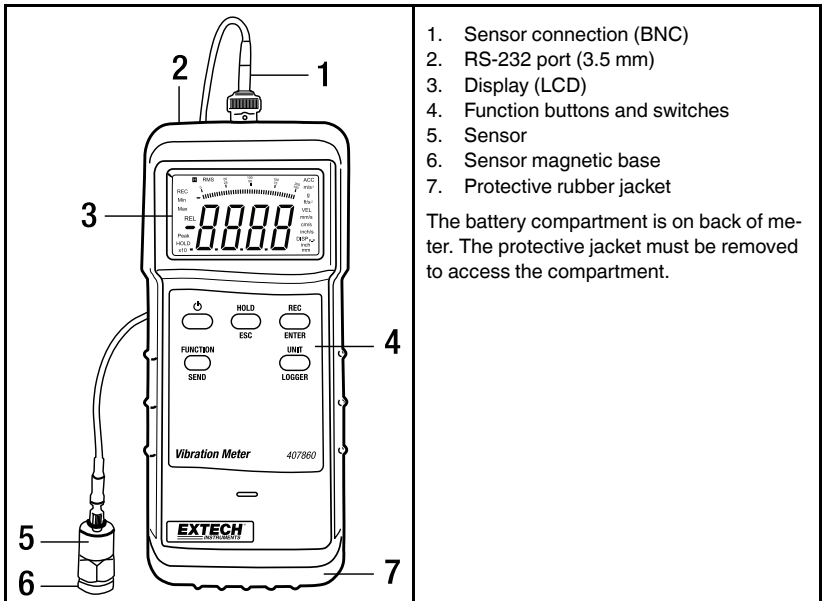
The 407860 measures displacement, velocity, and acceleration and its frequency sensitivity meets ISO 2954. This meter is shipped fully tested and calibrated and, with proper use, will provide years of reliable service.

Features:

- Professional, heavy duty vibration meter with protective rubber jacket.
- Detachable vibration sensor with cable and magnetic base.
- Large multifunction LCD with bar graph.
- Frequency range 10 Hz to 1 kHz. Sensitivity meets ISO 2954.
- Measures Acceleration, Velocity, and Displacement.
- RMS, PEAK, and Max HOLD measurement options.
- Display Hold function freezes displayed reading.
- Record and recall MAX/MIN readings.
- Automatic and manual data logger records up to 500 readings.
- RS-232 interface streams readings to a PC with optional software.
- Battery operated with automatic power OFF function.
- Supplied with meter, sensor, battery, carrying case, and user manual.

Description

Meter Description



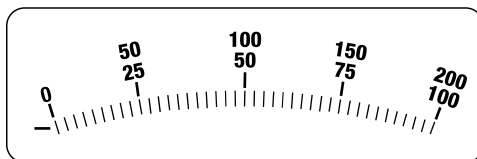
Button Description

	Short press to power ON; Long press to power OFF.
HOLD / ESC	Short press to freeze and unfreeze reading. Also used to scroll data log readings (increment). When streaming data from the RS-232 port, press this button to stop streaming.
REC / ENTER	Short press to start MAX/MIN recording, then short press to step through the MAX and MIN readings. Long press to exit the MAX/MIN mode. Refer to the dedicated MAX/MIN Recording section for complete information.
UNIT / LOGGER	Short press to select acceleration (ACC), velocity (VEL), or displacement (DISP) measurement modes. Press for five (5) seconds to toggle metric and imperial units. For Data Logger functions, see dedicated section.
FUNCTION / SEND	Press to step through RMS, PEAK, and Max HOLD functions. Also used to scroll data log readings (decrement). Long press to stream data to PC via RS-232 port (the display flashes '232' and the REC icon appears on the upper left). Press the ESC button to stop streaming.

Display Icon Descriptions

REC	Appears in the MAX/MIN and the Data Logger modes
MAX/MIN	MAX/MIN mode
PEAK	PEAK mode
HOLD	Displayed reading is frozen (press HOLD button to unfreeze)
Max HOLD	Reading represents highest measurement
ACC	Acceleration mode
m/s²	Meters per second squared (units for Acceleration mode)
g	Gravity acceleration mode
ft/s²	Feet per second squared (units for Acceleration mode)
VEL	Velocity mode active
mm/s	Millimeters per second (units for Velocity mode)
cm/s	Centimeters per second (units for Velocity mode)
Inch/s	Inches per second (units for Velocity mode)
DISP	Displacement mode
p-p	Peak to peak measurement (Displacement mode)
RMS	Root mean square measurement

Bar Graph Description



The bar graph has two ranges, shown above and listed below, that represent the measured vibration. The vibration is also shown, digitally, below the bar graph. The bar graph range switches automatically to best represent the measured vibration.

- Bar graph range 1: 0, 25, 50, 75, 100
- Bar graph range 2: 0, 50, 100, 150, 200

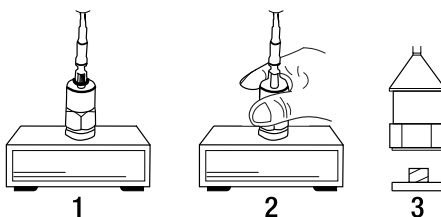
Operation

Sensor Connection

NOTE: Connect only the supplied sensor. There are no other approved sensors.

Plug the BNC end of the sensor cable to the to the BNC connector at the top of the meter. Attach the sensor to the machinery in one of the three ways listed and shown below.

1. Attach the sensor's magnetic base to a ferrous material on the equipment.
2. Manually hold the sensor against the equipment.
3. Unscrew and remove the magnet from the sensor and thread the sensor onto a part of the equipment.



Meter Power

The meter is powered by one 9 V battery, installed in the rear compartment. Refer to the Maintenance section for battery replacement instructions.

1. Short press the power button to switch ON the meter.
2. Press the power button until the meter beeps to switch OFF.
3. The meter switches OFF automatically after ten (10) minutes of inactivity. This feature is disabled in the MAX/MIN and Data Logger modes.

Select Meter Function

Press the **FUNCTION** button to step to the RMS, PEAK, or Max HOLD mode.

- **RMS:** The meter displays the effective value of vibration (primary measurement for most classes of equipment).
- **PEAK:** The meter displays the maximum amplitude of vibration (not available in Displacement mode).
- **Max HOLD:** The meter displays only the highest reading and does not change unless higher vibration is measured.

Select Measurement Type and Unit of Measure

Short press the UNIT button to step to the acceleration (ACC), velocity (VEL), or displacement (DISP) measurement type.

Press the UNIT button for five (5) seconds to toggle metric and imperial units.

Measurement	Metric units	Imperial units
Acceleration	(m/s) ² , G Meters per second squared and gravity (g) acceleration	(ft/s) ² Feet per second squared
Velocity	mm/s, cm/s Millimeters and centimeters per second	Inch/s Inches per second
Displacement (peak to peak [p-p])	mm (Millimeters)	Inches

Over Range indication

If the measurement exceeds the range of the meter, the measurement display will indicate four dashes (— — — —). See the Specifications section for range limits.

Display Hold

Press to freeze the displayed reading, **HOLD** will appear. Press again to exit.

MAX/MIN Recording

To record and view the maximum and minimum readings follow the steps below.

1. Press **REC** to begin recording (**REC** will appear). The displayed reading will continue show the actual measurement, but the meter will begin monitoring the highest (MAX) and lowest (MIN) readings.
2. Press again to view the highest reading. **MAX** will appear.
3. Press again to view the lowest reading. **MIN** will appear.
4. Press for two (2) seconds to exit. The mode icons will switch OFF.

Zero Adjustment

To zero the meter reading, follow the steps below. After this adjustment, the reading may still indicate a very small value due to sensor sensitivity and electronic meter noise, this is normal.

1. Switch OFF the machinery under test and attach the vibration sensor.
2. Switch ON the meter and set it to **ACC** and **RMS** operation.
3. Press the **HOLD** button until the meter beeps to zero the display.

Data Logger

Data Logger Overview

The data logger memory can store up to 500 readings. Readings can be logged manually or automatically. The following sections explain how to set the logger sample rate and how to log, recall, and clear readings.

Set the Sample Rate

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

1. With the meter OFF, press and hold the **HOLD** and **REC** buttons and momentarily press the power button.
2. When the display shows the sample rate, release the **HOLD** and **REC** buttons.
3. Use the **UNIT** button to step to the desired sample rate.
4. Press the **REC** button to save the selection. The meter will beep three times to confirm.
5. Cycle the meter power and continue with the following sections.

Automatic Logging

1. Press the **REC** button. The **REC** symbol will appear.
2. Press the **LOGGER** button for 3 seconds to start logging. The display will briefly indicate the sample rate and the **REC** indicator will flash.
3. The meter will beep each time a reading is stored.
4. Press the **LOGGER** button to pause/resume logging.
5. The meter emits a continuous tone when the 500 reading memory is full.
6. Press the **REC** button until the meter beeps to exit the logging mode.

Manual Logging

1. Set the sample rate to '0'.
2. Cycle meter power.
3. Press the **REC** button. The **REC** symbol will appear.
4. Press the **LOGGER** button to log one reading. The meter will beep and the display will briefly indicate the sample rate. Repeat this step to store additional readings.
5. The meter emits a continuous tone when the 500 reading memory is full.
6. Press the **REC** button until the meter beeps to exit the logging mode.

Recalling Logged Readings

1. With the meter OFF, press and hold the **HOLD** and **REC** buttons and momentarily press the power button.
2. When the display shows the sample rate, release the **HOLD** and **REC** buttons.
3. Use the **HOLD** (increment) button and the **FUNCTION** (decrement) button to scroll through the stored readings. When either button is pressed, the reading serial number will briefly appear followed by the stored reading.

Clearing Logged Readings

1. With the meter OFF, press and hold the **HOLD** and **REC** buttons and momentarily press the power button.
2. When the display shows the sample rate, release the **HOLD** and **REC** buttons.
3. Press the **REC** button until the meter emits a long beep. The display will indicate '0' when all readings are deleted.
4. Cycle meter power to return to normal operation.

PC Interface

To stream readings to a PC, from the RS-232 port at the top of the meter, the optional 407001-USB kit along with the 407001-PRO software (available free at www.extech.com) is required. Refer to the instructions provided with the software for complete information.

To start streaming reading data from the RS-232 port, long press the **SEND** button until '232' flashes on the display and the REC icon appears. Press the **ESC** button to stop streaming, the meter will beep three times.

Maintenance

Battery Replacement

When battery voltage is low, the battery icon appears . Replace the battery as explained below.

1. Remove the protective jacket that surrounds the meter.
2. Open the rear battery compartment using a screwdriver.
3. Remove the battery and install a new 9 V battery, observing correct polarity.
4. Securely replace the battery compartment cover before use.



Do not dispose of used batteries or rechargeable batteries in household waste. Please recycle. **Disposal:** Do not dispose of this instrument in household waste. Please recycle.

Cleaning and Storage

Wipe the meter housing and sensor with a damp cloth (water and mild detergent), as necessary. Do not use solvents or abrasives. Store the meter with the battery removed.

Specifications

General Specifications

Display	3.5 digit (1999 max. reading) LCD with bar graph
Frequency range	10 Hz to 1 kHz (sensitivity meets ISO 2594)
Sampling rate	One (1) reading per second
PC interface	Serial RS-232
Display hold	Freezes displayed reading
MIN/MAX memory	Record and recall highest and lowest readings
Data logger	Store up to 500 readings automatically or manually. Selectable logging rate from 1 to 3600 seconds.
Sensor thread size	#10-32 UNF
Power supply	9 V battery. Power consumption: 13 mA (approx.). Battery icon appears when battery voltage is low. Meter shuts OFF after 10 minutes of inactivity.
Operating conditions	32 to 122°F (0 to 50°C); < 80% RH
Dimensions	Meter: 7.1 x 2.8 x 1.3 in. (180 x 72 x 32 mm) Sensor: Length: 0.75 in. (19 mm); Diameter: 0.83 in. (21 mm)
Weight	Meter: 0.5 lbs. (230 g) Sensor and base: 1.3 oz. (38 g)

Measurement Specifications

Measurement	Unit	Range	Accuracy*
Acceleration	m/s ²	0.5 to 199.9 m/s ²	± (5% + 2 digits)
(RMS, Peak, or Max Hold)	G	0.05 to 20.39 G	
	ft/s ²	2 to 656 ft/s ²	
	Acceleration peak range: 1.0 to 199.9 m/s ²		
	Calibration point: 50 m/s ² @ 160 Hz		
Velocity	mm/s	0.5 to 199.9 mm/s	± (5% + 2 digits)
(RMS, Peak, or Max Hold)	cm/s	0.05 to 19.99 cm/s	
	in/s	0.02 to 7.87 in/s	
	Velocity peak range: 1.0 to 199 mm/s		
Calibration point: 50 m/s @ 160 Hz			
Displacement	mm	0.003 to 1.999 mm	± (5% + 2 digits)
(Peak to peak, p-p)	Inch	0.078 in.	
(RMS or Max Hold)	Calibration point: 0.141 mm @ 160 Hz		
*Accuracy is % of reading from 80 to 160 Hz @ 73.4°F (±9°F) (23°C [± 5°C])			

Appendix

When evaluating machinery it is useful to know its ISO 2372 or VDI 2056 classification to determine its vibration severity limits. Refer to the tables below.

Class I (Small Machines)

Individual parts of engines or machines, typically motors up to 15 kW (approx. 20 HP) integrated with the complete machine.

Vibration severity (mm/s)	Condition
0.00 to 0.71	Ideal
0.72 to 1.80	Acceptable
1.81 to 4.5	Moderate
> 4.5	Dangerous

Group II (Medium Machines)

Electrical motors with power between 15 and 75 kW (20 to 100 HP), or machines up to 300 kW without special foundations.

Vibration severity (mm/s)	Condition
0.00 to 1.12	Ideal
1.13 to 2.80	Acceptable
2.81 to 7.10	Moderate
> 7.10	Dangerous

Group III (Large Machines)

Large prime movers and large machines mounted on rigid and heavy foundations, typically over 100 HP.

Vibration severity (mm/s)	Condition
0.00 to 1.80	Ideal
1.81 to 4.50	Acceptable
4.51 to 11.20	Moderate
> 11.20	Dangerous

Group IV (Large, Turbo Machinery)

Large machinery with rotating masses mounted on foundations that are flexible in the direction of vibration measurement (e.g., turbo-generator sets, lightweight structures).

Vibration severity (mm/s)	Condition
0.00 to 2.80	Ideal
2.81 to 7.10	Acceptable
7.11 to 18.00	Moderate
> 18.00	Dangerous

Relative Sensitivity Table (ISO 2954)

Frequency	Relative sensitivity to 80 Hz		
	Normal value	Minimum value	Maximum value
10 Hz	1.0	0.8	1.1
20 Hz	1.0	0.9	1.1
40 Hz	1.0	0.9	1.1
80 Hz	1.0	1.0	1.0
160 Hz	1.0	0.9	1.1
500 Hz	1.0	0.9	1.1
1000 Hz	1.0	0.8	1.1

Glossary of Terms

Acceleration	The rate of change for velocity.
Displacement	Peak-to-peak distance from a reference position, or equilibrium point, of an object under test.
Peak	Maximum deviation of an object from its equilibrium position. In PEAK mode, the meter displays the maximum amplitude of vibration.
Peak to peak (p-p)	Displacement (see above). The distance from the maximum positive deviation point to the maximum negative deviation point with respect to an object's equilibrium position.
RMS	Square root of the average of a waveform's squared values. The RMS amplitude of vibration is 0.707 times the peak amplitude. In RMS mode, the meter displays the effective value of vibration (primary measurement for most classes of equipment).
Velocity	Rate of change for displacement.
Vibration	Oscillation or repetitive motion of an object, relative to its equilibrium position.

Customer Support

Customer Support Local Telephone List:

<https://support.flir.com/contact>

Returns (RMA):

<https://customer.flir.com/Home>

Warranty

FLIR Systems, Inc. warrants this Extech brand instrument to be free of defects in parts and workmanship for three (3) years from date of purchase. To view the full warranty, please visit the site below.

<https://www.flir.com/support-center/warranty/instruments/extech-product-warranty/>

Website

<http://www.flir.com>

Customer support

<http://support.flir.com>

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